Appendices for SWMU 51 RCRA Facility Investigation/ Corrective Measures Study Report

Final

July 2008

Appendix A

Quality Assurance/

Quality Control

Appendix A-1

Analytical Services and Procedures

ANALYTICAL SERVICES AND PROCEDURES

ANALYTICAL SERVICES

The analytical services for the field investigation program were provided by the following USACE-validated laboratories:

- GPL Laboratories (GPL), Frederick, MD: GPL used *USEPA Office of Soil Waste and Emergency Response Test Methods for Evaluating Soil Waste Physical and Chemical Methods, Update III.* (SW-846) (USEPA, 1996e) methodologies in providing analytical support for this investigation. Chemical analyses included: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polynuclear aromatic hydrocarbons (PAHs), metals, cyanide, pesticides, polychlorinated biphenyls (PCBs), herbicides, explosives, full toxicity characteristic leaching procedure (TCLP), and corrosivity as pH. GPL used *American Society for Testing and Materials* (ASTM) (ASTM, 2000) methodologies for percent solids and grain-size analysis and *USEPA Methods for Chemical Analysis of Water and Wastes* (MCAWW) (USEPA, 1983) for chemical oxygen demand (COD) analysis.
- Pace Analytical Services, Inc. (Pace), Minneapolis, MN: Pace was subcontracted by GPL to perform analytical support for dioxins/furans. Pace used *USEPA Office of Soil Waste and Emergency Response Test Methods for Evaluating Soil Waste Physical and Chemical Methods, Update III* (SW-846) (USEPA, 1996e) methodologies for this analysis.
- Geotechnical Services, Inc., Totowa, NJ: Geotechnical Services, Inc. was subcontracted by GPL to perform analytical support for geotechnical soil analysis. Geotechnical Services, Inc. used *American Society for Testing and Materials* (ASTM) (ASTM, 2000) methodologies in providing support for organic content, soil moisture content, soil bulk density, atterberg limits, measurement of hydraulic conductivity, soil porosity, and pH analysis.

ANALYTICAL PROCEDURES

Analytical protocols used were in accordance with USEPA-approved methods for the analysis of environmental (i.e., organic, inorganic, and physical parameters) and waste characterization samples. The methodologies for environmental samples are summarized in **Table A-1** and for waste characterization samples in **Table A-2**. A brief discussion of the methodologies is presented in the following sections below.

Organics

Target compound list (TCL) VOCs, TCL SVOCs, TCL pesticides, TCL PCBs, herbicides, explosives, including nitroglycerin (NG) and pentaerythritol tetranitrate (PETN), PAHs, and dioxins/furans were analyzed using USEPA-approved methodologies. The laboratory procedures and methodologies for organic compounds are summarized below.

Table A-1
Summary of Analytical Methods for Environmental Samples

Parameter	Matrix	Analytical Method
Chemical Parameters		
TCL VOCs	Aqueous	USEPA SW-846 5030B/8260B
	Soil	USEPA SW-846 5035B/8260B
TCL SVOCs	Aqueous	USEPA SW-846 3520C/8270C
	Soil	USEPA SW-846 3540C/8270C
TCL Pesticides	Aqueous	USEPA SW-846 3520C/8081A
	Soil	USEPA SW-846 3540C/8081A
TCL PCBs	Aqueous	USEPA SW-846 3520C/8082
	Soil	USEPA SW-846 3540C/8082
Herbicides	Aqueous	USEPA SW-846 8151A
	Soil	USEPA SW-846 8151A
Explosives & PETN	Aqueous	USEPA SW-846 8330
	Soil	USEPA SW-846 8330
Nitroglycerine	Aqueous	USEPA SW-846 8332
	Soil	USEPA SW-846 8332
Polynuclear Aromatic Hydrocarbons	Aqueous	USEPA SW-846 3520C/8270C SIM
	Soil	USEPA SW-846 3540C/8270C SIM
Dioxins/furans	Aqueous	USEPA SW-846 8290
	Soil	USEPA SW-846 8290
Cyanide	Soil	USEPA SW-846 9014
TAL Metals	Aqueous	USEPA SW-846 3010A/6020 & 7470A
	Soil	USEPA SW-846 3050B/6010B & 7471A
Geotechnical/Physical Parameters		
Grain Size	Soil	ASTM Method D-422-98
Percent Moisture	Soil	ASTM Method D-2216-98
Soil Bulk Density	Soil	ASTM D-2937
Soil Porosity	Soil	ASTM D-854 & ASTM D-2937
pH	Soil	ASTM D-4972
Organic Content	Soil	ASTM D-2974-00
Hydraulic Conductivity	Soil	ASTM D-5084-00
Atterberg Limits	Soil	ASTM D-4318-00

Table A-2
Summary of Analytical Methods for Waste Characterization Samples

Parameter	Matrix	Analytical Method
TCLP VOCs	Solid	USEPA SW-846 1311/5030B//8260B
TCLP SVOCs	Solid	USEPA SW-846 1311/3510C/8270C
TCLP Pesticides	Solid	USEPA SW-846 1311/3510C/8081A
TCLP Herbicides	Solid	USEPA SW-846 1311/8151A
TCLP Metals	Solid	USEPA SW-846 1311/3010A/6010B & 1311/7470A
TCL PCBs	Solid	USEPA SW-846 3540C/8082
Explosives & PETN	Solid	USEPA SW-846 8330
Nitroglycerine	Solid	USEPA SW-846 8332
TAL Metals	Aqueous	USEPA SW-846 3010A/6020 & 7470A
Chemical Oxygen Demand	Aqueous	USEPA MCAWW 410.4
Corrosivity as pH	Aqueous	USEPA SW-846 9040B

TCL VOCs: Aqueous and solid samples were analyzed for TCL VOCs using USEPA SW-846 Method 5030B/8260B for aqueous samples and USEPA SW-846 5035B/8260B for solid matrices using purge and trap technology. TCLP extracts were analyzed according to USEPA SW-846 Method 1311/5030B/8260B for investigative-derived material (IDM) solid samples. Soil samples were collected using an EnCore sampling device and subsequently sent to the laboratory for analysis. No sodium bisulfate was added to the soil due to the possibility of effervescence and ketone formation. An inert gas is bubbled through a mixture of reagent water and 5 gram soil sample or through a 25 mL aqueous sample contained in a specifically designed purging chamber at 40°C for soil and ambient temperature for water. The vapor was swept through a sorbent column where the purgeable compounds were trapped. After purging was completed for both solid and aqueous samples, the sorbent column was heated and backflushed with the inert gas to desorb the purgeable compounds onto a gas chromatograph programmed to separate the purgeable compounds, which were then detected with a mass spectrometer.

TCL SVOCs/PAHs: Aqueous and solid samples were analyzed for TCL SVOCs and PAHs using USEPA SW-846 Method 8270C. The use of selective ion monitoring (SIM) using USEPA SW-846 Method 8270C SIM was employed for PAH analysis to achieve lower quantitation and detection limits in order to meet screening criteria. Soil samples were extracted using soxhlet according to USEPA SW-846 Method 3540C and aqueous samples were extracted using a continuous liquid-liquid extraction technique according to USEPA SW-846 Method 3520C. TCLP SVOC extracts were extracted using a separatory funnel liquid-liquid extraction technique according to USEPA SW-846 Method 1311/3510C for solid IDM samples. The extracts were injected into a gas chromatograph programmed to separate the compounds, which are then detected with a mass spectrometer.

TCL Pesticides/PCBs: Aqueous and solid samples were analyzed for TCL pesticides using USEPA SW-846 Method 8081A and for TCL PCBs using USEPA SW-846 Method 8082. Samples were prepared for analysis using extraction techniques. Soil samples were extracted

using soxhlet according to USEPA SW-846 Method 3540C and aqueous samples were extracted using a continuous liquid-liquid extraction technique according to USEPA SW-846 Method 3520C. TCLP pesticide extracts were extracted using a separatory funnel liquid-liquid extraction technique according to USEPA SW-846 Method 1311/3510C for solid IDM samples. The extracts were injected onto a gas chromatography programmed to separate the compounds, which are then detected with an electronic capture device (ECD). Sulfur cleanups were employed to aid in the quantification based upon the matrix interferences. Sample concentrations were confirmed on dissimilar columns.

Herbicides: Aqueous and solid samples were analyzed for herbicides according to USEPA SW-846 Method 8151A. TCLP extracts were analyzed according to USEPA SW-846 Method 1311/8151A for solid IDM samples. Aqueous and solid samples were extracted with diethyl ether and then esterified with diazomethane. The derivatives were determined by gas chromatography with an electron capture detector (GC/ECD). The results were reported as acid equivalents. Sample concentrations were confirmed on dissimilar columns.

Explosives/PETN: Aqueous and solid (including IDM) samples were analyzed for explosives and PETN using USEPA SW-846 Method 8330. Aqueous samples of low concentration were extracted by a salting-out extraction procedure with acetonitrile and sodium chloride. The small volume of acetonitrile that remained undissolved above the salt water was drawn off and transferred to a smaller volumetric flask. The acetonitrile was back extracted by vigorous stirring with a specific volume of salt water. After equilibration, the phases were allowed to separate and the small volume of acetonitrile residing in the narrow neck of the volumetric flask was removed. The concentrated extract was diluted with reagent grade water, and an aliquot is separated on a C-18 reverse phase column. The wavelength was set at 254 nanometers and confirmed on a cyanide reverse column. Soil samples were extracted using acetonitirile in an ultrasonic bath, then filtered and chromatographed similarly to aqueous samples. Sample concentrations were confirmed on dissimilar columns.

Nitroglycerine: Aqueous and solid (including IDM) samples were analyzed for NG using USEPA SW-846 Method 8332. Soil samples were extracted with acetonitrile in an ultrasonic bath, then filtered and mixed with a calcium chloride solution. Aqueous samples were extracted according to USEPA SW-846 Method 8332, using a double salting-out procedure with acetonitrile. The extract was mixed with calcium chloride just prior to analysis. The concentration was quantified using an isocratic HPLC system equipped with a column heater and UV detector. Sample concentrations were confirmed on dissimilar columns.

Dioxins/furans: Aqueous and solid samples were analyzed for dioxin/furans using USEPA SW-846 Method 8290. The analytical method used high-resolution gas chromatography and high-resolution mass spectrometry (HRGC/HRMS) on purified sample extracts. This method is specific for the analysis of 2,3,7,8-tetrachlorinated dibenzofuran (2,3,7,8-TCDD), substituted penta-, hexa-, hepta- and octachlorinated dibenzo-p-dioxins and substituted penta-, hexa-, hepta- and octachlorinated dibenzofurans in aqueous and solid samples. The extracts were injected onto a high-resolution gas chromatograph programmed to separate the compounds, which are then detected with a high-resolution mass spectrometer as confirmation.

Inorganics

Target analyte list (TAL) metals and cyanide were analyzed using USEPA SW-846 methodologies. The laboratory procedures for inorganic compounds are summarized below.

TAL Metals: Aqueous (including IDM) and solid samples were analyzed for TAL metals using a combination of the following methodologies: inductively coupled plasma (ICP), ICP/ mass spectroscopy (MS), and cold vapor atomic absorption (CVAA). Trace metals were analyzed using USEPA SW-846 3010A/6020 for aqueous samples and USEPA SW-846 Method 3050B/6010B for solid samples. TCLP extracts were digested according to USEPA SW-846 Method 1311/3010A/6010B for the solid IDM samples. The ICP method involved the simultaneous or sequential multi-element determination of trace elements in solution. The basis of the method is the measurement of atomic emission by optical spectrometry. Samples were nebulized and the aerosol that was produced was transported to the plasma torch where excitation occurs. Characteristic atomic-line emission spectra are produced by a radio-frequency ICP. For ICP/MS, the ions produced were entrained in the plasma gas and introduced, by means of an interface into a mass spectrometer. The ions produced in the plasma were sorted according to their mass-to-charge ratios and quantified with a channel electron multiplier. A background correction technique was utilized to compensate for variable background contribution for the determination of trace elements.

Aqueous and solid samples were analyzed for mercury using CVAA according to USEPA SW-846 Method 7470A for aqueous samples and Method 7471A for solid samples. TCLP extracts were digested according to USEPA SW-846 Method 1311/7470A for solid IDM samples. A sample aliquot was initially digested with nitric acid to free combined mercury. The mercury was then reduced to its elemental state and aerated from the solution into a closed system. The mercury vapor was passed through a cell positioned in the path of the mercury light source and the measured abundance was proportional to the concentration of mercury in the sample.

Cyanide: Aqueous and solid samples were analyzed for cyanide using USEPA SW-846 method 9014. The cyanide as hydrocyanic acid (HCN) was released from cyanide complexes by means of a reflux-distillation operation and absorbed in a scrubber containing sodium hydroxide solution. The cyanide ion in the absorbing solution was then determined colorimetrically. In the colorimetric measurement, the cyanide was converted to cyanogen chloride, CNCl, by reaction with chloramine-T at a pH less than 8.0 without hydrolyzing the cyanate. After the reaction was complete, color was formed on the addition of pyridine-pyrazolone or pyridine-barbituric acid reagent. The absorbance was read at 620 nanometers (nm) when using pyridine-pyrazolone or 578 nm for pyridine-barbituric acid. To obtain colors of comparable intensity, the sample and the standards will contain the same salt content.

Waste Characterization

Samples collected to characterize IDM were analyzed for hazardous waste characteristics using USEPA-approved methodologies, including TCLP VOCs, TCLP SVOCs, TCLP metals, TCLP pesticides, TCLP herbicides, TCL PCBs, explosives, TAL metals, chemical oxygen demand (COD), and corrosivity as pH. The laboratory procedures and methodologies are summarized below.

TCLP Extraction: Solid IDM samples were collected for waste characterization and were extracted using the USEPA SW-846 Method 1311. The final liquid extract was separated from the sample material and combined with the initial liquid phase (if applicable). The sample TCLP extract was then treated as an aqueous sample for analysis for TCLP VOCs, SVOCs, pesticides, herbicides, and metals. A brief discussion of these procedures and methodologies is presented in the prior section.

Explosives/PETN/NG: Solid IDM samples were analyzed for explosives and PETN using USEPA SW-846 Method 8330 and for NG using USEPA SW-846 Method 8332. A brief discussion of these procedures and methodologies is presented in the prior section.

TCL PCBs: Solid IDM samples were analyzed for TCL PCBs using USEPA SW-846 Method 8082. A brief discussion of these procedure and methodology is presented in the prior section.

TAL Metals: Aqueous IDM samples (decontamination water) were analyzed for TAL metals using a combination of the following methodologies: inductively coupled plasma (ICP) / mass spectroscopy (MS) and cold vapor atomic absorption (CVAA). A brief discussion of these procedures and methodologies is presented in the prior section.

Corrosivity as pH: Aqueous IDM samples were analyzed for corrosivity as pH using USEPA SW-846 Method 9040B. A sample pH was directly measured electrometrically using either a glass electrode in combination with a reference potential or a combination electrode.

COD: Aqueous IDM samples were analyzed for COD using USEPA MCAWW Method 410.4. A sample was heated under acidic conditions at a slow, constant rate in an oven or block digestor in the presence of dichromate at 150°C for two hours. The COD was measured at 600 nm spectrophotometrically.

Geotechnical/Physical Analyses

Grain Size: Grain size distribution was determined using ASTM Method D-422-98 (ASTM, 2000). A No. 200 sieve was used to separate particles larger than 75 micrometer (µm) from the soil, while the distribution of particles smaller than 75 µm was determined by a sedimentation process, using a hydrometer to secure the necessary data.

Percent Moisture: Soil samples were analyzed for percent moisture using ASTM Method D-2216-98 (ASTM, 2000). Each sample was placed in a dish or crucible and weighed before and after drying in a controlled 110°C oven. The water content of a material is defined as the ratio, expressed as a percentage, of the mass of "pore" or "free" water in a given mass of material to the mass of the soil material particles.

Soil Bulk Density: Soil samples were analyzed for bulk density using ASTM Method D-2937-00 (ASTM, 2000). This method determines the in place density of soil by the drive-cylinder method. An undisturbed sample is obtained from a driven thin wall cylinder. The bulk density was calculated by dividing the dried mass of the sample by the volume of the sample.

Soil Porosity: Soil samples were analyzed for porosity using ASTM Method D-854 and D-2937 (ASTM, 2000). This method calculated the porosity of soil as the ratio of the volume of voids to the total sample volume. Specific gravity and in-place density were used in the calculation.

pH: Soil samples were analyzed for pH using ASTM Method D-4972 (ASTM, 2000). A sample pH was directly measured electrometrically using a combination electrode. Samples were analyzed using 1:1 with reagent water and 1:1 with calcium chloride prior to measurement. Both pH values were reported. The samples ionic strength can be inferred from both measurements.

Organic Content: Soil samples were analyzed for organic content using ASTM Method D-2974-00 (ASTM, 2000). This method involved the ignition of an oven-dried soil sample in a muffle furnace. The organic content (a percentage) was expressed as the difference of the weight of the sample before and after ignition, divided by the weight of the sample before ignition.

Hydraulic Conductivity: Soil samples were analyzed for hydraulic conductivity using ASTM Method D-5084-00 (ASTM, 2000). The hydraulic conductivity (also referred to as coefficient of permeability) was measured with a flexible wall permeameter at temperatures between about 15°C and 30°C for each sample.

Atterberg Limits: Atterberg limits were determined using ASTM Method D-4318-00 (ASTM, 2000). This method involved the determination of the plasticity index of soil.

Appendix A-2

Quality Assurance/Quality Control Evaluation

QUALITY ASSURANCE/QUALITY CONTROL EVALUATION

An independent Quality Assurance Project Plan Addendum (QAPA) was developed as part of MWP Addendum 017 (Shaw, 2004a). The QAPA was implemented through the integration of well-defined quality control elements for activities associated with the task assignment. The quality control criteria defined for sampling and analysis activities were developed in conjunction with specifications contained in USACE EM200-1-3, *Requirements for the Preparation of Sampling and Analysis Plans*, (USACE, 2001) as well as the *USACE Shell Guidance for Analytical Chemistry* (USACE, 2001).

Table A-3 outlines the data quality indicators as to their definitions, project goals, sampling and analytical assessments. Data quality was assessed through the evaluation of sampling activities and field measurements associated with the chemical analytical data in order to assess the reliability of the chemical analyses and the accuracy and precision of information acquired from the laboratory.

Table A-3
RFI Data Quality Indicators

Data Quality Indicator	Definition	Goal	Sampling Assessment	Analytical Assessment
Precision	Quantitative measure of the variability of a group of measurements in comparison to the average value	Low relative percent difference	Duplicate samples	MS/MSD or lab sample duplicate; Field sample duplicate
Accuracy	Bias in a measurement system	Low bias	Blank contamination	Analysis spike results (LCS, MS, MSD)
Representativeness	Degree to which the measured results accurately reflect the medium being sampled	100%	Holding times, blanks, associated documentation	Inferred from accuracy, precision, and completeness evaluation
Completeness	Percentage of measurements which are judged to be usable	98±2%	Records review	Data validation
Comparability	Qualitative parameter expressing the confidence with which one data set can be compared with another	High	Work plans, quality documents	Analytical methods
Sensitivity	Quantitative measure of the level of detection and quantitation.	High	Review of analytical method or procedures and instrumentation	Analysis of MDLs studies and MRLs per analyte, analytical method, and matrix

Review of Documentation

The following documentation was required by the field investigation program in order to provide a quality assessment of data collected during routine investigative activities:

- **Field Logbooks:** Hardback logbooks with numbered pages were used to log daily activities, and data collected during the course of field activities. Designated logbooks

were also used to record calibration records and equipment maintenance as they were performed. Entries into field logbooks were evaluated for completeness and accuracy.

- **Field Parameter Forms:** Documentation of collected samples was provided to the laboratory on parameter forms developed by Shaw specifically for USACE investigations. Field Parameter Forms were electronically generated based on information recorded in field logbooks and were completed at the time of shipment to be included with the Chain-of-Custody for every sample, including QC samples. The completed forms contained the required information for encoding chemical data into ERIS database.
- **Chain-of-Custody:** Samples were collected and relinquished under stringent Chain-of-Custody protocols as specified in the project QA plan. A review of the Chain-of-Custodies identified transcription errors that were corrected by drawing a single line through the incorrect information and subsequently correct information was supplied, dated, and initialed.
- **Sample Tracking Table:** Documentation of collected samples was recorded in an electronic sample tracking table as a tool to track project status. Field entries included the field sample identification, sample depth (where applicable), date collected, chain of custody and/or field parameter form number, and laboratory analyses requested.

Sampling activities were performed in compliance with standard operating procedures (SOPs) and each individual performing sampling was aware of the requisite protocols for collection of environmental samples.

Data Reporting

Data packages were provided to Shaw in CLP-like deliverables with electronic data deliverable files from the laboratory. Detected target compound values above the reporting limit and within the acceptable calibration range were reported as determined to no more than three significant figures. Target analytes detected below the lower calibration standard or reporting limit (whichever was greater) and above the method detection limit were reported as estimated values. Appropriate data qualifiers were applied during validation process and recorded in an electronic database.

Data Reduction and Validation

Data validation determines the acceptability or unacceptability of the data quality based on a set of pre-defined criteria. Data validation is defined as the systematic process for reviewing a data package against a set of criteria to provide assurance that the data is adequate for its intended uses. These criteria depend upon the type(s) of data involved and the purpose for which data are collected. The intended use of the data and the associated acceptance criteria for data quality was identified before the data collection effort began. Both the organic and inorganic chemical data (except for the waste characterization) were validated. The data were validated in accordance with MWP QAP requirements (URS, 2003), MWP Addendum 017 (Shaw, 2004a), *USACE Shell Guidance for Analytical Chemistry* (USACE, 2001), method-specific criteria from *USEPA Office of Soil Waste and Emergency Response Test Methods for Evaluating Soil Waste Physical and Chemical Methods, Update III.* (SW-846) (USEPA, 1996e), and laboratory SOPs. The data qualifier scheme was consistent with USEPA Region III conventions using the *USEPA Region III Modifications to National Functional Guidelines for Inorganic Data Review* (USEPA,

1993b), *USEPA Region III Modifications to the National Functional Guidelines for Organic Data Review Multi-media, Multi-concentration* (USEPA, 1994c), and the *USEPA Region III Dioxin/Furan Data Validation Guidance* (USEPA, 1999d) as appropriate.

Data packages were validated to ensure compliance with specified analytical, Quality Assurance/Quality Control (QA/QC) requirements, data reduction procedures, data reporting requirements, and required accuracy, precision, and completeness criteria. This includes (as applicable), but is not limited to:

- Sample preservation and holding times;
- Instrument performance check;
- Calibration (initial and continuing);
- Blanks (calibration, preparatory, rinse, trip);
- Matrix spike and spike duplicate recoveries;
- Laboratory and field sample duplicate pairs;
- Surrogate spike recoveries (for organics);
- Laboratory control samples;
- Interference check sample (for metals);
- Serial dilution (for metals);
- Internal standards and retention times (for GC, GC/MS); and,
- Quantitative verification.

Results were assessed for accuracy and precision of laboratory analysis to identify the limitations and quantity of data. The data validation reports are contained on the CD located at the back of this report. The quality of the data collected in support of the sampling activity was considered acceptable, unless qualified rejected "R" during the validation process. Samples qualified "B" for blank contamination were considered non-detect at the MRL or level of blank contamination, whichever was greater. Samples qualified "J", "UJ", "L", "UL", or "K" were considered acceptable as estimated or non-detect estimated.

Data Review

Data obtained from both the laboratory and data validation were reviewed by the Shaw Project Chemist to assess whether the project-specific data quality objectives, as defined in the associated QAP, were met.

Data Quality Objectives

Data quality objectives were developed concurrently with the Work Plan to ensure: (1) the reliability of field sampling, chemical analyses, and physical analyses; (2) the collection of sufficient data; (3) the quality of data generated was acceptable for its intended use; and (4) valid assumptions could be inferred from the data. Attainment of data quality objectives was assessed through evaluation of data collected using the following data quality indicators:

- **Precision** - a quantitative measure of the variability of a group of measurements in comparison to the average value;
- **Accuracy** - the bias in a measurement system;
- **Representativeness** - the degree to which the measured results accurately reflect the medium being sampled. Representativeness will be assessed based on accuracy, precision, and completeness;
- **Completeness** - the percentage of measurements which are judged to be useable;
- **Comparability** - defined as a qualitative parameter expressing the confidence with which one data set can be compared with another; and,
- **Sensitivity** - describes the method detection, quantitation, and reporting limits. It also may be expressed as the slope of the analytical curve (intensity verses concentration).

Data quality was assessed through the evaluation of sampling activities and field measurements associated with the chemical data in order to verify the reliability of the chemical analyses and the accuracy and precision of information acquired from the laboratory.

Precision: Method or laboratory precision performed by the laboratory was evaluated during the validation process. Overall sampling or field precision was evaluated during the data review process. Precision is measured by calculating and evaluating the relative percent difference (RPD) between the results of field or laboratory duplicate pairs. The RPD is calculated by the following equation:

$$\text{RPD (\%)} = \frac{/\text{XA} - \text{XB})/}{\text{XM} * 100}$$

Where:
XA and XB are duplicate analyses, and
XM is the mean value [(XA + XB)/2] of the duplicate analyses.

The RPD was calculated for those analytes which were detected at levels exceeding the method detection limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Analytical results were qualified as estimated (J) for RPDs exceeding criteria for both the sample and its duplicate pair.

Laboratory duplicate sample determinations were used to demonstrate acceptable method precision by the laboratory at the time of analysis and evaluated. Laboratory precision was performed either on the sample and its duplicate pair or the matrix spike and its spike duplicate pair. Duplicate analyses were performed to generate data in order to assess the long-term precision of the analytical method on various matrices. RPDs must be within established control limits.

- **Laboratory Duplicate Analysis:** Laboratory duplicate pairs (dupe) or laboratory spiked duplicate pairs (MSDs) were evaluated for SWMU 51. Laboratory duplicate pairs or laboratory spiked duplicate pairs were within specified precision criteria for each parameter and/or compound except for those compounds listed in the **Table A-4**. Analytical results

were qualified as estimated (J) for RPDs exceeding criteria for where the associated compounds were detected. In some RPD cases where the MS/MSD recoveries were low or high, the data were qualified bias low "L" or "UL" and "K", respectively. While these parameters were qualified estimated due to the high RPDs, the data was still considered useable, the precision data quality goal was met, and the qualified data did not impact the data quality for the RFI. Further discussion may be found in the data validation reports located in **Appendix A-3**.

Table A-4
Laboratory Duplicate Analysis

Field ID	Analyte	QC Type	Val Qual.	Comments
51SB1B	bromodichloromethane	MS/MSD	UL	%Rs Low
51SB1B	chloroethane	MS/MSD	UL	%Rs Low
51SB8B	2-butanone	MS/MSD	UL	%Rs Low
51SB8B	dibromochloromethane	MS/MSD	UL	%Rs Low
51SB8B	styrene	MS/MSD	UL	%Rs Low
51SB8B	tetrachloroethylene	MS/MSD	UL	%Rs Low
51SB8B	trans-1,3-dichloropropene	MS/MSD	UL	%Rs Low
51SB1B	chloroethane	MS/MSD	UL	%Rs Low
51SB8B	anthracene	MS/MSD	J	High RPD
51SB8B	fluoranthene	MS/MSD	J	High RPD
51SB8B	phenanthrene	MS/MSD	J	High RPD
51SB7A	2-methylnaphthalene	MS/MSD	J	High RPD
51SB7A	acenaphthene	MS/MSD	J	High RPD
51SB7A	acenaphthylene	MS/MSD	J	High RPD
51SB7A	anthracene	MS/MSD	J	High RPD
51SB7A	benzo(a)anthracene	MS/MSD	J	High RPD
51SB7A	benzo(a)pyrene	MS/MSD	J	High RPD
51SB7A	benzo(b)fluoranthene	MS/MSD	J	High RPD
51SB7A	benzo(g,h,i)perylene	MS/MSD	J	High RPD
51SB7A	benzo(k)fluoranthene	MS/MSD	J	High RPD
51SB7A	chrysene	MS/MSD	J	High RPD
51SB7A	dibenz(a,h)anthracene	MS/MSD	J	High RPD
51SB7A	fluoranthene	MS/MSD	J	High RPD
51SB7A	fluorene	MS/MSD	J	High RPD
51SB7A	indeno(1,2,3-c,d)pyrene	MS/MSD	J	High RPD
51SB7A	naphthalene	MS/MSD	J	High RPD
51SB7A	phenanthrene	MS/MSD	J	High RPD
51SB7A	pyrene	MS/MSD	J	High RPD
51SB1B	1,3-dinitrobenzene	MS/MSD	None	Spiked Sample <MRL
51SB1B	2,4-dinitrotoluene	MS/MSD	None	Amt. Spiked Low to Sample Conc.
51SB4A	2,4-dinitrotoluene	MS/MSD	None	Amt. Spiked Low to Sample Conc.
51SB4A	4-nitrotoluene	MS/MSD	None	Amt. Spiked Low to Sample Conc.

Table A-4 (Continued)
Laboratory Duplicate Analysis

Field ID	Analyte	QC Type	Val Qual.	Comments
51SB1B	calcium	Sample Dupe	None	Sample Conc. <MRL
51SB9A	cadmium	Sample Dupe	None	Sample Conc. <MRL
51SB9A	selenium	Sample Dupe	None	Sample Conc. <MRL
51SB3A	cadmium	Sample Dupe	None	Sample Conc. <MRL
51SB8B	antimony	Sample Dupe	None	Sample Conc. <MRL
51SB8B	cadmium	Sample Dupe	None	Sample Conc. <MRL
51SB8B	selenium	Sample Dupe	None	Sample Conc. <MRL
51SB8B	lead	Sample Dupe	J	High RPD
51SB6A	antimony	Sample Dupe	None	Sample Conc. <MRL
51SB7B	mercury	Sample Dupe	J	High RPD

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.
UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

- **Field Duplicate Analysis:** Field duplicates were collected during the RFI on a 10% frequency per matrix to identify the cumulative precision of the sampling and analytical process, which includes the homogenization of soil samples. The RPD was calculated for those analytes that were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. For where values exceeding calibration range, the diluted values were evaluated. If one of the duplicate pair was non-detect and other <2MRL, then the field duplicate was not evaluated. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil sample pairs. Field precision frequency was conducted on a site-wide basis. Field duplicate pairs were within specified precision criteria for each parameter and/or compound except for those compounds listed in the **Table A-5**. Analytical results were qualified as estimated "J" or estimated non-detect "UJ" for exceeding criteria. While these noted parameters were qualified estimated or estimated non-detect due to the high RPDs, the data was still considered useable, the precision data quality goal was met, and the qualified data did not impact the data quality for the RFI.

Table A-5
Field Duplicate Analysis

Field ID	Duplicate Pair	Analyte	Val Qual.	Comments
51SB1A	TMSB1A	Criteria Met	NA	None
51SB9B	TMSB9B	2,4-dinitrotoluene	J	High RPD
51SB9B	TMSB9B	o-nitrotoluene	J	High RPD
51SB9B	TMSB9B	m-nitrotoluene	J	High RPD
51SB9B	TMSB9B	p-nitrotoluene	J	High RPD
51SB8A	TMSB8A	benzo(a)anthracene	J, UJ	Sample >2MRL & Dupe Non-detect
51SB8A	TMSB8A	benzo(a)pyrene	J, UJ	Sample >2MRL & Dupe Non-detect
51SB8A	TMSB8A	benzo(b)fluoranthene	J, UJ	Sample >2MRL & Dupe Non-detect

Table A-5 (Continued)
Field Duplicate Analysis

Field ID	Duplicate Pair	Analyte	Val Qual.	Comments
51SB8A	TMSB8A	benzo(g,h,i)perylene	J, UJ	Sample >2MRL & Dupe Non-detect
51SB8A	TMSB8A	benzo(k)fluoranthene	J, UJ	Sample >2MRL & Dupe Non-detect
51SB8A	TMSB8A	chrysene	J, UJ	Sample >2MRL & Dupe Non-detect
51SB8A	TMSB8A	dibenz(a,h)anthracene	J, UJ	Sample >2MRL & Dupe Non-detect
51SB8A	TMSB8A	indeno(1,2,3-c,d)pyrene	J, UJ	Sample >2MRL & Dupe Non-detect
51SB8A	TMSB8A	pyrene	J	High RPD
51SB8A	TMSB8A	2,4-dinitrotoluene	J	High RPD
51SB8A	TMSB8A	o-nitrotoluene	J	High RPD
51SB8A	TMSB8A	p-nitrotoluene	J	High RPD
51SB5D	TMSB5D	arsenic	J	High RPD
51SB5D	TMSB5D	chromium	J	High RPD
51SB5D	TMSB5D	cobalt	J	High RPD
51SB5D	TMSB5D	copper	J	High RPD
51SB5D	TMSB5D	lead	J	High RPD
51SB5D	TMSB5D	magnesium	J	High RPD
51SB5D	TMSB5D	manganese	J	High RPD
51SB5D	TMSB5D	potassium	J	High RPD
51SB5D	TMSB5D	1,3-dinitrobenzene	J	High RPD
51SB5D	TMSB5D	2,4,6-trinitrotoluene	J	High RPD
51SB5D	TMSB5D	2,4-dinitrotoluene	J	High RPD
51SB5D	TMSB5D	RDX	J	High RPD

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise.
UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.
NA = Not Applicable.
MRL = Method Reporting Limit.

Accuracy: Accuracy is the measure of bias in a system. The accuracy of the results is measured by percent recovery (%R). Laboratory analytical accuracy was assessed through the use of laboratory blanks (method and instrument), rinse blanks, trip blanks, laboratory control samples (LCSs), and matrix spikes (MSs). Trip blanks were not required for soil samples, but were collected with associated rinse blank samples and evaluated. Laboratory analytical accuracy was reviewed during the validation of data. Sampling accuracy was assessed by evaluating blank contamination and the impact of contaminant contributions originating from non-point sources, such as field sampling equipment decontamination procedures, or laboratory contamination. QC samples evaluated for this assessment included equipment blanks and laboratory method or preparatory blanks. The data validation qualifiers would be applied for analytical non-conformances as outlined in the USEPA Region III validation guidance. For pre-made non-laboratory spiked samples (e.g. LCS), accuracy was measured by the following equation:

$$\%R = \frac{\text{test value}}{\text{true value}} * 100$$

For laboratory spiked samples (e.g. MS), accuracy was measured by the following equation:

$$\%R = \frac{\text{test value} - \text{spiked value}}{\text{true value}} * 100$$

Method and calibration blanks, rinse blanks, trip blanks, laboratory control samples, and matrix spikes were evaluated and discussion follows.

Method and Calibration Blanks: A method blank also known as a preparatory blank is a volume of analyte-free water or soil that is processed through the entire analytical scheme (i.e., extraction, digestion, concentration, and analysis) as with the actual samples. Method blanks monitor potential laboratory-induced contamination. Results were qualified "B" for blank contamination by the laboratory and/or through the data validation process. In accordance with USEPA Region III data validation guidelines, reported sample results were considered "non-detect" and qualified with the letter "B" if the detected sample concentration was within 5 times (10 times for common laboratory contaminants: methylene chloride, acetone, 2-butanone, OCDD, OCDF, and common phthalate esters) the concentration in the associated method blank. The method blank contamination assessment was evaluated during the data validation process and may be found in the data validation reports located in **Appendix A-3**. Method blanks were calculated and compared against the same matrix environmental samples on a batch specific basis. No unit conversions were necessary for method blanks since they were treated in the same manner as the samples. Calibration blanks were also compared against the environmental samples for select parameters. Calibration blanks are aqueous samples and were reported in µg/L or mg/L units. Performing blank assessments for solid matrix samples, action levels were calculated and expressed in soil units µg/kg or mg/kg from the given aqueous rinse blank concentrations to be compared against actual solid sample concentrations. This conversion is dependent upon the method performed, sample amounts used, and final digestate or extract volumes used during the analytical analysis. Action levels were based upon 100% solids and 1x dilution factor and adjusted for each sample as appropriate.

- **Method and Calibration Blank Analysis:** Method and calibration blanks were non-detect for each parameter and/or compound except for acetone, methylene chloride, 2-butanone, OCDD, styrene, mercury, aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, sodium, thallium, and vanadium for select SDGs. The "B" flagged sample data from the evaluation of QC blanks is presented in **Table A-6**. Analytical results qualified "B" were considered non-detect at the MRL or level of contamination, whichever was greater. Samples meeting the USEPA Region III condition were qualified. While these noted parameters were qualified "B" due to the blank contamination, the data was still considered useable, the accuracy data quality goal was met, and the qualified data did not impact the data quality for the RFI. For each of the other noted analytes, the samples were either non-detect for that compound or greater than the blank action level. Further discussion as to method and calibration blanks may be found in the data validation reports located in **Appendix A-3**.

Rinse blanks: The blank contamination assessment was performed to assess the impact of contaminant contributions originating from non-point sources, such as field sampling equipment decontamination procedures. Rinse blanks were intended to identify cross-contamination between samples as a result of sampling equipment decontamination procedures. Rinse blanks were collected by pouring the required volume of de-ionized, organic-free water over the equipment and collecting the water in the appropriate sample containers. Rinse blanks were performed at a rate of one per 20 samples collected or 5% per matrix per sampling technique. The rinse blank results were evaluated to ascertain the efficiency of decontamination and assess

Table A-6
B-Qualified Data Summary

Field ID	Analyte	Result	LQ	Units	Field ID	Analyte	Result	LQ	Units
51SB10A	antimony	0.6	BN	mg/kg	51SB5A	sodium	83.2	B	mg/kg
51SB10A	cadmium	0.12	B	mg/kg	51SB5A	thallium	1.4	B	mg/kg
51SB10A	selenium	0.39	B	mg/kg	51SB5A	acetone	110		µg/kg
51SB10A	sodium	84.5	B	mg/kg	51SB5B	antimony	4.2	BN	mg/kg
51SB10A	acetone	30		µg/kg	51SB5B	sodium	1020	B	mg/kg
51SB10A	di-n-butyl phthalate	130	J	µg/kg	51SB5B	thallium	5.8	B	mg/kg
51SB10A	naphthalene	14		µg/kg	51SB5B	acetone	67		µg/kg
51SB10B	antimony	0.67	BN	mg/kg	51SB5B	methylene chloride	8.5	JB	µg/kg
51SB10B	calcium	88.4	B	mg/kg	51SB5B	toluene	2900		µg/kg
51SB10B	sodium	163	B	mg/kg	51SB5C	antimony	0.8	BN	mg/kg
51SB10B	acetone	13	B	µg/kg	51SB5C	cadmium	0.04	B	mg/kg
51SB10B	methylene chloride	2.6	JB	µg/kg	51SB5C	calcium	37.3	B	mg/kg
51SB10B	toluene	1.4	J	µg/kg	51SB5C	sodium	292		mg/kg
51SB10B	di-n-butyl phthalate	81	J	µg/kg	51SB5C	zinc	15.3		mg/kg
51SB10C	antimony	0.52	BN	mg/kg	51SB5C	acetone	15		µg/kg
51SB10C	copper	2.1	E	mg/kg	51SB5C	di-n-butyl phthalate	83	J	µg/kg
51SB10C	sodium	164	B	mg/kg	51SB5D	OCDD	5.2	BJ	ng/kg
51SB10C	thallium	0.56	B	mg/kg	51SB5D	antimony	0.8	BN	mg/kg
51SB10C	zinc	15.5		mg/kg	51SB5D	sodium	421		mg/kg
51SB11A	2,6-dinitrotoluene	0.47		mg/kg	51SB5D	thallium	1.3	B	mg/kg
51SB11A	cadmium	0.11	B	mg/kg	51SB5D	zinc	14.2		mg/kg
51SB11A	sodium	61.9	B	mg/kg	51SB5D	acetone	5.7	J	µg/kg
51SB11A	acetone	20		µg/kg	51SB5D	di-n-butyl phthalate	150	J	µg/kg
51SB11A	methylene chloride	2.4	JB	µg/kg	51SB6A	sodium	75.4	B	mg/kg
51SB11B	2,6-dinitrotoluene	1.1		mg/kg	51SB6A	thallium	0.83	B	mg/kg
51SB11B	arsenic	1.1	B	mg/kg	51SB6A	mercury	0.095		mg/kg
51SB11B	calcium	29.5	B	mg/kg	51SB6A	2-butanone	5.6	JB	µg/kg
51SB11B	sodium	111	B	mg/kg	51SB6A	acetone	54		µg/kg
51SB11B	acetone	5.5	J	ug/kg	51SB6A	methylene chloride	1.4	JB	µg/kg
51SB11B	methylene chloride	3.2	JB	ug/kg	51SB6A	styrene	2.9	JB	µg/kg
51SB11C	2,6-dinitrotoluene	1.2		mg/kg	51SB6B	sodium	409	B	mg/kg
51SB11C	sodium	115	B	mg/kg	51SB6B	thallium	6.3	B	mg/kg
51SB11C	methylene chloride	2.3	JB	µg/kg	51SB6B	di-n-butyl phthalate	6800	J	µg/kg
51SB1A	cadmium	0.13	B	mg/kg	51SB6C	1,2,3,4,6,7,8-HPCDD	3.5	J	ng/kg

Table A-6 (Continued)
B-Qualified Data Summary

Field ID	Analyte	Result	LQ	Units	Field ID	Analyte	Result	LQ	Units
51SB1A	calcium	157		mg/kg	51SB6C	total HPCDD	6.5	J	ng/kg
51SB1A	sodium	75.4	B	mg/kg	51SB6C	sodium	81.9	B	mg/kg
51SB1A	acetone	17	B	µg/kg	51SB6C	mercury	0.036		mg/kg
51SB1A	methylene chloride	1.1	JB	µg/kg	51SB6C	2-butanone	9.4	JB	µg/kg
51SB1B	cadmium	0.088	B	mg/kg	51SB6C	acetone	12		µg/kg
51SB1B	calcium	34.6	B	mg/kg	51SB6C	methylene chloride	2	JB	µg/kg
51SB1B	sodium	78	B	mg/kg	51SB6C	styrene	2.6	JB	µg/kg
51SB1B	acetone	14	B	µg/kg	51SB6D	OCDD	38	A	ng/kg
51SB1B	methylene chloride	1.6	JB	µg/kg	51SB6D	sodium	563		mg/kg
51SB1C	copper	1.3		mg/kg	51SB6D	2-butanone	6.9	JB	ug/kg
51SB1C	sodium	84.7	B	mg/kg	51SB6D	acetone	7.1	J	µg/kg
51SB1C	acetone	6.3	JB	µg/kg	51SB6D	methylene chloride	1.9	JB	µg/kg
51SB2A	2,6-dinitrotoluene	0.29		mg/kg	51SB6D	styrene	2.3	JB	µg/kg
51SB2A	antimony	0.68	BN	mg/kg	51SB7A	selenium	0.33	B	mg/kg
51SB2A	cadmium	0.07	B	mg/kg	51SB7A	sodium	82.7	B	mg/kg
51SB2A	calcium	295		mg/kg	51SB7A	mercury	0.14		mg/kg
51SB2A	sodium	74.8	B	mg/kg	51SB7A	2-butanone	5.6	JB	µg/kg
51SB2A	thallium	0.78	B	mg/kg	51SB7A	acetone	16		µg/kg
51SB2A	acetone	110	B	µg/kg	51SB7A	methylene chloride	1.7	JB	µg/kg
51SB2A	methylene chloride	3.2	JB	µg/kg	51SB7A	styrene	2.7	JB	µg/kg
51SB2B	2,6-dinitrotoluene	6000		mg/kg	51SB7B	sodium	103	B	mg/kg
51SB2B	antimony	6	BN	mg/kg	51SB7B	mercury	0.053		mg/kg
51SB2B	selenium	1.9	B	mg/kg	51SB7B	2-butanone	8.8	JB	µg/kg
51SB2B	thallium	11.7	B	mg/kg	51SB7B	acetone	12		µg/kg
51SB2B	acetone	62	B	µg/kg	51SB7B	methylene chloride	1.5	JB	µg/kg
51SB2B	benzene	6.6	J	µg/kg	51SB7B	styrene	3.1	JB	µg/kg
51SB2B	methylene chloride	14	JB	µg/kg	51SB7C	sodium	72.4	B	mg/kg
51SB2B	bis(2-ethylhexyl) phthalate	27000	J	µg/kg	51SB7C	methylene chloride	1.6	JB	µg/kg
51SB2C	antimony	0.47	BN	mg/kg	51SB7C	styrene	2.3	JB	µg/kg
51SB2C	arsenic	1.2	B	mg/kg	51SB8A	antimony	0.68	BN	mg/kg
51SB2C	cadmium	0.13	B	mg/kg	51SB8A	selenium	0.25	B	mg/kg
51SB2C	calcium	108		mg/kg	51SB8A	sodium	69.8	B	mg/kg
51SB2C	selenium	0.17	B	mg/kg	51SB8A	mercury	0.039		mg/kg
51SB2C	sodium	326		mg/kg	51SB8A	acetone	81		µg/kg
51SB2C	acetone	23	B	µg/kg	51SB8A	methylene chloride	2.5	JB	µg/kg
51SB2C	m,p-xylenes	5.5	J	µg/kg	51SB8B	antimony	0.88	BN	mg/kg
51SB2C	methylene chloride	4.9	JB	µg/kg	51SB8B	calcium	32.2	B	mg/kg
51SB2C	o-xylene	2.7	J	µg/kg	51SB8B	selenium	0.17	B	mg/kg
51SB2D	antimony	0.82	BN	mg/kg	51SB8B	sodium	135	B	mg/kg
51SB2D	arsenic	1.4	B	mg/kg	51SB8B	acetone	6.8	J	µg/kg
51SB2D	copper	1.2		mg/kg	51SB8B	methylene chloride	2.1	JB	µg/kg
51SB2D	thallium	0.6	B	mg/kg	51SB8C	sodium	777		mg/kg

Table A-6 (Continued)
B-Qualified Data Summary

Field ID	Analyte	Result	LQ	Units	Field ID	Analyte	Result	LQ	Units
51SB2D	acetone	15	B	µg/kg	51SB8C	thallium	2.2	B	mg/kg
51SB2D	methylene chloride	4.1	JB	µg/kg	51SB8C	acetone	21		µg/kg
51SB3A	2,6-dinitrotoluene	0.44		mg/kg	51SB8C	methylene chloride	2.4	JB	ug/kg
51SB3A	sodium	81.7	B	mg/kg	51SB9A	2,6-dinitrotoluene	0.31		mg/kg
51SB3A	acetone	40		µg/kg	51SB9A	antimony	0.55	BN	mg/kg
51SB3A	methylene chloride	2.8	JB	µg/kg	51SB9A	cadmium	0.099	B	mg/kg
51SB3B	sodium	1180		mg/kg	51SB9A	selenium	0.28	B	mg/kg
51SB3B	acetone	93		µg/kg	51SB9A	sodium	66.2	B	mg/kg
51SB3B	methylene chloride	16	JB	µg/kg	51SB9A	acetone	14	B	µg/kg
51SB3C	arsenic	1	B	mg/kg	51SB9A	methylene chloride	3.4	JB	µg/kg
51SB3C	sodium	192	B	mg/kg	51SB9B	2,6-dinitrotoluene	0.22		mg/kg
51SB3C	2-butanone	8.3	J	µg/kg	51SB9B	antimony	0.76	BN	mg/kg
51SB3C	acetone	25		µg/kg	51SB9B	arsenic	1.4	B	mg/kg
51SB3C	benzene	2.7	J	µg/kg	51SB9B	cadmium	0.062	B	mg/kg
51SB3C	methylene chloride	2.9	JB	µg/kg	51SB9B	calcium	24.8	B	mg/kg
51SB3C	bis(2-ethylhexyl) phthalate	760		µg/kg	51SB9B	sodium	113	B	mg/kg
51SB3C	di-n-butyl phthalate	200	J	µg/kg	51SB9B	acetone	5.3	JB	µg/kg
51SB3D	ocdd	2.2	BJ	ng/kg	51SB9B	methylene chloride	4.3	JB	µg/kg
51SB3D	arsenic	1.2	B	mg/kg	51SB9C	2,6-dinitrotoluene	0.34		mg/kg
51SB3D	lead	1.4		mg/kg	51SB9C	arsenic	2.2		mg/kg
51SB3D	thallium	1.5	B	mg/kg	51SB9C	sodium	194	B	mg/kg
51SB3D	acetone	9.6	J	µg/kg	51SB9C	thallium	1.1	B	mg/kg
51SB3D	methylene chloride	2.8	JB	µg/kg	51SB9C	acetone	6.5	JB	µg/kg
51SB4A	antimony	0.82	BN	mg/kg	51SB9C	methylene chloride	4.2	JB	µg/kg
51SB4A	selenium	0.27	B	mg/kg	TMSB1A	cadmium	0.13	B	mg/kg
51SB4A	sodium	76	B	mg/kg	TMSB1A	calcium	140		mg/kg
51SB4A	thallium	0.63	B	mg/kg	TMSB1A	sodium	70.1	B	mg/kg
51SB4A	acetone	61		µg/kg	TMSB1A	acetone	18	B	µg/kg
51SB4B	antimony	4.3	BN	mg/kg	TMSB1A	methylene chloride	1.2	JB	µg/kg
51SB4B	cadmium	0.7	B	mg/kg	TMSB5D	1,2,3,4,6,7,8-HPCDD	2.1	J	ng/kg
51SB4B	sodium	3060		mg/kg	TMSB5D	OCDD	20		ng/kg
51SB4B	thallium	9.9	B	mg/kg	TMSB5D	total HPCDD	3.4	J	ng/kg
51SB4B	zinc	90		mg/kg	TMSB5D	antimony	0.66	BN	mg/kg
51SB4B	acetone	98		µg/kg	TMSB5D	sodium	525		mg/kg
51SB4B	methylene chloride	8.8	JB	µg/kg	TMSB5D	zinc	16.2		mg/kg
51SB4B	trichloroethene	19		µg/kg	TMSB8A	antimony	0.64	BN	mg/kg
51SB4C	sodium	466		mg/kg	TMSB8A	selenium	0.19	B	mg/kg
51SB4C	acetone	60	B	µg/kg	TMSB8A	sodium	75.1	B	mg/kg
51SB4C	toluene	3	J	µg/kg	TMSB8A	thallium	0.56	B	mg/kg
51SB4D	1,2,3,4,6,7,8-HPCDD	1.7	J	ng/kg	TMSB8A	mercury	0.024	B	mg/kg

Table A-6 (Continued)
B-Qualified Data Summary

Field ID	Analyte	Result	LQ	Units	Field ID	Analyte	Result	LQ	Units
51SB4D	OCDD	15		ng/kg	TMSB8A	acetone	78		µg/kg
51SB4D	total HPCDD	2.9	J	ng/kg	TMSB8A	methylene chloride	3.4	JB	µg/kg
51SB4D	antimony	0.53	BN	mg/kg	TMSB9B	2,6-dinitrotoluene	1.4		mg/kg
51SB4D	copper	0.59	BE	mg/kg	TMSB9B	arsenic	1.3	B	mg/kg
51SB4D	lead	0.82	B*	mg/kg	TMSB9B	calcium	22.5	B	mg/kg
51SB4D	sodium	442		mg/kg	TMSB9B	sodium	115	B	mg/kg
51SB4D	acetone	7.5	J	µg/kg	TMSB9B	thallium	0.71	B	mg/kg
51SB5A	antimony	0.55	BN	mg/kg	TMSB9B	acetone	5	JB	µg/kg
51SB5A	calcium	364		mg/kg	TMSB9B	methylene chloride	4.1	JB	µg/kg
51SB5A	selenium	0.44	B	mg/kg					

A (Dioxins) = MDL was based upon the signal-to-noise measurement.
B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.
B (Organics & Dioxins) = Analyte or compound has been detected in the sample and laboratory method blank.
E (Metals) = Reported value was estimated because of the presence of interferences.
J (All) = Indicates an estimated value for estimating a concentration <MRL and ≥ MDL.
N (Metals) = Laboratory spike sample recovery not within control limits.
* (Metals) = Laboratory duplicate analysis not within control limits.

the potential for cross-contamination. Rinse blanks were analyzed for the analytes of concern for the RFI. In accordance with USEPA Region III data validation guidelines, the detected concentration in the sample was qualified "B" for blank contamination and was considered non-detect if the sample concentration was within five times (10 times for common laboratory contaminants such as acetone, 2-butanone, methylene chloride, OCDD, OCDF, and phthalate esters) the concentration in the associated equipment blank. Rinse blanks are aqueous samples and were reported in µg/L or mg/L units. Performing blank assessments for solid matrix samples, action levels were calculated and expressed in soil units µg/kg or mg/kg from the given aqueous rinse blank concentrations to be compared against actual solid sample concentrations. This conversion is dependent upon the method performed, sample amounts used, and final digestate or extract volumes used during the analytical analysis. Action levels were based upon 100% solids and 1x dilution factor and adjusted for each sample as appropriate.

- **Rinse Blank Analysis:** Soil rinse blanks included samples 040204R and 040704R. These rinse blanks were taken from the stainless steel bowl and trowel and macro core cutting shoe used to collect the field soil samples. Rinse blank 040204R applies to samples collected 30 March 2004 through 01April 2004 and was collected for the parameters of interest. Rinse blank 040704R applies to samples collected 05 April 2004 through 07 April 2004 and was collected for the parameters of interest except, pesticides and herbicides. Pesticides and herbicides were evaluated for soil samples using rinse blank 040204R. For rinse blank 040204R, analytes were non-detect for each parameter and/or compound except for 2-butanone, acetone, benzene, ethylbenzene, m,p-xylenes, o-xylene, toluene, di-n-butyl phthalate, naphthalene, 1,2,3,4,6,7,8-HPCDD, OCDD, total HPCDD, aluminum, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, thallium, zinc, and mercury. For rinse blank 040704R, analytes were non-detect for each parameter and/or compound except for 2-butanone, acetone, benzene, ethylbenzene, m,p-xylenes, o-xylene, toluene, naphthalene, di-n-butyl phthalate, 2,4-dinitrotoluene, 2,6-dinitrotoluene, benzoic acid,

bis(2-ethylhexyl) phthalate, diethyl phthalate, phenol, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, and zinc.

Select samples were qualified "B" as applicable and were considered non-detect at the MRL or level of contamination, whichever was greater. While these parameters were qualified "B" due to the blank contamination, the data was still considered useable, the accuracy data quality goal was met, and the qualified data did not impact the data quality for the RFI. A discussion of the blank results is provided within each validation report (located in **Appendix A-3**). **Table A-6** indicates those data that are "B" flagged due to blank contamination and should be considered non-detect. Those compounds that were detected in both the blanks and the associated samples below the USEPA III guidance blank action levels are listed.

Trip Blanks: Trip blanks were prepared by the project contract laboratory and accompanied the aqueous samples requiring VOC analysis. For the SWMU 51 RFI, trip blanks were not required for the soil samples but were collected with the associated rinse blank samples. One trip blank was transported with each aqueous VOC sample cooler to the laboratory for each day of sampling. The trip blanks were prepared by pouring the required volume of de-ionized, organic-free water into appropriate sample containers in the laboratory. The trip blanks were analyzed for the TCL VOCs. The trip blank results were used to assess the potential incidental contamination due to sample transport before, during, and after field operations (i.e., exposure to air) and/or contamination due to the sample container. In accordance with USEPA Region III data validation guidelines, the detected concentration in the sample was considered a "non-detect" (i.e., qualified "B" for blank contamination) and was excluded from consideration if the sample concentration was within five times (10 times for common laboratory contaminants such as acetone, 2-butanone, methylene chloride) the concentration in the associated trip blank. Trip blanks were assessed with each associated rinse blank. Trip blanks are aqueous samples and were reported in µg/L units. Performing blank assessments for solid matrix samples, action levels were calculated and expressed in soil units µg/kg from the given aqueous rinse blank VOC concentrations to be compared against actual solid sample concentrations. This conversion is dependent upon the method performed, sample amounts used, and final volumes used during the analytical analysis. Action levels were based upon 100% solids and 1x dilution factor and adjusted for each sample as appropriate.

- **Trip Blank Analysis:** Trip blanks analyzed for TCL VOCs included samples 040204T and 040704T. Trip blank 040204T applies to rinse blank 040204R and trip blank 040704T applies to rinse blank 040704T. For trip blank 040204T, analytes were non-detect for each parameter and/or compound except for 1,1,1-trichloroethane, acetone, methylene chloride, and trichloroethene. For trip blank 040704T, analytes were non-detect for each parameter and/or compound except for acetone, methylene chloride, and 2-butanone.

  Select samples were qualified "B" as applicable and were considered non-detect at the MRL or level of contamination, whichever was greater. While these parameters were qualified "B" due to the blank contamination, the data was still considered useable, the accuracy data quality goal was met, and the qualified data did not impact the data quality for the RFI. A discussion of the blank results is provided within each validation report (located in **Appendix A-3**). **Table A-6** indicates those data that are "B" flagged due to

blank contamination and should be considered non-detect. Those compounds that were detected in both the blanks and the associated samples below the USEPA III guidance blank action levels are listed.

Laboratory control samples: The LCSs were analyzed to assess general method performance by the ability of the laboratory to successfully recover the target analytes from a control matrix. The LCS is similar in composition to the method blank. For aqueous analyses, spiked analyte-free reagent water was used. For soil analyses, a purified solid matrix (e.g., sand, sodium sulfate, or other purified solid) was used. The LCSs were spiked with single-component target analytes before it is carried through the preparation, cleanup, and determinative procedures. LCSs were performed at a rate of one per preparation batch per matrix. When samples were not subjected to a separate preparatory procedure (i.e., purge and trap VOC analyses, or aqueous Hg analysis), the CCV may have been used as the LCS, provided the CCV acceptance limits were used for evaluation.

- **Laboratory Control Sample Analysis:** The results of the LCS were evaluated, in conjunction with other QC information during the data validation process to ascertain the acceptability of the data generated for that batch of samples. For LCS samples, USACE Shell sporadic marginal failure (SMF) criteria limits were used for each method in the validation process. This approach broadens the assessment of LCSs to take into account the random account of percent recoveries just outside established limits and to assert if data qualification is warranted. The number of SMF allowances is proportional to the number of analytes measured. More SMF allowances are made for a higher number of spiked compounds. LCS were within specified criteria for each parameter and/or compound except for 2-butanone, 2-hexanone, 4-methyl-2-pentanone, acetone, bromomethane, 1,1-dichloroethene, trans-1,2-dichloroethene, carbon disulfide, dibenz(a,h)anthracene, benzo(k)fluoranthene, 1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, HMX, tetryl, 4-amino-2,6-dinitrotoluene, delta-BHC, and 2,4-D for select SDGs. Data qualifiers were applied as appropriate to associated samples based upon these outliers. Further details may be found in the data validation reports located on a CD at the back of this report. While qualification was applied due to high or low LCS recoveries, the data was still considered useable, the accuracy data quality goal was met, and the qualified data did not impact the data quality for the RFI.

Matrix spikes: The MS was used to assess the performance of the method as applied to a particular project matrix. A MS is an environmental sample to which known concentrations of certain target analytes have been added before sample manipulation from the preparation, cleanup, and determinative procedures have been implemented. The original field sample was mixed or shaken to ensure homogeneous fractions when allowed by the method. MSs were performed at a rate of one per preparation batch or 5% whichever was more frequent per matrix. The results of the MS are evaluated, in conjunction with other QC information during the validation process to assess the effect of the matrix on the bias of the analysis.

- **Matrix Spike and Matrix Spike Duplicate Analysis:** The results of the MS/MSD were evaluated, in conjunction with other QC information during the data validation process to ascertain the acceptability of the data generated for that batch of samples. For MS/MSD samples, USACE Shell SMF criteria limits were used for each method in the validation process. This approach broadens the assessment of MS/MSDs to take into account the random account of percent recoveries just outside established limits and to assert if data

qualification is warranted. The number of SMF allowances is proportional to the number of analytes measured. More SMF allowances are made for a higher number of spiked compounds. Matrix spikes and matrix spike duplicates were within specified criteria for each parameter and/or compound except for 2-butanone, 2-hexanone, acetone, benzene, dibromochloromethane, trans-1,3-dichloropropene, chlorobenzene, chloromethane, ethylbenzene, styrene, tetrachloroethylene, toluene, trichloroethene, m,p-xylenes, 2,4-dinitrotoluene, 4-nitrophenol, phenol, benzo(g,h,i)perylene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene; acenaphthene, acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, naphthalene, RDX, 4-amino-2,6-dinitrotoluene, 2,6-dinitrotoluene, 3-nitrotoluene, 2-nitrotoluene, 4-nitrotoluene, 4,4-DDD, 4,4-DDE, 4,4-DDT, aldrin, alpha-BHC, alpha-chlordane, beta-BHC, delta-BHC, endosulfan I, endosulfan II, endosulfan sulfate, gamma-BHC, gamma-chlordane, heptachlor epoxide, methoxychlor, dinoseb, OCDD, aluminum, antimony, iron, barium, chromium, magnesium, manganese, potassium, and vanadium for select SDGs. The spiked samples were qualified as applicable to USEPA Region III guidance. In some cases, the sample amount was greater than the amount spiked, therefore no qualifiers were required. Further details may be found in the data validation reports located in **Appendix A-3**. While qualification was applied due to high or low MS or MSD recoveries in some cases, the data was still considered useable, the accuracy data quality goal was met, and the qualified data did not impact the data quality for the RFI.

Completeness: Completeness is a measure of the amount of information that must be collected during the field investigation to allow for successful achievement of the objectives. An adequate amount and type of data must be collected for conclusions to be valid. Missing data may reduce the precision of estimates or introduce bias, thus lowering the confidence level of the conclusions. While completeness has been historically presented as a percentage of the data that is considered usable, this does not take into account critical sample locations or critical analytical parameters.

The amount and type of data that may be lost due to sampling or analytical error cannot be predicted or evaluated in advance. The importance of lost or suspect data will be evaluated in terms of the sample location, analytical parameter, nature of the problem, decision to be made, and the consequence of an erroneous decision. Critical locations or parameters for which data is found to be inadequate will either be re-sampled and re-analyzed or the data will be appropriately qualified based on the decision of the project QA manager. The completeness goal percentage of usable data is set at 98±2%.

Sampling completeness was assessed through evaluation of the total number of samples proposed for collection in the work plan versus the actual number of samples collected and analyzed. Analytical completeness was assessed by comparing the number of useable data points collected to the total number of data points generated. Completeness is calculated using the following equations:

$$\%\,\text{Sampling Completeness} = \frac{\text{No. of actual samples collected}}{\text{No. of proposed samples}}$$

$$\% \text{ Analytical Completeness} = \frac{\text{No. of usable data}}{\text{No. of requested analyses}}$$

For the purposes of this report, unusable data are defined to include rejected data points ("R" qualifier).

- **Completeness Analysis:** Eleven surface soil samples, twenty-seven subsurface soil samples, four field duplicate soil samples (two surface and two subsurface), four geotechnical soil samples (one surface and three subsurface), three IDM samples (one aqueous and two solid), three trip blanks, and three rinse blanks were proposed for collection at SWMU 51 as specified in MWP Addendum 017 (Shaw, 2004a). The field duplicates and rinse blanks were collected on a site-wide basis. The only modification was that only two rinse and trip blanks were required instead of the proposed three. Soil and rinse blank samples were collected and analyzed for the parameters specified in the Work Plan. The resulting sampling completeness quotient is 96.4% including proposed QC samples, however is 100% for environmental samples and meets the pre-defined goals of 98±2% for the sampling program.

  The overall analytical percent completeness was assessed by parameter group for the soil samples collected. Analysis of the soil samples resulted in the generation of 6,728 out of 6,759 data points deemed to be useable, generating an overall analytical completeness quotient of 99.5%. The un-useable data resulted from compound 2-butanone having poor calibration responses causing the majority of the non-detect samples to be qualified "R". The analytical percent completeness for VOCs resulted in the generation of 1,439 out of 1,470 data points deemed to be useable, generating an overall analytical completeness quotient of 97.9%. The completeness percentages met the pre-defined goal of 98±2% for the soil sampling events and did not impact the overall RFI.

Representativeness: Representativeness is a measure of the degree to which the measured results accurately reflect the medium being sampled. It is a qualitative parameter that is addressed through the proper design of the sampling program in terms of sample location, number of samples, and actual material collected as a "sample" of the whole.

Sampling protocols were developed to assure that samples collected are representative of the media. Field handling protocols (e.g., storage, handling in the field, and shipping) were designed to protect the representativeness of the collected samples. Proper field documentation and QC inspections were used to establish that protocols were followed and that sample identification and integrity was maintained and met pre-defined goals.

Comparability: Comparability is the confidence with which one data set can be compared to another. Comparability was controlled through the use of SOPs that have been developed to standardize the collection of measurements and samples and approved analytical technique with defined QC criteria. USEPA-approved methodologies were used in providing laboratory analytical support for this project. Laboratory SOPs were developed from these methods. Consistent and proper calibration of equipment throughout the field exercises, as described in the MQAP and QAPA, will assist in the comparability of measurements. Field documentation and QA audits were used to establish that protocols for sampling and measurement follow appropriate SOPs and met pre-defined goals.

Sensitivity (quantitation, reporting, and detection limits): The term sensitivity is used broadly to describe the method detection, quantitation, and reporting limits established to meet project-specific data quality objectives; and not limited to the definition which describes the capability of a method or instrument to discriminate between measurement responses. The method detection limits (MDLs) and the practical quantitation limits (PQLs) published within USEPA methods are based upon a reagent water matrix, and are not necessarily reflective of typical sample matrices; therefore, care was taken in establishing limits for laboratory analysis. Methods were selected based upon their sensitivity, technological, and economical considerations while keeping the screening values and available methodology in mind and were sufficient in meeting the given levels of concern (LOCs).

The laboratory generated MQLs and MDLs were compared at the onset of the project. The MDL is the minimum concentration of an analyte that can be measured and reported with a 99% confidence that the analyte is above zero and is identified from the analysis of a sample in a given matrix containing the analyte. The MDLs were derived by the method based upon 40 CFR Chapter 136 Appendix B. The MDL established using this procedure was used to assess the importance of the measurement of a future sample. The laboratory has statistically derived MDLs below the MQLs. The MDL values differ and change periodically because each MDL is laboratory, instrument, analyst, matrix, and method specific. Therefore, the more conservative MDLs were reported. The MQLs are the values at which the laboratory has demonstrated the ability to reliably quantitate the target value of an analyte for the method performed. MQLs are based upon the lowest calibration standard used for the initial calibration curve or the lowest verification standard performed and must be at least 3 times the MDL.

The laboratory used a method reporting limit (MRL) to report non-detects for each sample. The MRL is the USACE term for sample quantitation limit (USACE, 2001). The reporting limit is the threshold value below which the laboratory reports non-detected values as “U,” “ND,” or “<” and will vary for each sample based upon dilution, sample volumes, percent moistures (for solids), and the method performed.

Data is calculated over a linear range. The highest concentration of the standards is truncated until linearity is achieved (minimum of three concentration levels must remain). The resulting highest concentration within the linear range represents the upper quantitation limit. Each target compound for every sample was reported at a specific level. The target analytes detected above the MDL, but less than the MRL or 3 times the MDL (whichever was greater), were reported as estimated values “J”. Target analytes detected above the upper calibration standard were diluted and analyzed within established calibration windows. The units used for aqueous samples were µg/L or mg/L and for solid samples were mg/kg, µg/kg, or ng/kg.

- **SWMU 51 Sensitivity Analysis:** The method sensitivities (i.e., MDLs) were compared to the levels of concern for the samples collected. Comparing against the soil screening transfer levels (SSLs), compounds 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,2-dichloroethane, 1,2-dichloropropane, benzene, bromodichloromethane, carbon tetrachloride, chloroform, dibromochloromethane, tetrachloroethene, trans-1,3-dichloropropene, trichloroethene, vinyl chloride, naphthalene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2,6-dinitrotoluene, 2-methylnaphthalene, 3,3'-dichlorobenzidine, 4-chloroaniline, 4-nitrophenol, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-chloroethyl)ether, bis(2-chloroisopropyl)ether, carbazole, dibenz(a,h)anthracene, dibenzofuran, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, isophorone, naphthalene, nitrobenzene, n-nitrosodi-n-propylamine, n-nitrosodiphenylamine, 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, nitrobenzene, arsenic, and thallium had MDLS greater than the given SSLs for select samples. The samples had higher sensitivities due to required sample dilutions, sample volume adjustments, and/or moisture factors due to either high analyte concentration and/or matrix interferences. Though an uncertainty may be present with these sensitivity gaps between the SSLs to the MDLs for these compounds, it is unlikely that they present an impact to the decisions regarding the RFI.

  Comparing against the residential RBCs, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 3,3'-dichlorobenzidine, 3-nitroaniline, 4,6-dinitro-2-methylphenol, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-chloroethyl)ether, bis(2-chloroisopropyl)ether, dibenz(a,h)anthracene, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclopentadiene, indeno(1,2,3-cd)pyrene, nitrobenzene, n-nitrosodi-n-propylamine, pentachlorophenol, pyridine, PCB-1016, PCB-1232, PCB-1242, PCB-1248, PCB-1254, PCB-1260, 1,3-dinitrobenzene, 2,4,6-trinitrotoluene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 4-amino-2,6-dinitrotoluene, 4-nitrotoluene, nitrobenzene, RDX, tetryl, nitroglycerine, antimony, arsenic, and thallium had MDLs greater than the given residential RBCs for select samples. The samples had higher sensitivities due to required sample dilutions, sample volume adjustments, and/or moisture factors due to either high analyte concentration and/or matrix interferences. Though an uncertainty may be present with these sensitivity gaps between the residential RBCs to the MDLs for these compounds, it is unlikely that they present an impact to the decisions regarding the RFI.

  Comparing against the industrial RBCs, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 3,3'-dichlorobenzidine, 4,6-dinitro-2-methylphenol, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-chloroethyl)ether, dibenz(a,h)anthracene, hexachlorobenzene, indeno(1,2,3-cd)pyrene, n-nitrosodi-n-propylamine, pentachlorophenol, PCB-1016, PCB-1232, PCB-1242, PCB-1248, PCB-1254, PCB-1260, 2,4,6-trinitrotoluene, 2-nitrotoluene, 4-amino-2,6-dinitrotoluene, RDX, and nitroglycerine had MDLs greater than the given industrial RBCs for select samples. The samples had higher sensitivities due to required sample dilutions, sample volume adjustments, and/or moisture factors due to either high analyte concentration and/or matrix interferences. Though an uncertainty may be present with these sensitivity gaps between the industrial RBCs to the MDLs for these compounds, it is unlikely that they present an impact to the decisions regarding the RFI.

Comparing against site-wide metals background concentrations, thallium had a MDL greater than the given industrial RBC for select samples. The samples had higher sensitivities due to required sample dilutions, sample volume adjustments, and/or moisture factors due to either high analyte concentration and/or matrix interferences. Though an uncertainty may be present with these sensitivity gaps between the SSLs, background concentrations, and RBCs to the MDLs for these compounds, it is unlikely that they present an impact to the decisions regarding the RFI.

Levels of Concern

An integral part of the identification of DQOs is the establishment of LOCs. These levels were compared with analytical method reporting limits prior to analytical method selection to ensure the method was capable of addressing project DQOs, preclude occurrence of false negative issues, and assess best available technology limitations. Although LOCs selected as potential concerns may not necessarily reflect RFI-specific objectives, they were developed to ensure that the chosen analytical methods have detection limits sensitive enough to achieve compliance with appropriate site-specific screening levels or other specified criteria for soil. The laboratory MDLs were sufficient to meet (i.e., below) the LOCs for the SWMU 51 RFI. LOCs for SWMU 51 are based on soil applicable or relevant and appropriate requirements (ARARs) and To-Be-Considered Guidance (TBG). The soil TBC guidance includes:

- Facility-Wide Background inorganic concentrations (IT, 2001);
- USEPA Region III risk based concentrations (October, 2007); and,
- USEPA Drinking Water Standards and Health Advisories (August, 2006).

Appendix A-3

Validation Reports and Form Is

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant Data Validation – Dioxin Furans
Pace Laboratories, Inc. SDG 04-1087018 (GPL SDG 403225)

DATE: June 3, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on March 30, 2004. The sample was analyzed for Dioxin Furan compounds using USEPA SW-846 Method 8290 High Resolution Gas Chromatography/High Resolution Mass Spectroscopy (HRGC/HRMS). A total of four soil samples were validated in this SDG. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB6A	403225-001	51SB6C	403225-003
51SB6B	403225-002	51SB6D	403225-004

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *USEPA Region III Dioxin/Furan Data Validation Guidance* (March, 1999). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
X		Blank Analysis
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
	X	Internal Standards
	X	Cleanup Standards
	X	Laboratory Control Standard/Ongoing Precision Result
	X	Matrix Spike and Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/3/04
Date

RADFORD ARMY AMMUNITION PLANT VALIDATION REPORT
DIOXIN FURAN REVIEW
SDG 04-1087018 (GPL SDG 403225)

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For dioxin furan compounds in cooled @4°C ± 2°C soil samples, the maximum holding time is 30 days from sample collection to preparative extraction and 45 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 03/30/04, coolers were received by GPL Laboratories, Inc. at 3.0°C. The samples were then sent on to Pace Analytical for dioxin furan analysis and were received by the Pace Laboratories, Inc. at 2.7°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 03/30/04, extracted on 04/08/04, and analyzed for dioxin furans on 04/14/04 and 04/15/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory (or field) blank analyses is to determine the existence and magnitude of contamination problems resulting from field and laboratory activities. No contamination should be found in any of the blanks > MDL. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 50). Rinse blank 040204R applies to these samples and was analyzed in GPL SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. ng/kg	Action Level ng/kg	B qualified samples
04/13/04	Blank-4657	OCDD	1.1J	11.0	None
04/16/04	040204R	1,2,3,4,6,7,8-HpCDD	0.900J	4.50	51SB6C
04/16/04	040204R	OCDD	4.75J	47.5	51SB6D
04/16/04	040204R	Total HpCDD	0.900J	4.50	51SB6C

III-Instrument Performance Check

Instrument must be tuned with perfluorokerosene (PFK) to achieve a static resolving power of at least 10,000 (10% valley). Documentation of the mass spectrometer resolving power is accomplished by recording the peak profile of the high-mass reference signal (typically m/z 330.9792) obtained during a peak examination by using the low-mass PFK ion at m/z 292.9825 or lower in mass as reference. At the beginning of the each 12-hour period, the chromatographic resolution is verified in the same fashion as in the initial calibration through the analysis of HRCC solution on the DB-5 (or equivalent) column or through the analysis of the column performance solution on the SP-2331 or SP-225 (or equivalent) column. A 25% valley must be achieved between the close eluters.

- All PFK forms were verified and found to be in compliance with method specification. No qualifiers were applied.

IV-Initial Calibration
Once the window defining mix has been analyzed and the descriptor switching times have been verified, the five point calibration solutions can be analyzed prior to sample analysis. Initial calibration criteria are as follows:

- The percent relative standard deviations for the mean response factors RRF(n) from the 17 unlabeled standards must not exceed ±20%, and those for the labeled reference compounds must not exceed ±30%
- Isotopic ratio must be within the specified control limits in Table 8 (SW846 Method 8290).

- For initial calibration performed on 04/06/04 for all target compounds on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6B (403225-002), 51SB6C (403225-003), and 51SB6D (403225-004) apply to this initial calibration.

V-Continuing Calibration
The continuing calibration consists of two parts: evaluation of the mass resolution and retention time check. The following stipulates the continuing calibration criteria.

- The signal signal-to-noise ratio (S/N) must be at least 10:1 for each selected ion current profile (SICP) and for each GC signal representing the elution of a target analyte or labeled standard for each analyte.
- The relative response factor of each analyte for the unlabeled standard must be within ±20% of the average RF obtained from the initial calibration, and the RRF of each labeled standard must be within ±30% of the average RRF established during initial calibration. This is expressed in term of percent difference %D.

- For continuing calibration performed on 04/13/04 @11:05 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/13/04 @23:40 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Sample 51SB6A (403225-001) applies to this continuing calibration.

- For continuing calibration performed on 04/14/04 @11:30 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6B (403225-002), and 51SB6C (403225-003) apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @01:39 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB6B (403225-002), 51SB6C (403225-003), and 51SB6D (403225-004) apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @14:15 on instrument 10MSHR05, OCDF (26.1%) was outside criteria. No qualifiers were applied. Sample 51SB6D (403225-004) applies to this continuing calibration. OCDF was non-detect for sample 51SB6D (403225-004), therefore no qualifiers were applied based upon this outlier.

VI-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: Recoveries of the isotopically-labeled extraction standards to fall within the 40 to 135 percent range for the tetra- through octachlorinated congeners, or as stated in the data package

- All criteria were met. No qualifiers were applied.

VII-Cleanup Standards
Cleanup standards are added to every sample, blank, quality control sample, and calibration solution. This compound is added to the samples after extraction but prior to cleanup and is used to verify the percent recovery obtained using the isotope dilution technique. The control limits are 40-135%.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Standard (LCS) or Ongoing Precision Result (OPR)
LCSs/OPRs are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. Acceptable performance is determined by:

1. Recoveries of the isotopically-labeled extraction standards to fall within 40-135% control limits for the tetra- through octachlorinated congeners, or as stated in the data package;

2. Recoveries (accuracy) of the unlabeled compounds should be within $\pm$ 35% when spiked at the method quantitation limit and within $\pm$ 30% when spiked above 20 times the method quantitation limit, or as stated in the data package;

3. When duplicate OPR are required, the relative percent difference (RPD) of the unlabeled analytes concentrations should be within 30% when spiked at the method quantitation limit and within $\pm$ 25% when spiked above 20 times the method quantitation limit.

- Sample LCS-4658 was used as LCS. All criteria were met. No qualifiers were applied.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits (40-135%; 50%RPD).

- No MS/MSD was performed for this SDG.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed in this SDG.

XI-Quantitation Verification
The accuracy of analytical results was verified through the calculation of at least one the several parameters such as the %D, %RSD, % recovery, and/or compound concentration. Values were found to be within 10%. Any value reported by the laboratory as estimated "J" based on an analyte to internal standard ratio below the calibration curve was qualified as such. The signal signal-to-noise ratio (S/N) must be greater than 2.5 for each selected ion current profile (SICP) and for each GC signal representing the elution of a target analyte or labeled standard. For where the ion ratio failed the 25% criteria (I-lab flag), the estimated maximum possible concentration was reported and flagged estimated "J". For where any detected value had ether interference (E-lab flag), the estimated maximum possible concentration was reported and flagged estimated "J".

Sample: 51SB6A (403225-001), OCDD

A(x) = sum of the integrated ion abundances of the quantitation ions for the unlabeled ions;

A(is) = sum of the integrated ion abundances of the quantitation ions for the labeled ions;

Q(is) = quantity, in pg, of the internal standard added to the sample before extraction; Here need to multiply concentration (pg/uL) by final extract volume (uL).

W = weight, in g, of the sample (solid or organic liquid) as dry weight, or volume in mL of an aqueous sample; and

Avg. RRF(n) = calculated mean relative response factor for the unlabeled analyte.

$$\text{Conc. (ng/kg)} = \frac{(A(x))*Q(is)}{A(is)*W*Avg.RRF} = \frac{(1400000000+155000000)*(4.00)(1000)}{(107000000+121000000) * (12.47*0.8236) * 1.1323} =$$

= 4400 ng/kg

Reported Value = 4400 ng/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I Corr

Pace Analytical Services, In
1700 Elm Street - Suite 2(
Minneapolis, MN 554

Tel: 612-607-17(
Fax: 612- 607-64

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	403225-001-040-1/1		
Lab Sample ID	105493076		
Filename	F40413B_11		
Injected By	MRO		
Total Amount Extracted	12.5 g	Matrix	Solid
% Moisture	17.6	Dilution	NA
Dry Weight Extracted	10.3 g	Collected	03/30/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40413A_18 & F40413B_15	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/14/2004 08:46

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.190	2,3,7,8-TCDF-13C	2.00	99
Total TCDF	0.22 J	-----	0.190 J	2,3,7,8-TCDD-13C	2.00	98
				1,2,3,7,8-PeCDF-13C	2.00	98
2,3,7,8-TCDD	ND	-----	0.190	2,3,4,7,8-PeCDF-13C	2.00	98
Total TCDD	0.26 J	-----	0.190 J	1,2,3,7,8-PeCDD-13C	2.00	98
				1,2,3,4,7,8-HxCDF-13C	2.00	110
1,2,3,7,8-PeCDF	ND	-----	0.970	1,2,3,6,7,8-HxCDF-13C	2.00	101
2,3,4,7,8-PeCDF	ND	-----	0.970	2,3,4,6,7,8-HxCDF-13C	2.00	101
Total PeCDF	ND	-----	0.970	1,2,3,7,8,9-HxCDF-13C	2.00	106
				1,2,3,4,7,8-HxCDD-13C	2.00	105
1,2,3,7,8-PeCDD	ND	-----	0.970	1,2,3,6,7,8-HxCDD-13C	2.00	100
Total PeCDD	ND	-----	0.970	1,2,3,4,6,7,8-HpCDF-13C	2.00	96
				1,2,3,4,7,8,9-HpCDF-13C	2.00	92
1,2,3,4,7,8-HxCDF	ND	-----	0.970	1,2,3,4,6,7,8-HpCDD-13C	2.00	86
1,2,3,6,7,8-HxCDF	ND	-----	0.970	OCDD-13C	4.00	101
2,3,4,6,7,8-HxCDF	ND	-----	0.970			
1,2,3,7,8,9-HxCDF	ND	-----	0.970	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.970	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.970	2,3,7,8-TCDD-37Cl4	0.40	89
1,2,3,6,7,8-HxCDD	ND	-----	0.970			
1,2,3,7,8,9-HxCDD	ND	-----	0.970			
Total HxCDD	3.10 J	-----	0.970 J			
1,2,3,4,6,7,8-HpCDF	ND	-----	0.970	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.970	Equivalence: 4.7 ng/Kg		
Total HpCDF	ND	-----	0.970	(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	30.00	-----	0.970			
Total HpCDD	59.00	-----	0.970			
OCDF	2.30 J	-----	1.900 J			
OCDD	4400.00	-----	1.900			

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087018

REPORT OF LABORATORY ANALYSIS

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Form 1 Cover

Pace Analytical Services, Inc
1700 Elm Street - Suite 200
Minneapolis, MN 55414

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Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	403225-002-041-1/1		
Lab Sample ID	105493084		
Filename	F40414A_08		
Injected By	MRO		
Total Amount Extracted	17.8 g	Matrix	Solid
% Moisture	40.4	Dilution	NA
Dry Weight Extracted	10.6 g	Collected	03/30/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40413B_15 & F40414A_16	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/14/2004 19:02

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	82.0	-----	0.39	A	2,3,7,8-TCDF-13C	2.00	97
Total TCDF	390.0	-----	0.19		2,3,7,8-TCDD-13C	2.00	100
					1,2,3,7,8-PeCDF-13C	2.00	73
2,3,7,8-TCDD	-----	3.3 J	0.28	IA	2,3,4,7,8-PeCDF-13C	2.00	66
Total TCDD	8.9	-----	0.19		1,2,3,7,8-PeCDD-13C	2.00	74
					1,2,3,4,7,8-HxCDF-13C	2.00	133
1,2,3,7,8-PeCDF	-----	22.0 J	0.94	E	1,2,3,6,7,8-HxCDF-13C	2.00	107
2,3,4,7,8-PeCDF	-----	49.0 J	0.94	E	2,3,4,6,7,8-HxCDF-13C	2.00	94
Total PeCDF	400.0	-----	0.94		1,2,3,7,8,9-HxCDF-13C	2.00	90
					1,2,3,4,7,8-HxCDD-13C	2.00	126
1,2,3,7,8-PeCDD	27.0	-----	0.94		1,2,3,6,7,8-HxCDD-13C	2.00	102
Total PeCDD	100.0	-----	0.94		1,2,3,4,6,7,8-HpCDF-13C	2.00	81
					1,2,3,4,7,8,9-HpCDF-13C	2.00	64
1,2,3,4,7,8-HxCDF	-----	130.0 J	0.94	E	1,2,3,4,6,7,8-HpCDD-13C	2.00	70
1,2,3,6,7,8-HxCDF	41.0	-----	0.94		OCDD-13C	4.00	82
2,3,4,6,7,8-HxCDF	52.0	-----	0.94				
1,2,3,7,8,9-HxCDF	10.0	-----	0.94		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	1400.0	-----	0.94		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	46.0	-----	0.94		2,3,7,8-TCDD-37Cl4	0.40	82
1,2,3,6,7,8-HxCDD	120.0	-----	0.94				
1,2,3,7,8,9-HxCDD	86.0	-----	0.94				
Total HxCDD	780.0	-----	0.94				
1,2,3,4,6,7,8-HpCDF	970.0	-----	0.94		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	55.0	-----	1.30	A	Equivalence: 120 ng/Kg		
Total HpCDF	2900.0	-----	0.94		(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	2800.0	-----	0.94				
Total HpCDD	4900.0	-----	0.94				
OCDF	2400.0	-----	1.90				
OCDD	23000.0	-----	1.90				

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087018

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Pace Analytical™

Pace Analytical Services, In
1700 Elm Street - Suite 20
Minneapolis, MN 5541

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Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	403225-003-042-1/1		
Lab Sample ID	105493092		
Filename	F40414A_06		
Injected By	MRO		
Total Amount Extracted	12.3 g	Matrix	Solid
% Moisture	17.7	Dilution	NA
Dry Weight Extracted	10.1 g	Collected	03/30/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40413B_15 & F40414A_16	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/14/2004 17:23

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.200	2,3,7,8-TCDF-13C	2.00	88
Total TCDF	ND	-----	0.200	2,3,7,8-TCDD-13C	2.00	90
				1,2,3,7,8-PeCDF-13C	2.00	78
2,3,7,8-TCDD	ND	-----	0.200	2,3,4,7,8-PeCDF-13C	2.00	76
Total TCDD	ND	-----	0.200	1,2,3,7,8-PeCDD-13C	2.00	76
				1,2,3,4,7,8-HxCDF-13C	2.00	100
1,2,3,7,8-PeCDF	ND	-----	0.990	1,2,3,6,7,8-HxCDF-13C	2.00	93
2,3,4,7,8-PeCDF	ND	-----	0.990	2,3,4,6,7,8-HxCDF-13C	2.00	87
Total PeCDF	ND	-----	0.990	1,2,3,7,8,9-HxCDF-13C	2.00	90
				1,2,3,4,7,8-HxCDD-13C	2.00	96
1,2,3,7,8-PeCDD	ND	-----	0.990	1,2,3,6,7,8-HxCDD-13C	2.00	91
Total PeCDD	ND	-----	0.990	1,2,3,4,6,7,8-HpCDF-13C	2.00	78
				1,2,3,4,7,8,9-HpCDF-13C	2.00	73
1,2,3,4,7,8-HxCDF	ND	-----	0.990	1,2,3,4,6,7,8-HpCDD-13C	2.00	72
1,2,3,6,7,8-HxCDF	ND	-----	0.990	OCDD-13C	4.00	64
2,3,4,6,7,8-HxCDF	ND	-----	0.990			
1,2,3,7,8,9-HxCDF	ND	-----	0.990	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.990	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.990	2,3,7,8-TCDD-37Cl4	0.40	85
1,2,3,6,7,8-HxCDD	ND	-----	0.990			
1,2,3,7,8,9-HxCDD	ND	-----	0.990			
Total HxCDD	ND	-----	0.990			
1,2,3,4,6,7,8-HpCDF	ND	-----	0.990	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.990	Equivalence: 0.42 ng/Kg		
Total HpCDF	ND	-----	0.990	(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	3.5 B	-----	0.990 J			
Total HpCDD	6.5 B	-----	0.990 J			
OCDF	ND	-----	2.000			
OCDD	390.0	-----	2.000			

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087018

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Pace Analytical™

Pace Analytical Services, Ir
1700 Elm Street - Suite 2
Minneapolis, MN 554

Tel: 612-607-17
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Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	403225-004-043-1/1		
Lab Sample ID	105493134		
Filename	F40414B_08		
Injected By	BAL		
Total Amount Extracted	12.4 g	Matrix	Solid
% Moisture	16.5	Dilution	5
Dry Weight Extracted	10.4 g	Collected	03/30/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40414A_16 & F40414B_15	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/15/2004 09:06

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	20.0	A	2,3,7,8-TCDF-13C	2.00	69
Total TCDF	ND	-----	0.9		2,3,7,8-TCDD-13C	2.00	76
					1,2,3,7,8-PeCDF-13C	2.00	73
2,3,7,8-TCDD	ND	-----	22.0	A	2,3,4,7,8-PeCDF-13C	2.00	89
Total TCDD	ND	-----	0.9		1,2,3,7,8-PeCDD-13C	2.00	91
					1,2,3,4,7,8-HxCDF-13C	2.00	71
1,2,3,7,8-PeCDF	ND	-----	11.0	A	1,2,3,6,7,8-HxCDF-13C	2.00	69
2,3,4,7,8-PeCDF	ND	-----	9.7	A	2,3,4,6,7,8-HxCDF-13C	2.00	77
Total PeCDF	ND	-----	4.8		1,2,3,7,8,9-HxCDF-13C	2.00	74
					1,2,3,4,7,8-HxCDD-13C	2.00	64
1,2,3,7,8-PeCDD	ND	-----	9.4	A	1,2,3,6,7,8-HxCDD-13C	2.00	70
Total PeCDD	ND	-----	4.8		1,2,3,4,6,7,8-HpCDF-13C	2.00	71
					1,2,3,4,7,8,9-HpCDF-13C	2.00	75
1,2,3,4,7,8-HxCDF	ND	-----	9.1	A	1,2,3,4,6,7,8-HpCDD-13C	2.00	79
1,2,3,6,7,8-HxCDF	ND	-----	8.6	A	OCDD-13C	4.00	84
2,3,4,6,7,8-HxCDF	ND	-----	8.6	A			
1,2,3,7,8,9-HxCDF	ND	-----	12.0	A	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	4.8		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	12.0	A	2,3,7,8-TCDD-37Cl4	0.40	89
1,2,3,6,7,8-HxCDD	ND	-----	10.0	A			
1,2,3,7,8,9-HxCDD	ND	-----	12.0	A			
Total HxCDD	ND	-----	4.8				
1,2,3,4,6,7,8-HpCDF	ND	-----	7.5	A	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	9.1	A	Equivalence: 0.038 ng/Kg		
Total HpCDF	ND	-----	4.8		(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	ND	-----	9.9	A			
Total HpCDD	ND	-----	4.8				
OCDF	ND	-----	22.0	A			
OCDD	38 B	-----	19.0	A			

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087018

REPORT OF LABORATORY ANALYSIS

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Shaw Environmental, Inc.

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Edgewood, MD 21040-1037
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Explosives
GPL Laboratories, Inc., SDG 403225

DATE: May 18, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on March 30, 2004. Samples were analyzed for explosives using USEPA SW-846 8330. A total of eight soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB6A	403225-001	51SB6D	403225-004
51SB6BDL	403225-002DL	51SB7A	403225-005
51SB6BDL2	403225-002DL2	51SB7B	403225-006
51SB6C	403225-003	51SB7C	403225-007

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
X		Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

5/18/04
Date

RFAAP VALIDATION REPORT
EXPLOSIVES REVIEW
SDG 403225

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For explosives soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 03/30/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 03/30/04, extracted on 04/01/04 and 04/12/04, and analyzed for explosives on 04/07/04, 04/09/04, 04/10/04, and 04/16/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for explosive target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/07/04	BLK65654	All target compounds < MRL	NA	NA	None
04/20/04	BLK65882	All target compounds < MRL	NA	NA	None
04/16/04	040204R	All target compounds < MRL	NA	NA	None

III-Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 02/27-28/04 on instrument LCD, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), 51SB6BDL2 (403225-002DL2), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/07/04 @9:23 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), and 51SB6C (403225-003) apply to this continuing calibration.

- For continuing calibration performed on 04/07/04 @14:56 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), and 51SB6C (403225-003) apply to this continuing calibration.

- For continuing calibration performed on 04/09/04 @12:03 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB6BDL2 (403225-002DL2), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this continuing calibration.

- For continuing calibration performed on 04/09/04 @12:05 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB6BDL2 (403225-002DL2), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this continuing calibration.

- For continuing calibration performed on 04/09/04 @14:55 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB6BDL2 (403225-002DL2), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this continuing calibration.

- For continuing calibration performed on 04/09/04 @16:47 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB6BDL2 (403225-002DL2), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this continuing calibration.

- For continuing calibration performed on 04/12/04 @09:12 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/12/04 @9:22 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/16/04 @10:06 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/16/04 @19:26 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- Surrogate 4-nitroaniline was diluted out for samples 51SB6BDL (3%) and 51SB6BDL2 (0%). No qualifiers were applied based upon these outliers.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for explosives are 60-120% (40-150% for sporadic marginal failures (SMF)).

- Sample BKS65882 was used as LCS for explosives analyzed on 04/20/04. Compounds 2,4,6-trinitrotoluene (56%), HMX (83%), and tetryl (23%) were outside criteria. Since greater than 3 compounds were outside criteria and tetryl outside SMF criteria, all detects were qualified "L" and non-detects "UL" for these compounds based upon the low recoveries. Sample 51SB6D (403225-004) applies to this LCS.

- Sample BKS65654 was used as LCS for explosives analyzed on 04/07/04. Compounds 2,4,6-trinitrotoluene (73%) was outside lab criteria and within the USACE and SMF criteria. No qualifiers were applied based upon this outlier. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), 51SB6BDL2 (403225-002DL2), 51SB6C (403225-003), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for explosives are 50-140%; RPD ≤ 50% (40-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB7C (403225-007) was performed as MS/MSD for explosives. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed in this SDG.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D. The explosives for SW-846 method 8330 were air-dried prior to analysis because RDX and HMX are water soluble and moisture in the soil could affect the results.

- For sample 51SB6A (403225-001), all detects were within criteria. No qualifiers were applied.
- For samples 51SB6BDL (403225-002DL) and 51SB6BDL2 (403225-002DL2), compounds 2,6-dinitrotoluene, 4-nitrotoluene, 2,4-dinitrotoluene, 3-nitrotoluene, and 2,4,6-trinitrotoluene exceeded criteria and were qualified as estimated "J".
- For sample 51SB6C (403225-003), all detects were within criteria. No qualifiers were applied.
- For sample 51SB6D (403225-004), compounds 4-nitrotoluene, RDX, 1,3-dinitrobenzene, 2,4-dinitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".
- For sample 51SB7A (403225-005), compound 2,6-dinitrotoluene exceeded criteria and was qualified as estimated "J".
- For sample 51SB7B (403225-006), compound 2-amino-4,6-dinitrotoluene exceeded criteria and was qualified as estimated "J".
- For sample 51SB7C (403225-007), all detects were within criteria. No qualifiers were applied.

Sample: 51SB6BDL (403225-002DL), 1,3,5-trinitrobenzene

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D * 1000)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (407576484 * 20 * 100) / (481000 * 2 * 1 * 1000) = 850 mg/kg
Reported Value = 850 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-036-1/1
Sample Volume :	2	Lab File ID :	LCD23213.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/07/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
99-35-4	1,3,5-Trinitrobenzene	0.10	U
99-65-0	1,3-Dinitrobenzene	0.10	U
118-96-7	2,4,6-Trinitrotoluene	0.040	J
121-14-2	2,4-Dinitrotoluene	0.10	U
606-20-2	2,6-Dinitrotoluene	0.10	U
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U
2691-41-0	HMX	0.20	U
98-95-3	Nitrobenzene	0.10	U
121-82-4	RDX	0.20	U
479-45-8	Tetryl	0.20	U
99-08-1	m-Nitrotoluene	0.20	U
88-72-2	o-Nitrotoluene	0.20	U
99-99-0	p-Nitrotoluene	0.20	U

J

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SAMPLE NO
51SB6BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-037-1/1
Sample Volume :	2	Lab File ID :	LCD23216.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/07/2004
Injection Volume :	100 µL	Dilution Factor :	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	850		
99-65-0	1,3-Dinitrobenzene	10	U	
121-14-2	2,4-Dinitrotoluene	1400		J
606-20-2	2,6-Dinitrotoluene	1800		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	10	U	
2691-41-0	HMX	20	U	
98-95-3	Nitrobenzene	10	U	
121-82-4	RDX	20	U	
479-45-8	Tetryl	20	U	
99-08-1	m-Nitrotoluene	1600		J
88-72-2	o-Nitrotoluene	240		
99-99-0	p-Nitrotoluene	170		J

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SAMPLE NO
51SB6BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-037-1/1
Sample Volume :	2	Lab File ID :	LCD23280.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/10/2004
Injection Volume :	100 µL	Dilution Factor :	5000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
118-96-7	2,4,6-Trinitrotoluene	61000	J

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SAMPLE NO
51SB6C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-003-038-1/1
Sample Volume :	2	Lab File ID :	LCD23218.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/07/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
99-35-4	1,3,5-Trinitrobenzene	4.0	
99-65-0	1,3-Dinitrobenzene	0.10	U
118-96-7	2,4,6-Trinitrotoluene	18	
121-14-2	2,4-Dinitrotoluene	0.10	U
606-20-2	2,6-Dinitrotoluene	0.10	U
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U
2691-41-0	HMX	0.20	U
98-95-3	Nitrobenzene	0.10	U
121-82-4	RDX	0.20	U
479-45-8	Tetryl	0.20	U
99-08-1	m-Nitrotoluene	0.20	U
88-72-2	o-Nitrotoluene	0.20	U
99-99-0	p-Nitrotoluene	0.20	U

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SAMPLE NO
51SB6D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-004-039-1/1
Sample Volume :	2	Lab File ID :	LCD23436.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/16/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	18		
99-65-0	1,3-Dinitrobenzene	0.23		J
118-96-7	2,4,6-Trinitrotoluene	22		L
121-14-2	2,4-Dinitrotoluene	0.78		J
606-20-2	2,6-Dinitrotoluene	4.0		
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	UL
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	7.2		J
479-45-8	Tetryl	0.20	U	UL
99-08-1	m-Nitrotoluene	0.66		J
88-72-2	o-Nitrotoluene	9.1		
99-99-0	p-Nitrotoluene	3.4		J

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SAMPLE NO
51SB7A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-005-033-1/1
Sample Volume :	2	Lab File ID :	LCD23257.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/09/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	1.3		
121-14-2	2,4-Dinitrotoluene	0.090	J	J
606-20-2	2,6-Dinitrotoluene	0.070	J	J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	0.20	U	
88-72-2	o-Nitrotoluene	0.20	U	
99-99-0	p-Nitrotoluene	0.20	U	

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SAMPLE NO
51SB7B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-006-034-1/1
Sample Volume :	2	Lab File ID :	LCD23258.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/09/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
99-35-4	1,3,5-Trinitrobenzene	0.28	
99-65-0	1,3-Dinitrobenzene	0.10	U
118-96-7	2,4,6-Trinitrotoluene	1.3	
121-14-2	2,4-Dinitrotoluene	0.10	U
606-20-2	2,6-Dinitrotoluene	0.10	U
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.050	J
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U
2691-41-0	HMX	0.20	U
98-95-3	Nitrobenzene	0.10	U
121-82-4	RDX	0.20	U
479-45-8	Tetryl	0.20	U
99-08-1	m-Nitrotoluene	0.20	U
88-72-2	o-Nitrotoluene	0.20	U
99-99-0	p-Nitrotoluene	0.20	U

J

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SAMPLE NO
51SB7C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-007-035-1/1
Sample Volume :	2	Lab File ID :	LCD23259.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/09/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
99-35-4	1,3,5-Trinitrobenzene	0.10	J
99-65-0	1,3-Dinitrobenzene	0.10	U
118-96-7	2,4,6-Trinitrotoluene	0.41	
121-14-2	2,4-Dinitrotoluene	0.10	U
606-20-2	2,6-Dinitrotoluene	0.10	U
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U
2691-41-0	HMX	0.20	U
98-95-3	Nitrobenzene	0.10	U
121-82-4	RDX	0.20	U
479-45-8	Tetryl	0.20	U
99-08-1	m-Nitrotoluene	0.20	U
88-72-2	o-Nitrotoluene	0.20	U
99-99-0	p-Nitrotoluene	0.20	U

J

Shaw Environmental, Inc.

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Edgewood, MD 21040-1037
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Herbicides
GPL Laboratories, Inc., SDG 403225

DATE: May 18, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on March 30, 2004. Samples were analyzed for chlorinated herbicides using USEPA SW846 Method 8151A. A total of one soil sample was validated. The sample ID is:

Field Sample ID	Lab Sample ID
51SB6A	403225-001

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	System Monitoring Compounds
X		Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

E. Malarek

Eric Malarek, Chemist

5/18/04

Date

RFAAP VALIDATION REPORT
CHLORINATED HERBICIDES REVIEW
SDG 403225

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For chlorinated herbicides in cooled @4°C±2°C soil samples, the maximum holding time is 14 days from sample collection to extraction and 40 days from extraction to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 03/30/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil sample was collected on 03/30/04, extracted on 04/03/04, and analyzed for herbicides on 04/09/04. All criteria were met. No qualifiers were applied.

II-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. Percent relative standard deviation (%RSD) for a 5-point standard calibration should be ≤20% for each target compound.

- For initial calibration performed on 04/06/04 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Sample 51SB6A (403225-001) applies to this initial calibration.

III-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration establishes the response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. Percent difference (%D) between the initial calibration CF and the continuing calibration CF must be ≤15%.

- For continuing calibration performed on 04/09/04 @13:42 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied.

- For continuing calibration performed on 04/09/04 @14:07 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied.

- For continuing calibration performed on 04/09/04 @19:35 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied.

- For continuing calibration performed on 04/09/04 @20:00 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied.

IV-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field or laboratory activities. No contaminants should be detected in any of the associated blanks. Positive sample results are qualified "B" if the concentration of the analyte is ≤ five times (5X) the absolute maximum blank concentration. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 100). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/09/04	BLK65717	All target compounds < MRL	NA	NA	None
04/09/04	040204R	All target compounds < MRL	NA	NA	None

V-System Monitoring Compounds (Surrogates)

Laboratory performance on individual samples is established by means of spiking activities. All samples are spiked with surrogate compounds prior to sample preparation. Spike recoveries must be within the specified control limits.

Control Limit: 2,4-DCAA (29-143%) (USACE Shell Criteria: 70-130%)

- All criteria were met. No qualifiers were applied.

VI-Laboratory Control Samples

Data for laboratory control samples (LCS) are generated to determine long-term precision and accuracy of the analytical method. Percent recoveries must be within the specified control limits.

- Sample BKS65717 was used as the LCS. Compound 2,4-D (62%) was outside criteria. The sample was non-detect and was qualified bias low "UL" for 2,4-D based upon the low recovery.

VII-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits.

- Sample 404008-001 was used for the MS/MSD analysis. Since this is not a RFAAP sample, it was not evaluated in this report.

VIII-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed in this SDG.

IX-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. Percent difference (%D) between the calculated value and the reported value must be within 10%. All positive values must have less than or equal to 40% %D between the primary and secondary columns. Any sample value > MDL and < MRL is qualified as estimated, "J." All criteria were met. No qualifiers were applied.

Sample: BKS65717, 2,4-D

Conc. µg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (565889 * 10 * 1) / (2270 * 10 * 1) = 250 µg/kg
Reported Value = 250 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

GPL Laboratories

GPL Form I Copy
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-029-1/1
Sample Volume :	10	Lab File ID :	I27309.D
% Moisture:	16.2	Date Received	03/31/2004
Extraction:	EXT_SW8151	Date Extracted:	04/03/2004
Extract Volume:	10 mL	Date Analyzed	04/09/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
93-76-5	2,4,5-T	120	U
93-72-1	2,4,5-TP (Silvex)	120	U
94-75-7	2,4-D	120	U
94-82-6	2,4-DB	120	U
75-99-0	Dalapon	120	U
1918-00-9	Dicamba	120	U
120-36-5	Dichloroprop	120	U
88-85-7	Dinoseb	120	U
94-74-6	MCPA	12000	U
93-65-2	MCPP	12000	U

UL

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Nitroglycerine
GPL Laboratories, Inc., SDG 403225

DATE: June 1, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on March 30, 2004. Samples were analyzed for nitroglycerine using USEPA SW-846 8332. A total of seven soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB6A	403225-001	51SB7A	403225-005
51SB6BDL	403225-002DL	51SB7B	403225-006
51SB6C	403225-003	51SB7C	403225-007
51SB6D	403225-004		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/1/04
Date

RFAAP VALIDATION REPORT
NITROGLYCERINE REVIEW
SDG 403225

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For nitroglycerine soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 03/30/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 03/30/04, extracted on 04/01/04, and analyzed for nitroglycerine on 04/05/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.20). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/05/04	BLK65658	All target compounds < MRL	NA	NA	None
04/15/04	040204R	All target compounds < MRL	NA	NA	None

III-Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 03/28/04 on instrument LCC-UV, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/05/04 @12:06 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB6A (403225-001) applies to this continuing calibration.

- For continuing calibration performed on 04/05/04 @14:59 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB6BDL (403225-002DL), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), and 51SB7B (403225-006) apply to this continuing calibration.

- For continuing calibration performed on 04/05/04 @19:45 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this continuing calibration.

- For continuing calibration performed on 04/05/04 @20:28 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB7C (403225-007) applies to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- Surrogate 4-nitroaniline was diluted out for sample 51SB6BDL (370%). No qualifiers were applied based upon this outlier.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for nitroglycerine are 60-120%.

- Sample BKS65658 was used as LCS for nitroglycerine analyzed on 04/05/04. All criteria were met. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for nitroglycerine are 50-140%; RPD ≤ 50%.

- Sample 51SB6A (403225-001) was performed as MS/MSD for nitroglycerine. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed in this SDG.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB6A (403225-001), 51SB6C (403225-003), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007), nitroglycerine was non-detect. All criteria were met. No qualifiers were applied.

- For sample 51SB6BDL (403225-002DL), compound nitroglycerine was within criteria. No qualifiers were applied

- For sample 51SB6D (403225-004), compound nitroglycerine (62.2%) exceeded criteria and was qualified as estimated "J".

Sample: 51SB6BDL (403225-002DL), nitroglycerine

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (554506878 * 20 * 10) / (20330000 * 4 * 0.4082) = 3300 mg/kg
Reported Value = 3300 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

GPL Laboratories

Form I Org

GPL
FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-036-1/1
Sample Volume :	4	Lab File ID :	LC10780U.D
% Moisture:	16.2	Date Received	03/31/2004
Extraction:	EXT_8332	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/05/2004
Injection Volume :	25 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.0	U

GPL Laboratories

Form I copy

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6B DL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-037-1/1
Sample Volume :	4	Lab File ID :	LC10796U.D
% Moisture:	59.18	Date Received	03/31/2004
Extraction:	EXT_8332	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/05/2004
Injection Volume :	25 µL	Dilution Factor :	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	3300	

GPL Laboratories

Form 1 copy

GPL
FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB6C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-003-038-1/1
Sample Volume :	4	Lab File ID :	LC10798U.D
% Moisture:	17.79	Date Received	03/31/2004
Extraction:	EXT_8332	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/05/2004
Injection Volume :	25 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.1	U

GPL Laboratories

Form 1 copy

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-004-039-1/1
Sample Volume :	4	Lab File ID :	LC10799U.D
% Moisture:	16.83	Date Received	03/31/2004
Extraction:	EXT_8332	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/05/2004
Injection Volume :	25 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.7	J

GPL Laboratories

Form 1 Copy

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-005-033-1/1
Sample Volume :	4	Lab File ID :	LC10800U.D
% Moisture:	15.23	Date Received	03/31/2004
Extraction:	EXT_8332	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/05/2004
Injection Volume :	25 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.9	U

GPL Laboratories

Form I Cpy

GPL
FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB7B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-006-034-1/1
Sample Volume :	4	Lab File ID :	LC10801U.D
% Moisture:	19.57	Date Received	03/31/2004
Extraction:	EXT_8332	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/05/2004
Injection Volume :	25 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.2	U

Form I Corg

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-007-035-1/1
Sample Volume :	4	Lab File ID :	LC10806U.D
% Moisture:	17.25	Date Received	03/31/2004
Extraction:	EXT_8332	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/05/2004
Injection Volume :	25 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.0	U

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – PAHs
GPL Laboratories, Inc., SDG 403225

DATE: May 18, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on March 30, 2004. Samples were analyzed for polynuclear aromatic hydrocarbons (PAHs) using USEPA SW846 Methods 3540C/8270C low level. A total of seven soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB6A	403225-001	51SB7A	403225-005
51SB6BDL	403225-002DL	51SB7B	403225-006
51SB6C	403225-003	51SB7C	403225-007
51SB6D	403225-004		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	Surrogate Spikes
	X	Internal Standards
X		Laboratory Control Standard
X		Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

5/18/04

Date

RFAAP VALIDATION REPORT
POLYNUCLEAR AROMATIC HYDROCARBONS REVIEW
SDG 403225

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For polynuclear aromatic hydrocarbons (PAHs) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 03/30/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 03/30/04, extracted on 04/06/04, and analyzed for PAHs on 04/09/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for PAH compounds by GC/MS low level. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for the PAHs by USEPA SW-846 8270C low level was performed on 04/08/04 on instrument HP#H. All RRFs were ≥ 0.05. All criteria were met for the target compounds. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be ≥ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within ± 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the PAHs by USEPA SW-846 8270C low level performed on 04/09/04 @10:02 on instrument HP#H, all target compounds were within criteria. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to his continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 30). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/09/04	BLK65769	All compounds < MRL	NA	NA	None
04/12/04	040204R	Naphthalene	24.3	122	None

VI-Surrogate Spikes

Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria: Nitrobenzene-d5 (36-164%) – S1 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (54-124%) – S2 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (56-150%) – S3 (USACE Shell Criteria: 45-135%)

- For sample 51SB6BDL (403225-002DL), surrogate Nitrobenzene-d5 (210%) was above criteria. Since this surrogate was diluted out, no qualifiers were applied based upon this outlier. For sample 51SB6C (403225-003), surrogate 2-Fluorobiphenyl (53%) was below lab criteria limits and within USACE limits. Since the other two surrogates were within all criteria limits, no qualifiers were applied based upon this outlier. All other surrogates were within criteria.

VII-Internal Standards
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for PAHs by 8270C low level are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65769 was used as the LCS for PAHs by USEPA SW-846 8270C low level. Compounds benzo(k)fluoranthene (136%) and dibenz(a,h)anthracene (154%) exceeded criteria. All detects were qualified "K" and non-detects no qualifier based upon these outliers. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB7A (403225-005) was used for the MS/MSD analysis for PAHs. Compounds 2-methylnaphthalene (45%; RPD=62%); acenaphthene (53%; RPD=59%), acenaphthylene (48%; RPD=58%), anthracene (RPD=46%), benzo(a)anthracene (126%; RPD=50%), benzo(a)pyrene (124%; RPD=51%), benzo(b)fluoranthene (126%; RPD=46%), benzo(g,h,i)perylene (RPD=51%), benzo(k)fluoranthene (140%; RPD=52%), chrysene (129%; RPD=46%), dibenz(a,h)anthracene (142%; RPD=54%), fluoranthene (RPD=43%), fluorene (RPD=53%), indeno(1,2,3-c,d)pyrene (RPD=51%), naphthalene (42%; RPD=59%), phenanthrene (RPD=45%), and pyrene (RPD=43%) were outside criteria limits. All detects were qualified "J" estimated for the spiked sample and non-detects no qualifier based upon these outliers.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed in this SDG.

XI-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB6A (403225-001), phenanthrene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Is = Amount of internal standard injected (ng).
Vt = Volume of total extract (µL).
Ais = Area of characteristic ion for the internal standard.
RRF = Average relative response factor for compound being measured (from ICAL)
Vi = Volume of extract injected (µL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (85925 * 4 * 1000 * 1) / (1403083 * 0.877 * 1 * 30 * 0.8380) = 11 µg/kg
Reported Value = 11 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I OM

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-022-1/1
Sample Volume :	30	Lab File ID :	H25600.D
% Moisture:	16.2	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/06/2004
Extract Volume:	1 mL	Date Analyzed	04/09/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	8.0	U
83-32-9	Acenaphthene	8.0	U
208-96-8	Acenaphthylene	8.0	U
120-12-7	Anthracene	8.0	U
56-55-3	Benzo(a)anthracene	8.0	U
50-32-8	Benzo(a)pyrene	8.0	U
205-99-2	Benzo(b)fluoranthene	8.0	U
191-24-2	Benzo(g,h,i)perylene	8.0	U
207-08-9	Benzo(k)fluoranthene	8.0	U
218-01-9	Chrysene	8.0	U
53-70-3	Dibenz(a,h)Anthracene	8.0	U
206-44-0	Fluoranthene	8.0	U
86-73-7	Fluorene	8.0	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	8.0	U
91-20-3	Naphthalene	8.0	U
85-01-8	Phenanthrene	11	
129-00-0	Pyrene	8.0	U

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Form 1 Copy

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-023-1/1
Sample Volume :	30	Lab File ID :	H25608.D
% Moisture:	59.18	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/06/2004
Extract Volume:	1 mL	Date Analyzed	04/09/2004
Injection Volume :	μL	Dilution Factor :	20
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
91-57-6	2-Methylnaphthalene	330	U	
83-32-9	Acenaphthene	330	U	
208-96-8	Acenaphthylene	330	U	
120-12-7	Anthracene	330	U	
56-55-3	Benzo(a)anthracene	900		
50-32-8	Benzo(a)pyrene	950		
205-99-2	Benzo(b)fluoranthene	1600		
191-24-2	Benzo(g,h,i)perylene	590		
207-08-9	Benzo(k)fluoranthene	820		K
218-01-9	Chrysene	1300		
53-70-3	Dibenz(a,h)Anthracene	330	U	
206-44-0	Fluoranthene	3300		
86-73-7	Fluorene	330	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	540		
91-20-3	Naphthalene	330	U	
85-01-8	Phenanthrene	1300		
129-00-0	Pyrene	2300		

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Form I Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-003-024-1/1
Sample Volume :	30	Lab File ID :	H25601.D
% Moisture:	17.79	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/06/2004
Extract Volume:	1 mL	Date Analyzed	04/09/2004
Injection Volume :	µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	8.1	U
83-32-9	Acenaphthene	8.1	U
208-96-8	Acenaphthylene	8.1	U
120-12-7	Anthracene	8.1	U
56-55-3	Benzo(a)anthracene	8.1	U
50-32-8	Benzo(a)pyrene	8.1	U
205-99-2	Benzo(b)fluoranthene	8.1	U
191-24-2	Benzo(g,h,i)perylene	8.1	U
207-08-9	Benzo(k)fluoranthene	8.1	U
218-01-9	Chrysene	8.1	U
53-70-3	Dibenz(a,h)Anthracene	8.1	U
206-44-0	Fluoranthene	8.1	U
86-73-7	Fluorene	8.1	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	8.1	U
91-20-3	Naphthalene	8.1	U
85-01-8	Phenanthrene	8.1	U
129-00-0	Pyrene	8.1	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-004-025-1/1
Sample Volume :	30	Lab File ID :	H25602.D
% Moisture:	16.83	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/06/2004
Extract Volume:	1 mL	Date Analyzed	04/09/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	8.0	U
83-32-9	Acenaphthene	8.0	U
208-96-8	Acenaphthylene	8.0	U
120-12-7	Anthracene	8.0	U
56-55-3	Benzo(a)anthracene	8.0	U
50-32-8	Benzo(a)pyrene	8.0	U
205-99-2	Benzo(b)fluoranthene	8.0	U
191-24-2	Benzo(g,h,i)perylene	8.0	U
207-08-9	Benzo(k)fluoranthene	8.0	U
218-01-9	Chrysene	8.0	U
53-70-3	Dibenz(a,h)Anthracene	8.0	U
206-44-0	Fluoranthene	12	
86-73-7	Fluorene	8.0	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	8.0	U
91-20-3	Naphthalene	8.0	U
85-01-8	Phenanthrene	13	
129-00-0	Pyrene	10	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-005-026-1/1
Sample Volume :	30	Lab File ID :	H25603.D
% Moisture:	15.23	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/06/2004
Extract Volume:	1 mL	Date Analyzed	04/09/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
91-57-6	2-Methylnaphthalene	7.9	U	UJ
83-32-9	Acenaphthene	7.9	U	UJ
208-96-8	Acenaphthylene	7.9	U	UJ
120-12-7	Anthracene	7.9	U	UJ
56-55-3	Benzo(a)anthracene	7.9	U	UJ
50-32-8	Benzo(a)pyrene	7.9	U	UJ
205-99-2	Benzo(b)fluoranthene	7.9	U	UJ
191-24-2	Benzo(g,h,i)perylene	7.9	U	UJ
207-08-9	Benzo(k)fluoranthene	7.9	U	UJ
218-01-9	Chrysene	7.9	U	UJ
53-70-3	Dibenz(a,h)Anthracene	7.9	U	UJ
206-44-0	Fluoranthene	11		J
86-73-7	Fluorene	7.9	U	UJ
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.9	U	UJ
91-20-3	Naphthalene	7.9	U	UJ
85-01-8	Phenanthrene	14		J
129-00-0	Pyrene	7.9		J

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-006-027-1/1
Sample Volume :	30	Lab File ID :	H25604.D
% Moisture:	19.57	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/06/2004
Extract Volume:	1 mL	Date Analyzed	04/09/2004
Injection Volume :	μ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	8.3	U
83-32-9	Acenaphthene	8.3	U
208-96-8	Acenaphthylene	8.3	U
120-12-7	Anthracene	8.3	U
56-55-3	Benzo(a)anthracene	8.3	U
50-32-8	Benzo(a)pyrene	8.3	U
205-99-2	Benzo(b)fluoranthene	8.3	U
191-24-2	Benzo(g,h,i)perylene	8.3	U
207-08-9	Benzo(k)fluoranthene	8.3	U
218-01-9	Chrysene	8.3	U
53-70-3	Dibenz(a,h)Anthracene	8.3	U
206-44-0	Fluoranthene	8.3	U
86-73-7	Fluorene	8.3	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	8.3	U
91-20-3	Naphthalene	8.3	U
85-01-8	Phenanthrene	8.3	U
129-00-0	Pyrene	8.3	U

GPL Laboratories

Form 1 Copy

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-007-028-1/1
Sample Volume :	30	Lab File ID :	H25607.D
% Moisture:	17.25	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/06/2004
Extract Volume:	1 mL	Date Analyzed	04/09/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	8.1	U
83-32-9	Acenaphthene	8.1	U
208-96-8	Acenaphthylene	8.1	U
120-12-7	Anthracene	8.1	U
56-55-3	Benzo(a)anthracene	8.1	U
50-32-8	Benzo(a)pyrene	8.1	U
205-99-2	Benzo(b)fluoranthene	8.1	U
191-24-2	Benzo(g,h,i)perylene	8.1	U
207-08-9	Benzo(k)fluoranthene	8.1	U
218-01-9	Chrysene	8.1	U
53-70-3	Dibenz(a,h)Anthracene	8.1	U
206-44-0	Fluoranthene	8.1	U
86-73-7	Fluorene	8.1	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	8.1	U
91-20-3	Naphthalene	8.1	U
85-01-8	Phenanthrene	9.7	
129-00-0	Pyrene	8.1	U

Shaw Environmental, Inc.

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Pesticides and PCBs
GPL Laboratories, Inc., SDG 403225

DATE: June 1, 2004

The purpose of this memorandum is to present the data validation report for the sample collected for the SWMU 51 RFI at the RFAAP on March 30, 2004. Sample was analyzed for pesticides and PCBs using USEPA Method 3540C/8081A and 3540C/8082, respectively. A total of one soil sample was validated for pesticides and four samples analyzed for PCBs. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB6A*	403225-001*	51SB6C	403225-003
51SB6B	403225-002	51SB6D	403225-004

*Analyzed for pesticides and PCBs.

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (USEPA, September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
X		System Monitoring Compounds
X		Laboratory Control Samples
X		Matrix Spike/Spike Duplicate
	X	Field Sample Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/1/04

Date

RFAAP VALIDATION REPORT
PESTICIDE/PCB REVIEW
SDG 403225

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For pesticide and PCB soil samples, cooled @4°C ±2°C, the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis (USEPA criteria).

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 03/30/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The samples were collected 03/30/04 for pesticides and PCB compounds. They were extracted on 04/01/04 and analyzed for pesticides and PCBs on 04/06/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check (Degradation Standard)
Performance checks on the gas chromatograph with electron capture detector (GC/ECD) system are performed to ensure adequate resolution and instrument sensitivity. The performance evaluation mixture (PEM) must be analyzed at the beginning of the analytical sequence. The breakdown of Endrin and 4,4'-DDT must be ≤ 15% on both columns (USEPA and USACE criteria) and ≤ 30% combined Endrin and 4,4'-DDT on both columns (USEPA criteria).

- For analysis performed on 03/31/04, endrin and 4,4'-DDT breakdowns were 5.7% and 2.1% on column #1 and 8.5% and 2.6% on column #2, respectively. All criteria were met. No qualifiers were applied.

- For analysis performed on 04/02/04, endrin and 4,4'-DDT breakdowns were 10.1% and 5.7% on column #1 and 12.2% and 6.3% on column #2, respectively. All criteria were met. No qualifiers were applied.

- For analysis performed on 04/05/04, endrin and 4,4'-DDT breakdowns were 7.2% and 3.4% on column #1 and 8.1% and 3.9% on column #2, respectively. All criteria were met. No qualifiers were applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The percent relative standard deviation (%RSD) for all single peak target analytes, and aroclors 1016 and 1260 must be < 20% or the mean %RSD for all analytes in the standard must be ≤ 20%. If linear regression is used, the correlation coefficient must be ≥0.990 (USEPA and USACE criteria).

- For the pesticide initial calibration performed on 03/31/04 on instrument GC-K, all criteria were met. All compounds were determined using calibration factors with RSDs ≤20% for single peak pesticides. No qualifiers were applied. Sample 51SB6A (403225-001) applies to this initial calibration.

- For the PCB initial calibration performed on 03/31/04 on instrument GC-L, all criteria were met. All compounds were determined using calibration factors with RSDs ≤20% for PCB 1016 and PCB 1260. No qualifiers were applied. All samples apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for pesticide/PCB target compounds. Continuing calibration standards containing both target compounds and surrogates are analyzed at the beginning of each 12-hour analytical shift and after every 20 samples. The percent difference (%D) or the mean %RSD for all analytes in the standard from the initial calibration should be no greater than ± 15%.

- For pesticide continuing calibration performed on 04/06/04 @08:20 on instrument GC-K, all criteria were met on column #1 for all target compounds. For column #2, endrin (23.4%), 4,4'-DDD (15.5%), and endosulfan sulfate (19.2%) were outside criteria. All samples were non-detect for this compound, therefore no qualifiers were applied based upon these outliers. Sample 51SB6A (403225-001) applies to this continuing calibration.

- For pesticide continuing calibration performed on 04/06/04 @12:51 on instrument GC-K, 4,4'-DDT (15.2%), was outside criteria on column #1. For column #2, 4,4'-DDT (20.8%) was outside criteria. All samples were non-detect for this compound, therefore no qualifiers were applied based upon these outliers. Sample 51SB6A (403225-001) applies to this continuing calibration.

- For pesticide continuing calibration performed on 04/02/04 @22:07 on instrument GC-K, endosulfan sulfate (18.0%) was outside criteria on column #1. For column #2, endrin (17.2%), endosulfan sulfate (17.7%), and endrin ketone (15.5%) were outside criteria. No samples apply to his continuing calibration, therefore no qualifiers were applied based upon these outliers.

- For pesticide continuing calibration performed on 04/03/04 @02:36 on instrument GC-K, endosulfan sulfate (15.7%) was outside criteria on column #1. For column #2, endrin (19.5%) and endosulfan sulfate (17.3%) were outside criteria. No samples apply to this continuing calibration, therefore no qualifiers were applied based upon these outliers.

- For PCB continuing calibration performed on 04/06/04 @01:01 on instrument GC-L, all criteria were met on column #1 and column #2 for all target compounds. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6B (403225-002), 51SB6C (403225-003), and 51SB6D (403225-004) apply to this continuing calibration.

- For PCB continuing calibration performed on 04/06/04 @06:49 on instrument GC-L, all criteria were met on column #2 for all target compounds. For column #1, arochlor 1260 #1 (17.7%) and arochlor 1260 #2 (16.3%) were outside criteria. All samples were non-detect for this compound as well as the average of the peaks within criteria. Therefore, no qualifiers were applied based upon these outliers. Samples 51SB6A (403225-001), 51SB6B (403225-002), 51SB6C (403225-003), and 51SB6D (403225-004) apply to this continuing calibration.

V-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks > MDL or MRL (USEPA criteria) or all target compounds < one-half the MRL (USACE criteria). Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 30). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Parameter	Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
Pesticides	04/03/04	BKS65630	All < MRL	NA	NA	None
Pesticides	04/15/04	040204R	All < MRL	NA	NA	None
PCBs	04/06/04	BKS65631	All < MRL	NA	NA	None
PCBs	04/14/04	040204R	All < MRL	NA	NA	None

VI-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the specified laboratory control limits.

Criteria: Decachlorobiphenyl: Pesticides: 55-151% (USACE criteria 50-130%)
Tetrachloro-m-xylene: Pesticides: 34-100% (USACE criteria 50-130%)
Decachlorobiphenyl: PCBs: 47-161% (USACE criteria 50-130%)
Tetrachloro-m-xylene: PCBs: 54-168% (USACE criteria 50-130%)

- For pesticide analysis for sample 51SB6A (403225-001), surrogate decachlorobiphenyl (52%) was outside criteria. Since decachlorobiphenyl was within USACE criteria, the second surrogate tetrachloro-m-xylene was within all criteria, and all surrogates >10%, no qualifiers were applied based upon this outlier.

- For PCB analysis for sample 51SB6A (403225-001), surrogates decachlorobiphenyl (43%) and tetrachloro-m-xylene (53%) were outside criteria. Since both surrogates were below criteria on same column, the sample was qualified bias low "UL" for all PCBs based upon this outlier.

- For PCB analysis for sample 51SB6B (403225-002), surrogate decachlorobiphenyl (38%) was outside criteria. Since the second surrogate tetrachloro-m-xylene was within all criteria, and all surrogates >10%, no qualifiers were applied based upon this outlier.

- All other samples 51SB6C (403225-003) and 51SB6D (403225-004) tested for PCBs were within criteria for all surrogates.

VII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor long-term precision and accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within the specified control limits. USACE Shell limits for pesticides/PCBs are 50-130% (30-150% for sporadic marginal failures (SMF)).

- Sample BKS65630 was used for the LCS for TCL pesticide compounds. Delta-BHC (25%) was outside USACE and SMF criteria. Sample 51SB6A (403225-001) was non-detect for all target compounds. Delta-BHC was qualified bias low "UL" non-detect based upon the low recovery.

- Sample BKS65631 was used for the LCS for TCL PCB aroclors. All criteria were met. No qualifiers were applied.

VIII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits for pesticides/PCBs are 40-140%; RPD<50% (30-150%; RPD<60% for sporadic marginal failures (SMF) for pesticides).

- Sample 51SB6A (403225-001) was used for the MS/MSD analysis for pesticide compounds. Compounds 4,4-DDD (50%, 57%), 4,4-DDE (53%, 56%), 4,4-DDT (36%, 46%), aldrin (50%, 57%), alpha-chlordane (45%, 58%), endosulfan I (54%, 62%), endosulfan II (58%, 65%), endosulfan sulfate (52%, 55%), gamma-BHC (64%), gamma-chlordane (53%, 62%), heptachlor epoxide (59%) and methoxychlor (53%) were outside lab criteria. Sample 51SB6A (403225-001) was non-detect for all target compounds. Since greater than 2 compounds were outside criteria, all non-detects for the spiked sample were qualified "UL" for these compounds based upon the low recoveries.

- Sample 51SB6A (403225-001) was used for the MS/MSD analysis for PCB compounds. Arochlor 1260 (49%, 53%) was outside lab criteria. Sample 51SB6A (403225-001) was non-detect for all target compounds. All non-detects for the spiked sample were qualified "UL" for these compounds based upon the low recoveries.

IX-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. The project precision control criterion was established at 50% RPD for the solid samples.

- No field duplicates were analyzed with this SDG.

X-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The difference between the calculated value and the reported value must be within 10% difference. All samples were non-detect for PCBs, therefore the quantification verification not included here. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." The difference between the primary column and the confirmatory column must be ≤ 40% difference (USEPA and USACE criteria).

- All pesticides/PCBs were non-detect for this SDG for all samples. No qualifiers were applied.

Sample: 51SB6AMS (403225-001MS), endrin

Conc. µg/kg = (Ax * Vt * DF) / (CF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area/response for compound being measured.
Vt = Volume of total extract, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean V(t) = 10000 µL.
CF = Ave calibration response factor for compound being measured from ICAL (Area/pg)
Vi = Volume of extract injected (mL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100 = 1.0 for Wet Weight
DF = Dilution factor

Conc. µg/kg = (1441969 Area*10000µL*1) / (42620Area/pg*(1000 pg/ng)*1 µL*30g*0.8380) = 14 µg/kg

Reported Value = 14 µg/kg
% Difference = 0.0%
Values were within 10% difference

Sample: 51SB6AMS (403225-001MS), Aroclor 1260

Conc. µg/kg = (Ax * Vt * DF) / (CF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area/response for compound being measured.
Vt = Volume of total extract, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean V(t) = 10000 µL.
CF = Ave calibration response factor for compound being measured from ICAL (Area/pg)
Vi = Volume of extract injected (mL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100 = 1.0 for Wet Weight
DF = Dilution factor

Signal #1
Conc1 µg/kg = (80811Area*10000µL*1) / (382.3Area/pg*(1000 pg/ng)*1 µL*30g*0.8380) = 84.08 µg/kg
Conc2 µg/kg = (120852Area*10000µL*1) / (545.1Area/pg*(1000 pg/ng)*1 µL*30g*0.8380) = 88.19 µg/kg
Conc3 µg/kg = (141568Area*10000µL*1) / (622.1Area/pg*(1000 pg/ng)*1 µL*30g*0.8380) = 90.52 µg/kg
Conc4 µg/kg = (53750Area*10000µL*1) / (269.3Area/pg*(1000 pg/ng)*1 µL*30g*0.8380) = 79.39 µg/kg
Conc5 µg/kg = (137521Area*10000µL*1) / (702.4Area/pg*(1000 pg/ng)*1 µL*30g*0.8380) = 77.89 µg/kg
Average concentration = 84 µg/kg

Signal #2
Conc1 µg/kg = (613455Area*10000µL*1) / (1917Area/pg*(1000 pg/ng)*1 µL*30g*0.8380) = 127.29 µg/kg
Conc2 µg/kg = (466193Area*10000µL*1) / (1987Area/pg*(1000 pg/ng)*1 µL*30g*0.8380) = 93.33 µg/kg
Conc3 µg/kg = (227161Area*10000µL*1) / (973Area/pg*(1000 pg/ng)*1 µL*30g*0.8380) = 92.87 µg/kg
Conc4 µg/kg = (347427Area*10000µL*1) / (1507Area/pg*(1000 pg/ng)*1 µL*30g*0.8380) = 91.70 µg/kg
Conc5 µg/kg = (567595Area*10000µL*1) / (2810Area/pg*(1000 pg/ng)*1 µL*30g*0.8380) = 80.35 µg/kg
Average concentration = 97 µg/kg

Reported Value = 97 µg/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I Copy

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-029-1/1
Sample Volume :	30	Lab File ID :	K125293.D
% Moisture:	16.2	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/01/2004
Extract Volume:	10 mL	Date Analyzed	04/06/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
72-54-8	4,4-DDD	2.0	U	VL
72-55-9	4,4-DDE	2.0	U	VL
50-29-3	4,4-DDT	2.0	U	VL
309-00-2	Aldrin	2.0	U	VL
319-84-6	Alpha-BHC	2.0	U	
5103-71-9	Alpha-Chlordane	2.0	U	VL
319-85-7	Beta-BHC	2.0	U	
319-86-8	Delta-BHC	2.0	U	VL
959-98-8	Endosulfan I	2.0	U	VL
33213-65-9	Endosulfan II	2.0	U	VL
1031-07-8	Endosulfan Sulfate	2.0	U	VL
72-20-8	Endrin	2.0	U	
7421-93-4	Endrin Aldehyde	2.0	U	
53494-70-5	Endrin Ketone	2.0	U	
58-89-9	Gamma-BHC (Lindane)	2.0	U	VL
5566-34-7	Gamma-Chlordane	2.0	U	VL
76-44-8	Heptachlor	2.0	U	
1024-57-3	Heptachlor Epoxide	2.0	U	VL
72-43-5	Methoxychlor	2.0	U	VL
8001-35-2	Toxaphene	40	U	

GPL Laboratories

GPL Form I Org
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-029-1/1
Sample Volume :	30	Lab File ID :	L32953.D
% Moisture:	16.2	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/01/2004
Extract Volume:	10 mL	Date Analyzed	04/06/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	40	U	UL
11104-28-2	PCB-1221	40	U	UL
11141-16-5	PCB-1232	40	U	UL
53469-21-9	PCB-1242	40	U	UL
12672-29-6	PCB-1248	40	U	UL
11097-69-1	PCB-1254	40	U	UL
11096-82-5	PCB-1260	40	U	UL

GPL Laboratories

GPL Form 1 Copy
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-030-1/1
Sample Volume :	30	Lab File ID :	L32956.D
% Moisture:	59.18	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/01/2004
Extract Volume:	10 mL	Date Analyzed	04/06/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
12674-11-2	PCB-1016	82	U
11104-28-2	PCB-1221	82	U
11141-16-5	PCB-1232	82	U
53469-21-9	PCB-1242	82	U
12672-29-6	PCB-1248	82	U
11097-69-1	PCB-1254	82	U
11096-82-5	PCB-1260	82	U

GPL Laboratories

GPL Form I Corp
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-003-031-1/1
Sample Volume :	30	Lab File ID :	L32957.D
% Moisture:	17.79	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/01/2004
Extract Volume:	10 mL	Date Analyzed	04/06/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
12674-11-2	PCB-1016	41	U
11104-28-2	PCB-1221	41	U
11141-16-5	PCB-1232	41	U
53469-21-9	PCB-1242	41	U
12672-29-6	PCB-1248	41	U
11097-69-1	PCB-1254	41	U
11096-82-5	PCB-1260	41	U

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-004-032-1/1
Sample Volume :	30	Lab File ID :	L32958.D
% Moisture:	16.83	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracted:	04/01/2004
Extract Volume:	10 mL	Date Analyzed	04/06/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
12674-11-2	PCB-1016	40	U
11104-28-2	PCB-1221	40	U
11141-16-5	PCB-1232	40	U
53469-21-9	PCB-1242	40	U
12672-29-6	PCB-1248	40	U
11097-69-1	PCB-1254	40	U
11096-82-5	PCB-1260	40	U

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MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Pentaerythritol Tetranitrate GPL Laboratories, Inc., SDG 403225

DATE: June 1, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on March 30, 2004. Samples were analyzed for pentaerythritol tetranitrate (PETN) using USEPA SW-846 8330. A total of seven soil samples were validated. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB6A	403225-001	51SB7A	403225-005
51SB6B	403225-002	51SB7B	403225-006
51SB6C	403225-003	51SB7C	403225-007
51SB6D	403225-004		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable.

E. Malarek

Eric Malarek, Chemist

6/1/04

Date

RFAAP VALIDATION REPORT
PETN REVIEW
SDG 403225

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For PETN soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 03/30/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 03/30/04, extracted on 04/01/04 and 04/12/04, and analyzed for PETN on 04/09/04, 04/12/04, and 04/13/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/09/04	BLK65657	All target compounds < MRL	NA	NA	None
04/14/04	BLK65883	All target compounds < MRL	NA	NA	None
04/12/04	040204R	All target compounds < MRL	NA	NA	None

III-Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 03/03/04 on instrument LCC-UV, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6B (403225-002), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/09/04 @09:14 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this continuing calibration.

- For continuing calibration performed on 04/09/04 @13:45 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this continuing calibration.

- For continuing calibration performed on 04/12/04 @09:55 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB6B (403225-002) applies to this continuing calibration.

- For continuing calibration performed on 04/12/04 @12:17 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB6B (403225-002) applies to this continuing calibration.

- For continuing calibration performed on 04/13/04 @12:54 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB6D (403225-004RE) applies to this continuing calibration.

- For continuing calibration performed on 04/13/04 @17:42 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB6D (403225-004RE) applies to this continuing calibration.

- For continuing calibration performed on 04/13/04 @22:32 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @04:01 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- All criteria were met. No qualifiers were applied.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for PETN are 60-120%.

- Sample BKS65657 was used as LCS for PETN analyzed on 04/09/04. All criteria were met. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6B (403225-002), 51SB6C (403225-003), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this LCS.

- Sample BKS65883 was used as LCS for PETN analyzed on 04/14/04. All criteria were met. No qualifiers were applied. Sample 51SB6D (403225-004) applies to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for PETN are 50-140%; RPD ≤ 50%.

- Sample 51SB7C (403225-007) was performed as MS/MSD for PETN. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed in this SDG.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB6A (403225-001), 51SB6B (403225-002), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007), PETN was non-detect. All criteria were met. No qualifiers were applied.

Sample: 51SB7CMS (403225-007MS), PETN

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (33322961 * 20 * 1) / (162300 * 2 * 1 * 1000) = 2.1 mg/kg
Reported Value = 2.1 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-036-1/1
Sample Volume :	2	Lab File ID :	LC10949U.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/09/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-037-1/1
Sample Volume :	2	Lab File ID :	LC10993U.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/12/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB6C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-003-038-1/1
Sample Volume :	2	Lab File ID :	LC10950U.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/09/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-004-039-1/1
Sample Volume :	2	Lab File ID :	LC11026U.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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Form I Rev

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB7A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-005-033-1/1
Sample Volume :	2	Lab File ID :	LC10952U.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/09/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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SAMPLE NO
51SB7B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-006-034-1/1
Sample Volume :	2	Lab File ID :	LC10954U.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/09/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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form 1 Corp

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-007-035-1/1
Sample Volume :	2	Lab File ID :	LC10955U.D
% Moisture:		Date Received	03/31/2004
Extraction:	EXT_SW8330	Date Extracted:	04/01/2004
Extract Volume:	20 mL	Date Analyzed	04/09/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Semi-Volatiles
GPL Laboratories, Inc., SDG 403225

DATE: May 17, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on March 30, 2004. Samples were analyzed for semivolatile organic compounds (SVOCs) using USEPA SW846 Methods 3540C/8270C. A total of eight soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB6A	403225-001	51SB6D	403225-004
51SB6BDL	403225-002DL	51SB7A	403225-005
51SB6BDL2	403225-002DL2	51SB7B	403225-006
51SB6C	403225-003	51SB7C	403225-007

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
X		Initial Calibration
	X	Continuing Calibration
X		Blank Analysis
	X	Surrogate Spikes
	X	Internal Standards
	X	Laboratory Control Standard
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications, except for the following. For sample 51SB6BDL (403225-002DL), compounds 2,6-dinitrotoluene and diethyl phthalate exceeded the calibration range and were rejected "R". Sample 51SB6BDL2 (403225-002DL2) should be used for these compounds.

E. M

Eric Malarek, Chemist

5/17/04

Date

RFAAP VALIDATION REPORT
SEMIVOLATILES REVIEW
SDG 403225

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For semivolatile organic compound (SVOC) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 03/30/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 03/30/04, extracted on 04/01/04, and analyzed for TCL SVOCs on 04/07/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for compounds on the semivolatile target compound list (TCL). Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for the TCL SVOCs was performed on 03/31/04 on instrument HP#D. Target compounds 4-chloroaniline (16.1%), 4-nitroaniline (15.7%), phenanthrene (16.8%), anthracene (17.3%), carbazole (18.1%), di-n-butylphthalate (18.5%), and 3,3'-dichlorobenzidine (36.6%; grossly exceeding) were outside criteria. All RRFs were ≥ 0.05. Compounds 4-chloroaniline, 4-nitroaniline, phenanthrene, anthracene, carbazole, and di-n-butylphthalate were qualified estimated "J" for detects and no qualifier for non-detects for the high %RSDs. For compound 3,3'-dichlorobenzidine, all detects were qualified estimated "J" and non-detects "UJ" based upon the grossly exceeding %RSD. All samples were analyzed using this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be ≥ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within ± 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the TCL SVOCs performed on 04/06/04 @13:57 on instrument HP#D, target compound bis(2-chloroethyl)ether (20.7%) was outside criteria. All samples were non-detect for this compound, therefore no qualifiers were applied based upon this outlier. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), 51SB6BDL2 (403225-002DL2), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to his continuing calibration.

- For continuing calibration for the TCL SVOCs performed on 04/07/04 @09:42 on instrument HP#D, target compound 4,6-dinitro-2-methylphenol (21.3%) was outside criteria. All samples were non-detect for this compound, therefore no qualifiers were applied based upon this outlier. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), 51SB6BDL2 (403225-002DL2), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to his continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 33). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/06/04	BLK65627	All compounds < MRL	NA	NA	None
04/13/04	040204R	Di-n-butyl phthalate	149J	4900	51SB6BDL, 51SB6BDL2

J = Estimated value <MRL and >MDL

VI-Surrogate Spikes
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria: 2-Fluorophenol (31-125%) – S1 (USACE Shell Criteria: 35-140%)
Phenol – d5 (25-121%) – S2 (USACE Shell Criteria: 35-140%)
2,4,6-Tribromophenol (31-137%) – S3 (USACE Shell Criteria: 35-140%)
Nitrobenzene-d5 (29-117%) – S4 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (20-106%) – S5 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (26-160%) – S6 (USACE Shell Criteria: 45-135%)

- All criteria were met. No qualifiers were applied.

VII-Internal Standards
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for SVOCs are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65627 was used as the LCS for SVOCs by USEPA SW-846 8270C. All criteria were met. No qualifiers were applied. Samples 51SB6A (403225-001), 51SB6BDL (403225-002DL), 51SB6BDL2 (403225-002DL2), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB7A (403225-005) was used for the MS/MSD analysis for TCL SVOCs. All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed in this SDG.

XI-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J". For sample 51SB6BDL (403225-002DL), compounds 2,6-dinitrotoluene and diethyl phthalate exceeded the calibration range and were rejected "R". Sample 51SB6BDL2 (403225-002DL2) should be used for these compounds.

Sample: 51SB6B (403225-002), 2-nitroaniline

Conc. μg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where:
- Conc. = Sample concentration in μg/kg
- Ax = Area of characteristic ion for compound being measured.
- Is = Amount of internal standard injected (ng).
- Vt = Volume of total extract (μL).
- Ais = Area of characteristic ion for the internal standard.
- RRF = Average relative response factor for compound being measured (from ICAL)
- Vi = Volume of extract injected (μL).
- W(s) = Weight of sample extracted or diluted in grams.
- D = Percent dry weight (100 - % moisture in sample)/100
- DF = Dilution factor

Conc. μg/kg = (224217 * 40 * 1000 * 10) / (419647 * 0.385 * 1 * 30 * 0.4082) = 45000 μg/kg
Reported Value = 45000 μg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-022-1/1
Sample Volume :	30	Lab File ID :	D33451.D
% Moisture:	16.2	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	400	U	
95-50-1	1,2-Dichlorobenzene	400	U	
541-73-1	1,3-Dichlorobenzene	400	U	
106-46-7	1,4-Dichlorobenzene	400	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	400	U	
95-95-4	2,4,5-Trichlorophenol	400	U	
88-06-2	2,4,6-Trichlorophenol	400	U	
120-83-2	2,4-Dichlorophenol	400	U	
105-67-9	2,4-Dimethylphenol	400	U	
51-28-5	2,4-Dinitrophenol	800	U	
121-14-2	2,4-Dinitrotoluene	400	U	
606-20-2	2,6-Dinitrotoluene	400	U	
91-58-7	2-Chloronaphthalene	400	U	
95-57-8	2-Chlorophenol	400	U	
91-57-6	2-Methylnaphthalene	400	U	
88-74-4	2-Nitroaniline	400	U	
88-75-5	2-Nitrophenol	400	U	
95-48-7	2-methylphenol	400	U	
91-94-1	3,3-Dichlorobenzidine	800	U	UJ
99-09-2	3-Nitroaniline	400	U	
534-52-1	4,6-dinitro-2-methyl phenol	800	U	
101-55-3	4-Bromophenyl-phenylether	400	U	
106-47-8	4-Chloroaniline	400	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	400	U	
100-01-6	4-Nitroaniline	400	U	
100-02-7	4-Nitrophenol	800	U	
59-50-7	4-chloro-3-methylphenol	400	U	
106-44-5	4-methylphenol	400	U	
83-32-9	Acenaphthene	400	U	

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SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-022-1/1
Sample Volume :	30	Lab File ID :	D33451.D
% Moisture:	16.2	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
208-96-8	Acenaphthylene	400	U
120-12-7	Anthracene	400	U
56-55-3	Benzo(a)anthracene	400	U
50-32-8	Benzo(a)pyrene	400	U
205-99-2	Benzo(b)fluoranthene	400	U
191-24-2	Benzo(g,h,i)perylene	400	U
207-08-9	Benzo(k)fluoranthene	400	U
65-85-0	Benzoic Acid	800	U
100-51-6	Benzyl Alcohol	400	U
85-68-7	Benzyl Butyl Phthalate	400	U
86-74-8	Carbazole	400	U
218-01-9	Chrysene	400	U
53-70-3	Dibenz(a,h)Anthracene	400	U
132-64-9	Dibenzofuran	400	U
84-66-2	Diethyl Phthalate	400	U
131-11-3	Dimethyl Phthalate	400	U
206-44-0	Fluoranthene	400	U
86-73-7	Fluorene	400	U
118-74-1	Hexachlorobenzene	400	U
87-68-3	Hexachlorobutadiene	400	U
77-47-4	Hexachlorocyclopentadiene	400	U
67-72-1	Hexachloroethane	400	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	400	U
78-59-1	Isophorone	400	U
91-20-3	Naphthalene	400	U
98-95-3	Nitrobenzene	400	U
87-86-5	Pentachlorophenol	800	U
85-01-8	Phenanthrene	400	U
108-95-2	Phenol	400	U

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SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-022-1/1
Sample Volume :	30	Lab File ID :	D33451.D
% Moisture:	16.2	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	400	U
110-86-1	Pyridine	400	U
111-91-1	bis(2-chloroethoxy) methane	400	U
111-44-4	bis(2-chloroethyl) ether	400	U
117-81-7	bis(2-ethylhexyl) phthalate	400	U
84-74-2	di-n-Butyl Phthalate	400	U
117-84-0	di-n-Octyl Phthalate	400	U
621-64-7	n-Nitrosodi-n-Propylamine	400	U
86-30-6	n-Nitrosodiphenylamine	400	U

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SAMPLE NO
51SB6BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-023-1/1
Sample Volume :	30	Lab File ID :	D33467.D
% Moisture:	59.18	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µL	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	8200	U	
95-50-1	1,2-Dichlorobenzene	8200	U	
541-73-1	1,3-Dichlorobenzene	8200	U	
106-46-7	1,4-Dichlorobenzene	8200	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	8200	U	
95-95-4	2,4,5-Trichlorophenol	8200	U	
88-06-2	2,4,6-Trichlorophenol	8200	U	
120-83-2	2,4-Dichlorophenol	8200	U	
105-67-9	2,4-Dimethylphenol	8200	U	
51-28-5	2,4-Dinitrophenol	16000	U	
121-14-2	2,4-Dinitrotoluene	100000		
606-20-2	2,6-Dinitrotoluene	150000	E	R
91-58-7	2-Chloronaphthalene	8200	U	
95-57-8	2-Chlorophenol	8200	U	
91-57-6	2-Methylnaphthalene	8200	U	
88-74-4	2-Nitroaniline	45000		
88-75-5	2-Nitrophenol	8200	U	
95-48-7	2-methylphenol	8200	U	
91-94-1	3,3-Dichlorobenzidine	16000	U	UJ
99-09-2	3-Nitroaniline	8200	U	
534-52-1	4,6-dinitro-2-methyl phenol	16000	U	
101-55-3	4-Bromophenyl-phenylether	8200	U	
106-47-8	4-Chloroaniline	8200	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	8200	U	
100-01-6	4-Nitroaniline	8200	U	
100-02-7	4-Nitrophenol	16000	U	
59-50-7	4-chloro-3-methylphenol	8200	U	
106-44-5	4-methylphenol	8200	U	
83-32-9	Acenaphthene	8200	U	

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SAMPLE NO
51SB6BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-023-1/1
Sample Volume :	30	Lab File ID :	D33467.D
% Moisture:	59.18	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	8200	U	
120-12-7	Anthracene	8200	U	
56-55-3	Benzo(a)anthracene	8200	U	
50-32-8	Benzo(a)pyrene	8200	U	
205-99-2	Benzo(b)fluoranthene	8200	U	
191-24-2	Benzo(g,h,i)perylene	8200	U	
207-08-9	Benzo(k)fluoranthene	8200	U	
65-85-0	Benzoic Acid	16000	U	
100-51-6	Benzyl Alcohol	8200	U	
85-68-7	Benzyl Butyl Phthalate	8200	U	
86-74-8	Carbazole	8200	U	
218-01-9	Chrysene	8200	U	
53-70-3	Dibenz(a,h)Anthracene	8200	U	
132-64-9	Dibenzofuran	8200	U	
84-66-2	Diethyl Phthalate	350000	E	R
131-11-3	Dimethyl Phthalate	8200	U	
206-44-0	Fluoranthene	2500	J	J
86-73-7	Fluorene	8200	U	
118-74-1	Hexachlorobenzene	8200	U	
87-68-3	Hexachlorobutadiene	8200	U	
77-47-4	Hexachlorocyclopentadiene	8200	U	
67-72-1	Hexachloroethane	8200	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	8200	U	
78-59-1	Isophorone	8200	U	
91-20-3	Naphthalene	8200	U	
98-95-3	Nitrobenzene	8200	U	
87-86-5	Pentachlorophenol	16000	U	
85-01-8	Phenanthrene	8200	U	
108-95-2	Phenol	8200	U	

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SAMPLE NO
51SB6BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-023-1/1
Sample Volume :	30	Lab File ID :	D33467.D
% Moisture:	59.18	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	2000	J	J
110-86-1	Pyridine	8200	U	
111-91-1	bis(2-chloroethoxy) methane	8200	U	
111-44-4	bis(2-chloroethyl) ether	8200	U	
117-81-7	bis(2-ethylhexyl) phthalate	15000		
84-74-2	di-n-Butyl Phthalate	6800	J	B
117-84-0	di-n-Octyl Phthalate	8200	U	
621-64-7	n-Nitrosodi-n-Propylamine	8200	U	
86-30-6	n-Nitrosodiphenylamine	8200	U	

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SAMPLE NO
51SB6BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-023-1/1
Sample Volume :	30	Lab File ID :	D33468.D
% Moisture:	59.18	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µL	Dilution Factor	50
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	41000	U	
95-50-1	1,2-Dichlorobenzene	41000	U	
541-73-1	1,3-Dichlorobenzene	41000	U	
106-46-7	1,4-Dichlorobenzene	41000	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	41000	U	
95-95-4	2,4,5-Trichlorophenol	41000	U	
88-06-2	2,4,6-Trichlorophenol	41000	U	
120-83-2	2,4-Dichlorophenol	41000	U	
105-67-9	2,4-Dimethylphenol	41000	U	
51-28-5	2,4-Dinitrophenol	82000	U	
121-14-2	2,4-Dinitrotoluene	110000		
606-20-2	2,6-Dinitrotoluene	150000		
91-58-7	2-Chloronaphthalene	41000	U	
95-57-8	2-Chlorophenol	41000	U	
91-57-6	2-Methylnaphthalene	41000	U	
88-74-4	2-Nitroaniline	45000		
88-75-5	2-Nitrophenol	41000	U	
95-48-7	2-methylphenol	41000	U	
91-94-1	3,3-Dichlorobenzidine	82000	U	UJ
99-09-2	3-Nitroaniline	41000	U	
534-52-1	4,6-dinitro-2-methyl phenol	82000	U	
101-55-3	4-Bromophenyl-phenylether	41000	U	
106-47-8	4-Chloroaniline	41000	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	41000	U	
100-01-6	4-Nitroaniline	41000	U	
100-02-7	4-Nitrophenol	82000	U	
59-50-7	4-chloro-3-methylphenol	41000	U	
106-44-5	4-methylphenol	41000	U	
83-32-9	Acenaphthene	41000	U	

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FORM 1
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SAMPLE NO
51SB6BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-023-1/1
Sample Volume :	30	Lab File ID :	D33468.D
% Moisture:	59.18	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µL	Dilution Factor	50
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
208-96-8	Acenaphthylene	41000	U
120-12-7	Anthracene	41000	U
56-55-3	Benzo(a)anthracene	41000	U
50-32-8	Benzo(a)pyrene	41000	U
205-99-2	Benzo(b)fluoranthene	41000	U
191-24-2	Benzo(g,h,i)perylene	41000	U
207-08-9	Benzo(k)fluoranthene	41000	U
65-85-0	Benzoic Acid	82000	U
100-51-6	Benzyl Alcohol	41000	U
85-68-7	Benzyl Butyl Phthalate	41000	U
86-74-8	Carbazole	41000	U
218-01-9	Chrysene	41000	U
53-70-3	Dibenz(a,h)Anthracene	41000	U
132-64-9	Dibenzofuran	41000	U
84-66-2	Diethyl Phthalate	440000	
131-11-3	Dimethyl Phthalate	41000	U
206-44-0	Fluoranthene	41000	U
86-73-7	Fluorene	41000	U
118-74-1	Hexachlorobenzene	41000	U
87-68-3	Hexachlorobutadiene	41000	U
77-47-4	Hexachlorocyclopentadiene	41000	U
67-72-1	Hexachloroethane	41000	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	41000	U
78-59-1	Isophorone	41000	U
91-20-3	Naphthalene	41000	U
98-95-3	Nitrobenzene	41000	U
87-86-5	Pentachlorophenol	82000	U
85-01-8	Phenanthrene	41000	U
108-95-2	Phenol	41000	U

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SAMPLE NO
51SB6BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-023-1/1
Sample Volume :	30	Lab File ID :	D33468.D
% Moisture:	59.18	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	50
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	41000	U
110-86-1	Pyridine	41000	U
111-91-1	bis(2-chloroethoxy) methane	41000	U
111-44-4	bis(2-chloroethyl) ether	41000	U
117-81-7	bis(2-ethylhexyl) phthalate	16000	J
84-74-2	di-n-Butyl Phthalate	8000	J
117-84-0	di-n-Octyl Phthalate	41000	U
621-64-7	n-Nitrosodi-n-Propylamine	41000	U
86-30-6	n-Nitrosodiphenylamine	41000	U

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SAMPLE NO
51SB6C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-003-024-1/1
Sample Volume :	30	Lab File ID :	D33460.D
% Moisture:	17.79	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	410	U	
95-50-1	1,2-Dichlorobenzene	410	U	
541-73-1	1,3-Dichlorobenzene	410	U	
106-46-7	1,4-Dichlorobenzene	410	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	410	U	
95-95-4	2,4,5-Trichlorophenol	410	U	
88-06-2	2,4,6-Trichlorophenol	410	U	
120-83-2	2,4-Dichlorophenol	410	U	
105-67-9	2,4-Dimethylphenol	410	U	
51-28-5	2,4-Dinitrophenol	810	U	
121-14-2	2,4-Dinitrotoluene	140	J	J
606-20-2	2,6-Dinitrotoluene	140	J	J
91-58-7	2-Chloronaphthalene	410	U	
95-57-8	2-Chlorophenol	410	U	
91-57-6	2-Methylnaphthalene	410	U	
88-74-4	2-Nitroaniline	410	U	
88-75-5	2-Nitrophenol	410	U	
95-48-7	2-methylphenol	410	U	
91-94-1	3,3-Dichlorobenzidine	810	U	UJ
99-09-2	3-Nitroaniline	410	U	
534-52-1	4,6-dinitro-2-methyl phenol	810	U	
101-55-3	4-Bromophenyl-phenylether	410	U	
106-47-8	4-Chloroaniline	410	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	410	U	
100-01-6	4-Nitroaniline	410	U	
100-02-7	4-Nitrophenol	810	U	
59-50-7	4-chloro-3-methylphenol	410	U	
106-44-5	4-methylphenol	410	U	
83-32-9	Acenaphthene	410	U	

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SAMPLE NO
51SB6C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-003-024-1/1
Sample Volume :	30	Lab File ID :	D33460.D
% Moisture:	17.79	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
208-96-8	Acenaphthylene	410	U
120-12-7	Anthracene	410	U
56-55-3	Benzo(a)anthracene	410	U
50-32-8	Benzo(a)pyrene	410	U
205-99-2	Benzo(b)fluoranthene	410	U
191-24-2	Benzo(g,h,i)perylene	410	U
207-08-9	Benzo(k)fluoranthene	410	U
65-85-0	Benzoic Acid	810	U
100-51-6	Benzyl Alcohol	410	U
85-68-7	Benzyl Butyl Phthalate	410	U
86-74-8	Carbazole	410	U
218-01-9	Chrysene	410	U
53-70-3	Dibenz(a,h)Anthracene	410	U
132-64-9	Dibenzofuran	410	U
84-66-2	Diethyl Phthalate	410	U
131-11-3	Dimethyl Phthalate	410	U
206-44-0	Fluoranthene	410	U
86-73-7	Fluorene	410	U
118-74-1	Hexachlorobenzene	410	U
87-68-3	Hexachlorobutadiene	410	U
77-47-4	Hexachlorocyclopentadiene	410	U
67-72-1	Hexachloroethane	410	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	410	U
78-59-1	Isophorone	410	U
91-20-3	Naphthalene	410	U
98-95-3	Nitrobenzene	410	U
87-86-5	Pentachlorophenol	810	U
85-01-8	Phenanthrene	410	U
108-95-2	Phenol	410	U

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SAMPLE NO
51SB6C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-003-024-1/1
Sample Volume :	30	Lab File ID :	D33460.D
% Moisture:	17.79	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	410	U
110-86-1	Pyridine	410	U
111-91-1	bis(2-chloroethoxy) methane	410	U
111-44-4	bis(2-chloroethyl) ether	410	U
117-81-7	bis(2-ethylhexyl) phthalate	55	J
84-74-2	di-n-Butyl Phthalate	410	U
117-84-0	di-n-Octyl Phthalate	410	U
621-64-7	n-Nitrosodi-n-Propylamine	410	U
86-30-6	n-Nitrosodiphenylamine	410	U

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SAMPLE NO
51SB6D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-004-025-1/1
Sample Volume :	30	Lab File ID :	D33461.D
% Moisture:	16.83	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	400	U	
95-50-1	1,2-Dichlorobenzene	400	U	
541-73-1	1,3-Dichlorobenzene	400	U	
106-46-7	1,4-Dichlorobenzene	400	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	400	U	
95-95-4	2,4,5-Trichlorophenol	400	U	
88-06-2	2,4,6-Trichlorophenol	400	U	
120-83-2	2,4-Dichlorophenol	400	U	
105-67-9	2,4-Dimethylphenol	400	U	
51-28-5	2,4-Dinitrophenol	800	U	
121-14-2	2,4-Dinitrotoluene	570		
606-20-2	2,6-Dinitrotoluene	2300		
91-58-7	2-Chloronaphthalene	400	U	
95-57-8	2-Chlorophenol	400	U	
91-57-6	2-Methylnaphthalene	400	U	
88-74-4	2-Nitroaniline	77	J	J
88-75-5	2-Nitrophenol	400	U	
95-48-7	2-methylphenol	400	U	
91-94-1	3,3-Dichlorobenzidine	800	U	UJ
99-09-2	3-Nitroaniline	400	U	
534-52-1	4,6-dinitro-2-methyl phenol	800	U	
101-55-3	4-Bromophenyl-phenylether	400	U	
106-47-8	4-Chloroaniline	400	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	400	U	
100-01-6	4-Nitroaniline	400	U	
100-02-7	4-Nitrophenol	800	U	
59-50-7	4-chloro-3-methylphenol	400	U	
106-44-5	4-methylphenol	400	U	
83-32-9	Acenaphthene	400	U	

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SAMPLE NO
51SB6D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-004-025-1/1
Sample Volume :	30	Lab File ID :	D33461.D
% Moisture:	16.83	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
208-96-8	Acenaphthylene	400	U
120-12-7	Anthracene	400	U
56-55-3	Benzo(a)anthracene	400	U
50-32-8	Benzo(a)pyrene	400	U
205-99-2	Benzo(b)fluoranthene	400	U
191-24-2	Benzo(g,h,i)perylene	400	U
207-08-9	Benzo(k)fluoranthene	400	U
65-85-0	Benzoic Acid	800	U
100-51-6	Benzyl Alcohol	400	U
85-68-7	Benzyl Butyl Phthalate	400	U
86-74-8	Carbazole	400	U
218-01-9	Chrysene	400	U
53-70-3	Dibenz(a,h)Anthracene	400	U
132-64-9	Dibenzofuran	400	U
84-66-2	Diethyl Phthalate	1600	
131-11-3	Dimethyl Phthalate	400	U
206-44-0	Fluoranthene	400	U
86-73-7	Fluorene	400	U
118-74-1	Hexachlorobenzene	400	U
87-68-3	Hexachlorobutadiene	400	U
77-47-4	Hexachlorocyclopentadiene	400	U
67-72-1	Hexachloroethane	400	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	400	U
78-59-1	Isophorone	400	U
91-20-3	Naphthalene	400	U
98-95-3	Nitrobenzene	400	U
87-86-5	Pentachlorophenol	800	U
85-01-8	Phenanthrene	400	U
108-95-2	Phenol	400	U

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SAMPLE NO
51SB6D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-004-025-1/1
Sample Volume :	30	Lab File ID :	D33461.D
% Moisture:	16.83	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	400	U
110-86-1	Pyridine	400	U
111-91-1	bis(2-chloroethoxy) methane	400	U
111-44-4	bis(2-chloroethyl) ether	400	U
117-81-7	bis(2-ethylhexyl) phthalate	48	J
84-74-2	di-n-Butyl Phthalate	400	U
117-84-0	di-n-Octyl Phthalate	400	U
621-64-7	n-Nitrosodi-n-Propylamine	400	U
86-30-6	n-Nitrosodiphenylamine	400	U

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SAMPLE NO
51SB7A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-005-026-1/1
Sample Volume :	30	Lab File ID :	D33464.D
% Moisture:	15.23	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	390	U	
95-50-1	1,2-Dichlorobenzene	390	U	
541-73-1	1,3-Dichlorobenzene	390	U	
106-46-7	1,4-Dichlorobenzene	390	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	390	U	
95-95-4	2,4,5-Trichlorophenol	390	U	
88-06-2	2,4,6-Trichlorophenol	390	U	
120-83-2	2,4-Dichlorophenol	390	U	
105-67-9	2,4-Dimethylphenol	390	U	
51-28-5	2,4-Dinitrophenol	790	U	
121-14-2	2,4-Dinitrotoluene	390	U	
606-20-2	2,6-Dinitrotoluene	390	U	
91-58-7	2-Chloronaphthalene	390	U	
95-57-8	2-Chlorophenol	390	U	
91-57-6	2-Methylnaphthalene	390	U	
88-74-4	2-Nitroaniline	390	U	
88-75-5	2-Nitrophenol	390	U	
95-48-7	2-methylphenol	390	U	
91-94-1	3,3-Dichlorobenzidine	790	U	UJ
99-09-2	3-Nitroaniline	390	U	
534-52-1	4,6-dinitro-2-methyl phenol	790	U	
101-55-3	4-Bromophenyl-phenylether	390	U	
106-47-8	4-Chloroaniline	390	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	390	U	
100-01-6	4-Nitroaniline	390	U	
100-02-7	4-Nitrophenol	790	U	
59-50-7	4-chloro-3-methylphenol	390	U	
106-44-5	4-methylphenol	390	U	
83-32-9	Acenaphthene	390	U	

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SAMPLE NO
51SB7A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-005-026-1/1
Sample Volume :	30	Lab File ID :	D33464.D
% Moisture:	15.23	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
208-96-8	Acenaphthylene	390	U
120-12-7	Anthracene	390	U
56-55-3	Benzo(a)anthracene	390	U
50-32-8	Benzo(a)pyrene	390	U
205-99-2	Benzo(b)fluoranthene	390	U
191-24-2	Benzo(g,h,i)perylene	390	U
207-08-9	Benzo(k)fluoranthene	390	U
65-85-0	Benzoic Acid	790	U
100-51-6	Benzyl Alcohol	390	U
85-68-7	Benzyl Butyl Phthalate	390	U
86-74-8	Carbazole	390	U
218-01-9	Chrysene	390	U
53-70-3	Dibenz(a,h)Anthracene	390	U
132-64-9	Dibenzofuran	390	U
84-66-2	Diethyl Phthalate	1200	
131-11-3	Dimethyl Phthalate	390	U
206-44-0	Fluoranthene	390	U
86-73-7	Fluorene	390	U
118-74-1	Hexachlorobenzene	390	U
87-68-3	Hexachlorobutadiene	390	U
77-47-4	Hexachlorocyclopentadiene	390	U
67-72-1	Hexachloroethane	390	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	390	U
78-59-1	Isophorone	390	U
91-20-3	Naphthalene	390	U
98-95-3	Nitrobenzene	390	U
87-86-5	Pentachlorophenol	790	U
85-01-8	Phenanthrene	390	U
108-95-2	Phenol	390	U

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FORM 1
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SAMPLE NO
51SB7A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-005-026-1/1
Sample Volume :	30	Lab File ID :	D33464.D
% Moisture:	15.23	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	390	U
110-86-1	Pyridine	390	U
111-91-1	bis(2-chloroethoxy) methane	390	U
111-44-4	bis(2-chloroethyl) ether	390	U
117-81-7	bis(2-ethylhexyl) phthalate	390	U
84-74-2	di-n-Butyl Phthalate	390	U
117-84-0	di-n-Octyl Phthalate	390	U
621-64-7	n-Nitrosodi-n-Propylamine	390	U
86-30-6	n-Nitrosodiphenylamine	390	U

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SAMPLE NO
51SB7B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-006-027-1/1
Sample Volume :	30	Lab File ID :	D33462.D
% Moisture:	19.57	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	410	U	
95-50-1	1,2-Dichlorobenzene	410	U	
541-73-1	1,3-Dichlorobenzene	410	U	
106-46-7	1,4-Dichlorobenzene	410	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	410	U	
95-95-4	2,4,5-Trichlorophenol	410	U	
88-06-2	2,4,6-Trichlorophenol	410	U	
120-83-2	2,4-Dichlorophenol	410	U	
105-67-9	2,4-Dimethylphenol	410	U	
51-28-5	2,4-Dinitrophenol	830	U	
121-14-2	2,4-Dinitrotoluene	410	U	
606-20-2	2,6-Dinitrotoluene	410	U	
91-58-7	2-Chloronaphthalene	410	U	
95-57-8	2-Chlorophenol	410	U	
91-57-6	2-Methylnaphthalene	410	U	
88-74-4	2-Nitroaniline	410	U	
88-75-5	2-Nitrophenol	410	U	
95-48-7	2-methylphenol	410	U	
91-94-1	3,3-Dichlorobenzidine	830	U	UT
99-09-2	3-Nitroaniline	410	U	
534-52-1	4,6-dinitro-2-methyl phenol	830	U	
101-55-3	4-Bromophenyl-phenylether	410	U	
106-47-8	4-Chloroaniline	410	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	410	U	
100-01-6	4-Nitroaniline	410	U	
100-02-7	4-Nitrophenol	830	U	
59-50-7	4-chloro-3-methylphenol	410	U	
106-44-5	4-methylphenol	410	U	
83-32-9	Acenaphthene	410	U	

GPL Laboratories

Form I Copy

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-006-027-1/1
Sample Volume :	30	Lab File ID :	D33462.D
% Moisture:	19.57	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
208-96-8	Acenaphthylene	410	U
120-12-7	Anthracene	410	U
56-55-3	Benzo(a)anthracene	410	U
50-32-8	Benzo(a)pyrene	410	U
205-99-2	Benzo(b)fluoranthene	410	U
191-24-2	Benzo(g,h,i)perylene	410	U
207-08-9	Benzo(k)fluoranthene	410	U
65-85-0	Benzoic Acid	830	U
100-51-6	Benzyl Alcohol	410	U
85-68-7	Benzyl Butyl Phthalate	410	U
86-74-8	Carbazole	410	U
218-01-9	Chrysene	410	U
53-70-3	Dibenz(a,h)Anthracene	410	U
132-64-9	Dibenzofuran	410	U
84-66-2	Diethyl Phthalate	410	U
131-11-3	Dimethyl Phthalate	410	U
206-44-0	Fluoranthene	410	U
86-73-7	Fluorene	410	U
118-74-1	Hexachlorobenzene	410	U
87-68-3	Hexachlorobutadiene	410	U
77-47-4	Hexachlorocyclopentadiene	410	U
67-72-1	Hexachloroethane	410	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	410	U
78-59-1	Isophorone	410	U
91-20-3	Naphthalene	410	U
98-95-3	Nitrobenzene	410	U
87-86-5	Pentachlorophenol	830	U
85-01-8	Phenanthrene	410	U
108-95-2	Phenol	410	U

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-006-027-1/1
Sample Volume :	30	Lab File ID :	D33462.D
% Moisture:	19.57	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	410	U
110-86-1	Pyridine	410	U
111-91-1	bis(2-chloroethoxy) methane	410	U
111-44-4	bis(2-chloroethyl) ether	410	U
117-81-7	bis(2-ethylhexyl) phthalate	410	U
84-74-2	di-n-Butyl Phthalate	410	U
117-84-0	di-n-Octyl Phthalate	410	U
621-64-7	n-Nitrosodi-n-Propylamine	410	U
86-30-6	n-Nitrosodiphenylamine	45	J

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GPL Laboratories

Form 1 Comp

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-007-028-1/1
Sample Volume :	30	Lab File ID :	D33463.D
% Moisture:	17.25	Date Received	03/31/2004
Extraction:	SW3540C	Date Extracte	04/01/2004
Extract Volume	1 mL	Date Analyzed	04/07/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	400	U	
95-50-1	1,2-Dichlorobenzene	400	U	
541-73-1	1,3-Dichlorobenzene	400	U	
106-46-7	1,4-Dichlorobenzene	400	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	400	U	
95-95-4	2,4,5-Trichlorophenol	400	U	
88-06-2	2,4,6-Trichlorophenol	400	U	
120-83-2	2,4-Dichlorophenol	400	U	
105-67-9	2,4-Dimethylphenol	400	U	
51-28-5	2,4-Dinitrophenol	810	U	
121-14-2	2,4-Dinitrotoluene	400	U	
606-20-2	2,6-Dinitrotoluene	400	U	
91-58-7	2-Chloronaphthalene	400	U	
95-57-8	2-Chlorophenol	400	U	
91-57-6	2-Methylnaphthalene	400	U	
88-74-4	2-Nitroaniline	400	U	
88-75-5	2-Nitrophenol	400	U	
95-48-7	2-methylphenol	400	U	
91-94-1	3,3-Dichlorobenzidine	810	U	UJ
99-09-2	3-Nitroaniline	400	U	
534-52-1	4,6-dinitro-2-methyl phenol	810	U	
101-55-3	4-Bromophenyl-phenylether	400	U	
106-47-8	4-Chloroaniline	400	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	400	U	
100-01-6	4-Nitroaniline	400	U	
100-02-7	4-Nitrophenol	810	U	
59-50-7	4-chloro-3-methylphenol	400	U	
106-44-5	4-methylphenol	400	U	
83-32-9	Acenaphthene	400	U	

Form 1 Copy

GPL Laboratories

GPL
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205-99-2	Benzo(b)fluoranthene	400	U
191-24-2	Benzo(g,h,i)perylene	400	U
207-08-9	Benzo(k)fluoranthene	400	U
65-85-0	Benzoic Acid	810	U
100-51-6	Benzyl Alcohol	400	U
85-68-7	Benzyl Butyl Phthalate	400	U
86-74-8	Carbazole	400	U
218-01-9	Chrysene	400	U
53-70-3	Dibenz(a,h)Anthracene	400	U
132-64-9	Dibenzofuran	400	U
84-66-2	Diethyl Phthalate	400	U
131-11-3	Dimethyl Phthalate	400	U
206-44-0	Fluoranthene	400	U
86-73-7	Fluorene	400	U
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77-47-4	Hexachlorocyclopentadiene	400	U
67-72-1	Hexachloroethane	400	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	400	U
78-59-1	Isophorone	400	U
91-20-3	Naphthalene	400	U
98-95-3	Nitrobenzene	400	U
87-86-5	Pentachlorophenol	810	U
85-01-8	Phenanthrene	400	U
108-95-2	Phenol	400	U

GPL Laboratories

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GPL
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84-74-2	di-n-Butyl Phthalate	400	U
117-84-0	di-n-Octyl Phthalate	400	U
621-64-7	n-Nitrosodi-n-Propylamine	400	U
86-30-6	n-Nitrosodiphenylamine	400	U

J

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – TAL Inorganics
GPL Laboratories, Inc., SDG 403225

DATE: June 2, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on March 30, 2004. Samples were analyzed for target analyte list (TAL) Inorganics using USEPA SW-846 3050B/6010B for ICP metals, USEPA SW-846 7471A for mercury, and USEPA SW-846 9014 for cyanide. A total of seven soil samples were validated. All samples were analyzed for total TAL inorganics. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB6A	403225-001	51SB7A	403225-005
51SB6B	403225-002	51SB7B	403225-006
51SB6C	403225-003	51SB7C	403225-007
51SB6D	403225-004		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Inorganic Data Review* (April, 1993). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
X		Initial and Continuing Calibration
X		Blank Analysis
	X	ICP Interference Check Sample (ICS)
	X	Laboratory Control Sample (LCS)
X		Lab Sample Duplicate
X		Matrix Spike
	X	ICP Serial Dilution
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/2/04
Date

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

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GPL Laboratories, Inc., SDG 403225

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51SB6B	403225-002	51SB7B	403225-006
51SB6C	403225-003	51SB7C	403225-007
51SB6D	403225-004		

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	X	Laboratory Control Sample (LCS)
X		Lab Sample Duplicate
X		Matrix Spike
	X	ICP Serial Dilution
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

E. Malarek

Eric Malarek, Chemist

6/2/04

Date

RFAAP VALIDATION REPORT
TAL INORGANICS REVIEW
SDG 403225

I-Holding Times

The primary objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample analysis. The soil samples are received and stored cool @4 °C ± 2 °C, with a maximum holding time of 180 days for ICP metals, 28 days for mercury, and 14 days for cyanide from collection (USEPA criteria).

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 03/30/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: Samples were collected 03/30/04. They were digested on 04/02/04 and analyzed for ICP metals on 04/06/04. Samples were digested on 04/06/04 for mercury and were analyzed for mercury on 04/07/04. Samples were digested on 04/07/04 for cyanide and were analyzed for cyanide on 04/13/04. All holding time criteria were met. No qualifiers were applied.

II-Initial and Continuing Calibration

Requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of the analysis run, and continuing calibration verification documents that the initial calibration is still valid.

ICP: 1- blank (USACE <MDL)
3 – standards (r≥0.995)
ICV/CCV (90-110%) (USACE 90-110%)
MRL (70-130%) (USACE 80-120%)

Hg: 1 – blank (USACE <MDL)
5 – standards (r≥0.995)
ICV/CCV (80-120%) (USACE ICV 90-110% / CCV 80-120%)
MRL (80-120%)

CN: 1- blank (USACE <MDL)
5 – standards (r≥0.995)
ICV/CCV (85-115%)

- The samples were analyzed for ICP metals on 04/06/04. Mercury was analyzed on 04/07/04 with a correlation coefficient of 0.9998. Cyanide was analyzed on 04/13/04 with a correlation coefficient of 0.9999. All ICV/CCV standards were within criteria. No qualifiers were applied. **Table 2** summarizes the MRL standard analysis for metals. Samples with concentrations detected less than two times the MRL with out of criteria MRL recovery were qualified.

Table 2 MRL Analysis Summary

Analysis Date	Analysis	MRL (µg/L)	MRL (mg/kg)	MRL %Recovery	Qualified samples @ <2xMRL	Validation Qualifiers
04/06/04	ICP-Ni	10	1.0	76.4%	None	L, UL
04/06/04	ICP-Ag	3.0	0.3	129%, 128%	51SB6B	K
04/07/04	Hg	0.2	0.033	All within criteria	None	None

III-Blanks

Blanks (preparation and calibration blanks) are assessed to determine the existence and magnitude of contamination problems. No contaminants should be detected (i.e. <MDL) in any of the associated blanks. USACE Shell limits are < ½MRL for the method blank. Samples are qualified "B" when they are less than 5X the absolute value of the maximum blank concentration. **Table 3** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factors = 10 for ICP; 6 for Hg; and 40 for CN). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 3 Blank Contamination Analysis Summary

Analysis Date	Analysis	QC Blank ID	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/06/04	ICP-Al	ICB/CCBs	9.99B	50.0	None
04/06/04	ICP-As	ICB/CCBs	0.26B	1.3	None
04/06/04	ICP-Ba	ICB/CCBs	0.04B	0.20	None
04/06/04	ICP-Be	ICB/CCBs	0.01B	0.05	None
04/06/04	ICP-Cd	ICB/CCBs	0.05B	0.25	None
04/06/04	ICP-Ca	ICB/CCBs	12.0B	60.0	None
04/06/04	ICP-Cu	ICB/CCBs	0.68B	3.4	None
04/06/04	ICP-Fe	ICB/CCBs	6.16B	30.8	None
04/06/04	ICP-Mg	ICB/CCBs	14.4B	72.0	None
04/06/04	ICP-Mn	ICB/CCBs	0.08B	0.40	None
04/06/04	ICP-Se	ICB/CCBs	0.04B	0.20	None
04/07/04	Hg	ICB/CCBs	0.2B	1.0	None
04/13/04	CN	ICB/CCBs	<MRL	NA	None
04/06/04	ICP-Al	PBS	1.8B	9.0	None
04/06/04	ICP-Be	PBS	0.007B	0.035	None
04/06/04	ICP-Ca	PBS	14.8B	74.0	None
04/06/04	ICP-Cr	PBS	0.16B	0.80	None
04/06/04	ICP-Pb	PBS	0.24B	1.2	None
04/06/04	ICP-Mn	PBS	0.18B	0.90	None
04/06/04	ICP-Ni	PBS	0.37B	1.9	None
04/06/04	ICP-K	PBS	5.4B	27.0	None
04/06/04	ICP-Se	PBS	0.17B	0.85	51SB7A
04/06/04	ICP-Na	PBS	101B	505	51SB6A, 51SB6B, 51SB6C, 51SB6D, 51SB7A, 51SB7B, 51SB7C
04/06/04	ICP-Tl	PBS	0.95B	4.8	51SB6A, 51SB6B
04/07/04	Hg	PBS	0.022B	0.11	51SB6A, 51SB6C, 51SB7A, 51SB7B
04/13/04	CN	PBS	<MRL	NA	None
04/15/04	ICPMS-Al	040204R	0.10B	0.50	None
04/15/04	ICPMS-Ba	040204R	0.028B	0.14	None
04/15/04	ICPMS-Cd	040204R	0.017B	0.085	None
04/15/04	ICPMS-Ca	040204R	24.3B	120	None
04/15/04	ICPMS-Cr	040204R	0.13B	0.65	None
04/15/04	ICPMS-Co	040204R	0.0012B	0.0060	None
04/15/04	ICPMS-Cu	040204R	0.4E	2.0	None
04/15/04	ICPMS-Fe	040204R	1.87B	9.35	None
04/15/04	ICPMS-Pb	040204R	0.020B	0.10	None
04/15/04	ICPMS-Mg	040204R	3.86BE	19.3	None
04/15/04	ICPMS-Mn	040204R	0.22	1.10	None
04/15/04	ICPMS-Ni	040204R	0.035B	0.18	None
04/15/04	ICPMS-K	040204R	4.63BE	23.2	None
04/15/04	ICPMS-Na	040204R	16.9BE	84.5	51SB6A, 51SB6B, 51SB6C, 51SB7A, 51SB7B, 51SB7C
04/15/04	ICPMS-Tl	040204R	0.0076B	0.038	None
04/15/04	ICPMS-Zn	040204R	0.29BE	1.45	None
04/09/04	Hg	040204R	0.028BN	0.14	51SB6A, 51SB6C, 51SB7A, 51SB7B
04/15/04	CN	040204R	<MRL	NA	None

B = Value is estimated <MRL and >MDL
E = Serial Dilution percent difference not within limits.
N = Laboratory spike sample recovery not within control limits.

IV-ICP Interference Check Sample (ICS)
The ICP interference check sample (ICS) verifies interelement and background correction factors. ICP Interference Check is performed at the beginning and end of each sample analysis run. Control limits are 80-120% (USACE limits 80-120%).

- All criteria were met. No qualifiers were applied.

V-Laboratory Control Samples (LCS)
The laboratory control sample (LCS) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. All soil LCS results must fall within the control limits of 80-120% for ICPMS metals and mercury and 85-115% for cyanide. USACE Shell limits for metals are 80-120% (60-140% for sporadic marginal failures (SMF)).

- Sample BKS65653 was used as LCS for ICP metals analysis. All criteria were met. No qualifiers were applied.

- Sample BKS65752 was used as LCS for total mercury analysis. All criteria were met. No qualifiers were applied.

- Sample BKS1723 was used as LCS for total cyanide analysis. All criteria were met. No qualifiers were applied.

VI-Duplicate Sample Analysis
Duplicate sample determinations are used to demonstrate acceptable method precision by the laboratory at the time of analysis. Duplicate analysis are also performed to generate data in order to determine the long-term precision of the analytical method on various matrices. RPDs must be within established control limits. USACE Shell limits for metals are 25% RPD for ICP metals and 20% RPD for mercury and cyanide.

- Sample 51SB6A (403225-001) was used as sample duplicate for ICP metals analysis. Antimony (200%) was outside criteria. Antimony was outside due to low sample concentration, therefore no qualifiers were applied based upon this outliers.

- Sample 51SB7B (403225-006) was used as sample duplicate for mercury analysis. Mercury (34.4%) was outside criteria. Mercury was qualified as estimated "J" for detects.

- Sample 51SB6A (403225-001) was used for the sample duplicate analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VII-Matrix Spike
MS are generated to determine long-term accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. Specific criteria include the analyses of matrix spike and matrix spike duplicate samples at a frequency of one MS per 20 samples of similar matrix. MS recoveries and relative percent differences between MS recoveries should be within the specified limits. USACE Shell limits for metals are 75-125% for ICP metals and 80-120% for mercury and cyanide. Post digestion spikes limits are 75-125% for ICP metals and 85-115% for mercury and cyanide.

- Sample 51SB6A (403225-001) was used for the MS analysis for ICP analysis. Aluminum (1482%), antimony (42.3%), iron (205%), magnesium (139%), and potassium (134%) were outside of control limits. Post digestion spikes were within criteria for antimony, magnesium, and potassium. The sample concentration was >4 times the spike added for aluminum and iron, therefore no qualifiers were applied based upon this outlier. For antimony, the spiked sample was qualified bias "L". For magnesium and potassium, the spiked sample was qualified bias high "K".

- Sample 51SB7B (403225-006) was used for the MS analysis for mercury analysis. All criteria were met. No qualifiers were applied.

- Sample 51SB6A (403225-001) was used for the MS analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VIII-ICP Serial Dilution
An ICP serial dilution is performed to determine whether significant physical or chemical interferences exist due to sample matrix at high concentrations. An analysis of a 5-fold dilution should agree within 10% difference of the original result when the concentration in sample is a factor of 50 above MDL.

- The serial dilution for the ICP was analyzed for sample 51SB6A (403225-001). Antimony (100%), arsenic (13.4%), sodium (100%), and thallium (100%) were outside of criteria limits. Sample concentrations were <50 times MDL for antimony, arsenic, sodium, and thallium, therefore no qualifiers were applied based upon these outliers.

IX-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the aqueous samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate pair was analyzed with this SDG.

X-Quantitation Verification
The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." The following calculations were performed for verification.

ICP Sample: 51SB6A (403225-001), Total Barium

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(535.9613 μg/L)*(0.100 L)*(1)} / {(1.29 g)*(0.8380)} = 49.6 μg/g = 49.6 mg/kg

Reported concentration = 49.6 mg/kg
%D = 0.0%
Values were within 10% difference.

CVAA Sample: 51SB6A (403225-001), Total Mercury

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(0.718 μg/L)*(0.100 L)*(1)} / {(0.9 g)*(0.8380)} = 0.095 μg/g = 0.095 mg/kg

Reported concentration = 0.095 mg/kg
%D = 0.0%
Values were within 10% difference.

Cyanide Sample: 51SB6AMS (403225-001MS), Total Cyanide

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(39.2 μg/L)*(0.050 L)*(1)} / {(1.72 g)*(0.8380)} = 1.36 μg/g = 1.36 mg/kg

Reported concentration = 1.36 mg/kg
%D = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I OLM

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-001-036-1/1 **Client ID:** 51SB6A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/02/04 **Prep Batch:** 65653

Weight: 1.29 **Volume:** 100 **Percent Moisture:** 16.20

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.6**	**18.5**	**23300**		1	**ICPST**	**4/06/04**	**7:03**
Antimony	**206.84**	**0.46**	**1.9**	**0.64**	**BN**	L 1	**ICPST**	**4/06/04**	**7:03**
Arsenic	**189.04**	**0.19**	**1.9**	**3.3**		1	**ICPST**	**4/06/04**	**7:03**
Barium	**493.41**	**0.030**	**0.46**	**49.6**		1	**ICPST**	**4/06/04**	**7:03**
Beryllium	**313.04**	**0.0053**	**0.19**	**0.55**		1	**ICPST**	**4/06/04**	**7:03**
Cadmium	226.50	0.041	0.56	0.041	U	1	ICPST	4/06/04	7:03
Calcium	**317.93**	**7.0**	**92.5**	**254**		1	**ICPST**	**4/06/04**	**7:03**
Chromium	**267.72**	**0.11**	**0.46**	**26.4**	*	1	**ICPST**	**4/06/04**	**7:03**
Cobalt	**228.62**	**0.074**	**0.46**	**7.2**		1	**ICPST**	**4/06/04**	**7:03**
Copper	**324.75**	**0.088**	**0.93**	**11.0**		1	**ICPST**	**4/06/04**	**7:03**
Iron	**271.44**	**3.6**	**13.9**	**29800**		1	**ICPST**	**4/06/04**	**7:03**
Lead	**220.35**	**0.19**	**0.93**	**13.1**		1	**ICPST**	**4/06/04**	**7:03**
Magnesium	**279.08**	**2.3**	**23.1**	**1040**	**N**	K 1	**ICPST**	**4/06/04**	**7:03**
Manganese	**257.61**	**0.023**	**0.46**	**251**		1	**ICPST**	**4/06/04**	**7:03**
Nickel	**231.60**	**0.13**	**0.93**	**9.2**		1	**ICPST**	**4/06/04**	**7:03**
Potassium	**766.49**	**3.9**	**23.1**	**981**	**N**	K 1	**ICPST**	**4/06/04**	**7:03**
Selenium	196.03	0.16	1.9	0.16	U	1	ICPST	4/06/04	7:03
Silver	328.07	0.12	0.28	0.12	U	1	ICPST	4/06/04	7:03
Sodium	**330.23**	**31.2**	**231**	**75.4**	**B**	B 1	**ICPST**	**4/06/04**	**7:03**
Thallium	**190.86**	**0.54**	**2.8**	**0.83**	**B**	B 1	**ICPST**	**4/06/04**	**7:03**
Vanadium	**292.40**	**0.13**	**0.93**	**61.3**		1	**ICPST**	**4/06/04**	**7:03**
Zinc	**213.86**	**0.50**	**1.9**	**31.9**		1	**ICPST**	**4/06/04**	**7:03**

Comments: Sample Date: 03/30/04 Sample Time: 08:15 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

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Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-001-036-1/1 **Client ID:** 51SB6A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/06/04 **Prep Batch:** 65752

Weight: 0.90 **Volume:** 100 **Percent Moisture:** 16.20

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.013	0.027	0.095		B 1	CVAA	4/07/04	12:02

Comments: Sample Date: 03/30/04 Sample Time: 08:15 AM

5.05.0

E Serial dilution percent difference not within limits
U Result is less than the IDL
B Result is between IDL and RL

Form 1 Equivalent

Form I Orgy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB6A	Lab Sample ID:	403225-001-036-1/1
Sample Date/Time:	03/30/2004 08:15	Percent Moisture:	16.2
Receipt Date/Time:	03/31/2004 13:46	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.17	1	mg/kg	04/13/04 10:00

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Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-002-037-1/1 **Client ID:** 51SB6B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/02/04 **Prep Batch:** 65653

Weight: 1.33 **Volume:** 100 **Percent Moisture:** 59.18

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	6.3	73.7	18300		2	ICPST	4/06/04	8:07
Antimony	206.84	1.8	7.4	3.7	BN	J 2	ICPST	4/06/04	8:07
Arsenic	189.04	0.37	3.7	10.5		1	ICPST	4/06/04	7:59
Barium	493.41	0.059	0.92	146		1	ICPST	4/06/04	7:59
Beryllium	313.04	0.010	0.37	0.95		1	ICPST	4/06/04	7:59
Cadmium	226.50	0.16	2.2	5.0		2	ICPST	4/06/04	8:07
Calcium	317.93	14.0	184	29600		1	ICPST	4/06/04	7:59
Chromium	267.72	0.44	1.8	427	*	2	ICPST	4/06/04	8:07
Cobalt	228.62	0.15	0.92	5.1		1	ICPST	4/06/04	7:59
Copper	324.75	0.17	1.8	360		1	ICPST	4/06/04	7:59
Iron	271.44	14.5	55.3	168000		2	ICPST	4/06/04	8:07
Lead	220.35	0.77	3.7	4180		2	ICPST	4/06/04	8:07
Magnesium	279.08	9.4	92.1	4950	N	2	ICPST	4/06/04	8:07
Manganese	257.61	0.092	1.8	438		2	ICPST	4/06/04	8:07
Nickel	231.60	0.26	1.8	99.7		1	ICPST	4/06/04	7:59
Potassium	766.49	7.7	46.0	538	N	1	ICPST	4/06/04	7:59
Selenium	196.03	0.63	7.4	0.63	U	2	ICPST	4/06/04	8:07
Silver	328.07	0.24	0.55	0.27	B	K 1	ICPST	4/06/04	7:59
Sodium	330.23	124	921	409	B	B 2	ICPST	4/06/04	8:07
Thallium	190.86	2.1	11.1	6.3	B	B 2	ICPST	4/06/04	8:07
Vanadium	292.40	0.52	3.7	35.5		2	ICPST	4/06/04	8:07
Zinc	213.86	2.0	7.4	573		2	ICPST	4/06/04	8:07

Comments: Sample Date: 03/30/04 Sample Time: 08:30 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form 1 Copy

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Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-002-037-1/1 **Client ID:** 51SB6B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/06/04 **Prep Batch:** 65752

Weight: 0.75 **Volume:** 100 **Percent Moisture:** 59.18

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.033	0.065	0.42		1	CVAA	4/07/04	12:05

Comments: Sample Date: 03/30/04 Sample Time: 08:30 AM

E Serial dilution percent difference not within limits
U Result is less than the IDL
B Result is between IDL and RL

Form 1 Equivalent

Form I Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB6B	Lab Sample ID:	403225-002-037-1/1
Sample Date/Time:	03/30/2004 08:30	Percent Moisture:	59.18
Receipt Date/Time:	03/31/2004 13:46	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.32	1	mg/kg	04/13/04 10:00

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Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-003-038-1/1 **Client ID:** 51SB6C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/02/04 **Prep Batch:** 65653

Weight: 1.37 **Volume:** 100 **Percent Moisture:** 17.79

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.5**	**17.8**	**17600**		1	**ICPST**	**4/06/04**	**8:15**
Antimony	**206.84**	**0.44**	**1.8**	**0.50**	**BN**	J 1	**ICPST**	**4/06/04**	**8:15**
Arsenic	**189.04**	**0.18**	**1.8**	**1.6**	**B**	J 1	**ICPST**	**4/06/04**	**8:15**
Barium	**493.41**	**0.028**	**0.44**	**36.2**		1	**ICPST**	**4/06/04**	**8:15**
Beryllium	**313.04**	**0.0051**	**0.18**	**0.50**		1	**ICPST**	**4/06/04**	**8:15**
Cadmium	226.50	0.039	0.53	0.039	U	1	ICPST	4/06/04	8:15
Calcium	**317.93**	**6.7**	**88.8**	**639**		1	**ICPST**	**4/06/04**	**8:15**
Chromium	**267.72**	**0.11**	**0.44**	**13.4**	*	1	**ICPST**	**4/06/04**	**8:15**
Cobalt	**228.62**	**0.071**	**0.44**	**10.9**		1	**ICPST**	**4/06/04**	**8:15**
Copper	**324.75**	**0.084**	**0.89**	**7.3**		1	**ICPST**	**4/06/04**	**8:15**
Iron	**271.44**	**3.5**	**13.3**	**21400**		1	**ICPST**	**4/06/04**	**8:15**
Lead	**220.35**	**0.19**	**0.89**	**9.7**		1	**ICPST**	**4/06/04**	**8:15**
Magnesium	**279.08**	**2.3**	**22.2**	**950**	**N**	1	**ICPST**	**4/06/04**	**8:15**
Manganese	**257.61**	**0.022**	**0.44**	**335**		1	**ICPST**	**4/06/04**	**8:15**
Nickel	**231.60**	**0.12**	**0.89**	**7.4**		1	**ICPST**	**4/06/04**	**8:15**
Potassium	**766.49**	**3.7**	**22.2**	**919**	**N**	1	**ICPST**	**4/06/04**	**8:15**
Selenium	196.03	0.15	1.8	0.15	U	1	ICPST	4/06/04	8:15
Silver	328.07	0.12	0.27	0.12	U	1	ICPST	4/06/04	8:15
Sodium	**330.23**	**29.9**	**222**	**81.9**	**B**	J 1	**ICPST**	**4/06/04**	**8:15**
Thallium	190.86	0.51	2.7	0.51	U	1	ICPST	4/06/04	8:15
Vanadium	**292.40**	**0.12**	**0.89**	**41.2**		1	**ICPST**	**4/06/04**	**8:15**
Zinc	**213.86**	**0.48**	**1.8**	**25.6**		1	**ICPST**	**4/06/04**	**8:15**

Comments: Sample Date: 03/30/04 Sample Time: 08:45 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Copy

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Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-003-038-1/1 **Client ID:** 51SB6C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/06/04 **Prep Batch:** 65752

Weight: 0.76 **Volume:** 100 **Percent Moisture:** 17.79

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.032	0.036		B 1	CVAA	4/07/04	14:16

Comments: Sample Date: 03/30/04 Sample Time: 08:45 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form I Cyn

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB6C	Lab Sample ID:	403225-003-038-1/1
Sample Date/Time:	03/30/2004 08:45	Percent Moisture:	17.79
Receipt Date/Time:	03/31/2004 13:46	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.15	1	mg/kg	04/13/04 10:0(

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-004-039-1/1 **Client ID:** 51SB6D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/02/04 **Prep Batch:** 65653

Weight: 1.28 **Volume:** 100 **Percent Moisture:** 16.83

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.6**	**18.8**	**11600**		**1**	**ICPST**	**4/06/04**	**9:04**
Antimony	206.84	0.47	1.9	0.47	UN	1	ICPST	4/06/04	9:04
Arsenic	**189.04**	**0.19**	**1.9**	**5.0**		**1**	**ICPST**	**4/06/04**	**9:04**
Barium	**493.41**	**0.030**	**0.47**	**45.5**		**1**	**ICPST**	**4/06/04**	**9:04**
Beryllium	**313.04**	**0.0054**	**0.19**	**2.1**		**1**	**ICPST**	**4/06/04**	**9:04**
Cadmium	226.50	0.041	0.56	0.041	U	1	ICPST	4/06/04	9:04
Calcium	**317.93**	**7.1**	**93.9**	**422**		**1**	**ICPST**	**4/06/04**	**9:04**
Chromium	**267.72**	**0.11**	**0.47**	**16.3**	*	**1**	**ICPST**	**4/06/04**	**9:04**
Cobalt	**228.62**	**0.075**	**0.47**	**19.4**		**1**	**ICPST**	**4/06/04**	**9:04**
Copper	**324.75**	**0.089**	**0.94**	**10.3**		**1**	**ICPST**	**4/06/04**	**9:04**
Iron	**271.44**	**3.7**	**14.1**	**26200**		**1**	**ICPST**	**4/06/04**	**9:04**
Lead	**220.35**	**0.20**	**0.94**	**18.0**		**1**	**ICPST**	**4/06/04**	**9:04**
Magnesium	**279.08**	**2.4**	**23.5**	**3690**	N	**1**	**ICPST**	**4/06/04**	**9:04**
Manganese	**257.61**	**0.023**	**0.47**	**486**		**1**	**ICPST**	**4/06/04**	**9:04**
Nickel	**231.60**	**0.13**	**0.94**	**29.3**		**1**	**ICPST**	**4/06/04**	**9:04**
Potassium	**766.49**	**3.9**	**23.5**	**2430**	N	**1**	**ICPST**	**4/06/04**	**9:04**
Selenium	196.03	0.16	1.9	0.16	U	1	ICPST	4/06/04	9:04
Silver	328.07	0.24	0.56	0.24	U	2	ICPST	4/06/04	20:47
Sodium	**330.23**	**31.7**	**235**	**563**		**1**	**ICPST**	**4/06/04**	**9:04**
Thallium	190.86	0.54	2.8	0.54	U	1	ICPST	4/06/04	9:04
Vanadium	**292.40**	**0.13**	**0.94**	**8.8**		**1**	**ICPST**	**4/06/04**	**9:04**
Zinc	**213.86**	**0.51**	**1.9**	**14.3**		**1**	**ICPST**	**4/06/04**	**9:04**

Comments: Sample Date: 03/30/04 Sample Time: 09:15 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-004-039-1/1 **Client ID:** 51SB6D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/06/04 **Prep Batch:** 65752

Weight: 0.74 **Volume:** 100 **Percent Moisture:** 16.83

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.032	0.016	U	1	CVAA	4/07/04	14:18

Comments: Sample Date: 03/30/04 Sample Time: 09:15 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form I Org

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB6D	Lab Sample ID:	403225-004-039-1/1
Sample Date/Time:	03/30/2004 09:15	Percent Moisture:	16.83
Receipt Date/Time:	03/31/2004 13:46	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/13/04 10:00

Form 1 only

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-005-033-1/1 **Client ID:** 51SB7A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/02/04 **Prep Batch:** 65653

Weight: 1.27 **Volume:** 100 **Percent Moisture:** 15.23

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.6**	**18.6**	**16700**		1	**ICPST**	**4/06/04**	**9:11**
Antimony	206.84	0.46	1.9	0.46	UN	1	ICPST	4/06/04	9:11
Arsenic	**189.04**	**0.19**	**1.9**	**5.3**		1	**ICPST**	**4/06/04**	**9:11**
Barium	**493.41**	**0.030**	**0.46**	**76.3**		1	**ICPST**	**4/06/04**	**9:11**
Beryllium	**313.04**	**0.0053**	**0.19**	**0.41**		1	**ICPST**	**4/06/04**	**9:11**
Cadmium	226.50	0.041	0.56	0.041	U	1	ICPST	4/06/04	9:11
Calcium	**317.93**	**7.0**	**92.9**	**483**		1	**ICPST**	**4/06/04**	**9:11**
Chromium	**267.72**	**0.11**	**0.46**	**28.0**	*	1	**ICPST**	**4/06/04**	**9:11**
Cobalt	**228.62**	**0.074**	**0.46**	**13.9**		1	**ICPST**	**4/06/04**	**9:11**
Copper	**324.75**	**0.088**	**0.93**	**12.2**		1	**ICPST**	**4/06/04**	**9:11**
Iron	**271.44**	**3.7**	**13.9**	**23700**		1	**ICPST**	**4/06/04**	**9:11**
Lead	**220.35**	**0.20**	**0.93**	**34.1**		1	**ICPST**	**4/06/04**	**9:11**
Magnesium	**279.08**	**2.4**	**23.2**	**827**	N	1	**ICPST**	**4/06/04**	**9:11**
Manganese	**257.61**	**0.023**	**0.46**	**459**		1	**ICPST**	**4/06/04**	**9:11**
Nickel	**231.60**	**0.13**	**0.93**	**6.3**		1	**ICPST**	**4/06/04**	**9:11**
Potassium	**766.49**	**3.9**	**23.2**	**643**	N	1	**ICPST**	**4/06/04**	**9:11**
Selenium	**196.03**	**0.16**	**1.9**	**0.33**	B	1	**ICPST**	**4/06/04**	**9:11**
Silver	328.07	0.12	0.28	0.12	U	1	ICPST	4/06/04	9:11
Sodium	**330.23**	**31.3**	**232**	**82.7**	B	1	**ICPST**	**4/06/04**	**9:11**
Thallium	190.86	0.54	2.8	0.54	U	1	ICPST	4/06/04	9:11
Vanadium	**292.40**	**0.13**	**0.93**	**51.8**		1	**ICPST**	**4/06/04**	**9:11**
Zinc	**213.86**	**0.50**	**1.9**	**25.0**		1	**ICPST**	**4/06/04**	**9:11**

Comments: Sample Date: 03/30/04 Sample Time: 02:30 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Org

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-005-033-1/1 **Client ID:** 51SB7A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/06/04 **Prep Batch:** 65752

Weight: 0.73 **Volume:** 100 **Percent Moisture:** 15.23

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.032	0.14		B 1	CVAA	4/07/04	12:13

Comments: Sample Date: 03/30/04 Sample Time: 02:30 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form 8 Cyn

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB7A	Lab Sample ID:	403225-005-033-1/1
Sample Date/Time:	03/30/2004 14:30	Percent Moisture:	15.23
Receipt Date/Time:	03/31/2004 13:46	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.15	1	mg/kg	04/13/04 10:0

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-006-034-1/1 **Client ID:** 51SB7B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/02/04 **Prep Batch:** 65653

Weight: 1.28 **Volume:** 100 **Percent Moisture:** 19.57

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.7**	**19.4**	**27200**		**1**	**ICPST**	**4/06/04**	**9:19**
Antimony	206.84	0.49	1.9	0.49	UN	1	ICPST	4/06/04	9:19
Arsenic	**189.04**	**0.19**	**1.9**	**2.7**		**1**	**ICPST**	**4/06/04**	**9:19**
Barium	**493.41**	**0.031**	**0.49**	**76.6**		**1**	**ICPST**	**4/06/04**	**9:19**
Beryllium	**313.04**	**0.0055**	**0.19**	**0.68**		**1**	**ICPST**	**4/06/04**	**9:19**
Cadmium	226.50	0.043	0.58	0.043	U	1	ICPST	4/06/04	9:19
Calcium	**317.93**	**7.4**	**97.1**	**167**		**1**	**ICPST**	**4/06/04**	**9:19**
Chromium	**267.72**	**0.58**	**2.4**	**24.1**	*	**5**	**ICPST**	**4/06/04**	**9:27**
Cobalt	**228.62**	**0.078**	**0.49**	**179**		**1**	**ICPST**	**4/06/04**	**9:19**
Copper	**324.75**	**0.092**	**0.97**	**14.6**		**1**	**ICPST**	**4/06/04**	**9:19**
Iron	**271.44**	**3.8**	**14.6**	**33100**		**1**	**ICPST**	**4/06/04**	**9:19**
Lead	**220.35**	**1.0**	**4.9**	**66.7**		**5**	**ICPST**	**4/06/04**	**9:27**
Magnesium	**279.08**	**12.3**	**121**	**1470**	**N**	**5**	**ICPST**	**4/06/04**	**9:27**
Manganese	**257.61**	**0.12**	**2.4**	**3590**		**5**	**ICPST**	**4/06/04**	**9:27**
Nickel	**231.60**	**0.14**	**0.97**	**13.2**		**1**	**ICPST**	**4/06/04**	**9:19**
Potassium	**766.49**	**4.1**	**24.3**	**1340**	**N**	**1**	**ICPST**	**4/06/04**	**9:19**
Selenium	196.03	0.83	9.7	0.83	U	5	ICPST	4/06/04	9:27
Silver	328.07	0.63	1.5	0.63	U	5	ICPST	4/06/04	9:27
Sodium	**330.23**	**32.7**	**243**	**103**	**B**	**1**	**ICPST**	**4/06/04**	**9:19**
Thallium	190.86	2.8	14.6	2.8	U	5	ICPST	4/06/04	9:27
Vanadium	**292.40**	**0.68**	**4.9**	**66.1**		**5**	**ICPST**	**4/06/04**	**9:27**
Zinc	**213.86**	**0.52**	**1.9**	**41.9**		**1**	**ICPST**	**4/06/04**	**9:19**

Comments: Sample Date: 03/30/04 Sample Time: 02:45 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Only

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-006-034-1/1 **Client ID:** 51SB7B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/06/04 **Prep Batch:** 65752

Weight: 0.72 **Volume:** 100 **Percent Moisture:** 19.57

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.017	0.035	0.053		B 1	CVAA	4/07/04	12:16

Comments: Sample Date: 03/30/04 Sample Time: 02:45 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form 3 Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB7B	Lab Sample ID:	403225-006-034-1/1
Sample Date/Time:	03/30/2004 14:45	Percent Moisture:	19.57
Receipt Date/Time:	03/31/2004 13:46	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.17	1	mg/kg	04/13/04 10:0

Form I copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-007-035-1/1 **Client ID:** 51SB7C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/02/04 **Prep Batch:** 65653

Weight: 1.44 **Volume:** 100 **Percent Moisture:** 17.25

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.4**	**16.8**	**16400**		1	**ICPST**	**4/06/04**	**9:35**
Antimony	206.84	0.42	1.7	0.42	UN	1	ICPST	4/06/04	9:35
Arsenic	**189.04**	**0.17**	**1.7**	**2.1**		1	**ICPST**	**4/06/04**	**9:35**
Barium	**493.41**	**0.027**	**0.42**	**51.6**		1	**ICPST**	**4/06/04**	**9:35**
Beryllium	**313.04**	**0.0048**	**0.17**	**1.0**		1	**ICPST**	**4/06/04**	**9:35**
Cadmium	226.50	0.037	0.50	0.037	U	1	ICPST	4/06/04	9:35
Calcium	**317.93**	**6.4**	**83.9**	**310**		1	**ICPST**	**4/06/04**	**9:35**
Chromium	**267.72**	**0.10**	**0.42**	**24.7**	*	1	**ICPST**	**4/06/04**	**9:35**
Cobalt	**228.62**	**0.067**	**0.42**	**11.8**		1	**ICPST**	**4/06/04**	**9:35**
Copper	**324.75**	**0.080**	**0.84**	**10.3**		1	**ICPST**	**4/06/04**	**9:35**
Iron	**271.44**	**3.3**	**12.6**	**29100**		1	**ICPST**	**4/06/04**	**9:35**
Lead	**220.35**	**0.18**	**0.84**	**4.8**		1	**ICPST**	**4/06/04**	**9:35**
Magnesium	**279.08**	**2.1**	**21.0**	**5290**	N	1	**ICPST**	**4/06/04**	**9:35**
Manganese	**257.61**	**0.021**	**0.42**	**494**		1	**ICPST**	**4/06/04**	**9:35**
Nickel	**231.60**	**0.12**	**0.84**	**30.3**		1	**ICPST**	**4/06/04**	**9:35**
Potassium	**766.49**	**3.5**	**21.0**	**1270**	N	1	**ICPST**	**4/06/04**	**9:35**
Selenium	196.03	0.14	1.7	0.14	U	1	ICPST	4/06/04	9:35
Silver	328.07	0.11	0.25	0.11	U	1	ICPST	4/06/04	9:35
Sodium	**330.23**	**28.3**	**210**	**72.4**	**B**	1	**ICPST**	**4/06/04**	**9:35**
Thallium	190.86	0.49	2.5	0.49	U	1	ICPST	4/06/04	9:35
Vanadium	**292.40**	**0.12**	**0.84**	**24.5**		1	**ICPST**	**4/06/04**	**9:35**
Zinc	**213.86**	**0.45**	**1.7**	**21.4**		1	**ICPST**	**4/06/04**	**9:35**

Comments: Sample Date: 03/30/04 Sample Time: 03:30 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Corg

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 403225

Lab Sample ID: S 403225-007-035-1/1 **Client ID:** 51SB7C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/06/04 **Prep Batch:** 65752

Weight: 0.77 **Volume:** 100 **Percent Moisture:** 17.25

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.031	0.016	U	1	CVAA	4/07/04	12:19

Comments: Sample Date: 03/30/04 Sample Time: 03:30 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form I Equivalent

Form I Com

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB7C	Lab Sample ID:	403225-007-035-1/1
Sample Date/Time:	03/30/2004 15:30	Percent Moisture:	17.25
Receipt Date/Time:	03/31/2004 13:46	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.17	1	mg/kg	04/13/04 10:0(

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation - Volatiles
GPL Laboratories, Inc., SDG 403225

DATE: May 17, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on March 30, 2004. The samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs) using USEPA SW846 Method 5035/8260B. A total of seven soil samples were validated. The sample IDs are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB6A	403225-001	51SB7A	403225-005
51SB6B	403225-002	51SB7B	403225-006
51SB6C	403225-003	51SB7C	403225-007
51SB6D	403225-004		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated under data validation procedure Level M3 are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Results
X		Initial Calibration
X		Continuing Calibration
X		Blank Analysis
X		Laboratory Control Sample
	X	Matrix Spike/ Spike Duplicate Sample
X		System Monitoring Compounds
	X	Internal Standards
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with the noted qualifications, except for the following. Compound 2-butanone (RRF=0.032) was qualified for non-detects as rejected "R" for samples 51SB6B (403225-002) and 51SB7C (403225-007) based upon had poor calibration response.

Eric Malarek, Chemist

5/17/14
Date

RFAAP VALIDATION REPORT
VOLATILES REVIEW
SDG 403225

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of analysis. Holding time criteria: For Encore soil samples cooled @ 4°C ± 2°C; the maximum holding time is 2 days for preparation, 14 days from sample collection to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 03/30/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 03/30/04, prepped on 03/31/04, and analyzed for TCL VOCs on 04/02/04 and 04/09/02. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, bromofluorobenzene (BFB), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be ≥ 0.05 for all other compounds. Percent relative standard deviation (%RSD) must be ≤ 15% for each target compound and must be ≤ 30% for each calibration check compound. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For initial calibration for VOCs performed on 04/02/04 on instrument HP#A, target compounds bromomethane (18.0%), 2-butanone (RRF=0.032), 4-methyl-2-pentanone (17.4%), 2-hexanone (18.4%), and styrene (24.6%) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compounds bromomethane, 4-methyl-2-pentanone, 2-hexanone, and styrene were qualified "J" for detects and no qualifier for non-detects based upon the high %RSD. All samples were analyzed using this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Continuing calibration establishes the 12-hour relative response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be $\geq$ 0.05 for all other compounds. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within 20% for all target compounds. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for VOCs performed on 04/02/04 @ 13:53 on instrument HP#A, target compound 2-butanone (RRF=0.033) was outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Samples 51SB6A (403225-001), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply this continuing calibration.

- For continuing calibration for VOCs performed on 04/09/04 @ 09:13 on instrument HP#A, target compounds 2-butanone (54.3% grossly exceeding; RRF=0.015), 4-methyl-2-pentanone (39.3%), and 2-hexanone (43.2%; grossly exceeding) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compound 4-methyl-2-pentanone was qualified "J" for detects and no qualifier for non-detects based upon the high %D. Compound 2-hexanone was qualified "J" for detects and "UJ" for non-detects based upon the grossly exceeding high %D. Sample 51SB6B (403225-002) applies this continuing calibration.

V-Blank Analysis
The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of BFB. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants methylene chloride, acetone, and 2-butanone). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is $\leq$ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants methylene chloride, acetone, and 2-butanone, or 5 times (5X) the maximum amount for other volatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 1). Rinse blank 040204R and associated trip blank 040204T apply to these samples and were analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/02/04	BLK65715	2-butanone	4.1J	41	51SB6A, 51SB6C, 51SB6D, 51SB7A, 51SB7B
04/02/04	BLK65715	methylene chloride	4.0J	40	51SB6A, 51SB6C, 51SB6D, 51SB7A, 51SB7B, 51SB7C
04/02/04	BLK65715	styrene	3.5J	17.5	51SB6A, 51SB6C, 51SB6D, 51SB7A, 51SB7B, 51SB7C
04/09/04	BLK65969	acetone	3.4J	34	None
04/09/04	BLK65969	methylene chloride	1.5J	15	None
04/14/04	040204R	2-Butanone	2.1J	21	51SB6A, 51SB6C, 51SB6D, 51SB7A, 51SB7B
04/14/04	040204R	Acetone	34	340	51SB6A, 51SB6C, 51SB6D, 51SB7A, 51SB7B
04/14/04	040204R	Benzene	1.1	5.5	None
04/14/04	040204R	Ethylbenzene	0.58J	2.9	None
04/14/04	040204R	m,p-Xylenes	2.5	12.5	None
04/14/04	040204R	o-Xylene	0.90J	4.5	None
04/14/04	040204R	Toluene	4.7	23.5	None
04/14/04	040204T	1,1,1-Trichloroethane	0.83J	4.2	None
04/14/04	040204T	acetone	3.4J	34	51SB6C, 51SB6D, 51SB7A, 51SB7B
04/14/04	040204T	methylene chloride	0.93J	9.3	51SB6A, 51SB6C, 51SB6D, 51SB7A, 51SB7B, 51SB7C
04/14/04	040204T	trichloroethene	4.9	24.5	None

J = Estimated value <MRL and >MDL

VI-Laboratory Control Sample (LCS) and LCSD

Data for laboratory control samples (LCS) and LCSD are evaluated to determine long-term accuracy and precision of the analytical method on various matrices. Percent recoveries (%Rs) should be within the specified control limits. USACE Shell limits are 75-125%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- Sample BKSD65715 was used as the LCS and LCSD for the TCL VOC analysis. Compounds 2-butanone (70%), acetone (67, 69%), and bromomethane (72%) were below USACE criteria and within the SMF criteria. There were a total of 70 spike recoveries with 5 sporadic marginal failures. Based on this, no qualifiers were applied based upon these outliers. Samples 51SB6A (403225-001), 51SB6C (403225-003), 51SB6D (403225-004), 51SB7A (403225-005), 51SB7B (403225-006), and 51SB7C (403225-007) apply to this LCS/LCSD.

- Sample BKSD65969 was used as the LCS for the TCL VOC analysis. Compounds 2-butanone (280%) and 2-hexanone (56%) were outside USACE criteria and outside the SMF criteria. Compounds 4-methyl-2-pentanone (62%) and acetone (67%) were outside USACE criteria and within the SMF criteria. There were a total of 35 spike recoveries with 2 sporadic marginal failures and 2 outside both limits. All detects for 2-butanone were qualified bias high "K" and non-detects no qualifier. All detects for 2-hexanone, 4-methyl-2-pentanone, and acetone were qualified bias low "L" and "UL" for non-detects based upon these outliers. Sample 51SB6B (403225-002) applies to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 70-130%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- No MS/MSD was analyzed with this SDG.

VIII-System Monitoring Compounds (Surrogates)
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Recoveries for system monitoring compounds in volatile samples and blanks must be within the specified control limits.

Criteria: 1,2-Dichlorobenzene-d4 (74-122%) – SMC1 (USACE Shell Criteria: 70-130%)
1,2-Dichloroethane-d4 (64-120%) – SMC2 (USACE Shell Criteria: 70-130%)
4-Bromofluorobenzene (76-116%) – SMC3 (USACE Shell Criteria: 70-130%)
Toluene-d8 (76-120%) – SMC4 (USACE Shell Criteria: 70-130%)

- For sample 51SB6B (403225-002), surrogates 4-Bromofluorobenzene (118%) and 1,2-Dichlorobenzene-d4 (130%) were above laboratory criteria limits. All detects were qualified bias high "K" and non-detects no qualifier based upon these outliers for sample 51SB6B (403225-002). All other sample surrogates were within criteria.

IX-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: area counts (-50% to +100%) of the associated calibration standard, and retention time (± 30 seconds) from that of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed with this SDG.

XI-Quantitation Verification
The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB6A (403225-001), Acetone

Conc. (µg/kg) = {(Ax)*(Is)*(DF)*(Vp)} / {(Ais)*(RRF)*(Ws)*Fs)}
where: Ax is the compound area
Is is the corresponding internal standard concentration (ng/mL)
DF is the dilution factor
Vp is the volume purged (mL)
Ais is the corresponding internal standard area
RRF is the relative response factor
Ws is the weight of the sample (g)
Fs is the fraction solids for the sample = 1.0 for Wet Weight

Conc. µg/kg = (178451* 50 ng/mL * 1 * 5 mL) / (1524375 * 0.119 * 5.44g * 0.8380) = 54 µg/kg
Reported Conc. = 54 µg/kg
%D = 0.0
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I Cm

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-001-1/3
Sample Volume :	5.44	Lab File ID :	A43558.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	16.2	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.5	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.5	U	
79-00-5	1,1,2-Trichloroethane	5.5	U	
75-34-3	1,1-Dichloroethane	5.5	U	
75-35-4	1,1-Dichloroethene	5.5	U	
107-06-2	1,2-Dichloroethane	5.5	U	
78-87-5	1,2-Dichloropropane	5.5	U	
78-93-3	2-Butanone	5.6	JB	B
591-78-6	2-Hexanone	11	U	
108-10-1	4-Methyl-2-Pentanone	11	U	
67-64-1	Acetone	54		B
71-43-2	Benzene	5.5	U	
75-27-4	Bromodichloromethane	5.5	U	
75-25-2	Bromoform	5.5	U	
74-83-9	Bromomethane	11	U	
75-15-0	Carbon Disulfide	5.5	U	
56-23-5	Carbon Tetrachloride	5.5	U	
108-90-7	Chlorobenzene	5.5	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.5	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.5	U	
100-41-4	Ethylbenzene	5.5	U	
75-09-2	Methylene Chloride	1.4	JB	B
100-42-5	Styrene	2.9	JB	B
127-18-4	Tetrachloroethylene	5.5	U	
108-88-3	Toluene	5.5	U	
79-01-6	Trichloroethene	5.5	U	
75-01-4	Vinyl Chloride	11	U	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB6A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-001-001-1/3
Sample Volume :	5.44	Lab File ID :	A43558.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	16.2	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.5	U
10061-01-5	cis-1,3-Dichloropropene	5.5	U
136777-61-2	m,p-Xylenes	5.5	U
95-47-6	o-Xylene	5.5	U
156-60-5	trans-1,2-dichloroethene	5.5	U
10061-02-6	trans-1,3-dichloropropene	5.5	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB6B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-005-2/3
Sample Volume :	2.12	Lab File ID :	A43733.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	59.18	Date Analyzed	04/09/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	29	U	
79-34-5	1,1,2,2-Tetrachloroethane	29	U	
79-00-5	1,1,2-Trichloroethane	29	U	
75-34-3	1,1-Dichloroethane	29	U	
75-35-4	1,1-Dichloroethene	29	U	
107-06-2	1,2-Dichloroethane	29	U	
78-87-5	1,2-Dichloropropane	29	U	
78-93-3	2-Butanone	58	U	R
591-78-6	2-Hexanone	58	U	UJ
108-10-1	4-Methyl-2-Pentanone	58	U	UL
67-64-1	Acetone	58	U	VL
71-43-2	Benzene	29	U	
75-27-4	Bromodichloromethane	29	U	
75-25-2	Bromoform	29	U	
74-83-9	Bromomethane	58	U	
75-15-0	Carbon Disulfide	29	U	
56-23-5	Carbon Tetrachloride	29	U	
108-90-7	Chlorobenzene	29	U	
75-00-3	Chloroethane	58	U	
67-66-3	Chloroform	29	U	
74-87-3	Chloromethane	58	U	
124-48-1	Dibromochloromethane	29	U	
100-41-4	Ethylbenzene	29	U	
75-09-2	Methylene Chloride	58	U	
100-42-5	Styrene	29	U	
127-18-4	Tetrachloroethylene	29	U	
108-88-3	Toluene	29	U	
79-01-6	Trichloroethene	29	U	
75-01-4	Vinyl Chloride	58	U	

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SAMPLE NO
51SB6B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-002-005-2/3
Sample Volume :	2.12	Lab File ID :	A43733.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	59.18	Date Analyzed	04/09/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	29	U
10061-01-5	cis-1,3-Dichloropropene	29	U
136777-61-2	m,p-Xylenes	29	U
95-47-6	o-Xylene	29	U
156-60-5	trans-1,2-dichloroethene	29	U
10061-02-6	trans-1,3-dichloropropene	29	U

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SAMPLE NO
51SB6C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-003-007-1/3
Sample Volume :	5.71	Lab File ID :	A43560.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	17.79	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.3	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.3	U	
79-00-5	1,1,2-Trichloroethane	5.3	U	
75-34-3	1,1-Dichloroethane	5.3	U	
75-35-4	1,1-Dichloroethene	5.3	U	
107-06-2	1,2-Dichloroethane	5.3	U	
78-87-5	1,2-Dichloropropane	5.3	U	
78-93-3	2-Butanone	9.4	JB	B
591-78-6	2-Hexanone	11	U	
108-10-1	4-Methyl-2-Pentanone	11	U	
67-64-1	Acetone	12		B
71-43-2	Benzene	5.3	U	
75-27-4	Bromodichloromethane	5.3	U	
75-25-2	Bromoform	5.3	U	
74-83-9	Bromomethane	11	U	
75-15-0	Carbon Disulfide	5.3	U	
56-23-5	Carbon Tetrachloride	5.3	U	
108-90-7	Chlorobenzene	5.3	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.3	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.3	U	
100-41-4	Ethylbenzene	5.3	U	
75-09-2	Methylene Chloride	2.0	JB	B
100-42-5	Styrene	2.6	JB	B
127-18-4	Tetrachloroethylene	5.3	U	
108-88-3	Toluene	5.3	U	
79-01-6	Trichloroethene	5.3	U	
75-01-4	Vinyl Chloride	11	U	

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SAMPLE NO
51SB6C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-003-007-1/3
Sample Volume :	5.71	Lab File ID :	A43560.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	17.79	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.3	U
10061-01-5	cis-1,3-Dichloropropene	5.3	U
136777-61-2	m,p-Xylenes	5.3	U
95-47-6	o-Xylene	5.3	U
156-60-5	trans-1,2-dichloroethene	5.3	U
10061-02-6	trans-1,3-dichloropropene	5.3	U

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SAMPLE NO
51SB6D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-004-010-1/3
Sample Volume :	6.14	Lab File ID :	A43561.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	16.83	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.9	U	
79-34-5	1,1,2,2-Tetrachloroethane	4.9	U	
79-00-5	1,1,2-Trichloroethane	4.9	U	
75-34-3	1,1-Dichloroethane	4.9	U	
75-35-4	1,1-Dichloroethene	4.9	U	
107-06-2	1,2-Dichloroethane	4.9	U	
78-87-5	1,2-Dichloropropane	4.9	U	
78-93-3	2-Butanone	6.9	JB	B
591-78-6	2-Hexanone	9.8	U	
108-10-1	4-Methyl-2-Pentanone	9.8	U	
67-64-1	Acetone	7.1	J	B
71-43-2	Benzene	4.9	U	
75-27-4	Bromodichloromethane	4.9	U	
75-25-2	Bromoform	4.9	U	
74-83-9	Bromomethane	9.8	U	
75-15-0	Carbon Disulfide	4.9	U	
56-23-5	Carbon Tetrachloride	4.9	U	
108-90-7	Chlorobenzene	4.9	U	
75-00-3	Chloroethane	9.8	U	
67-66-3	Chloroform	4.9	U	
74-87-3	Chloromethane	2.8	J	J
124-48-1	Dibromochloromethane	4.9	U	
100-41-4	Ethylbenzene	4.9	U	
75-09-2	Methylene Chloride	1.9	JB	B
100-42-5	Styrene	2.3	JB	B
127-18-4	Tetrachloroethylene	4.9	U	
108-88-3	Toluene	4.9	U	
79-01-6	Trichloroethene	4.9	U	
75-01-4	Vinyl Chloride	9.8	U	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB6D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-004-010-1/3
Sample Volume :	6.14	Lab File ID :	A43561.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	16.83	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	4.9	U
10061-01-5	cis-1,3-Dichloropropene	4.9	U
136777-61-2	m,p-Xylenes	4.9	U
95-47-6	o-Xylene	4.9	U
156-60-5	trans-1,2-dichloroethene	4.9	U
10061-02-6	trans-1,3-dichloropropene	4.9	U

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SAMPLE NO
51SB7A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-005-013-1/3
Sample Volume :	5.52	Lab File ID :	A43562.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	15.23	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.3	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.3	U	
79-00-5	1,1,2-Trichloroethane	5.3	U	
75-34-3	1,1-Dichloroethane	5.3	U	
75-35-4	1,1-Dichloroethene	5.3	U	
107-06-2	1,2-Dichloroethane	5.3	U	
78-87-5	1,2-Dichloropropane	5.3	U	
78-93-3	2-Butanone	5.6	JB	B
591-78-6	2-Hexanone	11	U	
108-10-1	4-Methyl-2-Pentanone	11	U	
67-64-1	Acetone	16		B
71-43-2	Benzene	5.3	U	
75-27-4	Bromodichloromethane	5.3	U	
75-25-2	Bromoform	5.3	U	
74-83-9	Bromomethane	11	U	
75-15-0	Carbon Disulfide	5.3	U	
56-23-5	Carbon Tetrachloride	5.3	U	
108-90-7	Chlorobenzene	5.3	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.3	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.3	U	
100-41-4	Ethylbenzene	5.3	U	
75-09-2	Methylene Chloride	1.7	JB	B
100-42-5	Styrene	2.7	JB	B
127-18-4	Tetrachloroethylene	5.3	U	
108-88-3	Toluene	5.3	U	
79-01-6	Trichloroethene	5.3	U	
75-01-4	Vinyl Chloride	11	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-005-013-1/3
Sample Volume :	5.52	Lab File ID :	A43562.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	15.23	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.3	U
10061-01-5	cis-1,3-Dichloropropene	5.3	U
136777-61-2	m,p-Xylenes	5.3	U
95-47-6	o-Xylene	5.3	U
156-60-5	trans-1,2-dichloroethene	5.3	U
10061-02-6	trans-1,3-dichloropropene	5.3	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB7B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-006-016-1/3
Sample Volume :	6.48	Lab File ID :	A43563.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	19.57	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.8	U	
79-34-5	1,1,2,2-Tetrachloroethane	4.8	U	
79-00-5	1,1,2-Trichloroethane	4.8	U	
75-34-3	1,1-Dichloroethane	4.8	U	
75-35-4	1,1-Dichloroethene	4.8	U	
107-06-2	1,2-Dichloroethane	4.8	U	
78-87-5	1,2-Dichloropropane	4.8	U	
78-93-3	2-Butanone	8.8	JB	B
591-78-6	2-Hexanone	9.6	U	
108-10-1	4-Methyl-2-Pentanone	9.6	U	
67-64-1	Acetone	12		B
71-43-2	Benzene	4.8	U	
75-27-4	Bromodichloromethane	4.8	U	
75-25-2	Bromoform	4.8	U	
74-83-9	Bromomethane	9.6	U	
75-15-0	Carbon Disulfide	4.8	U	
56-23-5	Carbon Tetrachloride	4.8	U	
108-90-7	Chlorobenzene	4.8	U	
75-00-3	Chloroethane	9.6	U	
67-66-3	Chloroform	4.8	U	
74-87-3	Chloromethane	9.6	U	
124-48-1	Dibromochloromethane	4.8	U	
100-41-4	Ethylbenzene	4.8	U	
75-09-2	Methylene Chloride	1.5	JB	B
100-42-5	Styrene	3.1	JB	B
127-18-4	Tetrachloroethylene	4.8	U	
108-88-3	Toluene	4.8	U	
79-01-6	Trichloroethene	4.8	U	
75-01-4	Vinyl Chloride	9.6	U	

Form 1 Copy

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-006-016-1/3
Sample Volume :	6.48	Lab File ID :	A43563.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	19.57	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	4.8	U
10061-01-5	cis-1,3-Dichloropropene	4.8	U
136777-61-2	m,p-Xylenes	4.8	U
95-47-6	o-Xylene	4.8	U
156-60-5	trans-1,2-dichloroethene	4.8	U
10061-02-6	trans-1,3-dichloropropene	4.8	U

form I Copy

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-007-019-1/3
Sample Volume :	5.92	Lab File ID :	A43564.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	17.25	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.1	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.1	U	
79-00-5	1,1,2-Trichloroethane	5.1	U	
75-34-3	1,1-Dichloroethane	5.1	U	
75-35-4	1,1-Dichloroethene	5.1	U	
107-06-2	1,2-Dichloroethane	5.1	U	
78-87-5	1,2-Dichloropropane	5.1	U	
78-93-3	2-Butanone	10	U	R
591-78-6	2-Hexanone	10	U	
108-10-1	4-Methyl-2-Pentanone	10	U	
67-64-1	Acetone	10	U	
71-43-2	Benzene	5.1	U	
75-27-4	Bromodichloromethane	5.1	U	
75-25-2	Bromoform	5.1	U	
74-83-9	Bromomethane	10	U	
75-15-0	Carbon Disulfide	5.1	U	
56-23-5	Carbon Tetrachloride	5.1	U	
108-90-7	Chlorobenzene	5.1	U	
75-00-3	Chloroethane	10	U	
67-66-3	Chloroform	5.1	U	
74-87-3	Chloromethane	10	U	
124-48-1	Dibromochloromethane	5.1	U	
100-41-4	Ethylbenzene	5.1	U	
75-09-2	Methylene Chloride	1.6	JB	B
100-42-5	Styrene	2.3	JB	B
127-18-4	Tetrachloroethylene	5.1	U	
108-88-3	Toluene	5.1	U	
79-01-6	Trichloroethene	5.1	U	
75-01-4	Vinyl Chloride	10	U	

Form I Corr

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB7C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	403225
Case No.		SDG NO :	403225
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	403225-007-019-1/3
Sample Volume :	5.92	Lab File ID :	A43564.D
Level	Low	Date Received	03/31/2004
% Moisture: not dec	17.25	Date Analyzed	04/02/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.1	U
10061-01-5	cis-1,3-Dichloropropene	5.1	U
136777-61-2	m,p-Xylenes	5.1	U
95-47-6	o-Xylene	5.1	U
156-60-5	trans-1,2-dichloroethene	5.1	U
10061-02-6	trans-1,3-dichloropropene	5.1	U

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant Data Validation – Dioxin Furans
Pace Laboratories, Inc. SDG 04-1087014 (GPL SDG 404021)

DATE: June 11, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. The sample was analyzed for Dioxin Furan compounds using USEPA SW-846 Method 8290 High Resolution Gas Chromatography/High Resolution Mass Spectroscopy (HRGC/HRMS). A total of nine soil samples were validated in this SDG. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB4A	404021-001	51SB5B	404021-006
51SB4B	404021-002	51SB5C	404021-007
51SB4C	404021-003	51SB5D	404021-008
51SB4D	404021-004	TMSB5D	404021-009
51SB5A	404021-005		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *USEPA Region III Dioxin/Furan Data Validation Guidance* (March, 1999). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
X		Blank Analysis
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
	X	Internal Standards
	X	Cleanup Standards
	X	Laboratory Control Standard/Ongoing Precision Result
	X	Matrix Spike and Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

E. Malarek

Eric Malarek, Chemist

6/11/04

Date

RADFORD ARMY AMMUNITION PLANT VALIDATION REPORT
DIOXIN FURAN REVIEW
SDG 04-1087014 (GPL SDG 404021)

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For dioxin furan compounds in cooled @4°C ± 2°C soil samples, the maximum holding time is 30 days from sample collection to preparative extraction and 45 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by GPL Laboratories, Inc. at 4.0°C. The samples were then sent on to Pace Analytical for dioxin furan analysis and were received by the Pace Laboratories, Inc. at 3.1°C and 2.4°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/08/04, and analyzed for dioxin furans on 04/13/04, 04/14/04, and 04/15/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory (or field) blank analyses is to determine the existence and magnitude of contamination problems resulting from field and laboratory activities. No contamination should be found in any of the blanks > MDL. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 50). Rinse blank 040204R applies to these samples and was analyzed in GPL SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. ng/kg	Action Level ng/kg	B qualified samples
04/13/04	Blank-4657	OCDD	1.1J	11.0	51SB5D
04/16/04	040204R	1,2,3,4,6,7,8-HpCDD	0.900J	4.50	TMSB5D, 51SB4D
04/16/04	040204R	OCDD	4.75J	47.5	51SB5D, TMSB5D, 51SB4D
04/16/04	040204R	Total HpCDD	0.900J	4.50	TMSB5D, 51SB4D

III-Instrument Performance Check

Instrument must be tuned with perfluorokerosene (PFK) to achieve a static resolving power of at least 10,000 (10% valley). Documentation of the mass spectrometer resolving power is accomplished by recording the peak profile of the high-mass reference signal (typically m/z 330.9792) obtained during a peak examination by using the low-mass PFK ion at m/z 292.9825 or lower in mass as reference. At the beginning of the each 12-hour period, the chromatographic resolution is verified in the same fashion as in the initial calibration through the analysis of HRCC solution on the DB-5 (or equivalent) column or through the analysis of the column performance solution on the SP-2331 or SP-225 (or equivalent) column. A 25% valley must be achieved between the close eluters.

- All PFK forms were verified and found to be in compliance with method specification. No qualifiers were applied.

IV-Initial Calibration
Once the window defining mix has been analyzed and the descriptor switching times have been verified, the five point calibration solutions can be analyzed prior to sample analysis. Initial calibration criteria are as follows:

- The percent relative standard deviations for the mean response factors RRF(n) from the 17 unlabeled standards must not exceed ±20%, and those for the labeled reference compounds must not exceed ±30%
- Isotopic ratio must be within the specified control limits in Table 8 (SW846 Method 8290).

- For initial calibration performed on 04/06/04 for all target compounds on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5C (404021-007), 51SB5D (404021-008), and TMSB5D (404021-009) apply to this initial calibration.

V-Continuing Calibration
The continuing calibration consists of two parts: evaluation of the mass resolution and retention time check. The following stipulates the continuing calibration criteria.

- The signal signal-to-noise ratio (S/N) must be at least 10:1 for each selected ion current profile (SICP) and for each GC signal representing the elution of a target analyte or labeled standard for each analyte.
- The relative response factor of each analyte for the unlabeled standard must be within ±20% of the average RF obtained from the initial calibration, and the RRF of each labeled standard must be within ±30% of the average RRF established during initial calibration. This is expressed in term of percent difference %D.

- For continuing calibration performed on 04/13/04 @11:05 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB5A (404021-005), 51SB5B (404021-006), and 51SB5C (404021-007) apply to this continuing calibration.

- For continuing calibration performed on 04/13/04 @23:40 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB4B (404021-002) and 51SB4D (404021-004) apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @11:30 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @18:22 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4C (404021-003), 51SB5D (404021-008), and TMSB5D (404021-009) apply to this continuing calibration.

- For continuing calibration performed on 04/16/04 @06:06 on instrument 10MSHR05, cleanup standards 1,2,3,7,8-PeCDF (34.9%) and 2,3,4,7,8-PeCDF (31.3%) were outside criteria. No qualifiers were applied. No samples apply to this continuing calibration.

VI-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: Recoveries of the isotopically-labeled extraction standards to fall within the 40 to 135 percent range for the tetra- through octachlorinated congeners, or as stated in the data package

- All criteria were met. No qualifiers were applied.

VII-Cleanup Standards
Cleanup standards are added to every sample, blank, quality control sample, and calibration solution. This compound is added to the samples after extraction but prior to cleanup and is used to verify the percent recovery obtained using the isotope dilution technique. The control limits are 40-135%.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Standard (LCS) or Ongoing Precision Result (OPR)
LCSs/OPRs are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. Acceptable performance is determined by:

1. Recoveries of the isotopically-labeled extraction standards to fall within 40-135% control limits for the tetra- through octachlorinated congeners, or as stated in the data package;

2. Recoveries (accuracy) of the unlabeled compounds should be within $\pm$ 35% when spiked at the method quantitation limit and within $\pm$ 30% when spiked above 20 times the method quantitation limit, or as stated in the data package;

3. When duplicate OPR are required, the relative percent difference (RPD) of the unlabeled analytes concentrations should be within 30% when spiked at the method quantitation limit and within $\pm$ 25% when spiked above 20 times the method quantitation limit.

- Sample LCS-4658 was used as LCS. All criteria were met. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5C (404021-007), 51SB5D (404021-008), and TMSB5D (404021-009) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits (40-135%; 50%RPD).

- Sample 51SB4C (404021-003) was performed as MS/MSD for dioxin furans. All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB5D (404021-008) and TMSB5D (404021-009) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (ng/kg)	Duplicate Result (ng/kg)	%RPD	Qualifier
51SB5D	404021-008	OCDD	5.2 BJ	20	NA*	None
51SB5D	404021-008	1,2,3,4,6,7,8-HpCDD	0.990 U	2.1 J	NA*	None
51SB5D	404021-008	Total HpCDD	0.990 U	3.4 J	NA*	None

J = Estimated value <MRL and >MDL.
B = Found in associated method blank.
U = Value non-detect at MRL.
NA* = Not Applicable. OCDD, 1,2,3,4,6,7,8-HpCDD, and Total HpCDD were found in the blanks (Section II), therefore not evaluated for the duplicate analysis.

XI-Quantitation Verification

The accuracy of analytical results was verified through the calculation of at least one the several parameters such as the %D, %RSD, % recovery, and/or compound concentration. Values were found to be within 10%. Any value reported by the laboratory as estimated "J" based on an analyte to internal standard ratio below the calibration curve was qualified as such. The signal signal-to-noise ratio (S/N) must be greater than 2.5 for each selected ion current profile (SICP) and for each GC signal representing the elution of a target analyte or labeled standard. For where the ion ratio failed the 25% criteria (I-lab flag), the estimated maximum possible concentration was reported and flagged estimated "J". For where any detected value had ether interference (E-lab flag), the estimated maximum possible concentration was reported and flagged estimated "J".

Sample: 51SB4A (404021-001), OCDD

A(x) = sum of the integrated ion abundances of the quantitation ions for the unlabeled ions;

A(is) = sum of the integrated ion abundances of the quantitation ions for the labeled ions;

Q(is) = quantity, in pg, of the internal standard added to the sample before extraction; Here need to multiply concentration (pg/uL) by final extract volume (uL).

W = weight, in g, of the sample (solid or organic liquid) as dry weight, or volume in mL of an aqueous sample; and

Avg. RRF(n) = calculated mean relative response factor for the unlabeled analyte.

$$\text{Conc. (ng/kg)} = \frac{(A(x))*Q(is)}{A(is)*W*Avg.RRF} = \frac{(435000000+488000000)*(4.00)(1000)}{(79600000+89100000) * (12.2*0.8260) * 1.1323} =$$

= 1900 ng/kg

Reported Value = 1900 ng/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I Cdn

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Pace Analytical™

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404021-001-008-4/4		
Lab Sample ID	105493001		
Filename	F40415A_08		
Injected By	BAL		
Total Amount Extracted	12.2 g	Matrix	Solid
% Moisture	17.4	Dilution	NA
Dry Weight Extracted	10.1 g	Collected	04/01/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40415A_03 & F40415A_17	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/15/2004 22:40

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.200		2,3,7,8-TCDF-13C	2.00	86
Total TCDF	ND	-----	0.200		2,3,7,8-TCDD-13C	2.00	85
					1,2,3,7,8-PeCDF-13C	2.00	74
2,3,7,8-TCDD	ND	-----	0.200		2,3,4,7,8-PeCDF-13C	2.00	75
Total TCDD	ND	-----	0.200		1,2,3,7,8-PeCDD-13C	2.00	92
					1,2,3,4,7,8-HxCDF-13C	2.00	93
1,2,3,7,8-PeCDF	ND	-----	0.990		1,2,3,6,7,8-HxCDF-13C	2.00	83
2,3,4,7,8-PeCDF	ND	-----	0.990		2,3,4,6,7,8-HxCDF-13C	2.00	82
Total PeCDF	ND	-----	0.990		1,2,3,7,8,9-HxCDF-13C	2.00	90
					1,2,3,4,7,8-HxCDD-13C	2.00	82
1,2,3,7,8-PeCDD	ND	-----	0.990		1,2,3,6,7,8-HxCDD-13C	2.00	86
Total PeCDD	ND	-----	0.990		1,2,3,4,6,7,8-HpCDF-13C	2.00	86
					1,2,3,4,7,8,9-HpCDF-13C	2.00	85
1,2,3,4,7,8-HxCDF	ND	-----	0.990		1,2,3,4,6,7,8-HpCDD-13C	2.00	83
1,2,3,6,7,8-HxCDF	ND	-----	0.990		OCDD-13C	4.00	92
2,3,4,6,7,8-HxCDF	ND	-----	0.990				
1,2,3,7,8,9-HxCDF	ND	-----	0.990		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.990		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.990		2,3,7,8-TCDD-37Cl4	0.40	86
1,2,3,6,7,8-HxCDD	ND	-----	0.990				
1,2,3,7,8,9-HxCDD	ND	-----	0.990				
Total HxCDD	2.6	-----	0.990	J J			
1,2,3,4,6,7,8-HpCDF	ND	-----	0.990		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.990		Equivalence: 2.1 ng/Kg		
Total HpCDF	ND	-----	0.990		(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	20.0	-----	0.990				
Total HpCDD	42.0	-----	0.990				
OCDF	ND	-----	2.000				
OCDD	1900.0	-----	2.000				

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087014

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Pace Analytical™

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404021-002-016-4/4		
Lab Sample ID	105493035		
Filename	F40413B_08		
Injected By	MRO		
Total Amount Extracted	28.5 g	Matrix	Solid
% Moisture	64.5	Dilution	NA
Dry Weight Extracted	10.1 g	Collected	04/01/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40413A_18 & F40413B_15	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/14/2004 06:17

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	130.0	-----	0.54	A	2,3,7,8-TCDF-13C	2.00	76
Total TCDF	650.0	-----	0.20		2,3,7,8-TCDD-13C	2.00	72
					1,2,3,7,8-PeCDF-13C	2.00	44
2,3,7,8-TCDD	-----	1.1	0.53	IA J	2,3,4,7,8-PeCDF-13C	2.00	42
Total TCDD	ND	-----	0.20		1,2,3,7,8-PeCDD-13C	2.00	42
					1,2,3,4,7,8-HxCDF-13C	2.00	90
1,2,3,7,8-PeCDF	43.0	-----	0.99		1,2,3,6,7,8-HxCDF-13C	2.00	80
2,3,4,7,8-PeCDF	88.0	-----	0.99		2,3,4,6,7,8-HxCDF-13C	2.00	76
Total PeCDF	530.0	-----	0.99		1,2,3,7,8,9-HxCDF-13C	2.00	66
					1,2,3,4,7,8-HxCDD-13C	2.00	79
1,2,3,7,8-PeCDD	6.0	-----	0.99		1,2,3,6,7,8-HxCDD-13C	2.00	79
Total PeCDD	15.0	-----	0.99		1,2,3,4,6,7,8-HpCDF-13C	2.00	52
					1,2,3,4,7,8,9-HpCDF-13C	2.00	41
1,2,3,4,7,8-HxCDF	82.0	-----	0.99		1,2,3,4,6,7,8-HpCDD-13C	2.00	50
1,2,3,6,7,8-HxCDF	34.0	-----	0.99		OCDD-13C	4.00	51
2,3,4,6,7,8-HxCDF	32.0	-----	0.99				
1,2,3,7,8,9-HxCDF	17.0	-----	0.99		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	600.0	-----	0.99		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	16.0	-----	0.99		2,3,7,8-TCDD-37Cl4	0.40	115
1,2,3,6,7,8-HxCDD	63.0	-----	0.99				
1,2,3,7,8,9-HxCDD	31.0	-----	0.99				
Total HxCDD	260.0	-----	0.99				
1,2,3,4,6,7,8-HpCDF	400.0	-----	1.70	A	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	47.0	-----	2.30	A	Equivalence: 130 ng/Kg		
Total HpCDF	970.0	-----	0.99		(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	1900.0	-----	3.40	A			
Total HpCDD	3200.0	-----	0.99				
OCDF	1100.0	-----	2.00				
OCDD	17000.0	-----	2.00				

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
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Report No.....1087014

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1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Pace Analytical™

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404021-003-024-4/4		
Lab Sample ID	105493050		
Filename	F40415A_09		
Injected By	BAL		
Total Amount Extracted	11.6 g	Matrix	Solid
% Moisture	11.9	Dilution	NA
Dry Weight Extracted	10.2 g	Collected	04/01/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40415A_03 & F40415A_17	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/15/2004 23:29

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	0.47	-----	0.20	J J	2,3,7,8-TCDF-13C	2.00	106
Total TCDF	1.00	-----	0.20	J J	2,3,7,8-TCDD-13C	2.00	85
					1,2,3,7,8-PeCDF-13C	2.00	80
2,3,7,8-TCDD	ND	-----	0.31	A	2,3,4,7,8-PeCDF-13C	2.00	79
Total TCDD	ND	-----	0.20		1,2,3,7,8-PeCDD-13C	2.00	78
					1,2,3,4,7,8-HxCDF-13C	2.00	116
1,2,3,7,8-PeCDF	ND	-----	0.98		1,2,3,6,7,8-HxCDF-13C	2.00	102
2,3,4,7,8-PeCDF	ND	-----	0.98		2,3,4,6,7,8-HxCDF-13C	2.00	100
Total PeCDF	ND	-----	0.98		1,2,3,7,8,9-HxCDF-13C	2.00	108
					1,2,3,4,7,8-HxCDD-13C	2.00	87
1,2,3,7,8-PeCDD	ND	-----	0.98		1,2,3,6,7,8-HxCDD-13C	2.00	87
Total PeCDD	ND	-----	0.98		1,2,3,4,6,7,8-HpCDF-13C	2.00	70
					1,2,3,4,7,8,9-HpCDF-13C	2.00	72
1,2,3,4,7,8-HxCDF	ND	-----	0.98		1,2,3,4,6,7,8-HpCDD-13C	2.00	57
1,2,3,6,7,8-HxCDF	ND	-----	0.98		OCDD-13C	4.00	76
2,3,4,6,7,8-HxCDF	ND	-----	0.98				
1,2,3,7,8,9-HxCDF	ND	-----	0.98		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.98		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.98		2,3,7,8-TCDD-37Cl4	0.40	86
1,2,3,6,7,8-HxCDD	ND	-----	0.98				
1,2,3,7,8,9-HxCDD	ND	-----	0.98				
Total HxCDD	ND	-----	0.98				
1,2,3,4,6,7,8-HpCDF	ND	-----	0.98		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.98		Equivalence: 0.25 ng/Kg		
Total HpCDF	ND	-----	0.98		(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	6.60	-----	0.98				
Total HpCDD	12.00	-----	0.98				
OCDF	3.20	-----	2.00	J J			
OCDD	130.00	-----	2.00				

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
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Tel: 612-607-1700
Fax: 612- 607-6444

Pace Analytical™

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404021-004-032-4/4		
Lab Sample ID	105493068		
Filename	F40413B_10		
Injected By	MRO		
Total Amount Extracted	11.9 g	Matrix	Solid
% Moisture	15.6	Dilution	NA
Dry Weight Extracted	10.1 g	Collected	04/01/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40413A_18 & F40413B_15	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/14/2004 07:56

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.200	2,3,7,8-TCDF-13C	2.00	95
Total TCDF	ND	-----	0.200	2,3,7,8-TCDD-13C	2.00	94
				1,2,3,7,8-PeCDF-13C	2.00	90
2,3,7,8-TCDD	ND	-----	0.200	2,3,4,7,8-PeCDF-13C	2.00	88
Total TCDD	ND	-----	0.200	1,2,3,7,8-PeCDD-13C	2.00	90
				1,2,3,4,7,8-HxCDF-13C	2.00	110
1,2,3,7,8-PeCDF	ND	-----	0.990	1,2,3,6,7,8-HxCDF-13C	2.00	98
2,3,4,7,8-PeCDF	ND	-----	0.990	2,3,4,6,7,8-HxCDF-13C	2.00	97
Total PeCDF	ND	-----	0.990	1,2,3,7,8,9-HxCDF-13C	2.00	100
				1,2,3,4,7,8-HxCDD-13C	2.00	102
1,2,3,7,8-PeCDD	ND	-----	0.990	1,2,3,6,7,8-HxCDD-13C	2.00	97
Total PeCDD	ND	-----	0.990	1,2,3,4,6,7,8-HpCDF-13C	2.00	95
				1,2,3,4,7,8,9-HpCDF-13C	2.00	89
1,2,3,4,7,8-HxCDF	ND	-----	0.990	1,2,3,4,6,7,8-HpCDD-13C	2.00	95
1,2,3,6,7,8-HxCDF	ND	-----	0.990	OCDD-13C	4.00	91
2,3,4,6,7,8-HxCDF	ND	-----	0.990			
1,2,3,7,8,9-HxCDF	ND	-----	0.990	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.990	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.990	2,3,7,8-TCDD-37Cl4	0.40	89
1,2,3,6,7,8-HxCDD	ND	-----	0.990			
1,2,3,7,8,9-HxCDD	ND	-----	0.990			
Total HxCDD	ND	-----	0.990			
1,2,3,4,6,7,8-HpCDF	ND	-----	0.990	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.990	Equivalence: 0.032 ng/Kg		
Total HpCDF	ND	-----	0.990	(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	1.7	-----	0.990 J B			
Total HpCDD	2.9	-----	0.990 J B			
OCDF	ND	-----	2.000			
OCDD	15.0	-----	2.000 B			

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
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B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

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E = PCDE Interference
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1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404021-005-040-4/4		
Lab Sample ID	105492920		
Filename	F40413A_13		
Injected By	MRO		
Total Amount Extracted	12.1 g	Matrix	Solid
% Moisture	16.4	Dilution	NA
Dry Weight Extracted	10.1 g	Collected	04/01/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40413A_03 & F40413A_18	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/13/2004 19:32

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.200		2,3,7,8-TCDF-13C	2.00	90
Total TCDF	ND	-----	0.200		2,3,7,8-TCDD-13C	2.00	88
					1,2,3,7,8-PeCDF-13C	2.00	84
2,3,7,8-TCDD	ND	-----	0.200		2,3,4,7,8-PeCDF-13C	2.00	83
Total TCDD	2.5	-----	0.200		1,2,3,7,8-PeCDD-13C	2.00	85
					1,2,3,4,7,8-HxCDF-13C	2.00	98
1,2,3,7,8-PeCDF	ND	-----	0.990		1,2,3,6,7,8-HxCDF-13C	2.00	83
2,3,4,7,8-PeCDF	ND	-----	0.990		2,3,4,6,7,8-HxCDF-13C	2.00	88
Total PeCDF	ND	-----	0.990		1,2,3,7,8,9-HxCDF-13C	2.00	90
					1,2,3,4,7,8-HxCDD-13C	2.00	92
1,2,3,7,8-PeCDD	ND	-----	0.990		1,2,3,6,7,8-HxCDD-13C	2.00	87
Total PeCDD	2.6	-----	0.990	J J	1,2,3,4,6,7,8-HpCDF-13C	2.00	82
					1,2,3,4,7,8,9-HpCDF-13C	2.00	76
1,2,3,4,7,8-HxCDF	ND	-----	0.990		1,2,3,4,6,7,8-HpCDD-13C	2.00	75
1,2,3,6,7,8-HxCDF	ND	-----	0.990		OCDD-13C	4.00	86
2,3,4,6,7,8-HxCDF	ND	-----	0.990				
1,2,3,7,8,9-HxCDF	ND	-----	0.990		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.990		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.990		2,3,7,8-TCDD-37Cl4	0.40	88
1,2,3,6,7,8-HxCDD	ND	-----	0.990				
1,2,3,7,8,9-HxCDD	ND	-----	0.990				
Total HxCDD	6.5	-----	0.990				
1,2,3,4,6,7,8-HpCDF	ND	-----	0.990		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.990		Equivalence: 6.3 ng/Kg		
Total HpCDF	ND	-----	0.990		(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	38.0	-----	0.990				
Total HpCDD	71.0	-----	0.990				
OCDF	ND	-----	2.000				
OCDD	5900.0	-----	2.000				

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
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J = Concentration detected is below the calibration range
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1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404021-006-048-4/4		
Lab Sample ID	105492938		
Filename	F40413A_14		
Injected By	MRO		
Total Amount Extracted	22.3 g	Matrix	Solid
% Moisture	54.7	Dilution	NA
Dry Weight Extracted	10.1 g	Collected	04/01/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40413A_03 & F40413A_18	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/13/2004 20:21

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	160.0	-----	0.20		2,3,7,8-TCDF-13C	2.00	82
Total TCDF	610.0	-----	0.20		2,3,7,8-TCDD-13C	2.00	80
					1,2,3,7,8-PeCDF-13C	2.00	69
2,3,7,8-TCDD	-----	0.48	0.20	I J	2,3,4,7,8-PeCDF-13C	2.00	67
Total TCDD	4.2	-----	0.20		1,2,3,7,8-PeCDD-13C	2.00	68
					1,2,3,4,7,8-HxCDF-13C	2.00	96
1,2,3,7,8-PeCDF	40.0	-----	0.99		1,2,3,6,7,8-HxCDF-13C	2.00	83
2,3,4,7,8-PeCDF	85.0	-----	0.99		2,3,4,6,7,8-HxCDF-13C	2.00	71
Total PeCDF	600.0	-----	0.99		1,2,3,7,8,9-HxCDF-13C	2.00	75
					1,2,3,4,7,8-HxCDD-13C	2.00	93
1,2,3,7,8-PeCDD	4.6	-----	0.99	J J	1,2,3,6,7,8-HxCDD-13C	2.00	73
Total PeCDD	20.0	-----	0.99		1,2,3,4,6,7,8-HpCDF-13C	2.00	62
					1,2,3,4,7,8,9-HpCDF-13C	2.00	57
1,2,3,4,7,8-HxCDF	78.0	-----	0.99		1,2,3,4,6,7,8-HpCDD-13C	2.00	64
1,2,3,6,7,8-HxCDF	31.0	-----	0.99		OCDD-13C	4.00	65
2,3,4,6,7,8-HxCDF	34.0	-----	0.99				
1,2,3,7,8,9-HxCDF	12.0	-----	0.99		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	700.0	-----	0.99		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	14.0	-----	0.99		2,3,7,8-TCDD-37Cl4	0.40	84
1,2,3,6,7,8-HxCDD	57.0	-----	0.99				
1,2,3,7,8,9-HxCDD	28.0	-----	0.99				
Total HxCDD	270.0	-----	0.99				
1,2,3,4,6,7,8-HpCDF	360.0	-----	0.99		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	42.0	-----	0.99		Equivalence: 130 ng/Kg		
Total HpCDF	1200.0	-----	0.99		(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	1600.0	-----	0.99				
Total HpCDD	2600.0	-----	0.99				
OCDF	940.0	-----	2.00				
OCDD	16000.0	-----	2.00				

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
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Nn = Value obtained from additional analysis

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Fax: 612- 607-6444

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Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404021-007-056-4/4		
Lab Sample ID	105492953		
Filename	F40413A_15		
Injected By	MRO		
Total Amount Extracted	11.5 g	Matrix	Solid
% Moisture	11.2	Dilution	NA
Dry Weight Extracted	10.2 g	Collected	04/01/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40413A_03 & F40413A_18	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/13/2004 21:11

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery	
2,3,7,8-TCDF	0.37	-----	0.200	J J	2,3,7,8-TCDF-13C	2.00	91	
Total TCDF	0.62	-----	0.200	J J	2,3,7,8-TCDD-13C	2.00	88	
					1,2,3,7,8-PeCDF-13C	2.00	82	
2,3,7,8-TCDD	ND	-----	0.200		2,3,4,7,8-PeCDF-13C	2.00	79	
Total TCDD	ND	-----	0.200		1,2,3,7,8-PeCDD-13C	2.00	81	
					1,2,3,4,7,8-HxCDF-13C	2.00	98	
1,2,3,7,8-PeCDF	ND	-----	0.980		1,2,3,6,7,8-HxCDF-13C	2.00	87	
2,3,4,7,8-PeCDF	ND	-----	0.980		2,3,4,6,7,8-HxCDF-13C	2.00	85	
Total PeCDF	ND	-----	0.980		1,2,3,7,8,9-HxCDF-13C	2.00	84	
					1,2,3,4,7,8-HxCDD-13C	2.00	103	
1,2,3,7,8-PeCDD	ND	-----	0.980		1,2,3,6,7,8-HxCDD-13C	2.00	101	I
Total PeCDD	ND	-----	0.980		1,2,3,4,6,7,8-HpCDF-13C	2.00	81	
					1,2,3,4,7,8,9-HpCDF-13C	2.00	81	
1,2,3,4,7,8-HxCDF	ND	-----	0.980		1,2,3,4,6,7,8-HpCDD-13C	2.00	91	
1,2,3,6,7,8-HxCDF	ND	-----	0.980		OCDD-13C	4.00	95	
2,3,4,6,7,8-HxCDF	ND	-----	0.980					
1,2,3,7,8,9-HxCDF	ND	-----	0.980		1,2,3,4-TCDD-13C	2.00	NA	
Total HxCDF	ND	-----	0.980		1,2,3,7,8,9-HxCDD-13C	2.00	NA	
1,2,3,4,7,8-HxCDD	ND	-----	0.980		2,3,7,8-TCDD-37Cl4	0.40	83	
1,2,3,6,7,8-HxCDD	ND	-----	0.980					
1,2,3,7,8,9-HxCDD	ND	-----	0.980					
Total HxCDD	ND	-----	0.980					
1,2,3,4,6,7,8-HpCDF	1.00	-----	0.980	J J	Total 2,3,7,8-TCDD			
1,2,3,4,7,8,9-HpCDF	ND	-----	0.980		Equivalence: 0.23 ng/Kg			
Total HpCDF	1.00	-----	0.980	J J	(Using ITE Factors)			
1,2,3,4,6,7,8-HpCDD	6.30	-----	0.980					
Total HpCDD	6.30	-----	0.980					
OCDF	3.20	-----	2.000	J J				
OCDD	110.00	-----	2.000					

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

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Pace Analytical™

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404021-008-064-4/4		
Lab Sample ID	105492961		
Filename	F40415A_06		
Injected By	BAL		
Total Amount Extracted	12.3 g	Matrix	Solid
% Moisture	17.4	Dilution	NA
Dry Weight Extracted	10.1 g	Collected	04/01/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40415A_03 & F40415A_17	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/15/2004 21:02

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.200		2,3,7,8-TCDF-13C	2.00	92
Total TCDF	ND	-----	0.200		2,3,7,8-TCDD-13C	2.00	91
					1,2,3,7,8-PeCDF-13C	2.00	81
2,3,7,8-TCDD	ND	-----	0.200		2,3,4,7,8-PeCDF-13C	2.00	81
Total TCDD	ND	-----	0.200		1,2,3,7,8-PeCDD-13C	2.00	97
					1,2,3,4,7,8-HxCDF-13C	2.00	98
1,2,3,7,8-PeCDF	ND	-----	0.990		1,2,3,6,7,8-HxCDF-13C	2.00	90
2,3,4,7,8-PeCDF	ND	-----	0.990		2,3,4,6,7,8-HxCDF-13C	2.00	88
Total PeCDF	ND	-----	0.990		1,2,3,7,8,9-HxCDF-13C	2.00	97
					1,2,3,4,7,8-HxCDD-13C	2.00	87
1,2,3,7,8-PeCDD	ND	-----	0.990		1,2,3,6,7,8-HxCDD-13C	2.00	94
Total PeCDD	ND	-----	0.990		1,2,3,4,6,7,8-HpCDF-13C	2.00	94
					1,2,3,4,7,8,9-HpCDF-13C	2.00	92
1,2,3,4,7,8-HxCDF	ND	-----	0.990		1,2,3,4,6,7,8-HpCDD-13C	2.00	94
1,2,3,6,7,8-HxCDF	ND	-----	0.990		OCDD-13C	4.00	89
2,3,4,6,7,8-HxCDF	ND	-----	0.990				
1,2,3,7,8,9-HxCDF	ND	-----	0.990		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.990		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.990		2,3,7,8-TCDD-37Cl4	0.40	89
1,2,3,6,7,8-HxCDD	ND	-----	0.990				
1,2,3,7,8,9-HxCDD	ND	-----	0.990				
Total HxCDD	ND	-----	0.990				
1,2,3,4,6,7,8-HpCDF	ND	-----	0.990		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.990		Equivalence: 0.0052 ng/Kg		
Total HpCDF	ND	-----	0.990		(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	ND	-----	0.990				
Total HpCDD	ND	-----	0.990				
OCDF	ND	-----	2.000				
OCDD	5.2	-----	2.000	BJ B			

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

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Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Pace Analytical™

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404021-009-072-4/4		
Lab Sample ID	105492979		
Filename	F40415A_07		
Injected By	BAL		
Total Amount Extracted	12.4 g	Matrix	Solid
% Moisture	17.6	Dilution	NA
Dry Weight Extracted	10.2 g	Collected	04/01/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40415A_03 & F40415A_17	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/15/2004 21:50

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.200		2,3,7,8-TCDF-13C	2.00	74
Total TCDF	ND	-----	0.200		2,3,7,8-TCDD-13C	2.00	74
					1,2,3,7,8-PeCDF-13C	2.00	64
2,3,7,8-TCDD	ND	-----	0.200		2,3,4,7,8-PeCDF-13C	2.00	65
Total TCDD	ND	-----	0.200		1,2,3,7,8-PeCDD-13C	2.00	79
					1,2,3,4,7,8-HxCDF-13C	2.00	80
1,2,3,7,8-PeCDF	ND	-----	0.980		1,2,3,6,7,8-HxCDF-13C	2.00	72
2,3,4,7,8-PeCDF	ND	-----	0.980		2,3,4,6,7,8-HxCDF-13C	2.00	70
Total PeCDF	ND	-----	0.980		1,2,3,7,8,9-HxCDF-13C	2.00	78
					1,2,3,4,7,8-HxCDD-13C	2.00	68
1,2,3,7,8-PeCDD	ND	-----	0.980		1,2,3,6,7,8-HxCDD-13C	2.00	76
Total PeCDD	ND	-----	0.980		1,2,3,4,6,7,8-HpCDF-13C	2.00	72
					1,2,3,4,7,8,9-HpCDF-13C	2.00	70
1,2,3,4,7,8-HxCDF	ND	-----	0.980		1,2,3,4,6,7,8-HpCDD-13C	2.00	73
1,2,3,6,7,8-HxCDF	ND	-----	0.980		OCDD-13C	4.00	67
2,3,4,6,7,8-HxCDF	ND	-----	0.980				
1,2,3,7,8,9-HxCDF	ND	-----	0.980		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.980		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.980		2,3,7,8-TCDD-37Cl4	0.40	84
1,2,3,6,7,8-HxCDD	ND	-----	0.980				
1,2,3,7,8,9-HxCDD	ND	-----	0.980				
Total HxCDD	ND	-----	0.980				
1,2,3,4,6,7,8-HpCDF	ND	-----	0.980		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.980		Equivalence: 0.040 ng/Kg		
Total HpCDF	ND	-----	0.980		(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	2.1	-----	0.980	J B			
Total HpCDD	3.4	-----	0.980	J B			
OCDF	ND	-----	2.000				
OCDD	20.0	-----	2.000	B			

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

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REPORT OF LABORATORY ANALYSIS

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Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Explosives
GPL Laboratories, Inc., SDG 404021

DATE: June 10, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. Samples were analyzed for explosives using USEPA SW-846 8330. A total of nineteen soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB4A	404021-001	51SB5C	404021-007
51SB4A	404021-001DL	51SB5C	404021-007RE
51SB4B	404021-002	51SB5D	404021-008
51SB4B	404021-002DL	TMSB5D	404021-009
51SB4C	404021-003	TMSB5D	404021-009DL
51SB4C	404021-003DL	51SB10A	404021-010
51SB4D	404021-004	51SB10B	404021-011
51SB5A	404021-005	51SB10C	404021-012
51SB5B	404021-006	51SB10C	404021-012DL
51SB5B	404021-006DL		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
X		System Monitoring Compounds
X		Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
X		Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications, except for the following. For sample 51SB5C (404021-007), surrogate 4-nitroaniline (26%) was outside criteria. The sample was re-analyzed 51SB5C (404021-007RE) with 0% recovery. Sample 51SB5CRE (404021-007RE) was rejected "R" based upon these outliers. Sample 51SB5C (404021-007) was qualified "L" for detects and "UL" for non-detects and should be used for the RFI.

Eric Malarek, Chemist

6/10/24

Date

RFAAP VALIDATION REPORT
EXPLOSIVES REVIEW
SDG 404021

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For explosives soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 4.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/12/04, and analyzed for explosives on 04/13/04, 04/14/04, 04/15/04, and 04/16/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for explosive target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/13/04	BLK65879	All target compounds < MRL	NA	NA	None
04/19/04	BLK65963	All target compounds < MRL	NA	NA	None
04/16/04	040204R	All target compounds < MRL	NA	NA	None

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 02/27-28/04 on instrument LCD, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4A (404021-001DL), 51SB4B (404021-002), 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB4C (404021-003DL), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5B (404021-006DL), 51SB5C (404021-007), 51SB5C (404021-007RE), 51SB5D (404021-008), TMSB5D (404021-009), TMSB5D (404021-009DL), 51SB10A (404021-010), 51SB10B (404021-011), 51SB10C (404021-012), and 51SB10C (404021-012DL) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/14/04 @09:44 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB4B (404021-002), 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), and 51SB5C (404021-007) apply to this continuing calibration.

- For continuing calibration performed on 04/13/04 @23:06 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @10:53 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5D (404021-008), 51SB10A (404021-010), 51SB10B (404021-011), 51SB5C (404021-007), TMSB5D (404021-009DL), and 51SB10C (404021-012DL) apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @13:37 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5D (404021-008), 51SB10A (404021-010), 51SB10B (404021-011), 51SB5C (404021-007), TMSB5D (404021-009DL), and 51SB10C (404021-012DL) apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @02:27 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB4B (404021-002DL), 51SB4C (404021-003DL), and 51SB5B (404021-006DL) apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @16:03 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB5B (404021-006DL) applies to this continuing calibration.

- For continuing calibration performed on 04/16/04 @06:38 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB5C (404021-007) applies to this continuing calibration.

- For continuing calibration performed on 04/16/04 @18:35 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/19/04 @09:01 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/19/04 @22:31 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/16/04 @19:26 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- Surrogate 4-nitroaniline was diluted out for samples 51SB4ADL (15%), 51SB4BDL (20%), 51SB4CDL (19%), 51SB5BDL (0%), TMSB5DDL (46%), and 51SB10CDL (34%). No qualifiers were applied based upon these outliers. For sample 51SB5C (404021-007), surrogate 4-nitroaniline (26%) was outside criteria. The sample was re-analyzed 51SB5C (404021-007RE) with 0% recovery. Sample 51SB5CRE (404021-007RE) was rejected "R" based upon these outliers. Sample 51SB5C (404021-007) was qualified "L" for detects and "UL" for non-detects and should be used for the RFI.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for explosives are 60-120% (40-150% for sporadic marginal failures (SMF)).

- Sample BKS65879 was used as LCS for explosives analyzed on 04/13/04. Compounds 2,4,6-trinitrotoluene (65%) and tetryl (40%) were outside lab and USACE criteria and within SMF criteria. Since less than 3 compounds were outside USACE criteria and within SMF criteria, no qualifiers were applied based upon these outliers. Samples 51SB4A (404021-001), 51SB4A (404021-001DL), 51SB4B (404021-002), 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB4C (404021-003DL), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5B (404021-006DL), 51SB5C (404021-007RE), 51SB5D (404021-008), TMSB5D (404021-009), TMSB5D (404021-009DL), 51SB10A (404021-010), 51SB10B (404021-011), 51SB10C (404021-012), and 51SB10C (404021-012DL) apply to this LCS.

- Sample BKS65963 was used as LCS for explosives analyzed on 04/19/04. Compounds 1,3,5-trinitrobenzene (47%), 4-amino-2,6-dinitrotoluene (127%), and tetryl (40%) were outside lab and USACE criteria and within SMF criteria. Since only 3 compounds were outside USACE criteria and within SMF criteria, no qualifiers were applied based upon these outliers. Sample 51SB5C (404021-007) applies to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for explosives are 50-140%; RPD ≤ 50% (40-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB4A (404021-001) was performed as MS/MSD for explosives. Compounds 2,4-dinitrotoluene (173%; RPD=47%), 2,6-dinitrotoluene (133%), 3-nitrotoluene (193%, 160%), 2-nitrotoluene (1667%, 1333%), and 4-nitrotoluene (567%, 433%; RPD=25%) were outside laboratory and/or USACE criteria. The sample concentration was greater than the spike added for 2,4-dinitrotoluene, 2,6-dinitrotoluene, 3-nitrotoluene, 2-nitrotoluene, and 4-nitrotoluene and LCS was within criteria (see Section VI), therefore no qualifiers were applied based upon these outliers.

VIII-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB5D (404021-008) and TMSB5D (404021-009) was collected. Diluted sample TMSB5D (404021-009DL) was also evaluated. The field duplicate evaluation is noted in **Table 3.** For where values exceeding calibration range, the diluted values were evaluated. If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB5D	404021-008	1,3,5-Trinitrobenzene	5.7	7.7	29.9	None
51SB5D	404021-008	1,3-Dinitrobenzene	0.060 J	0.14	80.0	J
51SB5D	404021-008	2,4,6-Trinitrotoluene	8.9	15	51.5	J
51SB5D	404021-008	2,4-Dinitrotoluene	15	33	75.0	J
51SB5D	404021-008	2,6-Dinitrotoluene	6.1	8.5	32.9	None
51SB5D	404021-008	m-Nitrotoluene	2.3	1.5	42.1	None
51SB5D	404021-008	o-Nitrotoluene	31	19	48.0	None
51SB5D	404021-008	p-Nitrotoluene	14	8.8	45.6	None
51SB5D	404021-008	RDX	2.4	4.4	58.8	J

J = Estimated value.

IX-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D. The explosives for SW-846 method 8330 were air-dried prior to analysis because RDX and HMX are water soluble and moisture in the soil could affect the results.

- For samples 51SB4A (404021-001) and 51SB4B (404021-002), compounds 2,6-dinitrotoluene and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB4C (404021-003), compounds 2,6-dinitrotoluene, RDX, 1,3-dinitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB4D (404021-004), compounds 1,3,5-trinitrobenzene, 2,6-dinitrotoluene, 4-nitrotoluene, RDX, 1,3-dinitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB5A (404021-005), compounds 2,6-dinitrotoluene, 1,3-dinitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For samples 51SB5B (404021-006), 51SB5C (404021-007RE) and 51SB10A (404021-010), compounds 2,6-dinitrotoluene, 4-nitrotoluene, 1,3-dinitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB5C (404021-007), compounds 1,3,5-trinitrobenzene, 2,6-dinitrotoluene, 4-nitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For samples 51SB5D (404021-008) and TMSB5D (404021-009), compounds 2,6-dinitrotoluene, 4-nitrotoluene, RDX, 1,3-dinitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB10B (404021-011), compounds 2,6-dinitrotoluene, 4-nitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB10C (404021-012), compounds 2,6-dinitrotoluene, RDX, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

Sample: 51SB4A (404021-001), 2,4-dinitrotoluene

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D * 1000)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (132148712 * 20 * 1) / (521800 * 2 * 1 * 1000) = 2.5 mg/kg
Reported Value = 2.5 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-007-3/4
Sample Volume :	2	Lab File ID :	LCD23390.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.14		
121-14-2	2,4-Dinitrotoluene	2.5		
606-20-2	2,6-Dinitrotoluene	1.7		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	9.2		J

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SAMPLE NO
51SB4ADL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :-		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-007-3/4
Sample Volume :	2	Lab File ID :	LCD23412.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µ L	Dilution Factor :	5
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
88-72-2	o-Nitrotoluene	110	
99-99-0	p-Nitrotoluene	62	

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SAMPLE NO
51SB4B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-015-3/4
Sample Volume :	2	Lab File ID :	LCD23364.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	12		
99-65-0	1,3-Dinitrobenzene	0.10	J	J
606-20-2	2,6-Dinitrotoluene	17		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	9.3		J

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SAMPLE NO
51SB4BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No.:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-015-3/4
Sample Volume :	2	Lab File ID :	LCD23402.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µL	Dilution Factor :	5
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
118-96-7	2,4,6-Trinitrotoluene	64	
121-14-2	2,4-Dinitrotoluene	79	
88-72-2	o-Nitrotoluene	100	
99-99-0	p-Nitrotoluene	72	

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SAMPLE NO
51SB4C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-023-3/4
Sample Volume :	2	Lab File ID :	LCD23365.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	14		
99-65-0	1,3-Dinitrobenzene	0.18		J
606-20-2	2,6-Dinitrotoluene	22		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	5.3		J
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	12		J

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SAMPLE NO
51SB4CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-023-3/4
Sample Volume :	2	Lab File ID :	LCD23403.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µL	Dilution Factor :	5
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
118-96-7	2,4,6-Trinitrotoluene	75	
121-14-2	2,4-Dinitrotoluene	110	
88-72-2	o-Nitrotoluene	140	
99-99-0	p-Nitrotoluene	86	

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SAMPLE NO
51SB4D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-004-031-3/4
Sample Volume :	2	Lab File ID :	LCD23392.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	1.6		J
99-65-0	1,3-Dinitrobenzene	0.090	J	J
118-96-7	2,4,6-Trinitrotoluene	5.3		
121-14-2	2,4-Dinitrotoluene	9.7		
606-20-2	2,6-Dinitrotoluene	4.0		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	4.7		J
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	3.2		J
88-72-2	o-Nitrotoluene	36		
99-99-0	p-Nitrotoluene	22		J

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SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No.:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-039-3/4
Sample Volume :	2	Lab File ID :	LCD23393.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.18		J
118-96-7	2,4,6-Trinitrotoluene	0.12		
121-14-2	2,4-Dinitrotoluene	0.68		
606-20-2	2,6-Dinitrotoluene	0.38		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	1.9		J
88-72-2	o-Nitrotoluene	24		
99-99-0	p-Nitrotoluene	13		

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SAMPLE NO: 51SB5B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-047-3/4
Sample Volume :	2	Lab File ID :	LCD23417.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µ L	Dilution Factor :	1000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	100	U	
99-65-0	1,3-Dinitrobenzene	20	J	J
121-14-2	2,4-Dinitrotoluene	22000		
606-20-2	2,6-Dinitrotoluene	6000		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	100	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	100	U	
2691-41-0	HMX	200	U	
98-95-3	Nitrobenzene	100	U	
121-82-4	RDX	200	U	
479-45-8	Tetryl	200	U	
99-08-1	m-Nitrotoluene	1100		J
88-72-2	o-Nitrotoluene	11000		
99-99-0	p-Nitrotoluene	8000		J

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SAMPLE NO
51SB5BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No.:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-047-3/4
Sample Volume :	2	Lab File ID :	LCD23404.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µ L	Dilution Factor :	5000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
118-96-7	2,4,6-Trinitrotoluene	27000	

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SAMPLE NO
51SB5C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-055-3/4
Sample Volume :	2	Lab File ID :	LCD23438.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/15/2004
Extract Volume:	20 mL	Date Analyzed	04/16/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	Y pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	5.2		J
99-65-0	1,3-Dinitrobenzene	0.10	U	UL
118-96-7	2,4,6-Trinitrotoluene	8.0		L
121-14-2	2,4-Dinitrotoluene	29		L
606-20-2	2,6-Dinitrotoluene	5.7		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	UL
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	UL
2691-41-0	HMX	0.20	U	UL
98-95-3	Nitrobenzene	0.10	U	UL
121-82-4	RDX	0.20	U	UL
479-45-8	Tetryl	0.20	U	UL
99-08-1	m-Nitrotoluene	2.7		J
88-72-2	o-Nitrotoluene	34		L
99-99-0	p-Nitrotoluene	20		J

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SAMPLE NO
51SB5CRE

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-055-3/4
Sample Volume :	2	Lab File ID :	LCD23410.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	3.6		R
99-65-0	1,3-Dinitrobenzene	0.31		R
118-96-7	2,4,6-Trinitrotoluene	9.8		R
121-14-2	2,4-Dinitrotoluene	32		R
606-20-2	2,6-Dinitrotoluene	6.6		R
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	R
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	R
2691-41-0	HMX	0.20	U	R
98-95-3	Nitrobenzene	0.10	U	R
121-82-4	RDX	0.20	U	R
479-45-8	Tetryl	0.20	U	R
99-08-1	m-Nitrotoluene	2.8		R
88-72-2	o-Nitrotoluene	36		R
99-99-0	p-Nitrotoluene	21		R

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SAMPLE NO
51SB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-063-3/4
Sample Volume :	2	Lab File ID :	LCD23373.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	5.7		
99-65-0	1,3-Dinitrobenzene	0.060	J	J
118-96-7	2,4,6-Trinitrotoluene	8.9		J
121-14-2	2,4-Dinitrotoluene	15		J
606-20-2	2,6-Dinitrotoluene	6.1		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	2.4		J
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	2.3		J
88-72-2	o-Nitrotoluene	31		
99-99-0	p-Nitrotoluene	14		J

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SAMPLE NO
TMSB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-071-3/4
Sample Volume :	2	Lab File ID :	LCD23374.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	7.7		
99-65-0	1,3-Dinitrobenzene	0.14		J
118-96-7	2,4,6-Trinitrotoluene	15		J
606-20-2	2,6-Dinitrotoluene	8.5		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	4.4		J
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	1.5		J
88-72-2	o-Nitrotoluene	19		
99-99-0	p-Nitrotoluene	8.8		J

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SAMPLE NO
TMSB5DDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-071-3/4
Sample Volume :	2	Lab File ID :	LCD23398.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µ L	Dilution Factor :	2
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
121-14-2	2,4-Dinitrotoluene	33	J

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB10A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No.:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-010-079-3/4
Sample Volume :	2	Lab File ID :	LCD23395.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.080	J	J
118-96-7	2,4,6-Trinitrotoluene	0.24		
121-14-2	2,4-Dinitrotoluene	0.93		
606-20-2	2,6-Dinitrotoluene	0.53		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	1.7		J
88-72-2	o-Nitrotoluene	21		
99-99-0	p-Nitrotoluene	11		J

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FORM 1
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SAMPLE NO
51SB10B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-011-087-3/4
Sample Volume :	2	Lab File ID :	LCD23396.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.39		
121-14-2	2,4-Dinitrotoluene	1.3		
606-20-2	2,6-Dinitrotoluene	0.75		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	2.9		J
88-72-2	o-Nitrotoluene	36		
99-99-0	p-Nitrotoluene	18		J

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-012-095-3/4
Sample Volume :	2	Lab File ID :	LCD23377.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.98		
121-14-2	2,4-Dinitrotoluene	2.3		
606-20-2	2,6-Dinitrotoluene	1.5		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	2.1		J
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	8.2		J

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No.:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-012-095-3/4
Sample Volume :	2	Lab File ID :	LCD23399.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µL	Dilution Factor :	2
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
88-72-2	o-Nitrotoluene	93	
99-99-0	p-Nitrotoluene	45	

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MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Herbicides
GPL Laboratories, Inc., SDG 404021

DATE: June 11, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. Samples were analyzed for chlorinated herbicides using USEPA SW846 Method 8151A. A total of two soil samples were validated. The sample ID is:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB4A	404021-001	51SB5A	404021-005

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable.

E-Malarek

Eric Malarek, Chemist

6/11/04

Date

RFAAP VALIDATION REPORT
CHLORINATED HERBICIDES REVIEW
SDG 404021

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For chlorinated herbicides in cooled @4°C±2°C soil samples, the maximum holding time is 14 days from sample collection to extraction and 40 days from extraction to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 4.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/07/04, and analyzed for herbicides on 04/12/04. All criteria were met. No qualifiers were applied.

II-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. Percent relative standard deviation (%RSD) for a 5-point standard calibration should be ≤20% for each target compound.

- For initial calibration performed on 04/06/04 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Samples 51SB4A (404021-001) and 51SB5A (404021-005) apply to this initial calibration.

III-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration establishes the response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. Percent difference (%D) between the initial calibration CF and the continuing calibration CF must be ≤15%.

- For continuing calibration performed on 04/12/04 @13:26 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Samples 51SB4A (404021-001) and 51SB5A (404021-005) apply to this continuing calibration.

- For continuing calibration performed on 04/12/04 @14:08 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Samples 51SB4A (404021-001) and 51SB5A (404021-005) apply to this continuing calibration.

- For continuing calibration performed on 04/12/04 @17:54 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Samples 51SB4A (404021-001) and 51SB5A (404021-005) apply to this continuing calibration.

- For continuing calibration performed on 04/12/04 @18:19 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Samples 51SB4A (404021-001) and 51SB5A (404021-005) apply to this continuing calibration.

IV-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field or laboratory activities. No contaminants should be detected in any of the associated blanks. Positive sample results are qualified "B" if the concentration of the analyte is ≤ five times (5X) the absolute maximum blank concentration. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 100). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/12/04	BLK65835	All target compounds < MRL	NA	NA	None
04/09/04	040204R	All target compounds < MRL	NA	NA	None

V-System Monitoring Compounds (Surrogates)

Laboratory performance on individual samples is established by means of spiking activities. All samples are spiked with surrogate compounds prior to sample preparation. Spike recoveries must be within the specified control limits.

Control Limit: 2,4-DCAA (29-143%) (USACE Shell Criteria: 70-130%)

- All criteria were met. No qualifiers were applied.

VI-Laboratory Control Samples

Data for laboratory control samples (LCS) are generated to determine long-term precision and accuracy of the analytical method. Percent recoveries must be within the specified control limits.

- Sample BKS65835 was used as the LCS. All criteria were met. No qualifiers were applied. Samples 51SB4A (404021-001) and 51SB5A (404021-005) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits.

- Sample 404008-001 was used for the MS/MSD analysis. Since this is not a RFAAP sample, it was not evaluated in this report.

VIII-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed in this SDG.

IX-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. Percent difference (%D) between the calculated value and the reported value must be within 10%. All positive values must have less than or equal to 40% %D between the primary and secondary columns. Any sample value > MDL and < MRL is qualified as estimated, "J." All criteria were met. No qualifiers were applied.

Sample: BKS65835, 2,4-D

Conc. µg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (726425 * 10 * 1) / (2270 * 10 * 1) = 320 µg/kg
Reported Value = 320 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

GPL Laboratories

GPL FORM 1 Form I Copy
ANALYSIS DATA SHEET

SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-006-2/4
Sample Volume :	10	Lab File ID :	I27335.D
% Moisture:	15.64	Date Received	04/02/2004
Extraction:	EXT_SW8151	Date Extracted:	04/07/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
93-76-5	2,4,5-T	120	U
93-72-1	2,4,5-TP (Silvex)	120	U
94-75-7	2,4-D	120	U
94-82-6	2,4-DB	120	U
75-99-0	Dalapon	120	U
1918-00-9	Dicamba	120	U
120-36-5	Dichloroprop	120	U
88-85-7	Dinoseb	120	U
94-74-6	MCPA	12000	U
93-65-2	MCPP	12000	U

GPL Laboratories

GPL FORM 1 Form I Only
ANALYSIS DATA SHEET

SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-038-2/4
Sample Volume :	10	Lab File ID :	I27336.D
% Moisture:	17.91	Date Received	04/02/2004
Extraction:	EXT_SW8151	Date Extracted:	04/07/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
93-76-5	2,4,5-T	120	U
93-72-1	2,4,5-TP (Silvex)	120	U
94-75-7	2,4-D	120	U
94-82-6	2,4-DB	120	U
75-99-0	Dalapon	120	U
1918-00-9	Dicamba	120	U
120-36-5	Dichloroprop	120	U
88-85-7	Dinoseb	120	U
94-74-6	MCPA	12000	U
93-65-2	MCPP	12000	U

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MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Nitroglycerine
GPL Laboratories, Inc., SDG 404021

DATE: June 10, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 1, 2004. Samples were analyzed for nitroglycerine using USEPA SW-846 8332. A total of thirteen soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB4A	404021-001	51SB5C	404021-007
51SB4B	404021-002	51SB5D	404021-008
51SB4C	404021-003	TMSB5D	404021-009
51SB4D	404021-004	51SB10A	404021-010
51SB5A	404021-005	51SB10B	404021-011
51SB5B	404021-006	51SB10C	404021-012
51SB5B	404021-006DL		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
X		System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications, except for the following. For sample 51SB5B (404021-006), surrogate 4-nitroaniline (8213%) was grossly outside of criteria due to matrix interferences. This sample was qualified as rejected "R" due to these matrix interferences. Sample 51SB5B (404021-006DL) should be used for the RFI.

Eric Malarek, Chemist

6/10/04
Date

RFAAP VALIDATION REPORT
NITROGLYCERINE REVIEW
SDG 404021

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For nitroglycerine soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 4.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/12/04, and analyzed for nitroglycerine on 04/15/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.20). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/15/04	BLK65881	All target compounds < MRL	NA	NA	None
04/15/04	040204R	All target compounds < MRL	NA	NA	None

III-Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 04/15/04 on instrument HPLC-E, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5B (404021-006DL), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/15/04 @13:52 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4D (404021-004), 51SB5A (404021-005), and 51SB5C (404021-007) apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @16:43 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB4C (404021-003), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @19:56 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/16/04 @01:19 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB5B (404021-006) applies to this continuing calibration.

- For continuing calibration performed on 04/16/04 @04:00 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/16/04 @09:31 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB5B (404021-006DL) applies to this continuing calibration.

- For continuing calibration performed on 04/16/04 @12:15 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- Surrogate 4-nitroaniline was diluted out for sample 51SB5B (404021-006DL) (0%). No qualifiers were applied based upon this outlier. For sample 51SB5B (404021-006), surrogate 4-nitroaniline (8213%) was grossly outside of criteria due to matrix interferences. This sample was qualified as rejected "R" due to these matrix interferences. Sample 51SB5B (404021-006DL) should be used for the RFI.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for nitroglycerine are 60-120%.

- Sample BKS65881 was used as LCS for nitroglycerine analyzed on 04/15/04. All criteria were met. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5B (404021-006DL), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for nitroglycerine are 50-140%; RPD ≤ 50%.

- Sample 51SB4A (404021-001) was performed as MS/MSD for nitroglycerine. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB5D (404021-008) and TMSB5D (404021-009) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB5D	404021-008	Nitroglycerine	6.4 U	6.1 U	NA	None

U = Value non-detect at MRL.

NA = Not Applicable.

IX-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5B (404021-006DL), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012), nitroglycerine was non-detect. All criteria were met. No qualifiers were applied.

- Sample 51SB5B (404021-006) exhibited matrix interferences (See Section V). This sample was rejected "R" due to these matrix interferences. Sample 51SB5B (404021-006DL) should be used for the RFI

Sample: 51SB4AMS (404021-001MS), nitroglycerine

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (27099890 * 20 * 1) / (2542000 * 4 * 0.8436) = 63 mg/kg
Reported Value = 63 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-007-3/4
Sample Volume :	4	Lab File ID :	LCE0683.D
% Moisture:	15.64	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.9	U

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SAMPLE NO
51SB4B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-015-3/4
Sample Volume :	4	Lab File ID :	LCE0686.D
% Moisture:	55.28	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	11	U

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SAMPLE NO
51SB4C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-023-3/4
Sample Volume :	4	Lab File ID :	LCE0699.D
% Moisture:	13.6	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.8	U

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SAMPLE NO
51SB4D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-004-031-3/4
Sample Volume :	4	Lab File ID :	LCE0690.D
% Moisture:	15.94	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.0	U

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SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-039-3/4
Sample Volume :	4	Lab File ID :	LCE0691.D
% Moisture:	17.91	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.1	U

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FORM I
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SAMPLE NO
51SB5B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-047-3/4
Sample Volume :	4	Lab File ID :	LCE0742.D
% Moisture:	63.33	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/16/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	14	U

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FORM 1
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SAMPLE NO
51SB5B DL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-047-3/4
Sample Volume :	4	Lab File ID :	LCE0758.D
% Moisture:	63.33	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/16/2004
Injection Volume :	25 µ L	Dilution Factor	1000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	14000	U

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SAMPLE NO
51SB5C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-055-3/4
Sample Volume :	4	Lab File ID :	LCE0692.D
% Moisture:	7.73	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.4	U

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SAMPLE NO
51SB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-063-3/4
Sample Volume :	4	Lab File ID :	LCE0700.D
% Moisture:	21.32	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.4	U

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SAMPLE NO
TMSB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-071-3/4
Sample Volume :	4	Lab File ID :	LCE0701.D
% Moisture:	17.78	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.1	U

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SAMPLE NO
51SB10A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-010-079-3/4
Sample Volume :	4	Lab File ID :	LCE0702.D
% Moisture:	15.33	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.9	U

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SAMPLE NO
51SB10B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-011-087-3/4
Sample Volume :	4	Lab File ID :	LCE0703.D
% Moisture:	11.88	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.7	U

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SAMPLE NO
51SB10C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-012-095-3/4
Sample Volume :	4	Lab File ID :	LCE0704.D
% Moisture:	13.61	Date Received	04/13/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.8	U

Shaw Environmental, Inc.

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Edgewood, MD 21040-1037
410.612.6350
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – PAHs
GPL Laboratories, Inc., SDG 404021

DATE: June 9, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 1, 2004. Samples were analyzed for polynuclear aromatic hydrocarbons (PAHs) using USEPA SW846 Methods 3540C/8270C low level. A total of twelve soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB4A	404021-001	51SB5C	404021-007
51SB4B	404021-002DL	51SB5D	404021-008
51SB4C	404021-003	TMSB5D	404021-009
51SB4D	404021-004	51SB10A	404021-010
51SB5A	404021-005	51SB10B	404021-011
51SB5B	404021-006DL	51SB10C	404021-012

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
X		Blank Analysis
	X	Surrogate Spikes
	X	Internal Standards
	X	Laboratory Control Standard
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/9/04
Date

RFAAP VALIDATION REPORT
POLYNUCLEAR AROMATIC HYDROCARBONS REVIEW
SDG 404021

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For polynuclear aromatic hydrocarbons (PAHs) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 4.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/08/04, and analyzed for PAHs on 04/12/04 and 04/13/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for PAH compounds by GC/MS low level. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for the PAHs by USEPA SW-846 8270C low level was performed on 04/12/04 on instrument HP#H. All RRFs were ≥ 0.05. All criteria were met for the target compounds. Samples 51SB4A (404021-001), 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006DL), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be ≥ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within ± 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the PAHs by USEPA SW-846 8270C low level performed on 04/12/04 @16:58 on instrument HP#H, all target compounds were within criteria. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to his continuing calibration.

- For continuing calibration for the PAHs by USEPA SW-846 8270C low level performed on 04/13/04 @16:18 on instrument HP#H, all target compounds were within criteria. No qualifiers were applied. Samples 51SB4B (404021-002DL), 51SB4C (404021-003), and 51SB5B (404021-006DL) apply to his continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 26.8). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/12/04	BLK65817	All compounds < MRL	NA	NA	None
04/12/04	040204R	Naphthalene	24.3	122	51SB10A

VI-Surrogate Spikes

Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria: Nitrobenzene-d5 (36-164%) – S1 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (54-124%) – S2 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (56-150%) – S3 (USACE Shell Criteria: 45-135%)

- For samples 51SB4B (404021-002DL) and 51SB5B (404021-006DL), surrogate nitrobenzene-d5 (550% and 650%) was above lab and USACE criteria, respectively. Since this surrogate was diluted out, no qualifiers were applied based upon these outliers. For sample 51SB4B (404021-002DL), surrogate 2-Fluorobiphenyl (150%) was above lab criteria limits and USACE limits. Since this surrogate was diluted out, no qualifiers were applied based upon this outlier. All other surrogates were within criteria.

VII-Internal Standards
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for PAHs by 8270C low level are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65817 was used as the LCS for PAHs by USEPA SW-846 8270C low level. All criteria were met. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006DL), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB8B (404027-002) was used for the MS/MSD analysis for PAHs and was analyzed in SDG 404027. Compounds anthracene (RPD=42%), fluoranthene (RPD=41%), and phenanthrene (RPD=42%) were outside lab criteria. Three compounds were outside USACE criteria and within SMF criteria. All detects were qualified "J" estimated for the spiked sample and non-detects no qualifier based upon these outliers.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB5D (404021-008) and TMSB5D (404021-009) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB5D	404021-008	Phenanthrene	15	14	6.9	None

XI-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB4C (404021-003), phenanthrene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Is = Amount of internal standard injected (ng).
Vt = Volume of total extract (µL).
Ais = Area of characteristic ion for the internal standard.
RRF = Average relative response factor for compound being measured (from ICAL)
Vi = Volume of extract injected (µL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (251226 * 4 * 1000 * 1) / (1912887 * 0.880 * 1 * 30 * 0.8640) = 23 µg/kg
Reported Value = 23 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-005-1/4
Sample Volume :	30	Lab File ID :	H25633.D
% Moisture:	15.64	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/12/2004
Injection Volume :	µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.9	U
83-32-9	Acenaphthene	7.9	U
208-96-8	Acenaphthylene	7.9	U
120-12-7	Anthracene	7.9	U
56-55-3	Benzo(a)anthracene	7.9	U
50-32-8	Benzo(a)pyrene	7.9	U
205-99-2	Benzo(b)fluoranthene	7.9	U
191-24-2	Benzo(g,h,i)perylene	7.9	U
207-08-9	Benzo(k)fluoranthene	7.9	U
218-01-9	Chrysene	7.9	U
53-70-3	Dibenz(a,h)Anthracene	7.9	U
206-44-0	Fluoranthene	7.9	U
86-73-7	Fluorene	7.9	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.9	U
91-20-3	Naphthalene	7.9	U
85-01-8	Phenanthrene	7.9	U
129-00-0	Pyrene	7.9	U

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SAMPLE NO
51SB4BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-013-1/4
Sample Volume :	30	Lab File ID :	H25651.D
% Moisture:	55.28	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	10 mL	Date Analyzed	04/13/2004
Injection Volume :	µL	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	1500	U
83-32-9	Acenaphthene	1500	U
208-96-8	Acenaphthylene	1500	U
120-12-7	Anthracene	1500	U
56-55-3	Benzo(a)anthracene	1500	U
50-32-8	Benzo(a)pyrene	1500	U
205-99-2	Benzo(b)fluoranthene	1500	U
191-24-2	Benzo(g,h,i)perylene	1500	U
207-08-9	Benzo(k)fluoranthene	1500	U
218-01-9	Chrysene	1500	U
53-70-3	Dibenz(a,h)Anthracene	1500	U
206-44-0	Fluoranthene	1500	U
86-73-7	Fluorene	1500	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	1500	U
91-20-3	Naphthalene	1500	U
85-01-8	Phenanthrene	1500	U
129-00-0	Pyrene	1500	U

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SAMPLE NO
51SB4C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-021-1/4
Sample Volume :	30	Lab File ID :	H25649.D
% Moisture:	13.6	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.7	U
83-32-9	Acenaphthene	7.7	U
208-96-8	Acenaphthylene	7.7	U
120-12-7	Anthracene	7.7	U
56-55-3	Benzo(a)anthracene	7.7	U
50-32-8	Benzo(a)pyrene	7.7	U
205-99-2	Benzo(b)fluoranthene	7.7	U
191-24-2	Benzo(g,h,i)perylene	7.7	U
207-08-9	Benzo(k)fluoranthene	7.7	U
218-01-9	Chrysene	7.7	U
53-70-3	Dibenz(a,h)Anthracene	7.7	U
206-44-0	Fluoranthene	7.7	U
86-73-7	Fluorene	7.7	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.7	U
91-20-3	Naphthalene	7.7	U
85-01-8	Phenanthrene	23	
129-00-0	Pyrene	7.7	U

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SAMPLE NO
51SB4D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-004-029-1/4
Sample Volume :	30	Lab File ID :	H25635.D
% Moisture:	15.94	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/12/2004
Injection Volume :	µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.9	U
83-32-9	Acenaphthene	7.9	U
208-96-8	Acenaphthylene	7.9	U
120-12-7	Anthracene	7.9	U
56-55-3	Benzo(a)anthracene	7.9	U
50-32-8	Benzo(a)pyrene	7.9	U
205-99-2	Benzo(b)fluoranthene	7.9	U
191-24-2	Benzo(g,h,i)perylene	7.9	U
207-08-9	Benzo(k)fluoranthene	7.9	U
218-01-9	Chrysene	7.9	U
53-70-3	Dibenz(a,h)Anthracene	7.9	U
206-44-0	Fluoranthene	7.9	U
86-73-7	Fluorene	7.9	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.9	U
91-20-3	Naphthalene	7.9	U
85-01-8	Phenanthrene	9.9	
129-00-0	Pyrene	7.9	U

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SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-037-1/4
Sample Volume :	30	Lab File ID :	H25636.D
% Moisture:	17.91	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	8.1	U
83-32-9	Acenaphthene	8.1	U
208-96-8	Acenaphthylene	8.1	U
120-12-7	Anthracene	8.1	U
56-55-3	Benzo(a)anthracene	8.1	U
50-32-8	Benzo(a)pyrene	8.1	U
205-99-2	Benzo(b)fluoranthene	8.1	U
191-24-2	Benzo(g,h,i)perylene	8.1	U
207-08-9	Benzo(k)fluoranthene	8.1	U
218-01-9	Chrysene	8.1	U
53-70-3	Dibenz(a,h)Anthracene	8.1	U
206-44-0	Fluoranthene	8.1	U
86-73-7	Fluorene	8.1	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	8.1	U
91-20-3	Naphthalene	8.1	U
85-01-8	Phenanthrene	11	
129-00-0	Pyrene	8.1	U

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SAMPLE NO
51SB5BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-045-1/4
Sample Volume :	30	Lab File ID :	H25650.D
% Moisture:	63.33	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	10 mL	Date Analyzed	04/13/2004
Injection Volume :	µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	1800	U
83-32-9	Acenaphthene	1800	U
208-96-8	Acenaphthylene	1800	U
120-12-7	Anthracene	1800	U
56-55-3	Benzo(a)anthracene	1800	U
50-32-8	Benzo(a)pyrene	1800	U
205-99-2	Benzo(b)fluoranthene	1800	U
191-24-2	Benzo(g,h,i)perylene	1800	U
207-08-9	Benzo(k)fluoranthene	1800	U
218-01-9	Chrysene	1800	U
53-70-3	Dibenz(a,h)Anthracene	1800	U
206-44-0	Fluoranthene	1800	U
86-73-7	Fluorene	1800	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	1800	U
91-20-3	Naphthalene	1800	U
85-01-8	Phenanthrene	1800	U
129-00-0	Pyrene	1800	U

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SAMPLE NO
51SB5C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.-		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-053-1/4
Sample Volume :	30	Lab File ID :	H25637.D
% Moisture:	7.73	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.2	U
83-32-9	Acenaphthene	7.2	U
208-96-8	Acenaphthylene	7.2	U
120-12-7	Anthracene	7.2	U
56-55-3	Benzo(a)anthracene	7.2	U
50-32-8	Benzo(a)pyrene	7.2	U
205-99-2	Benzo(b)fluoranthene	7.2	U
191-24-2	Benzo(g,h,i)perylene	7.2	U
207-08-9	Benzo(k)fluoranthene	7.2	U
218-01-9	Chrysene	7.2	U
53-70-3	Dibenz(a,h)Anthracene	7.2	U
206-44-0	Fluoranthene	7.2	U
86-73-7	Fluorene	7.2	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.2	U
91-20-3	Naphthalene	7.2	U
85-01-8	Phenanthrene	18	
129-00-0	Pyrene	7.2	U

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SAMPLE NO
51SB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-061-1/4
Sample Volume :	30	Lab File ID :	H25638.D
% Moisture:	21.32	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	8.5	U
83-32-9	Acenaphthene	8.5	U
208-96-8	Acenaphthylene	8.5	U
120-12-7	Anthracene	8.5	U
56-55-3	Benzo(a)anthracene	8.5	U
50-32-8	Benzo(a)pyrene	8.5	U
205-99-2	Benzo(b)fluoranthene	8.5	U
191-24-2	Benzo(g,h,i)perylene	8.5	U
207-08-9	Benzo(k)fluoranthene	8.5	U
218-01-9	Chrysene	8.5	U
53-70-3	Dibenz(a,h)Anthracene	8.5	U
206-44-0	Fluoranthene	8.5	U
86-73-7	Fluorene	8.5	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	8.5	U
91-20-3	Naphthalene	8.5	U
85-01-8	Phenanthrene	15	
129-00-0	Pyrene	8.5	U

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Form I OM

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-069-1/4
Sample Volume :	30	Lab File ID :	H25639.D
% Moisture:	17.78	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	8.1	U
83-32-9	Acenaphthene	8.1	U
208-96-8	Acenaphthylene	8.1	U
120-12-7	Anthracene	8.1	U
56-55-3	Benzo(a)anthracene	8.1	U
50-32-8	Benzo(a)pyrene	8.1	U
205-99-2	Benzo(b)fluoranthene	8.1	U
191-24-2	Benzo(g,h,i)perylene	8.1	U
207-08-9	Benzo(k)fluoranthene	8.1	U
218-01-9	Chrysene	8.1	U
53-70-3	Dibenz(a,h)Anthracene	8.1	U
206-44-0	Fluoranthene	8.1	U
86-73-7	Fluorene	8.1	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	8.1	U
91-20-3	Naphthalene	8.1	U
85-01-8	Phenanthrene	14	
129-00-0	Pyrene	8.1	U

Form I Org

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-010-077-1/4
Sample Volume :	30	Lab File ID :	H25640.D
% Moisture:	15.33	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
91-57-6	2-Methylnaphthalene	20		
83-32-9	Acenaphthene	7.9	U	
208-96-8	Acenaphthylene	7.9	U	
120-12-7	Anthracene	7.9	U	
56-55-3	Benzo(a)anthracene	7.9	U	
50-32-8	Benzo(a)pyrene	7.9	U	
205-99-2	Benzo(b)fluoranthene	7.9	U	
191-24-2	Benzo(g,h,i)perylene	7.9	U	
207-08-9	Benzo(k)fluoranthene	7.9	U	
218-01-9	Chrysene	7.9	U	
53-70-3	Dibenz(a,h)Anthracene	7.9	U	
206-44-0	Fluoranthene	14		
86-73-7	Fluorene	7.9	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.9	U	
91-20-3	Naphthalene	14		B
85-01-8	Phenanthrene	30		
129-00-0	Pyrene	11		

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.-		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-011-085-1/4
Sample Volume :	30	Lab File ID :	H25641.D
% Moisture:	11.88	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Vqlume :	µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.6	U
83-32-9	Acenaphthene	7.6	U
208-96-8	Acenaphthylene	7.6	U
120-12-7	Anthracene	7.6	U
56-55-3	Benzo(a)anthracene	7.6	U
50-32-8	Benzo(a)pyrene	7.6	U
205-99-2	Benzo(b)fluoranthene	7.6	U
191-24-2	Benzo(g,h,i)perylene	7.6	U
207-08-9	Benzo(k)fluoranthene	7.6	U
218-01-9	Chrysene	7.6	U
53-70-3	Dibenz(a,h)Anthracene	7.6	U
206-44-0	Fluoranthene	7.6	U
86-73-7	Fluorene	7.6	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.6	U
91-20-3	Naphthalene	7.6	U
85-01-8	Phenanthrene	9.8	
129-00-0	Pyrene	7.6	U

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Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-012-093-1/4
Sample Volume :	30	Lab File ID :	H25642.D
% Moisture:	13.61	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.7	U
83-32-9	Acenaphthene	7.7	U
208-96-8	Acenaphthylene	7.7	U
120-12-7	Anthracene	7.7	U
56-55-3	Benzo(a)anthracene	7.7	U
50-32-8	Benzo(a)pyrene	7.7	U
205-99-2	Benzo(b)fluoranthene	7.7	U
191-24-2	Benzo(g,h,i)perylene	7.7	U
207-08-9	Benzo(k)fluoranthene	7.7	U
218-01-9	Chrysene	7.7	U
53-70-3	Dibenz(a,h)Anthracene	7.7	U
206-44-0	Fluoranthene	7.7	U
86-73-7	Fluorene	7.7	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.7	U
91-20-3	Naphthalene	7.7	U
85-01-8	Phenanthrene	18	
129-00-0	Pyrene	7.7	U

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Pesticides and PCBs
GPL Laboratories, Inc., SDG 404021

DATE: June 9, 2004

The purpose of this memorandum is to present the data validation report for the sample collected for the SWMU 51 RFI at the RFAAP on April 1, 2004. Sample was analyzed for pesticides and PCBs using USEPA Method 3540C/8081A and 3540C/8082, respectively. A total of two soil samples were validated for pesticides and nine soil samples analyzed for PCBs. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB4A*	404021-001*	51SB5B	404021-006
51SB4B	404021-002	51SB5C	404021-007
51SB4C	404021-003	51SB5D	404021-008
51SB4D	404021-004	TMSB5D	404021-009
51SB5A*	404021-005*		

*Analyzed for pesticides and PCBs.

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (USEPA, September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
X		System Monitoring Compounds
X		Laboratory Control Samples
X		Matrix Spike/Spike Duplicate
	X	Field Sample Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/9/04
Date

RFAAP VALIDATION REPORT
PESTICIDE/PCB REVIEW
SDG 404021

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For pesticide and PCB soil samples, cooled @4°C ±2°C, the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis (USEPA criteria).

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 4.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The samples were collected 04/01/04 for pesticides and PCB compounds. They were extracted on 04/10/04 and analyzed for pesticides and PCBs on 04/12/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check (Degradation Standard)
Performance checks on the gas chromatograph with electron capture detector (GC/ECD) system are performed to ensure adequate resolution and instrument sensitivity. The performance evaluation mixture (PEM) must be analyzed at the beginning of the analytical sequence. The breakdown of Endrin and 4,4'-DDT must be ≤ 15% on both columns (USEPA and USACE criteria) and ≤ 30% combined Endrin and 4,4'-DDT on both columns (USEPA criteria).

- For analysis performed on 03/31/04, endrin and 4,4'-DDT breakdowns were 5.7% and 2.1% on column #1 and 8.5% and 2.6% on column #2, respectively. All criteria were met. No qualifiers were applied.

- For analysis performed on 04/12/04, endrin and 4,4'-DDT breakdowns were 10.4% and 5.6% on column #1 and 12.0% and 6.6% on column #2, respectively. All criteria were met. No qualifiers were applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The percent relative standard deviation (%RSD) for all single peak target analytes, and aroclors 1016 and 1260 must be < 20% or the mean %RSD for all analytes in the standard must be ≤ 20%. If linear regression is used, the correlation coefficient must be ≥0.990 (USEPA and USACE criteria).

- For the pesticide initial calibration performed on 03/31/04 on instrument GC-K, all criteria were met. All compounds were determined using calibration factors with RSDs ≤20% for single peak pesticides. No qualifiers were applied. Samples 51SB4A (404021-001) and 51SB5A (404021-005) apply to this initial calibration.

- For the PCB initial calibration performed on 03/31/04 on instrument GC-L, all criteria were met. All compounds were determined using calibration factors with RSDs ≤20% for PCB 1016 and PCB 1260. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5C (404021-007), 51SB5D (404021-008), and TMSB5D (404021-009) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for pesticide/PCB target compounds. Continuing calibration standards containing both target compounds and surrogates are analyzed at the beginning of each 12-hour analytical shift and after every 20 samples. The percent difference (%D) or the mean %RSD for all analytes in the standard from the initial calibration should be no greater than ± 15%.

- For pesticide continuing calibration performed on 04/12/04 @21:18 on instrument GC-K, all criteria were met on column #1 for all target compounds. For column #2, endrin (32.4%) and endrin keytone (16.0%) were outside criteria. All samples were non-detect for this compound, therefore no qualifiers were applied based upon these outliers. Samples 51SB4A (404021-001) and 51SB5A (404021-005) apply to this continuing calibration.

- For PCB continuing calibration performed on 04/12/04 @14:54 on instrument GC-L, all criteria were met on column #1 and column #2 for all target compounds. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), and 51SB5B (404021-006) apply to his continuing calibration.

- For PCB continuing calibration performed on 04/12/04 @21:38 on instrument GC-L, the following %Ds were determined. For column #1, arochlor 1016 #3 (18.6%) and arochlor 1016 #4 (15.4%) were outside criteria. The average of the peaks for arochlor 1016 was within criteria and all samples were non-detect. For column #2, arochlor 1016 was within criteria. For column #1, arochlor 1260 #2 (22.6%), arochlor 1260 #4 (40.0%), and arochlor 1260 #5 (29.2%) were outside criteria. For column #2, Arochlor 1260 #1 (24.8%), arochlor 1260 #2 (17.2%), arochlor 1260 #3 (21.1%), and arochlor 1260 #4 (20.6%) were outside criteria. All samples were non-detect for this compound. Therefore, no qualifiers were applied based upon these outliers. Samples 51SB5C (404021-007), 51SB5D (404021-008), and TMSB5D (404021-009) apply to this continuing calibration.

- For PCB continuing calibration performed on 04/13/04 @01:59 on instrument GC-L, the following %Ds were determined. For column #1, arochlor 1016 #2 (15.1%) and arochlor 1016 #3 (21.3%) were outside criteria. The average of the peaks for arochlor 1016 was within criteria and all samples were non-detect. For column #2, arochlor 1016 was within criteria. For column #1, arochlor 1260 #1 (19.6%), arochlor 1260 #2 (16.9%), arochlor 1260 #3 (18.8%), arochlor 1260 #4 (16.4%), and arochlor 1260 #5 (24.7%) were outside criteria. For column #2, Arochlor 1260 #2 (17.1%), arochlor 1260 #4 (15.2%), and arochlor 1260 #5 (21.6%) were outside criteria. All samples were non-detect for this compound. Therefore, no qualifiers were applied based upon these outliers. No samples apply to this continuing calibration.

V-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks > MDL or MRL (USEPA criteria) or all target compounds < one-half the MRL (USACE criteria). Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 30). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Parameter	Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
Pesticides	04/12/04	BKS65858	All < MRL	NA	NA	None
Pesticides	04/15/04	040204R	All < MRL	NA	NA	None
PCBs	04/12/04	BKS65862	All < MRL	NA	NA	None
PCBs	04/14/04	040204R	All < MRL	NA	NA	None

VI-System Monitoring Compound (Surrogates)

Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the specified laboratory control limits.

Criteria: Decachlorobiphenyl: Pesticides: 55-151% (USACE criteria 50-130%)
Tetrachloro-m-xylene: Pesticides: 34-100% (USACE criteria 50-130%)
Decachlorobiphenyl: PCBs: 47-161% (USACE criteria 50-130%)
Tetrachloro-m-xylene: PCBs: 54-168% (USACE criteria 50-130%)

- For pesticide analysis, all criteria were met. No qualifiers were applied.
- For PCB analysis for sample 51SB4B (404021-002), surrogates decachlorobiphenyl (46%) and tetrachloro-m-xylene (0%, 0% => matrix) were outside criteria. Since both surrogates were below criteria, the sample was qualified bias low "UL" for all PCBs based upon these outliers.
- For PCB analysis for sample 51SB4C (404021-003), surrogates decachlorobiphenyl (155%) and tetrachloro-m-xylene (0%, 0% => matrix) were outside criteria. Since both surrogates were below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.
- For PCB analysis for sample 51SB4D (404021-004), surrogate tetrachloro-m-xylene (0%, 0% => matrix) was outside criteria. Since the surrogate was below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.
- For PCB analysis for sample 51SB5B (404021-006), surrogates decachlorobiphenyl (42%, 27%) and tetrachloro-m-xylene (0%, 0% => matrix) were outside criteria. Since both surrogates were below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.
- For PCB analysis for sample 51SB5C (404021-007), surrogate tetrachloro-m-xylene (0%, 0% => matrix) was outside criteria. Since the surrogate was below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.
- For PCB analysis for sample 51SB5D (404021-008), surrogate tetrachloro-m-xylene (0%, 0% => matrix) was outside criteria. Since the surrogate was below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.
- For PCB analysis for sample TMSB5D (404021-009), surrogate tetrachloro-m-xylene (0%, 0% => matrix) was outside criteria. Since the surrogate was below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.
- All other samples 51SB4A (404021-001) and 51SB5A (404021-005) tested for PCBs were within criteria for all surrogates.

VII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor long-term precision and accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within the specified control limits. USACE Shell limits for pesticides/PCBs are 50-130% (30-150% for sporadic marginal failures (SMF)).

- Sample BKS65858 was used for the LCS for TCL pesticide compounds. Delta-BHC (19%) was outside USACE and SMF criteria. Samples 51SB4A (404021-001) and 51SB5A (404021-005) were non-detect for all target compounds. Delta-BHC was qualified bias low "UL" non-detect based upon the low recovery.

- Sample BKS65862 was used for the LCS for TCL PCB aroclors. All criteria were met. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5C (404021-007), 51SB5D (404021-008), and TMSB5D (404021-009) apply to this LCS.

VIII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits for pesticides/PCBs are 40-140%; RPD<50% (30-150%; RPD<60% for sporadic marginal failures (SMF) for pesticides).

- Sample 51SB5A (404021-005) was used for the MS/MSD analysis for pesticide compounds. Compounds 4,4-DDD (60%, 59%), 4,4-DDE (53%, 54%), 4,4-DDT (55%, 55%), aldrin (57%, 61%), alpha-BHC (53%, 53%), alpha-chlordane (49%, 49%), beta-BHC (119%, 118%), delta-BHC (18%, 17%), endosulfan I (52%, 50%), endosulfan II (65%, 65%), endosulfan sulfate (58%, 56%), gamma-BHC (57%, 56%), and gamma-chlordane (58%, 57%) were outside lab criteria. All RPDs were within criteria. Sample 51SB5A (404021-005) was non-detect for all target compounds. All non-detects for the spiked sample were qualified "UL" for these compounds (except beta-BHC) based upon the low recoveries. Beta-BHC was non-detect for the spiked sample and recovered high. Therefore, no qualifiers were applied based upon this outlier.

- Sample 51SB5A (404021-005) was used for the MS/MSD analysis for PCB compounds. All criteria were met. No qualifiers were applied.

IX-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. The project precision control criterion was established at 50% RPD for the solid samples.

- Field soil sample duplicate pair 51SB5D (404021-008) and TMSB5D (404021-009) was collected for PCBs only. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB5D	404021-008	All PCBs <MRL	NA	NA	NA	None

NA = Not Applicable

X-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. The difference between the calculated value and the reported value must be within 10% difference. All samples were non-detect for PCBs, therefore the quantification verification not included here. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." The difference between the primary column and the confirmatory column must be ≤ 40% difference (USEPA and USACE criteria).

- For this SDG, all pesticides/PCBs were non-detect for all samples. No qualifiers were applied.

Sample: 51SB5AMS (404021-005MS), endrin

Conc. µg/kg = (Ax * Vt * DF) / (CF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area/response for compound being measured.
Vt = Volume of total extract, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean V(t) = 10000 µL.
CF = Ave calibration response factor for compound being measured from ICAL (Area/pg)
Vi = Volume of extract injected (mL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100 = 1.0 for Wet Weight
DF = Dilution factor

Conc. µg/kg = (1551791 Area*10000µL*1) / (42620Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 15 µg/kg

Reported Value = 15 µg/kg
% Difference = 0.0%
Values were within 10% difference

Sample: 51SB5AMS (404021-005MS), Aroclor 1260

Conc. µg/kg = (Ax * Vt * DF) / (CF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area/response for compound being measured.
Vt = Volume of total extract, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean V(t) = 10000 µL.
CF = Ave calibration response factor for compound being measured from ICAL (Area/pg)
Vi = Volume of extract injected (mL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100 = 1.0 for Wet Weight
DF = Dilution factor

Signal #1
Conc1 µg/kg = (140694Area*10000µL*1) / (382.3Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 149.44 µg/kg
Conc2 µg/kg = (213944Area*10000µL*1) / (545.1Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 159.37 µg/kg
Conc3 µg/kg = (249460Area*10000µL*1) / (622.1Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 162.83 µg/kg
Conc4 µg/kg = (94744Area*10000µL*1) / (269.3Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 142.86 µg/kg
Conc5 µg/kg = (231104Area*10000µL*1) / (702.4Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 133.60 µg/kg
Average concentration = 150 µg/kg

Signal #2
Conc1 µg/kg = (786176Area*10000µL*1) / (1917Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 166.53 µg/kg
Conc2 µg/kg = (756020Area*10000µL*1) / (1987Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 154.50 µg/kg
Conc3 µg/kg = (397020Area*10000µL*1) / (973Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 165.69 µg/kg
Conc4 µg/kg = (580532Area*10000µL*1) / (1507Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 156.42 µg/kg
Conc5 µg/kg = (976496Area*10000µL*1) / (2810Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 141.11 µg/kg
Average concentration = 160 µg/kg

Reported Value = 160 µg/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
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SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-006-2/4
Sample Volume :	30	Lab File ID :	K125413.D
% Moisture:	15.64	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
72-54-8	4,4-DDD	2.0	U
72-55-9	4,4-DDE	2.0	U
50-29-3	4,4-DDT	2.0	U
309-00-2	Aldrin	2.0	U
319-84-6	Alpha-BHC	2.0	U
5103-71-9	Alpha-Chlordane	2.0	U
319-85-7	Beta-BHC	2.0	U
319-86-8	Delta-BHC	2.0	U UL
959-98-8	Endosulfan I	2.0	U
33213-65-9	Endosulfan II	2.0	U
1031-07-8	Endosulfan Sulfate	2.0	U
72-20-8	Endrin	2.0	U
7421-93-4	Endrin Aldehyde	2.0	U
53494-70-5	Endrin Ketone	2.0	U
58-89-9	Gamma-BHC (Lindane)	2.0	U
5566-34-7	Gamma-Chlordane	2.0	U
76-44-8	Heptachlor	2.0	U
1024-57-3	Heptachlor Epoxide	2.0	U
72-43-5	Methoxychlor	2.0	U
8001-35-2	Toxaphene	40	U

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FORM 1
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SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-006-2/4
Sample Volume :	30	Lab File ID :	L33044.D
% Moisture:	15.64	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
12674-11-2	PCB-1016	40	U
11104-28-2	PCB-1221	40	U
11141-16-5	PCB-1232	40	U
53469-21-9	PCB-1242	40	U
12672-29-6	PCB-1248	40	U
11097-69-1	PCB-1254	40	U
11096-82-5	PCB-1260	40	U

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FORM I
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Form I Org

SAMPLE NO
51SB4B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-014-2/4
Sample Volume :	30	Lab File ID :	L33045.D
% Moisture:	55.28	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	75	U	UL
11104-28-2	PCB-1221	75	U	UL
11141-16-5	PCB-1232	75	U	UL
53469-21-9	PCB-1242	75	U	UL
12672-29-6	PCB-1248	75	U	UL
11097-69-1	PCB-1254	75	U	UL
11096-82-5	PCB-1260	75	U	UL

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SAMPLE NO
51SB4C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-022-2/4
Sample Volume :	30	Lab File ID :	L33046.D
% Moisture:	13.6	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	39	U	VL
11104-28-2	PCB-1221	39	U	VL
11141-16-5	PCB-1232	39	U	VL
53469-21-9	PCB-1242	39	U	VL
12672-29-6	PCB-1248	39	U	VL
11097-69-1	PCB-1254	39	U	VL
11096-82-5	PCB-1260	39	U	VL

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SAMPLE NO
51SB4D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-004-030-2/4
Sample Volume :	30	Lab File ID :	L33047.D
% Moisture:	15.94	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	40	U	UL
11104-28-2	PCB-1221	40	U	UL
11141-16-5	PCB-1232	40	U	UL
53469-21-9	PCB-1242	40	U	UL
12672-29-6	PCB-1248	40	U	UL
11097-69-1	PCB-1254	40	U	UL
11096-82-5	PCB-1260	40	U	UL

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FORM 1
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SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-038-2/4
Sample Volume :	30	Lab File ID :	K125414.D
% Moisture:	17.91	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
72-54-8	4,4-DDD	2.0	U	UL
72-55-9	4,4-DDE	2.0	U	UL
50-29-3	4,4-DDT	2.0	U	UL
309-00-2	Aldrin	2.0	U	UL
319-84-6	Alpha-BHC	2.0	U	UL
5103-71-9	Alpha-Chlordane	2.0	U	UL
319-85-7	Beta-BHC	2.0	U	
319-86-8	Delta-BHC	2.0	U	UL
959-98-8	Endosulfan I	2.0	U	UL
33213-65-9	Endosulfan II	2.0	U	UL
1031-07-8	Endosulfan Sulfate	2.0	U	UL
72-20-8	Endrin	2.0	U	
7421-93-4	Endrin Aldehyde	2.0	U	
53494-70-5	Endrin Ketone	2.0	U	
58-89-9	Gamma-BHC (Lindane)	2.0	U	UL
5566-34-7	Gamma-Chlordane	2.0	U	UL
76-44-8	Heptachlor	2.0	U	
1024-57-3	Heptachlor Epoxide	2.0	U	
72-43-5	Methoxychlor	2.0	U	
8001-35-2	Toxaphene	41	U	

GPL Laboratories

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FORM I
ANALYSIS DATA SHEET

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SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-038-2/4
Sample Volume :	30	Lab File ID :	L33048.D
% Moisture:	17.91	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
12674-11-2	PCB-1016	41	U
11104-28-2	PCB-1221	41	U
11141-16-5	PCB-1232	41	U
53469-21-9	PCB-1242	41	U
12672-29-6	PCB-1248	41	U
11097-69-1	PCB-1254	41	U
11096-82-5	PCB-1260	41	U

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SAMPLE NO
51SB5B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-046-2/4
Sample Volume :	30	Lab File ID :	L33051.D
% Moisture:	63.33	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	91	U	VL
11104-28-2	PCB-1221	91	U	VL
11141-16-5	PCB-1232	91	U	VL
53469-21-9	PCB-1242	91	U	VL
12672-29-6	PCB-1248	91	U	VL
11097-69-1	PCB-1254	91	U	VL
11096-82-5	PCB-1260	91	U	VL

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SAMPLE NO
51SB5C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-054-2/4
Sample Volume :	30	Lab File ID :	L33054.D
% Moisture:	7.73	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	36	U	UL
11104-28-2	PCB-1221	36	U	UL
11141-16-5	PCB-1232	36	U	UL
53469-21-9	PCB-1242	36	U	UL
12672-29-6	PCB-1248	36	U	UL
11097-69-1	PCB-1254	36	U	UL
11096-82-5	PCB-1260	36	U	UL

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FORM 1
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SAMPLE NO
51SB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-062-2/4
Sample Volume :	30	Lab File ID :	L33055.D
% Moisture:	21.32	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	42	U	UL
11104-28-2	PCB-1221	42	U	UL
11141-16-5	PCB-1232	42	U	UL
53469-21-9	PCB-1242	42	U	UL
12672-29-6	PCB-1248	42	U	UL
11097-69-1	PCB-1254	42	U	UL
11096-82-5	PCB-1260	42	U	UL

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FORM I
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SAMPLE NO
TMSB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-070-2/4
Sample Volume :	30	Lab File ID :	L33056.D
% Moisture:	17.78	Date Received	04/13/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	41	U	UL
11104-28-2	PCB-1221	41	U	UL
11141-16-5	PCB-1232	41	U	UL
53469-21-9	PCB-1242	41	U	UL
12672-29-6	PCB-1248	41	U	UL
11097-69-1	PCB-1254	41	U	UL
11096-82-5	PCB-1260	41	U	UL

Shaw Environmental, Inc.

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Pentaerythritol Tetranitrate GPL Laboratories, Inc., SDG 404021

DATE: June 10, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. Samples were analyzed for pentaerythritol tetranitrate (PETN) using USEPA SW-846 8330. A total of thirteen soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB4A	404021-001	51SB5C	404021-007
51SB4B	404021-002	51SB5D	404021-008
51SB4C	404021-003	TMSB5D	404021-009
51SB4D	404021-004	51SB10A	404021-010
51SB5A	404021-005	51SB10B	404021-011
51SB5B	404021-006	51SB10C	404021-012
51SB5B	404021-006DL		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
X		System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable, except for the following. For sample 51SB5B (404021-006), surrogate 4-nitroaniline (223%, 209%) was grossly outside of criteria due to matrix interferences. This sample was qualified as rejected "R" due to these matrix interferences. Sample 51SB5B (404021-006DL) should be used for the RFI.

Eric Malarek, Chemist

6/10/04

Date

RFAAP VALIDATION REPORT
PETN REVIEW
SDG 404021

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For PETN soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 4.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/12/04, and analyzed for PETN on 04/13/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/13/04	BLK65880	All target compounds < MRL	NA	NA	None
04/12/04	040204R	All target compounds < MRL	NA	NA	None

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 03/03/04 on instrument LCC-UV, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5B (404021-006DL), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/13/04 @12:54 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), and 51SB4D (404021-004) apply to this continuing calibration.

- For continuing calibration performed on 04/13/04 @17:42 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB5A (404021-005), 51SB5B (404021-006), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to this continuing calibration.

- For continuing calibration performed on 04/13/04 @22:32 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @07:14 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB5B (404021-006DL) applies to this continuing calibration.

- For continuing calibration performed on 04/14/04 @12:53 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- Surrogate 4-nitroaniline was diluted out for sample 51SB5B (404021-006DL) (0%, 3%). No qualifiers were applied based upon this outlier.

- For sample 51SB5B (404021-006) (233%, 209%), surrogate 4-nitroaniline was grossly outside of criteria due to matrix interferences. This sample was qualified as rejected "R" due to these matrix interferences. Sample 51SB5B (404021-006DL) should be used for the RFI.

- For sample 51SB5C (404021-007), 4-nitroaniline (25.9%) was outside criteria. This sample was qualified bias low non-detect "UL" based upon this outlier.

- Surrogate 4-nitroaniline was within criteria for all other samples.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for PETN are 60-120%.

- Sample BKS65880 was used as LCS for PETN analyzed on 04/13/04. All criteria were met. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5B (404021-006DL), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for PETN are 50-140%; RPD ≤ 50%.

- Sample 51SB4A (404021-001) was performed as MS/MSD for PETN. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB5D (404021-008) and TMSB5D (404021-009) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB5D	404021-008	PETN	0.50 U	0.50 U	NA	None

U = Value non-detect at MRL.
NA = Not Applicable.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012), PETN was non-detect. All criteria were met. No qualifiers were applied.

- For samples 51SB5B (404021-006) and 51SB5A (404021-006DL), compound PETN exceeded criteria and were qualified as estimated "J".

- Sample 51SB5B (404021-006) exhibited matrix interferences (See Section V). This sample was rejected "R" due to these matrix interferences. Sample 51SB5B (404021-006DL) should be used for the RFI.

Sample: 51SB5A (404021-006DL), PETN

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (10087016 * 20 * 100) / (162300 * 2 * 1 * 1000) = 62 mg/kg
Reported Value = 62 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I Cm

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-007-3/4
Sample Volume :	2	Lab File ID :	LC11047U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

Form I Org

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-015-3/4
Sample Volume :	2	Lab File ID :	LC11031U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

GPL Laboratories

Form I Dry

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-023-3/4
Sample Volume :	2	Lab File ID :	LC11032U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

Form I Corp

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-004-031-3/4
Sample Volume :	2	Lab File ID :	LC11033U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

Form I Corr

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-039-3/4
Sample Volume :	2	Lab File ID :	LC11037U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-047-3/4
Sample Volume :	2	Lab File ID :	LC11038U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	70	R

Form I Org

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5B DL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-047-3/4
Sample Volume :	2	Lab File ID :	LC11092U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
78-11-5	Pentaerythritol Tetranitrate	62		J

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SAMPLE NO
51SB5C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-055-3/4
Sample Volume :	2	Lab File ID :	LC11041U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
78-11-5	Pentaerythritol Tetranitrate	0.50	U	UL

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ANALYSIS DATA SHEET

SAMPLE NO
51SB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-063-3/4
Sample Volume :	2	Lab File ID :	LC11042U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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SAMPLE NO
TMSB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-071-3/4
Sample Volume :	2	Lab File ID :	LC11043U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-010-079-3/4
Sample Volume :	2	Lab File ID :	LC11044U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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SAMPLE NO
51SB10B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-011-087-3/4
Sample Volume :	2	Lab File ID :	LC11045U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-012-095-3/4
Sample Volume :	2	Lab File ID :	LC11046U.D
% Moisture:		Date Received	04/13/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

Shaw Environmental, Inc.

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Semi-Volatiles
GPL Laboratories, Inc., SDG 404021

DATE: June 8, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. Samples were analyzed for semivolatile organic compounds (SVOCs) using USEPA SW846 Methods 3540C/8270C. A total of eighteen soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB4A	404021-001	51SB5C	404021-007
51SB4B	404021-002DL	51SB5C	404021-007DL
51SB4B	404021-002DL2	51SB5D	404021-008
51SB4C	404021-003	51SB5D	404021-008DL
51SB4C	404021-003DL	TMSB5D	404021-009
51SB4D	404021-004	TMSB5D	404021-009DL
51SB5A	404021-005	51SB10A	404021-010
51SB5B	404021-006DL	51SB10B	404021-011
51SB5B	404021-006DL2	51SB10C	404021-012

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
X		Initial Calibration
X		Continuing Calibration
X		Blank Analysis
	X	Surrogate Spikes
	X	Internal Standards
	X	Laboratory Control Standard
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications, except for the following. For samples 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB5B (404021-006DL), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), compounds 2,4-dinitrotoluene exceeded the calibration range and were rejected "R". For samples 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB5B (404021-006DL), and 51SB5C (404021-007), 2,6-dinitrotoluene exceeded the calibration range and were rejected "R". The diluted samples 51SB4B (404021-002DL2), 51SB4C (404021-003DL), 51SB5B (404021-006DL2), 51SB5C (404021-007DL), 51SB5D (404021-008DL), and TMSB5D (404021-009DL) should be used for these compounds.

E. Malarek

Eric Malarek, Chemist

6/8/04

Date

RFAAP VALIDATION REPORT
SEMIVOLATILES REVIEW
SDG 404021

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For semivolatile organic compound (SVOC) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 4.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/10/04, and analyzed for TCL SVOCs on 04/13/04 and 04/14/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for compounds on the semivolatile target compound list (TCL). Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for the TCL SVOCs was performed on 04/12/04 on instrument HP#D. Target compounds benzoic acid (38.2%; grossly exceeding), hexachlorocyclopentadiene (44.0%; grossly exceeding), 2,4-dinitrophenol (23.6%), 4-nitrophenol (21.5%), fluorene (17.4%), 4-chlorophenyl-phenylether (17.3%), 4-nitroaniline (16.1%), 3,3'-dichlorobenzidine (16.6%), benzo(b)fluoranthene (17.7%), and benzo(k)fluoranthene (17.9%) were outside criteria. All RRFs were ≥ 0.05. Compounds 2,4-dinitrophenol, 4-nitrophenol, fluorene, 4-chlorophenyl-phenylether, 4-nitroaniline, 3,3'-dichlorobenzidine, benzo(b)fluoranthene, and benzo(k)fluoranthene were qualified estimated "J" for detects and no qualifier for non-detects for the high %RSDs. For compounds benzoic acid and hexachlorocyclopentadiene, all detects were qualified estimated "J" and non-detects "UJ" based upon the grossly exceeding %RSD. All samples were analyzed using this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be $\geq$ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within $\pm$ 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the TCL SVOCs performed on 04/13/04 @12:44 on instrument HP#D, target compound 3-nitroaniline (21.9%), 4-nitrophenol (20.7%), 4-nitroaniline (32.4%), 3,3'-dichlorobenzidine (42.0%; grossly exceeding), and di-n-octylphthalate (35.8%) were outside criteria. All samples were non-detect for 3-nitroaniline, 4-nitrophenol, 4-nitroaniline, and di-n-octylphthalate, therefore no qualifiers were applied based upon these outliers. Compound 3,3'-dichlorobenzidine was qualified estimated non-detect "UJ" based upon the grossly exceeding %D. Samples 51SB4A (404021-001), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), and 51SB10B (404021-011) apply to his continuing calibration.

- For continuing calibration for the TCL SVOCs performed on 04/13/04 @22:38 on instrument HP#D, target compound 3,3'-dichlorobenzidine (23.7%), bis(2-ethylhexyl)phthalate (23.6%), and di-n-octylphthalate (49.9%; grossly exceeding) were outside criteria. For 3,3'-dichlorobenzidine and bis(2-ethylhexyl)phthalate, all detects were qualified estimated "J" and non-detects no qualifier based upon these outlier. Compound di-n-octylphthalate was qualified estimated non-detect "UJ" based upon the grossly exceeding %D. Samples 51SB10C (404021-012), 51SB4C (404021-003DL), 51SB5D (404021-008DL), TMSB5D (404021-009DL), 51SB5B (404021-006DL), and 51SB4B (404021-002DL) apply to his continuing calibration.

- For continuing calibration for the TCL SVOCs performed on 04/14/04 @09:50 on instrument HP#D, target compound pyrene (21.8%), 3,3'-dichlorobenzidine (24.6%), bis(2-ethylhexyl)phthalate (27.8%), and di-n-octylphthalate (58.4%; grossly exceeding) were outside criteria. For pyrene, 3,3'-dichlorobenzidine, and bis(2-ethylhexyl)phthalate, all detects were qualified estimated "J" and non-detects no qualifier based upon these outlier. Compound di-n-octylphthalate was qualified estimated non-detect "UJ" based upon the grossly exceeding %D. Samples 51SB5C (404021-007DL), 51SB5B (404021-006DL2), and 51SB4B (404021-002DL2) apply to his continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 33). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/13/04	BLK65837	All compounds < MRL	NA	NA	None
04/13/04	040204R	Di-n-butyl phthalate	149J	4900	51SB5C, 51SB5D, 51SB10A, 51SB10B

J = Estimated value <MRL and >MDL

VI-Surrogate Spikes

Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria:
2-Fluorophenol (31-125%) – S1 (USACE Shell Criteria: 35-140%)
Phenol – d5 (25-121%) – S2 (USACE Shell Criteria: 35-140%)
2,4,6-Tribromophenol (31-137%) – S3 (USACE Shell Criteria: 35-140%)
Nitrobenzene-d5 (29-117%) – S4 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (20-106%) – S5 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (26-160%) – S6 (USACE Shell Criteria: 45-135%)

- For samples 51SB4B (404021-002DL2) and 51SB5B (404021-006DL2), all surrogates were diluted out. No qualifiers were applied based upon these outliers. All criteria were met for all other samples. No qualifiers were applied.

VII-Internal Standards

Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for SVOCs are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65837 was used as the LCS for select SVOCs by USEPA SW-846 8270C. All criteria were met. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002DL), 51SB4B (404021-002DL2), 51SB4C (404021-003), 51SB4C (404021-003DL), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006DL), 51SB5B (404021-006DL2), 51SB5C (404021-007), 51SB5C (404021-007DL), 51SB5D (404021-008), 51SB5D (404021-008DL), TMSB5D (404021-009), TMSB5D (404021-009DL), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB10B (404021-011) was used for the MS/MSD analysis for select SVOCs. All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB5D (404021-008) and TMSB5D (404021-009) was collected. Diluted samples 51SB5D (404021-008DL) and TMSB5D (404021-009DL) were also evaluated. The field duplicate evaluation is noted in **Table 3.** For where values exceeding calibration range, the diluted values were evaluated. If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB5D	404021-008	2,4-Dinitrotoluene	13000 E	17000 E	NA	None
51SB5D	404021-008	2,6-Dinitrotoluene	4400	4900	10.8	None
51SB5D	404021-008	4,6-dinitro-2-methyl phenol	140 J	170 J	19.4	None
51SB5D	404021-008	di-n-Butyl Phthalate	150 J	410 U	NA	None
51SB5D	404021-008DL	2,4-Dinitrotoluene	11000	15000	30.8	None
51SB5D	404021-008DL	2,6-Dinitrotoluene	3800	4400	14.6	None

E = Value exceeded calibration range.
J = Estimated value <MRL and >MDL.
U = Value non-detect at MRL.
NA = Not Applicable

XI-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J". For samples 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB5B (404021-006DL), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), compounds 2,4-dinitrotoluene exceeded the calibration range and were rejected "R". For samples 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB5B (404021-006DL), and 51SB5C (404021-007), 2,6-dinitrotoluene exceeded the calibration range and were rejected "R". The diluted samples 51SB4B (404021-002DL2), 51SB4C (404021-003DL), 51SB5B (404021-006DL2), 51SB5C (404021-007DL), 51SB5D (404021-008DL), and TMSB5D (404021-009DL) should be used for these compounds.

Sample: 51SB4B (404021-002DL2), 2,4-dinitrotoluene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where:
- Conc. = Sample concentration in µg/kg
- Ax = Area of characteristic ion for compound being measured.
- Is = Amount of internal standard injected (ng).
- Vt = Volume of total extract (µL).
- Ais = Area of characteristic ion for the internal standard.
- RRF = Average relative response factor for compound being measured (from ICAL)
- Vi = Volume of extract injected (µL).
- W(s) = Weight of sample extracted or diluted in grams.
- D = Percent dry weight (100 - % moisture in sample)/100
- DF = Dilution factor

Conc. µg/kg = (803392 * 40 * 10000 * 500) / (591162 * 0.520 * 1 * 30 * 0.4472) = 39000000 µg/kg
Reported Value = 39000000 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

RFAAP VALIDATION REPORT
SEMIVOLATILES REVIEW
SDG 404021

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For semivolatile organic compound (SVOC) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 4.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/10/04, and analyzed for TCL SVOCs on 04/13/04 and 04/14/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for compounds on the semivolatile target compound list (TCL). Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for the TCL SVOCs was performed on 04/12/04 on instrument HP#D. Target compounds benzoic acid (38.2%; grossly exceeding), hexachlorocyclopentadiene (44.0%; grossly exceeding), 2,4-dinitrophenol (23.6%), 4-nitrophenol (21.5%), fluorene (17.4%), 4-chlorophenyl-phenylether (17.3%), 4-nitroaniline (16.1%), pentachlorophenol (21.7%), 3,3'-dichlorobenzidine (16.6%), benzo(b)fluoranthene (17.7%), and benzo(k)fluoranthene (17.9%) were outside criteria. All RRFs were ≥ 0.05. Compounds 2,4-dinitrophenol, 4-nitrophenol, fluorene, 4-chlorophenyl-phenylether, 4-nitroaniline, pentachlorophenol, 3,3'-dichlorobenzidine, benzo(b)fluoranthene, and benzo(k)fluoranthene were qualified estimated "J" for detects and no qualifier for non-detects for the high %RSDs. For compounds benzoic acid and hexachlorocyclopentadiene, all detects were qualified estimated "J" and non-detects "UJ" based upon the grossly exceeding %RSD. All samples were analyzed using this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be ≥ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within ± 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the TCL SVOCs performed on 04/13/04 @12:44 on instrument HP#D, target compound 3-nitroaniline (21.9%), 4-nitrophenol (20.7%), 4-nitroaniline (32.4%), 3,3'-dichlorobenzidine (42.0%; grossly exceeding), and di-n-octylphthalate (35.8%) were outside criteria. All samples were non-detect for 3-nitroaniline, 4-nitrophenol, 4-nitroaniline, and di-n-octylphthalate, therefore no qualifiers were applied based upon these outliers. Compound 3,3'-dichlorobenzidine was qualified estimated non-detect "UJ" based upon the grossly exceeding %D. Samples 51SB4A (404021-001), 51SB4C (404021-003), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), and 51SB10B (404021-011) apply to his continuing calibration.

- For continuing calibration for the TCL SVOCs performed on 04/13/04 @22:38 on instrument HP#D, target compound 3,3'-dichlorobenzidine (23.7%), bis(2-ethylhexyl)phthalate (23.6%), and di-n-octylphthalate (49.9%; grossly exceeding) were outside criteria. For 3,3'-dichlorobenzidine and bis(2-ethylhexyl)phthalate, all detects were qualified estimated "J" and non-detects no qualifier based upon these outlier. Compound di-n-octylphthalate was qualified estimated non-detect "UJ" based upon the grossly exceeding %D. Samples 51SB10C (404021-012), 51SB4C (404021-003DL), 51SB5D (404021-008DL), TMSB5D (404021-009DL), 51SB5B (404021-006DL), and 51SB4B (404021-002DL) apply to his continuing calibration.

- For continuing calibration for the TCL SVOCs performed on 04/14/04 @09:50 on instrument HP#D, target compound pyrene (21.8%), 3,3'-dichlorobenzidine (24.6%), bis(2-ethylhexyl)phthalate (27.8%), and di-n-octylphthalate (58.4%; grossly exceeding) were outside criteria. For pyrene, 3,3'-dichlorobenzidine, and bis(2-ethylhexyl)phthalate, all detects were qualified estimated "J" and non-detects no qualifier based upon these outlier. Compound di-n-octylphthalate was qualified estimated non-detect "UJ" based upon the grossly exceeding %D. Samples 51SB5C (404021-007DL), 51SB5B (404021-006DL2), and 51SB4B (404021-002DL2) apply to his continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 33). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/13/04	BLK65837	All compounds < MRL	NA	NA	None
04/13/04	040204R	Di-n-butyl phthalate	149J	4900	51SB5C, 51SB5D, 51SB10A, 51SB10B

J = Estimated value <MRL and >MDL

VI-Surrogate Spikes

Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria:
2-Fluorophenol (31-125%) – S1 (USACE Shell Criteria: 35-140%)
Phenol – d5 (25-121%) – S2 (USACE Shell Criteria: 35-140%)
2,4,6-Tribromophenol (31-137%) – S3 (USACE Shell Criteria: 35-140%)
Nitrobenzene-d5 (29-117%) – S4 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (20-106%) – S5 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (26-160%) – S6 (USACE Shell Criteria: 45-135%)

- For samples 51SB4B (404021-002DL2) and 51SB5B (404021-006DL2), all surrogates were diluted out. No qualifiers were applied based upon these outliers. All criteria were met for all other samples. No qualifiers were applied.

VII-Internal Standards

Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for SVOCs are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65837 was used as the LCS for select SVOCs by USEPA SW-846 8270C. All criteria were met. No qualifiers were applied. Samples 51SB4A (404021-001), 51SB4B (404021-002DL), 51SB4B (404021-002DL2), 51SB4C (404021-003), 51SB4C (404021-003DL), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006DL), 51SB5B (404021-006DL2), 51SB5C (404021-007), 51SB5C (404021-007DL), 51SB5D (404021-008), 51SB5D (404021-008DL), TMSB5D (404021-009), TMSB5D (404021-009DL), 51SB10A (404021-010), 51SB10B (404021-011), and 51SB10C (404021-012) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB10B (404021-011) was used for the MS/MSD analysis for select SVOCs. All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed in this SDG.

XI-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J". For samples 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB5B (404021-006DL), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), compounds 2,4-dinitrotoluene exceeded the calibration range and were rejected "R". For samples 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB5B (404021-006DL), and 51SB5C (404021-007), 2,6-dinitrotoluene exceeded the calibration range and were rejected "R". The diluted samples 51SB4B (404021-002DL2), 51SB4C (404021-003DL), 51SB5B (404021-006DL2), 51SB5C (404021-007DL), 51SB5D (404021-008DL), and TMSB5D (404021-009DL) should be used for these compounds.

Sample: 51SB4B (404021-002DL2), 2,4-dinitrotoluene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Is = Amount of internal standard injected (ng).
Vt = Volume of total extract (µL).
Ais = Area of characteristic ion for the internal standard.
RRF = Average relative response factor for compound being measured (from ICAL)
Vi = Volume of extract injected (µL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (803392 * 40 * 10000 * 500) / (591162 * 0.520 * 1 * 30 * 0.4472) = 39000000 µg/kg
Reported Value = 39000000 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I Org

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-005-1/4
Sample Volume :	30	Lab File ID :	D33582.D
% Moisture:	15.64	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	400	U	
95-50-1	1,2-Dichlorobenzene	400	U	
541-73-1	1,3-Dichlorobenzene	400	U	
106-46-7	1,4-Dichlorobenzene	400	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	400	U	
95-95-4	2,4,5-Trichlorophenol	400	U	
88-06-2	2,4,6-Trichlorophenol	400	U	
120-83-2	2,4-Dichlorophenol	400	U	
105-67-9	2,4-Dimethylphenol	400	U	
51-28-5	2,4-Dinitrophenol	790	U	
121-14-2	2,4-Dinitrotoluene	400	U	
606-20-2	2,6-Dinitrotoluene	400	U	
91-58-7	2-Chloronaphthalene	400	U	
95-57-8	2-Chlorophenol	400	U	
91-57-6	2-Methylnaphthalene	400	U	
88-74-4	2-Nitroaniline	400	U	
88-75-5	2-Nitrophenol	400	U	
95-48-7	2-methylphenol	400	U	
91-94-1	3,3-Dichlorobenzidine	790	U	UJ
99-09-2	3-Nitroaniline	400	U	
534-52-1	4,6-dinitro-2-methyl phenol	790	U	
101-55-3	4-Bromophenyl-phenylether	400	U	
106-47-8	4-Chloroaniline	400	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	400	U	
100-01-6	4-Nitroaniline	400	U	
100-02-7	4-Nitrophenol	790	U	
59-50-7	4-chloro-3-methylphenol	400	U	
106-44-5	4-methylphenol	400	U	
83-32-9	Acenaphthene	400	U	

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GPL Laboratories

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FORM 1
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SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-005-1/4
Sample Volume :	30	Lab File ID :	D33582.D
% Moisture:	15.64	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	400	U	
120-12-7	Anthracene	400	U	
56-55-3	Benzo(a)anthracene	400	U	
50-32-8	Benzo(a)pyrene	400	U	
205-99-2	Benzo(b)fluoranthene	400	U	
191-24-2	Benzo(g,h,i)perylene	400	U	
207-08-9	Benzo(k)fluoranthene	400	U	
65-85-0	Benzoic Acid	790	U	UJ
100-51-6	Benzyl Alcohol	400	U	
85-68-7	Benzyl Butyl Phthalate	400	U	
86-74-8	Carbazole	400	U	
218-01-9	Chrysene	400	U	
53-70-3	Dibenz(a,h)Anthracene	400	U	
132-64-9	Dibenzofuran	400	U	
84-66-2	Diethyl Phthalate	400	U	
131-11-3	Dimethyl Phthalate	400	U	
206-44-0	Fluoranthene	400	U	
86-73-7	Fluorene	400	U	
118-74-1	Hexachlorobenzene	400	U	
87-68-3	Hexachlorobutadiene	400	U	
77-47-4	Hexachlorocyclopentadiene	400	U	UJ
67-72-1	Hexachloroethane	400	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	400	U	
78-59-1	Isophorone	400	U	
91-20-3	Naphthalene	400	U	
98-95-3	Nitrobenzene	400	U	
87-86-5	Pentachlorophenol	790	U	
85-01-8	Phenanthrene	400	U	
108-95-2	Phenol	400	U	

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SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-005-1/4
Sample Volume :	30	Lab File ID :	D33582.D
% Moisture:	15.64	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	400	U
110-86-1	Pyridine	400	U
111-91-1	bis(2-chloroethoxy) methane	400	U
111-44-4	bis(2-chloroethyl) ether	400	U
117-81-7	bis(2-ethylhexyl) phthalate	400	U
84-74-2	di-n-Butyl Phthalate	400	U
117-84-0	di-n-Octyl Phthalate	400	U
621-64-7	n-Nitrosodi-n-Propylamine	400	U
86-30-6	n-Nitrosodiphenylamine	400	U

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SAMPLE NO
51SB4BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-013-1/4
Sample Volume :	30	Lab File ID :	D33602.D
% Moisture:	55.28	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	75000	U	
95-50-1	1,2-Dichlorobenzene	75000	U	
541-73-1	1,3-Dichlorobenzene	75000	U	
106-46-7	1,4-Dichlorobenzene	75000	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	75000	U	
95-95-4	2,4,5-Trichlorophenol	75000	U	
88-06-2	2,4,6-Trichlorophenol	75000	U	
120-83-2	2,4-Dichlorophenol	75000	U	
105-67-9	2,4-Dimethylphenol	75000	U	
51-28-5	2,4-Dinitrophenol	150000	U	
121-14-2	2,4-Dinitrotoluene	41000000	E	R
606-20-2	2,6-Dinitrotoluene	13000000	E	R
91-58-7	2-Chloronaphthalene	75000	U	
95-57-8	2-Chlorophenol	75000	U	
91-57-6	2-Methylnaphthalene	75000	U	
88-74-4	2-Nitroaniline	75000	U	
88-75-5	2-Nitrophenol	75000	U	
95-48-7	2-methylphenol	75000	U	
91-94-1	3,3-Dichlorobenzidine	150000	U	
99-09-2	3-Nitroaniline	75000	U	
534-52-1	4,6-dinitro-2-methyl phenol	150000	U	
101-55-3	4-Bromophenyl-phenylether	75000	U	
106-47-8	4-Chloroaniline	75000	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	75000	U	
100-01-6	4-Nitroaniline	75000	U	
100-02-7	4-Nitrophenol	150000	U	
59-50-7	4-chloro-3-methylphenol	75000	U	
106-44-5	4-methylphenol	75000	U	
83-32-9	Acenaphthene	75000	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-013-1/4
Sample Volume :	30	Lab File ID :	D33602.D
% Moisture:	55.28	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	75000	U	
120-12-7	Anthracene	75000	U	
56-55-3	Benzo(a)anthracene	75000	U	
50-32-8	Benzo(a)pyrene	75000	U	
205-99-2	Benzo(b)fluoranthene	75000	U	
191-24-2	Benzo(g,h,i)perylene	75000	U	
207-08-9	Benzo(k)fluoranthene	75000	U	
65-85-0	Benzoic Acid	150000	U	UJ
100-51-6	Benzyl Alcohol	75000	U	
85-68-7	Benzyl Butyl Phthalate	75000	U	
86-74-8	Carbazole	75000	U	
218-01-9	Chrysene	75000	U	
53-70-3	Dibenz(a,h)Anthracene	75000	U	
132-64-9	Dibenzofuran	75000	U	
84-66-2	Diethyl Phthalate	75000	U	
131-11-3	Dimethyl Phthalate	75000	U	
206-44-0	Fluoranthene	75000	U	
86-73-7	Fluorene	75000	U	
118-74-1	Hexachlorobenzene	75000	U	
87-68-3	Hexachlorobutadiene	75000	U	
77-47-4	Hexachlorocyclopentadiene	75000	U	UJ
67-72-1	Hexachloroethane	75000	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	75000	U	
78-59-1	Isophorone	75000	U	
91-20-3	Naphthalene	75000	U	
98-95-3	Nitrobenzene	75000	U	
87-86-5	Pentachlorophenol	150000	U	
85-01-8	Phenanthrene	75000	U	
108-95-2	Phenol	75000	U	

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SAMPLE NO
51SB4BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-013-1/4
Sample Volume :	30	Lab File ID :	D33602.D
% Moisture:	55.28	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	75000	U	
110-86-1	Pyridine	75000	U	
111-91-1	bis(2-chloroethoxy) methane	75000	U	
111-44-4	bis(2-chloroethyl) ether	75000	U	
117-81-7	bis(2-ethylhexyl) phthalate	32000	J	J
84-74-2	di-n-Butyl Phthalate	75000	U	
117-84-0	di-n-Octyl Phthalate	75000	U	UJ
621-64-7	n-Nitrosodi-n-Propylamine	75000	U	
86-30-6	n-Nitrosodiphenylamine	75000	U	

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SAMPLE NO
51SB4BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-013-1/4
Sample Volume :	30	Lab File ID :	D33608.D
% Moisture:	55.28	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µL	Dilution Factor	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	3700000	U
95-50-1	1,2-Dichlorobenzene	3700000	U
541-73-1	1,3-Dichlorobenzene	3700000	U
106-46-7	1,4-Dichlorobenzene	3700000	U
108-60-1	2,2-Oxybis(1-Chloropropane)	3700000	U
95-95-4	2,4,5-Trichlorophenol	3700000	U
88-06-2	2,4,6-Trichlorophenol	3700000	U
120-83-2	2,4-Dichlorophenol	3700000	U
105-67-9	2,4-Dimethylphenol	3700000	U
51-28-5	2,4-Dinitrophenol	7500000	U
121-14-2	2,4-Dinitrotoluene	39000000	
606-20-2	2,6-Dinitrotoluene	9500000	
91-58-7	2-Chloronaphthalene	3700000	U
95-57-8	2-Chlorophenol	3700000	U
91-57-6	2-Methylnaphthalene	3700000	U
88-74-4	2-Nitroaniline	3700000	U
88-75-5	2-Nitrophenol	3700000	U
95-48-7	2-methylphenol	3700000	U
91-94-1	3,3-Dichlorobenzidine	7500000	U
99-09-2	3-Nitroaniline	3700000	U
534-52-1	4,6-dinitro-2-methyl phenol	7500000	U
101-55-3	4-Bromophenyl-phenylether	3700000	U
106-47-8	4-Chloroaniline	3700000	U
7005-72-3	4-Chlorophenyl Phenyl Ether	3700000	U
100-01-6	4-Nitroaniline	3700000	U
100-02-7	4-Nitrophenol	7500000	U
59-50-7	4-chloro-3-methylphenol	3700000	U
106-44-5	4-methylphenol	3700000	U
83-32-9	Acenaphthene	3700000	U

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SAMPLE NO
51SB4BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-013-1/4
Sample Volume :	30	Lab File ID :	D33608.D
% Moisture:	55.28	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	3700000	U	
120-12-7	Anthracene	3700000	U	
56-55-3	Benzo(a)anthracene	3700000	U	
50-32-8	Benzo(a)pyrene	3700000	U	
205-99-2	Benzo(b)fluoranthene	3700000	U	
191-24-2	Benzo(g,h,i)perylene	3700000	U	
207-08-9	Benzo(k)fluoranthene	3700000	U	
65-85-0	Benzoic Acid	7500000	U	UJ
100-51-6	Benzyl Alcohol	3700000	U	
85-68-7	Benzyl Butyl Phthalate	3700000	U	
86-74-8	Carbazole	3700000	U	
218-01-9	Chrysene	3700000	U	
53-70-3	Dibenz(a,h)Anthracene	3700000	U	
132-64-9	Dibenzofuran	3700000	U	
84-66-2	Diethyl Phthalate	3700000	U	
131-11-3	Dimethyl Phthalate	3700000	U	
206-44-0	Fluoranthene	3700000	U	
86-73-7	Fluorene	3700000	U	
118-74-1	Hexachlorobenzene	3700000	U	
87-68-3	Hexachlorobutadiene	3700000	U	
77-47-4	Hexachlorocyclopentadiene	3700000	U	UJ
67-72-1	Hexachloroethane	3700000	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	3700000	U	
78-59-1	Isophorone	3700000	U	
91-20-3	Naphthalene	3700000	U	
98-95-3	Nitrobenzene	3700000	U	
87-86-5	Pentachlorophenol	7500000	U	
85-01-8	Phenanthrene	3700000	U	
108-95-2	Phenol	3700000	U	

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SAMPLE NO
51SB4BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-013-1/4
Sample Volume :	30	Lab File ID :	D33608.D
% Moisture:	55.28	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	3700000	U
110-86-1	Pyridine	3700000	U
111-91-1	bis(2-chloroethoxy) methane	3700000	U
111-44-4	bis(2-chloroethyl) ether	3700000	U
117-81-7	bis(2-ethylhexyl) phthalate	3700000	U
84-74-2	di-n-Butyl Phthalate	3700000	U
117-84-0	di-n-Octyl Phthalate	3700000	U UJ
621-64-7	n-Nitrosodi-n-Propylamine	3700000	U
86-30-6	n-Nitrosodiphenylamine	3700000	U

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SAMPLE NO
51SB4C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-021-1/4
Sample Volume :	30	Lab File ID :	D33583.D
% Moisture:	13.6	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	390	U	
95-50-1	1,2-Dichlorobenzene	390	U	
541-73-1	1,3-Dichlorobenzene	390	U	
106-46-7	1,4-Dichlorobenzene	390	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	390	U	
95-95-4	2,4,5-Trichlorophenol	390	U	
88-06-2	2,4,6-Trichlorophenol	390	U	
120-83-2	2,4-Dichlorophenol	390	U	
105-67-9	2,4-Dimethylphenol	390	U	
51-28-5	2,4-Dinitrophenol	550	J	J
121-14-2	2,4-Dinitrotoluene	48000	E	R
606-20-2	2,6-Dinitrotoluene	9100	E	R
91-58-7	2-Chloronaphthalene	390	U	
95-57-8	2-Chlorophenol	390	U	
91-57-6	2-Methylnaphthalene	390	U	
88-74-4	2-Nitroaniline	390	U	
88-75-5	2-Nitrophenol	390	U	
95-48-7	2-methylphenol	390	U	
91-94-1	3,3-Dichlorobenzidine	770	U	UJ
99-09-2	3-Nitroaniline	390	U	
534-52-1	4,6-dinitro-2-methyl phenol	2100		
101-55-3	4-Bromophenyl-phenylether	390	U	
106-47-8	4-Chloroaniline	390	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	390	U	
100-01-6	4-Nitroaniline	390	U	
100-02-7	4-Nitrophenol	770	U	
59-50-7	4-chloro-3-methylphenol	390	U	
106-44-5	4-methylphenol	390	U	
83-32-9	Acenaphthene	390	U	

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SAMPLE NO
51SB4C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-021-1/4
Sample Volume :	30	Lab File ID :	D33583.D
% Moisture:	13.6	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	390	U	
120-12-7	Anthracene	390	U	
56-55-3	Benzo(a)anthracene	390	U	
50-32-8	Benzo(a)pyrene	390	U	
205-99-2	Benzo(b)fluoranthene	390	U	
191-24-2	Benzo(g,h,i)perylene	390	U	
207-08-9	Benzo(k)fluoranthene	390	U	
65-85-0	Benzoic Acid	770	U	UJ
100-51-6	Benzyl Alcohol	390	U	
85-68-7	Benzyl Butyl Phthalate	390	U	
86-74-8	Carbazole	390	U	
218-01-9	Chrysene	390	U	
53-70-3	Dibenz(a,h)Anthracene	390	U	
132-64-9	Dibenzofuran	390	U	
84-66-2	Diethyl Phthalate	390	U	
131-11-3	Dimethyl Phthalate	390	U	
206-44-0	Fluoranthene	390	U	
86-73-7	Fluorene	390	U	
118-74-1	Hexachlorobenzene	390	U	
87-68-3	Hexachlorobutadiene	390	U	
77-47-4	Hexachlorocyclopentadiene	390	U	UJ
67-72-1	Hexachloroethane	390	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	390	U	
78-59-1	Isophorone	390	U	
91-20-3	Naphthalene	390	U	
98-95-3	Nitrobenzene	390	U	
87-86-5	Pentachlorophenol	770	U	
85-01-8	Phenanthrene	390	U	
108-95-2	Phenol	390	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-021-1/4
Sample Volume :	30	Lab File ID :	D33583.D
% Moisture:	13.6	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	390	U
110-86-1	Pyridine	390	U
111-91-1	bis(2-chloroethoxy) methane	390	U
111-44-4	bis(2-chloroethyl) ether	390	U
117-81-7	bis(2-ethylhexyl) phthalate	47	J
84-74-2	di-n-Butyl Phthalate	390	U
117-84-0	di-n-Octyl Phthalate	390	U
621-64-7	n-Nitrosodi-n-Propylamine	390	U
86-30-6	n-Nitrosodiphenylamine	390	U

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GPL Laboratories

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-021-1/4
Sample Volume :	30	Lab File ID :	D33596.D
% Moisture:	13.6	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	3900	U
95-50-1	1,2-Dichlorobenzene	3900	U
541-73-1	1,3-Dichlorobenzene	3900	U
106-46-7	1,4-Dichlorobenzene	3900	U
108-60-1	2,2-Oxybis(1-Chloropropane)	3900	U
95-95-4	2,4,5-Trichlorophenol	3900	U
88-06-2	2,4,6-Trichlorophenol	3900	U
120-83-2	2,4-Dichlorophenol	3900	U
105-67-9	2,4-Dimethylphenol	3900	U
51-28-5	2,4-Dinitrophenol	7700	U
121-14-2	2,4-Dinitrotoluene	28000	
606-20-2	2,6-Dinitrotoluene	6700	
91-58-7	2-Chloronaphthalene	3900	U
95-57-8	2-Chlorophenol	3900	U
91-57-6	2-Methylnaphthalene	3900	U
88-74-4	2-Nitroaniline	3900	U
88-75-5	2-Nitrophenol	3900	U
95-48-7	2-methylphenol	3900	U
91-94-1	3,3-Dichlorobenzidine	7700	U
99-09-2	3-Nitroaniline	3900	U
534-52-1	4,6-dinitro-2-methyl phenol	1300	J
101-55-3	4-Bromophenyl-phenylether	3900	U
106-47-8	4-Chloroaniline	3900	U
7005-72-3	4-Chlorophenyl Phenyl Ether	3900	U
100-01-6	4-Nitroaniline	3900	U
100-02-7	4-Nitrophenol	7700	U
59-50-7	4-chloro-3-methylphenol	3900	U
106-44-5	4-methylphenol	3900	U
83-32-9	Acenaphthene	3900	U

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GPL Laboratories

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-021-1/4
Sample Volume :	30	Lab File ID :	D33596.D
% Moisture:	13.6	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	3900	U	
120-12-7	Anthracene	3900	U	
56-55-3	Benzo(a)anthracene	3900	U	
50-32-8	Benzo(a)pyrene	3900	U	
205-99-2	Benzo(b)fluoranthene	3900	U	
191-24-2	Benzo(g,h,i)perylene	3900	U	
207-08-9	Benzo(k)fluoranthene	3900	U	
65-85-0	Benzoic Acid	7700	U	UJ
100-51-6	Benzyl Alcohol	3900	U	
85-68-7	Benzyl Butyl Phthalate	3900	U	
86-74-8	Carbazole	3900	U	
218-01-9	Chrysene	3900	U	
53-70-3	Dibenz(a,h)Anthracene	3900	U	
132-64-9	Dibenzofuran	3900	U	
84-66-2	Diethyl Phthalate	3900	U	
131-11-3	Dimethyl Phthalate	3900	U	
206-44-0	Fluoranthene	3900	U	
86-73-7	Fluorene	3900	U	
118-74-1	Hexachlorobenzene	3900	U	
87-68-3	Hexachlorobutadiene	3900	U	
77-47-4	Hexachlorocyclopentadiene	3900	U	UJ
67-72-1	Hexachloroethane	3900	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	3900	U	
78-59-1	Isophorone	3900	U	
91-20-3	Naphthalene	3900	U	
98-95-3	Nitrobenzene	3900	U	
87-86-5	Pentachlorophenol	7700	U	
85-01-8	Phenanthrene	3900	U	
108-95-2	Phenol	3900	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-021-1/4
Sample Volume :	30	Lab File ID :	D33596.D
% Moisture:	13.6	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	3900	U	
110-86-1	Pyridine	3900	U	
111-91-1	bis(2-chloroethoxy) methane	3900	U	
111-44-4	bis(2-chloroethyl) ether	3900	U	
117-81-7	bis(2-ethylhexyl) phthalate	3900	U	
84-74-2	di-n-Butyl Phthalate	3900	U	
117-84-0	di-n-Octyl Phthalate	3900	U	UJ
621-64-7	n-Nitrosodi-n-Propylamine	3900	U	
86-30-6	n-Nitrosodiphenylamine	3900	U	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB4D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-004-029-1/4
Sample Volume :	30	Lab File ID :	D33584.D
% Moisture:	15.94	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	400	U	
95-50-1	1,2-Dichlorobenzene	400	U	
541-73-1	1,3-Dichlorobenzene	400	U	
106-46-7	1,4-Dichlorobenzene	400	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	400	U	
95-95-4	2,4,5-Trichlorophenol	400	U	
88-06-2	2,4,6-Trichlorophenol	400	U	
120-83-2	2,4-Dichlorophenol	400	U	
105-67-9	2,4-Dimethylphenol	400	U	
51-28-5	2,4-Dinitrophenol	790	U	
121-14-2	2,4-Dinitrotoluene	5400		
606-20-2	2,6-Dinitrotoluene	2900		
91-58-7	2-Chloronaphthalene	400	U	
95-57-8	2-Chlorophenol	400	U	
91-57-6	2-Methylnaphthalene	400	U	
88-74-4	2-Nitroaniline	400	U	
88-75-5	2-Nitrophenol	400	U	
95-48-7	2-methylphenol	400	U	
91-94-1	3,3-Dichlorobenzidine	790	U	UJ
99-09-2	3-Nitroaniline	400	U	
534-52-1	4,6-dinitro-2-methyl phenol	790	U	
101-55-3	4-Bromophenyl-phenylether	400	U	
106-47-8	4-Chloroaniline	400	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	400	U	
100-01-6	4-Nitroaniline	400	U	
100-02-7	4-Nitrophenol	790	U	
59-50-7	4-chloro-3-methylphenol	400	U	
106-44-5	4-methylphenol	400	U	
83-32-9	Acenaphthene	400	U	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB4D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-004-029-1/4
Sample Volume :	30	Lab File ID :	D33584.D
% Moisture:	15.94	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	400	U	
120-12-7	Anthracene	400	U	
56-55-3	Benzo(a)anthracene	400	U	
50-32-8	Benzo(a)pyrene	400	U	
205-99-2	Benzo(b)fluoranthene	400	U	
191-24-2	Benzo(g,h,i)perylene	400	U	
207-08-9	Benzo(k)fluoranthene	400	U	
65-85-0	Benzoic Acid	790	U	UJ
100-51-6	Benzyl Alcohol	400	U	
85-68-7	Benzyl Butyl Phthalate	400	U	
86-74-8	Carbazole	400	U	
218-01-9	Chrysene	400	U	
53-70-3	Dibenz(a,h)Anthracene	400	U	
132-64-9	Dibenzofuran	400	U	
84-66-2	Diethyl Phthalate	400	U	
131-11-3	Dimethyl Phthalate	400	U	
206-44-0	Fluoranthene	400	U	
86-73-7	Fluorene	400	U	
118-74-1	Hexachlorobenzene	400	U	
87-68-3	Hexachlorobutadiene	400	U	
77-47-4	Hexachlorocyclopentadiene	400	U	UJ
67-72-1	Hexachloroethane	400	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	400	U	
78-59-1	Isophorone	400	U	
91-20-3	Naphthalene	400	U	
98-95-3	Nitrobenzene	400	U	
87-86-5	Pentachlorophenol	790	U	
85-01-8	Phenanthrene	400	U	
108-95-2	Phenol	400	U	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB4D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-004-029-1/4
Sample Volume :	30	Lab File ID :	D33584.D
% Moisture:	15.94	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	400	U
110-86-1	Pyridine	400	U
111-91-1	bis(2-chloroethoxy) methane	400	U
111-44-4	bis(2-chloroethyl) ether	400	U
117-81-7	bis(2-ethylhexyl) phthalate	400	U
84-74-2	di-n-Butyl Phthalate	400	U
117-84-0	di-n-Octyl Phthalate	400	U
621-64-7	n-Nitrosodi-n-Propylamine	400	U
86-30-6	n-Nitrosodiphenylamine	400	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-037-1/4
Sample Volume :	30	Lab File ID :	D33585.D
% Moisture:	17.91	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	410	U	
95-50-1	1,2-Dichlorobenzene	410	U	
541-73-1	1,3-Dichlorobenzene	410	U	
106-46-7	1,4-Dichlorobenzene	410	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	410	U	
95-95-4	2,4,5-Trichlorophenol	410	U	
88-06-2	2,4,6-Trichlorophenol	410	U	
120-83-2	2,4-Dichlorophenol	410	U	
105-67-9	2,4-Dimethylphenol	410	U	
51-28-5	2,4-Dinitrophenol	810	U	
121-14-2	2,4-Dinitrotoluene	370	J	J
606-20-2	2,6-Dinitrotoluene	100	J	J
91-58-7	2-Chloronaphthalene	410	U	
95-57-8	2-Chlorophenol	410	U	
91-57-6	2-Methylnaphthalene	410	U	
88-74-4	2-Nitroaniline	410	U	
88-75-5	2-Nitrophenol	410	U	
95-48-7	2-methylphenol	410	U	
91-94-1	3,3-Dichlorobenzidine	810	U	UJ
99-09-2	3-Nitroaniline	410	U	
534-52-1	4,6-dinitro-2-methyl phenol	810	U	
101-55-3	4-Bromophenyl-phenylether	410	U	
106-47-8	4-Chloroaniline	410	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	410	U	
100-01-6	4-Nitroaniline	410	U	
100-02-7	4-Nitrophenol	810	U	
59-50-7	4-chloro-3-methylphenol	410	U	
106-44-5	4-methylphenol	410	U	
83-32-9	Acenaphthene	410	U	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-037-1/4
Sample Volume :	30	Lab File ID :	D33585.D
% Moisture:	17.91	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	410	U	
120-12-7	Anthracene	410	U	
56-55-3	Benzo(a)anthracene	410	U	
50-32-8	Benzo(a)pyrene	410	U	
205-99-2	Benzo(b)fluoranthene	410	U	
191-24-2	Benzo(g,h,i)perylene	410	U	
207-08-9	Benzo(k)fluoranthene	410	U	
65-85-0	Benzoic Acid	810	U	UJ
100-51-6	Benzyl Alcohol	410	U	
85-68-7	Benzyl Butyl Phthalate	410	U	
86-74-8	Carbazole	410	U	
218-01-9	Chrysene	410	U	
53-70-3	Dibenz(a,h)Anthracene	410	U	
132-64-9	Dibenzofuran	410	U	
84-66-2	Diethyl Phthalate	410	U	
131-11-3	Dimethyl Phthalate	410	U	
206-44-0	Fluoranthene	410	U	
86-73-7	Fluorene	410	U	
118-74-1	Hexachlorobenzene	410	U	
87-68-3	Hexachlorobutadiene	410	U	
77-47-4	Hexachlorocyclopentadiene	410	U	UJ
67-72-1	Hexachloroethane	410	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	410	U	
78-59-1	Isophorone	410	U	
91-20-3	Naphthalene	410	U	
98-95-3	Nitrobenzene	410	U	
87-86-5	Pentachlorophenol	810	U	
85-01-8	Phenanthrene	410	U	
108-95-2	Phenol	410	U	

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-037-1/4
Sample Volume :	30	Lab File ID :	D33585.D
% Moisture:	17.91	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	410	U
110-86-1	Pyridine	410	U
111-91-1	bis(2-chloroethoxy) methane	410	U
111-44-4	bis(2-chloroethyl) ether	410	U
117-81-7	bis(2-ethylhexyl) phthalate	410	U
84-74-2	di-n-Butyl Phthalate	410	U
117-84-0	di-n-Octyl Phthalate	410	U
621-64-7	n-Nitrosodi-n-Propylamine	410	U
86-30-6	n-Nitrosodiphenylamine	410	U

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-045-1/4
Sample Volume :	30	Lab File ID :	D33600.D
% Moisture:	63.33	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µL	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	91000	U
95-50-1	1,2-Dichlorobenzene	91000	U
541-73-1	1,3-Dichlorobenzene	91000	U
106-46-7	1,4-Dichlorobenzene	91000	U
108-60-1	2,2-Oxybis(1-Chloropropane)	91000	U
95-95-4	2,4,5-Trichlorophenol	91000	U
88-06-2	2,4,6-Trichlorophenol	91000	U
120-83-2	2,4-Dichlorophenol	91000	U
105-67-9	2,4-Dimethylphenol	91000	U
51-28-5	2,4-Dinitrophenol	180000	U
121-14-2	2,4-Dinitrotoluene	26000000	E
606-20-2	2,6-Dinitrotoluene	6400000	E
91-58-7	2-Chloronaphthalene	91000	U
95-57-8	2-Chlorophenol	91000	U
91-57-6	2-Methylnaphthalene	91000	U
88-74-4	2-Nitroaniline	91000	U
88-75-5	2-Nitrophenol	91000	U
95-48-7	2-methylphenol	91000	U
91-94-1	3,3-Dichlorobenzidine	180000	U
99-09-2	3-Nitroaniline	91000	U
534-52-1	4,6-dinitro-2-methyl phenol	180000	U
101-55-3	4-Bromophenyl-phenylether	91000	U
106-47-8	4-Chloroaniline	91000	U
7005-72-3	4-Chlorophenyl Phenyl Ether	91000	U
100-01-6	4-Nitroaniline	91000	U
100-02-7	4-Nitrophenol	180000	U
59-50-7	4-chloro-3-methylphenol	91000	U
106-44-5	4-methylphenol	91000	U
83-32-9	Acenaphthene	91000	U

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-045-1/4
Sample Volume :	30	Lab File ID :	D33600.D
% Moisture:	63.33	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	91000	U	
120-12-7	Anthracene	91000	U	
56-55-3	Benzo(a)anthracene	91000	U	
50-32-8	Benzo(a)pyrene	91000	U	
205-99-2	Benzo(b)fluoranthene	91000	U	
191-24-2	Benzo(g,h,i)perylene	91000	U	
207-08-9	Benzo(k)fluoranthene	91000	U	
65-85-0	Benzoic Acid	180000	U	UJ
100-51-6	Benzyl Alcohol	91000	U	
85-68-7	Benzyl Butyl Phthalate	91000	U	
86-74-8	Carbazole	91000	U	
218-01-9	Chrysene	91000	U	
53-70-3	Dibenz(a,h)Anthracene	91000	U	
132-64-9	Dibenzofuran	91000	U	
84-66-2	Diethyl Phthalate	91000	U	
131-11-3	Dimethyl Phthalate	91000	U	
206-44-0	Fluoranthene	91000	U	
86-73-7	Fluorene	91000	U	
118-74-1	Hexachlorobenzene	91000	U	
87-68-3	Hexachlorobutadiene	91000	U	
77-47-4	Hexachlorocyclopentadiene	91000	U	UJ
67-72-1	Hexachloroethane	91000	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	91000	U	
78-59-1	Isophorone	91000	U	
91-20-3	Naphthalene	91000	U	
98-95-3	Nitrobenzene	91000	U	
87-86-5	Pentachlorophenol	180000	U	
85-01-8	Phenanthrene	91000	U	
108-95-2	Phenol	91000	U	

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SAMPLE NO
51SB5BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-045-1/4
Sample Volume :	30	Lab File ID :	D33600.D
% Moisture:	63.33	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	91000	U	
110-86-1	Pyridine	91000	U	
111-91-1	bis(2-chloroethoxy) methane	91000	U	
111-44-4	bis(2-chloroethyl) ether	91000	U	
117-81-7	bis(2-ethylhexyl) phthalate	30000	J	J
84-74-2	di-n-Butyl Phthalate	91000	U	
117-84-0	di-n-Octyl Phthalate	91000	U	UJ
621-64-7	n-Nitrosodi-n-Propylamine	91000	U	
86-30-6	n-Nitrosodiphenylamine	91000	U	

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SAMPLE NO
51SB5BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-045-1/4
Sample Volume :	30	Lab File ID :	D33607.D
% Moisture:	63.33	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	250
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	2300000	U
95-50-1	1,2-Dichlorobenzene	2300000	U
541-73-1	1,3-Dichlorobenzene	2300000	U
106-46-7	1,4-Dichlorobenzene	2300000	U
108-60-1	2,2-Oxybis(1-Chloropropane)	2300000	U
95-95-4	2,4,5-Trichlorophenol	2300000	U
88-06-2	2,4,6-Trichlorophenol	2300000	U
120-83-2	2,4-Dichlorophenol	2300000	U
105-67-9	2,4-Dimethylphenol	2300000	U
51-28-5	2,4-Dinitrophenol	4500000	U
121-14-2	2,4-Dinitrotoluene	21000000	
606-20-2	2,6-Dinitrotoluene	5000000	
91-58-7	2-Chloronaphthalene	2300000	U
95-57-8	2-Chlorophenol	2300000	U
91-57-6	2-Methylnaphthalene	2300000	U
88-74-4	2-Nitroaniline	2300000	U
88-75-5	2-Nitrophenol	2300000	U
95-48-7	2-methylphenol	2300000	U
91-94-1	3,3-Dichlorobenzidine	4500000	U
99-09-2	3-Nitroaniline	2300000	U
534-52-1	4,6-dinitro-2-methyl phenol	4500000	U
101-55-3	4-Bromophenyl-phenylether	2300000	U
106-47-8	4-Chloroaniline	2300000	U
7005-72-3	4-Chlorophenyl Phenyl Ether	2300000	U
100-01-6	4-Nitroaniline	2300000	U
100-02-7	4-Nitrophenol	4500000	U
59-50-7	4-chloro-3-methylphenol	2300000	U
106-44-5	4-methylphenol	2300000	U
83-32-9	Acenaphthene	2300000	U

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SAMPLE NO
51SB5BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-045-1/4
Sample Volume :	30	Lab File ID :	D33607.D
% Moisture:	63.33	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	250
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	2300000	U	
120-12-7	Anthracene	2300000	U	
56-55-3	Benzo(a)anthracene	2300000	U	
50-32-8	Benzo(a)pyrene	2300000	U	
205-99-2	Benzo(b)fluoranthene	2300000	U	
191-24-2	Benzo(g,h,i)perylene	2300000	U	
207-08-9	Benzo(k)fluoranthene	2300000	U	
65-85-0	Benzoic Acid	4500000	U	UJ
100-51-6	Benzyl Alcohol	2300000	U	
85-68-7	Benzyl Butyl Phthalate	2300000	U	
86-74-8	Carbazole	2300000	U	
218-01-9	Chrysene	2300000	U	
53-70-3	Dibenz(a,h)Anthracene	2300000	U	
132-64-9	Dibenzofuran	2300000	U	
84-66-2	Diethyl Phthalate	2300000	U	
131-11-3	Dimethyl Phthalate	2300000	U	
206-44-0	Fluoranthene	2300000	U	
86-73-7	Fluorene	2300000	U	
118-74-1	Hexachlorobenzene	2300000	U	
87-68-3	Hexachlorobutadiene	2300000	U	
77-47-4	Hexachlorocyclopentadiene	2300000	U	UJ
67-72-1	Hexachloroethane	2300000	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	2300000	U	
78-59-1	Isophorone	2300000	U	
91-20-3	Naphthalene	2300000	U	
98-95-3	Nitrobenzene	2300000	U	
87-86-5	Pentachlorophenol	4500000	U	
85-01-8	Phenanthrene	2300000	U	
108-95-2	Phenol	2300000	U	

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SAMPLE NO
51SB5BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-045-1/4
Sample Volume :	30	Lab File ID :	D33607.D
% Moisture:	63.33	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	10 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µL	Dilution Factor	250
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	2300000	U
110-86-1	Pyridine	2300000	U
111-91-1	bis(2-chloroethoxy) methane	2300000	U
111-44-4	bis(2-chloroethyl) ether	2300000	U
117-81-7	bis(2-ethylhexyl) phthalate	2300000	U
84-74-2	di-n-Butyl Phthalate	2300000	U
117-84-0	di-n-Octyl Phthalate	2300000	U VJ
621-64-7	n-Nitrosodi-n-Propylamine	2300000	U
86-30-6	n-Nitrosodiphenylamine	2300000	U

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SAMPLE NO
51SB5C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-053-1/4
Sample Volume :	30	Lab File ID :	D33586.D
% Moisture:	7.73	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	360	U	
95-50-1	1,2-Dichlorobenzene	360	U	
541-73-1	1,3-Dichlorobenzene	360	U	
106-46-7	1,4-Dichlorobenzene	360	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	360	U	
95-95-4	2,4,5-Trichlorophenol	360	U	
88-06-2	2,4,6-Trichlorophenol	360	U	
120-83-2	2,4-Dichlorophenol	360	U	
105-67-9	2,4-Dimethylphenol	360	U	
51-28-5	2,4-Dinitrophenol	720	U	
121-14-2	2,4-Dinitrotoluene	60000	E	R
606-20-2	2,6-Dinitrotoluene	13000	E	R
91-58-7	2-Chloronaphthalene	360	U	
95-57-8	2-Chlorophenol	360	U	
91-57-6	2-Methylnaphthalene	360	U	
88-74-4	2-Nitroaniline	360	U	
88-75-5	2-Nitrophenol	360	U	
95-48-7	2-methylphenol	360	U	
91-94-1	3,3-Dichlorobenzidine	720	U	UJ
99-09-2	3-Nitroaniline	360	U	
534-52-1	4,6-dinitro-2-methyl phenol	200	J	J
101-55-3	4-Bromophenyl-phenylether	360	U	
106-47-8	4-Chloroaniline	360	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	360	U	
100-01-6	4-Nitroaniline	360	U	
100-02-7	4-Nitrophenol	720	U	
59-50-7	4-chloro-3-methylphenol	360	U	
106-44-5	4-methylphenol	360	U	
83-32-9	Acenaphthene	360	U	

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SAMPLE NO
51SB5C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-053-1/4
Sample Volume :	30	Lab File ID :	D33586.D
% Moisture:	7.73	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	360	U	
120-12-7	Anthracene	360	U	
56-55-3	Benzo(a)anthracene	360	U	
50-32-8	Benzo(a)pyrene	360	U	
205-99-2	Benzo(b)fluoranthene	360	U	
191-24-2	Benzo(g,h,i)perylene	360	U	
207-08-9	Benzo(k)fluoranthene	360	U	
65-85-0	Benzoic Acid	720	U	UJ
100-51-6	Benzyl Alcohol	360	U	
85-68-7	Benzyl Butyl Phthalate	360	U	
86-74-8	Carbazole	360	U	
218-01-9	Chrysene	360	U	
53-70-3	Dibenz(a,h)Anthracene	360	U	
132-64-9	Dibenzofuran	360	U	
84-66-2	Diethyl Phthalate	360	U	
131-11-3	Dimethyl Phthalate	360	U	
206-44-0	Fluoranthene	360	U	
86-73-7	Fluorene	360	U	
118-74-1	Hexachlorobenzene	360	U	
87-68-3	Hexachlorobutadiene	360	U	
77-47-4	Hexachlorocyclopentadiene	360	U	UJ
67-72-1	Hexachloroethane	360	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	360	U	
78-59-1	Isophorone	360	U	
91-20-3	Naphthalene	360	U	
98-95-3	Nitrobenzene	360	U	
87-86-5	Pentachlorophenol	720	U	
85-01-8	Phenanthrene	360	U	
108-95-2	Phenol	360	U	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB5C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-053-1/4
Sample Volume :	30	Lab File ID :	D33586.D
% Moisture:	7.73	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	360	U	
110-86-1	Pyridine	360	U	
111-91-1	bis(2-chloroethoxy) methane	360	U	
111-44-4	bis(2-chloroethyl) ether	360	U	
117-81-7	bis(2-ethylhexyl) phthalate	67	J	J
84-74-2	di-n-Butyl Phthalate	83	J	B
117-84-0	di-n-Octyl Phthalate	360	U	
621-64-7	n-Nitrosodi-n-Propylamine	360	U	
86-30-6	n-Nitrosodiphenylamine	360	U	

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SAMPLE NO
51SB5CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-053-1/4
Sample Volume :	30	Lab File ID :	D33606.D
% Moisture:	7.73	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	3600	U
95-50-1	1,2-Dichlorobenzene	3600	U
541-73-1	1,3-Dichlorobenzene	3600	U
106-46-7	1,4-Dichlorobenzene	3600	U
108-60-1	2,2-Oxybis(1-Chloropropane)	3600	U
95-95-4	2,4,5-Trichlorophenol	3600	U
88-06-2	2,4,6-Trichlorophenol	3600	U
120-83-2	2,4-Dichlorophenol	3600	U
105-67-9	2,4-Dimethylphenol	3600	U
51-28-5	2,4-Dinitrophenol	7200	U
121-14-2	2,4-Dinitrotoluene	44000	
606-20-2	2,6-Dinitrotoluene	11000	
91-58-7	2-Chloronaphthalene	3600	U
95-57-8	2-Chlorophenol	3600	U
91-57-6	2-Methylnaphthalene	3600	U
88-74-4	2-Nitroaniline	3600	U
88-75-5	2-Nitrophenol	3600	U
95-48-7	2-methylphenol	3600	U
91-94-1	3,3-Dichlorobenzidine	7200	U
99-09-2	3-Nitroaniline	3600	U
534-52-1	4,6-dinitro-2-methyl phenol	7200	U
101-55-3	4-Bromophenyl-phenylether	3600	U
106-47-8	4-Chloroaniline	3600	U
7005-72-3	4-Chlorophenyl Phenyl Ether	3600	U
100-01-6	4-Nitroaniline	3600	U
100-02-7	4-Nitrophenol	7200	U
59-50-7	4-chloro-3-methylphenol	3600	U
106-44-5	4-methylphenol	3600	U
83-32-9	Acenaphthene	3600	U

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SAMPLE NO
51SB5CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-053-1/4
Sample Volume :	30	Lab File ID :	D33606.D
% Moisture:	7.73	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	3600	U	
120-12-7	Anthracene	3600	U	
56-55-3	Benzo(a)anthracene	3600	U	
50-32-8	Benzo(a)pyrene	3600	U	
205-99-2	Benzo(b)fluoranthene	3600	U	
191-24-2	Benzo(g,h,i)perylene	3600	U	
207-08-9	Benzo(k)fluoranthene	3600	U	
65-85-0	Benzoic Acid	7200	U	UJ
100-51-6	Benzyl Alcohol	3600	U	
85-68-7	Benzyl Butyl Phthalate	3600	U	
86-74-8	Carbazole	3600	U	
218-01-9	Chrysene	3600	U	
53-70-3	Dibenz(a,h)Anthracene	3600	U	
132-64-9	Dibenzofuran	3600	U	
84-66-2	Diethyl Phthalate	3600	U	
131-11-3	Dimethyl Phthalate	3600	U	
206-44-0	Fluoranthene	3600	U	
86-73-7	Fluorene	3600	U	
118-74-1	Hexachlorobenzene	3600	U	
87-68-3	Hexachlorobutadiene	3600	U	
77-47-4	Hexachlorocyclopentadiene	3600	U	UJ
67-72-1	Hexachloroethane	3600	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	3600	U	
78-59-1	Isophorone	3600	U	
91-20-3	Naphthalene	3600	U	
98-95-3	Nitrobenzene	3600	U	
87-86-5	Pentachlorophenol	7200	U	
85-01-8	Phenanthrene	3600	U	
108-95-2	Phenol	3600	U	

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SAMPLE NO
51SB5CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-053-1/4
Sample Volume :	30	Lab File ID :	D33606.D
% Moisture:	7.73	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	10
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	3600	U
110-86-1	Pyridine	3600	U
111-91-1	bis(2-chloroethoxy) methane	3600	U
111-44-4	bis(2-chloroethyl) ether	3600	U
117-81-7	bis(2-ethylhexyl) phthalate	3600	U
84-74-2	di-n-Butyl Phthalate	3600	U
117-84-0	di-n-Octyl Phthalate	3600	U VJ
621-64-7	n-Nitrosodi-n-Propylamine	3600	U
86-30-6	n-Nitrosodiphenylamine	3600	U

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SAMPLE NO
51SB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-061-1/4
Sample Volume :	30	Lab File ID :	D33587.D
% Moisture:	21.32	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	420	U	
95-50-1	1,2-Dichlorobenzene	420	U	
541-73-1	1,3-Dichlorobenzene	420	U	
106-46-7	1,4-Dichlorobenzene	420	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	420	U	
95-95-4	2,4,5-Trichlorophenol	420	U	
88-06-2	2,4,6-Trichlorophenol	420	U	
120-83-2	2,4-Dichlorophenol	420	U	
105-67-9	2,4-Dimethylphenol	420	U	
51-28-5	2,4-Dinitrophenol	850	U	
121-14-2	2,4-Dinitrotoluene	13000	E	R
606-20-2	2,6-Dinitrotoluene	4400		
91-58-7	2-Chloronaphthalene	420	U	
95-57-8	2-Chlorophenol	420	U	
91-57-6	2-Methylnaphthalene	420	U	
88-74-4	2-Nitroaniline	420	U	
88-75-5	2-Nitrophenol	420	U	
95-48-7	2-methylphenol	420	U	
91-94-1	3,3-Dichlorobenzidine	850	U	UJ
99-09-2	3-Nitroaniline	420	U	"
534-52-1	4,6-dinitro-2-methyl phenol	140	J	J
101-55-3	4-Bromophenyl-phenylether	420	U	
106-47-8	4-Chloroaniline	420	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	420	U	
100-01-6	4-Nitroaniline	420	U	
100-02-7	4-Nitrophenol	850	U	
59-50-7	4-chloro-3-methylphenol	420	U	
106-44-5	4-methylphenol	420	U	
83-32-9	Acenaphthene	420	U	

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SAMPLE NO
51SB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-061-1/4
Sample Volume :	30	Lab File ID :	D33587.D
% Moisture:	21.32	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	420	U	
120-12-7	Anthracene	420	U	
56-55-3	Benzo(a)anthracene	420	U	
50-32-8	Benzo(a)pyrene	420	U	
205-99-2	Benzo(b)fluoranthene	420	U	
191-24-2	Benzo(g,h,i)perylene	420	U	
207-08-9	Benzo(k)fluoranthene	420	U	
65-85-0	Benzoic Acid	850	U	UJ
100-51-6	Benzyl Alcohol	420	U	
85-68-7	Benzyl Butyl Phthalate	420	U	
86-74-8	Carbazole	420	U	
218-01-9	Chrysene	420	U	
53-70-3	Dibenz(a,h)Anthracene	420	U	
132-64-9	Dibenzofuran	420	U	
84-66-2	Diethyl Phthalate	420	U	
131-11-3	Dimethyl Phthalate	420	U	
206-44-0	Fluoranthene	420	U	
86-73-7	Fluorene	420	U	
118-74-1	Hexachlorobenzene	420	U	
87-68-3	Hexachlorobutadiene	420	U	
77-47-4	Hexachlorocyclopentadiene	420	U	UJ
67-72-1	Hexachloroethane	420	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	420	U	
78-59-1	Isophorone	420	U	
91-20-3	Naphthalene	420	U	
98-95-3	Nitrobenzene	420	U	
87-86-5	Pentachlorophenol	850	U	
85-01-8	Phenanthrene	420	U	
108-95-2	Phenol	420	U	

GPL Laboratories

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-061-1/4
Sample Volume :	30	Lab File ID :	D33587.D
% Moisture:	21.32	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	420	U
110-86-1	Pyridine	420	U
111-91-1	bis(2-chloroethoxy) methane	420	U
111-44-4	bis(2-chloroethyl) ether	420	U
117-81-7	bis(2-ethylhexyl) phthalate	420	U
84-74-2	di-n-Butyl Phthalate	150	J B
117-84-0	di-n-Octyl Phthalate	420	U
621-64-7	n-Nitrosodi-n-Propylamine	420	U
86-30-6	n-Nitrosodiphenylamine	420	U

GPL Laboratories

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5DDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-061-1/4
Sample Volume :	30	Lab File ID :	D33598.D
% Moisture:	21.32	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	5
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	2100	U
95-50-1	1,2-Dichlorobenzene	2100	U
541-73-1	1,3-Dichlorobenzene	2100	U
106-46-7	1,4-Dichlorobenzene	2100	U
108-60-1	2,2-Oxybis(1-Chloropropane)	2100	U
95-95-4	2,4,5-Trichlorophenol	2100	U
88-06-2	2,4,6-Trichlorophenol	2100	U
120-83-2	2,4-Dichlorophenol	2100	U
105-67-9	2,4-Dimethylphenol	2100	U
51-28-5	2,4-Dinitrophenol	4200	U
121-14-2	2,4-Dinitrotoluene	11000	
606-20-2	2,6-Dinitrotoluene	3800	
91-58-7	2-Chloronaphthalene	2100	U
95-57-8	2-Chlorophenol	2100	U
91-57-6	2-Methylnaphthalene	2100	U
88-74-4	2-Nitroaniline	2100	U
88-75-5	2-Nitrophenol	2100	U
95-48-7	2-methylphenol	2100	U
91-94-1	3,3-Dichlorobenzidine	4200	U
99-09-2	3-Nitroaniline	2100	U
534-52-1	4,6-dinitro-2-methyl phenol	4200	U
101-55-3	4-Bromophenyl-phenylether	2100	U
106-47-8	4-Chloroaniline	2100	U
7005-72-3	4-Chlorophenyl Phenyl Ether	2100	U
100-01-6	4-Nitroaniline	2100	U
100-02-7	4-Nitrophenol	4200	U
59-50-7	4-chloro-3-methylphenol	2100	U
106-44-5	4-methylphenol	2100	U
83-32-9	Acenaphthene	2100	U

GPL Laboratories

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5DDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-061-1/4
Sample Volume :	30	Lab File ID :	D33598.D
% Moisture:	21.32	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	5
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	2100	U	
120-12-7	Anthracene	2100	U	
56-55-3	Benzo(a)anthracene	2100	U	
50-32-8	Benzo(a)pyrene	2100	U	
205-99-2	Benzo(b)fluoranthene	2100	U	
191-24-2	Benzo(g,h,i)perylene	2100	U	
207-08-9	Benzo(k)fluoranthene	2100	U	
65-85-0	Benzoic Acid	4200	U	UJ
100-51-6	Benzyl Alcohol	2100	U	
85-68-7	Benzyl Butyl Phthalate	2100	U	
86-74-8	Carbazole	2100	U	
218-01-9	Chrysene	2100	U	
53-70-3	Dibenz(a,h)Anthracene	2100	U	
132-64-9	Dibenzofuran	2100	U	
84-66-2	Diethyl Phthalate	2100	U	
131-11-3	Dimethyl Phthalate	2100	U	
206-44-0	Fluoranthene	2100	U	
86-73-7	Fluorene	2100	U	
118-74-1	Hexachlorobenzene	2100	U	
87-68-3	Hexachlorobutadiene	2100	U	
77-47-4	Hexachlorocyclopentadiene	2100	U	UJ
67-72-1	Hexachloroethane	2100	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	2100	U	
78-59-1	Isophorone	2100	U	
91-20-3	Naphthalene	2100	U	
98-95-3	Nitrobenzene	2100	U	
87-86-5	Pentachlorophenol	4200	U	
85-01-8	Phenanthrene	2100	U	
108-95-2	Phenol	2100	U	

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5DDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-061-1/4
Sample Volume :	30	Lab File ID :	D33598.D
% Moisture:	21.32	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µ L	Dilution Factor	5
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	2100	U	
110-86-1	Pyridine	2100	U	
111-91-1	bis(2-chloroethoxy) methane	2100	U	
111-44-4	bis(2-chloroethyl) ether	2100	U	
117-81-7	bis(2-ethylhexyl) phthalate	2100	U	
84-74-2	di-n-Butyl Phthalate	2100	U	
117-84-0	di-n-Octyl Phthalate	2100	U	UJ
621-64-7	n-Nitrosodi-n-Propylamine	2100	U	
86-30-6	n-Nitrosodiphenylamine	2100	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-069-1/4
Sample Volume :	30	Lab File ID :	D33588.D
% Moisture:	17.78	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	410	U	
95-50-1	1,2-Dichlorobenzene	410	U	
541-73-1	1,3-Dichlorobenzene	410	U	
106-46-7	1,4-Dichlorobenzene	410	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	410	U	
95-95-4	2,4,5-Trichlorophenol	410	U	
88-06-2	2,4,6-Trichlorophenol	410	U	
120-83-2	2,4-Dichlorophenol	410	U	
105-67-9	2,4-Dimethylphenol	410	U	
51-28-5	2,4-Dinitrophenol	410	U	
121-14-2	2,4-Dinitrotoluene	810	U	
606-20-2	2,6-Dinitrotoluene	17000	E	R
91-58-7	2-Chloronaphthalene	4900		
95-57-8	2-Chlorophenol	410	U	
91-57-6	2-Methylnaphthalene	410	U	
88-74-4	2-Nitroaniline	410	U	
88-75-5	2-Nitrophenol	410	U	
95-48-7	2-methylphenol	410	U	
91-94-1	3,3-Dichlorobenzidine	410	U	
99-09-2	3-Nitroaniline	810	U	UJ
534-52-1	4,6-dinitro-2-methyl phenol	410	U	
101-55-3	4-Bromophenyl-phenylether	170	J	J
106-47-8	4-Chloroaniline	410	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	410	U	
100-01-6	4-Nitroaniline	410	U	
100-02-7	4-Nitrophenol	410	U	
59-50-7	4-chloro-3-methylphenol	810	U	
106-44-5	4-methylphenol	410	U	
83-32-9	Acenaphthene	410	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-069-1/4
Sample Volume :	30	Lab File ID :	D33588.D
% Moisture:	17.78	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	410	U	
120-12-7	Anthracene	410	U	
56-55-3	Benzo(a)anthracene	410	U	
50-32-8	Benzo(a)pyrene	410	U	
205-99-2	Benzo(b)fluoranthene	410	U	
191-24-2	Benzo(g,h,i)perylene	410	U	
207-08-9	Benzo(k)fluoranthene	410	U	
65-85-0	Benzoic Acid	810	U	UJ
100-51-6	Benzyl Alcohol	410	U	
85-68-7	Benzyl Butyl Phthalate	410	U	
86-74-8	Carbazole	410	U	
218-01-9	Chrysene	410	U	
53-70-3	Dibenz(a,h)Anthracene	410	U	
132-64-9	Dibenzofuran	410	U	
84-66-2	Diethyl Phthalate	410	U	
131-11-3	Dimethyl Phthalate	410	U	
206-44-0	Fluoranthene	410	U	
86-73-7	Fluorene	410	U	
118-74-1	Hexachlorobenzene	410	U	
87-68-3	Hexachlorobutadiene	410	U	
77-47-4	Hexachlorocyclopentadiene	410	U	UJ
67-72-1	Hexachloroethane	410	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	410	U	
78-59-1	Isophorone	410	U	
91-20-3	Naphthalene	410	U	
98-95-3	Nitrobenzene	410	U	
87-86-5	Pentachlorophenol	810	U	
85-01-8	Phenanthrene	410	U	
108-95-2	Phenol	410	U	

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-069-1/4
Sample Volume :	30	Lab File ID :	D33588.D
% Moisture:	17.78	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	410	U
110-86-1	Pyridine	410	U
111-91-1	bis(2-chloroethoxy) methane	410	U
111-44-4	bis(2-chloroethyl) ether	410	U
117-81-7	bis(2-ethylhexyl) phthalate	410	U
84-74-2	di-n-Butyl Phthalate	410	U
117-84-0	di-n-Octyl Phthalate	410	U
621-64-7	n-Nitrosodi-n-Propylamine	410	U
86-30-6	n-Nitrosodiphenylamine	410	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB5DDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-069-1/4
Sample Volume :	30	Lab File ID :	D33599.D
% Moisture:	17.78	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µL	Dilution Factor	5
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	2000	U
95-50-1	1,2-Dichlorobenzene	2000	U
541-73-1	1,3-Dichlorobenzene	2000	U
106-46-7	1,4-Dichlorobenzene	2000	U
108-60-1	2,2-Oxybis(1-Chloropropane)	2000	U
95-95-4	2,4,5-Trichlorophenol	2000	U
88-06-2	2,4,6-Trichlorophenol	2000	U
120-83-2	2,4-Dichlorophenol	2000	U
105-67-9	2,4-Dimethylphenol	2000	U
51-28-5	2,4-Dinitrophenol	4100	U
121-14-2	2,4-Dinitrotoluene	15000	
606-20-2	2,6-Dinitrotoluene	4400	
91-58-7	2-Chloronaphthalene	2000	U
95-57-8	2-Chlorophenol	2000	U
91-57-6	2-Methylnaphthalene	2000	U
88-74-4	2-Nitroaniline	2000	U
88-75-5	2-Nitrophenol	2000	U
95-48-7	2-methylphenol	2000	U
91-94-1	3,3-Dichlorobenzidine	4100	U
99-09-2	3-Nitroaniline	2000	U
534-52-1	4,6-dinitro-2-methyl phenol	4100	U
101-55-3	4-Bromophenyl-phenylether	2000	U
106-47-8	4-Chloroaniline	2000	U
7005-72-3	4-Chlorophenyl Phenyl Ether	2000	U
100-01-6	4-Nitroaniline	2000	U
100-02-7	4-Nitrophenol	4100	U
59-50-7	4-chloro-3-methylphenol	2000	U
106-44-5	4-methylphenol	2000	U
83-32-9	Acenaphthene	2000	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB5DDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-069-1/4
Sample Volume :	30	Lab File ID :	D33599.D
% Moisture:	17.78	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µL	Dilution Factor	5
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	2000	U	
120-12-7	Anthracene	2000	U	
56-55-3	Benzo(a)anthracene	2000	U	
50-32-8	Benzo(a)pyrene	2000	U	
205-99-2	Benzo(b)fluoranthene	2000	U	
191-24-2	Benzo(g,h,i)perylene	2000	U	
207-08-9	Benzo(k)fluoranthene	2000	U	
65-85-0	Benzoic Acid	4100	U	UJ
100-51-6	Benzyl Alcohol	2000	U	
85-68-7	Benzyl Butyl Phthalate	2000	U	
86-74-8	Carbazole	2000	U	
218-01-9	Chrysene	2000	U	
53-70-3	Dibenz(a,h)Anthracene	2000	U	
132-64-9	Dibenzofuran	2000	U	
84-66-2	Diethyl Phthalate	2000	U	
131-11-3	Dimethyl Phthalate	2000	U	
206-44-0	Fluoranthene	2000	U	
86-73-7	Fluorene	2000	U	
118-74-1	Hexachlorobenzene	2000	U	
87-68-3	Hexachlorobutadiene	2000	U	
77-47-4	Hexachlorocyclopentadiene	2000	U	UJ
67-72-1	Hexachloroethane	2000	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	2000	U	
78-59-1	Isophorone	2000	U	
91-20-3	Naphthalene	2000	U	
98-95-3	Nitrobenzene	2000	U	
87-86-5	Pentachlorophenol	4100	U	
85-01-8	Phenanthrene	2000	U	
108-95-2	Phenol	2000	U	

GPL Laboratories

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB5DDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-069-1/4
Sample Volume :	30	Lab File ID :	D33599.D
% Moisture:	17.78	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/14/2004
Injection Volume :	1 µL	Dilution Factor	5
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	2000	U
110-86-1	Pyridine	2000	U
111-91-1	bis(2-chloroethoxy) methane	2000	U
111-44-4	bis(2-chloroethyl) ether	2000	U
117-81-7	bis(2-ethylhexyl) phthalate	2000	U
84-74-2	di-n-Butyl Phthalate	2000	U
117-84-0	di-n-Octyl Phthalate	2000	U UJ
621-64-7	n-Nitrosodi-n-Propylamine	2000	U
86-30-6	n-Nitrosodiphenylamine	2000	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-010-077-1/4
Sample Volume :	30	Lab File ID :	D33589.D
% Moisture:	15.33	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	390	U	
95-50-1	1,2-Dichlorobenzene	390	U	
541-73-1	1,3-Dichlorobenzene	390	U	
106-46-7	1,4-Dichlorobenzene	390	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	390	U	
95-95-4	2,4,5-Trichlorophenol	390	U	
88-06-2	2,4,6-Trichlorophenol	390	U	
120-83-2	2,4-Dichlorophenol	390	U	
105-67-9	2,4-Dimethylphenol	390	U	
51-28-5	2,4-Dinitrophenol	790	U	
121-14-2	2,4-Dinitrotoluene	1200		
606-20-2	2,6-Dinitrotoluene	270	J	J
91-58-7	2-Chloronaphthalene	390	U	
95-57-8	2-Chlorophenol	390	U	
91-57-6	2-Methylnaphthalene	390	U	
88-74-4	2-Nitroaniline	390	U	
88-75-5	2-Nitrophenol	390	U	
95-48-7	2-methylphenol	390	U	
91-94-1	3,3-Dichlorobenzidine	790	U	UJ
99-09-2	3-Nitroaniline	390	U	
534-52-1	4,6-dinitro-2-methyl phenol	790	U	
101-55-3	4-Bromophenyl-phenylether	390	U	
106-47-8	4-Chloroaniline	390	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	390	U	
100-01-6	4-Nitroaniline	390	U	
100-02-7	4-Nitrophenol	790	U	
59-50-7	4-chloro-3-methylphenol	390	U	
106-44-5	4-methylphenol	390	U	
83-32-9	Acenaphthene	390	U	

GPL Laboratories

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-010-077-1/4
Sample Volume :	30	Lab File ID :	D33589.D
% Moisture:	15.33	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	390	U	
120-12-7	Anthracene	390	U	
56-55-3	Benzo(a)anthracene	390	U	
50-32-8	Benzo(a)pyrene	390	U	
205-99-2	Benzo(b)fluoranthene	390	U	
191-24-2	Benzo(g,h,i)perylene	390	U	
207-08-9	Benzo(k)fluoranthene	390	U	
65-85-0	Benzoic Acid	790	U	UJ
100-51-6	Benzyl Alcohol	390	U	
85-68-7	Benzyl Butyl Phthalate	390	U	
86-74-8	Carbazole	390	U	
218-01-9	Chrysene	390	U	
53-70-3	Dibenz(a,h)Anthracene	390	U	
132-64-9	Dibenzofuran	390	U	
84-66-2	Diethyl Phthalate	390	U	
131-11-3	Dimethyl Phthalate	390	U	
206-44-0	Fluoranthene	390	U	
86-73-7	Fluorene	390	U	
118-74-1	Hexachlorobenzene	390	U	
87-68-3	Hexachlorobutadiene	390	U	
77-47-4	Hexachlorocyclopentadiene	390	U	UJ
67-72-1	Hexachloroethane	390	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	390	U	
78-59-1	Isophorone	390	U	
91-20-3	Naphthalene	390	U	
98-95-3	Nitrobenzene	390	U	
87-86-5	Pentachlorophenol	790	U	
85-01-8	Phenanthrene	390	U	
108-95-2	Phenol	390	U	

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SAMPLE NO
51SB10A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-010-077-1/4
Sample Volume :	30	Lab File ID :	D33589.D
% Moisture:	15.33	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	390	U
110-86-1	Pyridine	390	U
111-91-1	bis(2-chloroethoxy) methane	390	U
111-44-4	bis(2-chloroethyl) ether	390	U
117-81-7	bis(2-ethylhexyl) phthalate	390	U
84-74-2	di-n-Butyl Phthalate	130	J B
117-84-0	di-n-Octyl Phthalate	390	U
621-64-7	n-Nitrosodi-n-Propylamine	390	U
86-30-6	n-Nitrosodiphenylamine	390	U

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SAMPLE NO
51SB10B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-011-085-1/4
Sample Volume :	30	Lab File ID :	D33590.D
% Moisture:	11.88	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	380	U	
95-50-1	1,2-Dichlorobenzene	380	U	
541-73-1	1,3-Dichlorobenzene	380	U	
106-46-7	1,4-Dichlorobenzene	380	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	380	U	
95-95-4	2,4,5-Trichlorophenol	380	U	
88-06-2	2,4,6-Trichlorophenol	380	U	
120-83-2	2,4-Dichlorophenol	380	U	
105-67-9	2,4-Dimethylphenol	380	U	
51-28-5	2,4-Dinitrophenol	760	U	
121-14-2	2,4-Dinitrotoluene	380	U	
606-20-2	2,6-Dinitrotoluene	380	U	
91-58-7	2-Chloronaphthalene	380	U	
95-57-8	2-Chlorophenol	380	U	
91-57-6	2-Methylnaphthalene	380	U	
88-74-4	2-Nitroaniline	380	U	
88-75-5	2-Nitrophenol	380	U	
95-48-7	2-methylphenol	380	U	
91-94-1	3,3-Dichlorobenzidine	760	U	UJ
99-09-2	3-Nitroaniline	380	U	
534-52-1	4,6-dinitro-2-methyl phenol	760	U	
101-55-3	4-Bromophenyl-phenylether	380	U	
106-47-8	4-Chloroaniline	380	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	380	U	
100-01-6	4-Nitroaniline	380	U	
100-02-7	4-Nitrophenol	760	U	
59-50-7	4-chloro-3-methylphenol	380	U	
106-44-5	4-methylphenol	380	U	
83-32-9	Acenaphthene	380	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-011-085-1/4
Sample Volume :	30	Lab File ID :	D33590.D
% Moisture:	11.88	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	380	U	
120-12-7	Anthracene	380	U	
56-55-3	Benzo(a)anthracene	380	U	
50-32-8	Benzo(a)pyrene	380	U	
205-99-2	Benzo(b)fluoranthene	380	U	
191-24-2	Benzo(g,h,i)perylene	380	U	
207-08-9	Benzo(k)fluoranthene	380	U	
65-85-0	Benzoic Acid	760	U	UJ
100-51-6	Benzyl Alcohol	380	U	
85-68-7	Benzyl Butyl Phthalate	380	U	
86-74-8	Carbazole	380	U	
218-01-9	Chrysene	380	U	
53-70-3	Dibenz(a,h)Anthracene	380	U	
132-64-9	Dibenzofuran	380	U	
84-66-2	Diethyl Phthalate	380	U	
131-11-3	Dimethyl Phthalate	380	U	
206-44-0	Fluoranthene	380	U	
86-73-7	Fluorene	380	U	
118-74-1	Hexachlorobenzene	380	U	
87-68-3	Hexachlorobutadiene	380	U	
77-47-4	Hexachlorocyclopentadiene	380	U	UJ
67-72-1	Hexachloroethane	380	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	380	U	
78-59-1	Isophorone	380	U	
91-20-3	Naphthalene	380	U	
98-95-3	Nitrobenzene	380	U	
87-86-5	Pentachlorophenol	760	U	
85-01-8	Phenanthrene	380	U	
108-95-2	Phenol	380	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-011-085-1/4
Sample Volume :	30	Lab File ID :	D33590.D
% Moisture:	11.88	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	380	U	
110-86-1	Pyridine	380	U	
111-91-1	bis(2-chloroethoxy) methane	380	U	
111-44-4	bis(2-chloroethyl) ether	380	U	
117-81-7	bis(2-ethylhexyl) phthalate	380	U	
84-74-2	di-n-Butyl Phthalate	81	J	B
117-84-0	di-n-Octyl Phthalate	380	U	
621-64-7	n-Nitrosodi-n-Propylamine	380	U	
86-30-6	n-Nitrosodiphenylamine	380	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-012-093-1/4
Sample Volume :	30	Lab File ID :	D33595.D
% Moisture:	13.61	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	390	U
95-50-1	1,2-Dichlorobenzene	390	U
541-73-1	1,3-Dichlorobenzene	390	U
106-46-7	1,4-Dichlorobenzene	390	U
108-60-1	2,2-Oxybis(1-Chloropropane)	390	U
95-95-4	2,4,5-Trichlorophenol	390	U
88-06-2	2,4,6-Trichlorophenol	390	U
120-83-2	2,4-Dichlorophenol	390	U
105-67-9	2,4-Dimethylphenol	390	U
51-28-5	2,4-Dinitrophenol	770	U
121-14-2	2,4-Dinitrotoluene	390	U
606-20-2	2,6-Dinitrotoluene	390	U
91-58-7	2-Chloronaphthalene	390	U
95-57-8	2-Chlorophenol	390	U
91-57-6	2-Methylnaphthalene	390	U
88-74-4	2-Nitroaniline	390	U
88-75-5	2-Nitrophenol	390	U
95-48-7	2-methylphenol	390	U
91-94-1	3,3-Dichlorobenzidine	770	U
99-09-2	3-Nitroaniline	390	U
534-52-1	4,6-dinitro-2-methyl phenol	770	U
101-55-3	4-Bromophenyl-phenylether	390	U
106-47-8	4-Chloroaniline	390	U
7005-72-3	4-Chlorophenyl Phenyl Ether	390	U
100-01-6	4-Nitroaniline	390	U
100-02-7	4-Nitrophenol	770	U
59-50-7	4-chloro-3-methylphenol	390	U
106-44-5	4-methylphenol	390	U
83-32-9	Acenaphthene	390	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-012-093-1/4
Sample Volume :	30	Lab File ID :	D33595.D
% Moisture:	13.61	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	390	U	
120-12-7	Anthracene	390	U	
56-55-3	Benzo(a)anthracene	390	U	
50-32-8	Benzo(a)pyrene	390	U	
205-99-2	Benzo(b)fluoranthene	390	U	
191-24-2	Benzo(g,h,i)perylene	390	U	
207-08-9	Benzo(k)fluoranthene	390	U	
65-85-0	Benzoic Acid	770	U	UJ
100-51-6	Benzyl Alcohol	390	U	
85-68-7	Benzyl Butyl Phthalate	390	U	
86-74-8	Carbazole	390	U	
218-01-9	Chrysene	390	U	
53-70-3	Dibenz(a,h)Anthracene	390	U	
132-64-9	Dibenzofuran	390	U	
84-66-2	Diethyl Phthalate	390	U	
131-11-3	Dimethyl Phthalate	390	U	
206-44-0	Fluoranthene	390	U	
86-73-7	Fluorene	390	U	
118-74-1	Hexachlorobenzene	390	U	
87-68-3	Hexachlorobutadiene	390	U	
77-47-4	Hexachlorocyclopentadiene	390	U	UJ
67-72-1	Hexachloroethane	390	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	390	U	
78-59-1	Isophorone	390	U	
91-20-3	Naphthalene	390	U	
98-95-3	Nitrobenzene	390	U	
87-86-5	Pentachlorophenol	770	U	
85-01-8	Phenanthrene	390	U	
108-95-2	Phenol	390	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-012-093-1/4
Sample Volume :	30	Lab File ID :	D33595.D
% Moisture:	13.61	Date Received	04/02/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	390	U	
110-86-1	Pyridine	390	U	
111-91-1	bis(2-chloroethoxy) methane	390	U	
111-44-4	bis(2-chloroethyl) ether	390	U	
117-81-7	bis(2-ethylhexyl) phthalate	390	U	
84-74-2	di-n-Butyl Phthalate	390	U	
117-84-0	di-n-Octyl Phthalate	390	U	UJ
621-64-7	n-Nitrosodi-n-Propylamine	390	U	
86-30-6	n-Nitrosodiphenylamine	390	U	

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – TAL Inorganics
GPL Laboratories, Inc., SDG 404021

DATE: June 11, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. Samples were analyzed for target analyte list (TAL) Inorganics using USEPA SW-846 3050B/6010B for ICP metals, USEPA SW-846 7471A for mercury, and USEPA SW-846 9014 for cyanide. A total of twelve soil samples were validated. All samples were analyzed for total TAL inorganics. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB4A	404021-001	51SB5C	404021-007
51SB4B	404021-002	51SB5D	404021-008
51SB4C	404021-003	TMSB5D	404021-009
51SB4D	404021-004	51SB10A	404021-010
51SB5A	404021-005	51SB10B	404021-011
51SB5B	404021-006	51SB10C	404021-012

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Inorganic Data Review* (April, 1993). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Initial and Continuing Calibration
X		Blank Analysis
	X	ICP Interference Check Sample (ICS)
	X	Laboratory Control Sample (LCS)
X		Lab Sample Duplicate
X		Matrix Spike
X		ICP Serial Dilution
X		Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

E. Malarek

Eric Malarek, Chemist

6/11/04

Date

RFAAP VALIDATION REPORT
TAL INORGANICS REVIEW
SDG 404021

I-Holding Times

The primary objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample analysis. The soil samples are received and stored cool @4 °C ± 2 °C, with a maximum holding time of 180 days for ICP metals, 28 days for mercury, and 14 days for cyanide from collection (USEPA criteria).

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 4.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: Samples were collected 04/01/04. They were digested on 04/07/04 and analyzed for ICP metals on 04/08/04 and 04/09/04. Samples were digested on 04/09/04 for mercury and were analyzed for mercury on 04/10/04. Samples were digested on 04/12/04 for cyanide and were analyzed for cyanide on 04/13/04. All holding time criteria were met. No qualifiers were applied.

II-Initial and Continuing Calibration

Requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of the analysis run, and continuing calibration verification documents that the initial calibration is still valid.

ICP: 1- blank (USACE <MDL)
3 – standards (r≥0.995)
ICV/CCV (90-110%) (USACE 90-110%)
MRL (70-130%) (USACE 80-120%)

Hg: 1 – blank (USACE <MDL)
5 – standards (r≥0.995)
ICV/CCV (80-120%) (USACE ICV 90-110% / CCV 80-120%)
MRL (80-120%)

CN: 1- blank (USACE <MDL)
5 – standards (r≥0.995)
ICV/CCV (85-115%)

- The samples were analyzed for ICP metals on 04/08/04 and 04/09/04. Mercury was analyzed on 04/10/04 with a correlation coefficient of 0.9999. Cyanide was analyzed on 04/13/04 with a correlation coefficient of 0.9998. All ICV/CCV standards were within criteria. No qualifiers were applied. **Table 2** summarizes the MRL standard analysis for metals. Samples with concentrations detected less than two times the MRL with out of criteria MRL recovery were qualified.

Table 2 MRL Analysis Summary

Analysis Date	Analysis	MRL (µg/L)	MRL (mg/kg)	MRL %Recovery	Qualified samples @ <2xMRL	Validation Qualifiers
04/08/04	ICP	Various	Various	All within criteria	None	None
04/09/04	ICP	Various	Various	All within criteria	None	None
04/10/04	Hg	0.2	0.033	All within criteria	None	None

III-Blanks

Blanks (preparation and calibration blanks) are assessed to determine the existence and magnitude of contamination problems. No contaminants should be detected (i.e. <MDL) in any of the associated blanks. USACE Shell limits are < ½MRL for the method blank. Samples are qualified "B" when they are less than 5X the absolute value of the maximum blank concentration. **Table 3** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factors = 10 for ICP; 6 for Hg; and 40 for CN). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 3 Blank Contamination Analysis Summary

Analysis Date	Analysis	QC Blank ID	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/08/04	ICP-Al	ICB/CCBs	9.19B	45.9	None
04/08/04	ICP-Be	ICB/CCBs	0.01B	0.05	None
04/08/04	ICP-Ca	ICB/CCBs	7.80B	39.0	51SB5C
04/08/04	ICP-Cu	ICB/CCBs	0.24B	1.2	51SB4D
04/08/04	ICP-Mg	ICB/CCBs	10.4B	52.0	None
04/08/04	ICP-Mn	ICB/CCBs	0.06B	0.30	None
04/08/04	ICP-Se	ICB/CCBs	0.18B	0.90	51SB4A, 51SB5A, 51SB10A
04/09/04	ICP-Al	ICB/CCBs	3.50B	17.5	None
04/09/04	ICP-Ba	ICB/CCBs	0.07B	0.35	None
04/09/04	ICP-Fe	ICB/CCBs	4.95B	24.7	None
04/09/04	ICP-Mg	ICB/CCBs	7.13B	35.7	None
04/09/04	ICP-Mn	ICB/CCBs	0.09B	0.45	None
04/10/04	Hg	ICB/CCBs	<MRL	NA	None
04/13/04	CN	ICB/CCBs	<MRL	NA	None
04/08/04	ICP-Sb	PBS	0.51B	2.6	51SB4A, 51SB4B, 51SB4D, 51SB5A, 51SB5B, 51SB5C, 51SB5D, TMSB5D, 51SB10A, 51SB10B, 51SB10C
04/08/04	ICP-Ba	PBS	0.039B	0.20	None
04/08/04	ICP-Be	PBS	0.0090B	0.045	None
04/08/04	ICP-Ca	PBS	21.0B	105	51SB5C, 51SB10B
04/08/04	ICP-Cr	PBS	0.14B	0.70	None
04/08/04	ICP-Co	PBS	0.15B	0.75	None
04/08/04	ICP-Fe	PBS	5.9B	29.5	None
04/08/04	ICP-Pb	PBS	0.23B	1.15	51SB4D
04/08/04	ICP-Mg	PBS	5.2B	26.0	None
04/08/04	ICP-Mn	PBS	0.20B	1.0	None
04/08/04	ICP-Ni	PBS	0.44B	2.2	None
04/08/04	ICP-Na	PBS	92.6B	463	51SB4A, 51SB4B, 51SB4C, 51SB4D, 51SB5A, 51SB5C, 51SB5D, 51SB10A, 51SB10B, 51SB10C
04/08/04	ICP-Tl	PBS	1.5B	7.5	51SB4A, 51SB4B, 51SB5A, 51SB5B, 51SB5D, 51SB10C
04/10/04	Hg	PBS	<MRL	NA	None
04/13/04	CN	PBS	<MRL	NA	None
04/15/04	ICPMS-Al	040204R	0.10B	0.50	None
04/15/04	ICPMS-Ba	040204R	0.028B	0.14	None
04/15/04	ICPMS-Cd	040204R	0.017B	0.085	51SB5C, 51SB4B
04/15/04	ICPMS-Ca	040204R	24.3B	120	51SB5C, 51SB10B
04/15/04	ICPMS-Cr	040204R	0.13B	0.65	None
04/15/04	ICPMS-Co	040204R	0.0012B	0.0060	None
04/15/04	ICPMS-Cu	040204R	0.4E	2.0	51SB4D, 51SB10C
04/15/04	ICPMS-Fe	040204R	1.87B	9.35	None
04/15/04	ICPMS-Pb	040204R	0.020B	0.10	None
04/15/04	ICPMS-Mg	040204R	3.86BE	19.3	None
04/15/04	ICPMS-Mn	040204R	0.22	1.10	None
04/15/04	ICPMS-Ni	040204R	0.035B	0.18	None
04/15/04	ICPMS-K	040204R	4.63BE	23.2	None
04/15/04	ICPMS-Na	040204R	16.9BE	84.5	51SB4A, 51SB5A, 51SB10A
04/15/04	ICPMS-Tl	040204R	0.0076B	0.038	None
04/15/04	ICPMS-Zn	040204R	0.29BE	1.45	None

Table 3 Blank Contamination Analysis Summary, Continued

Analysis Date	Analysis	QC Blank ID	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/09/04	Hg	040204R	0.028BN	0.14	None
04/15/04	CN	040204R	<MRL	NA	None

B = Value is estimated <MRL and >MDL.
E = Serial Dilution percent difference not within limits.
N = Laboratory spike sample recovery not within control limits.

IV-ICP Interference Check Sample (ICS)
The ICP interference check sample (ICS) verifies interelement and background correction factors. ICP Interference Check is performed at the beginning and end of each sample analysis run. Control limits are 80-120% (USACE limits 80-120%).

- All criteria were met. No qualifiers were applied.

V-Laboratory Control Samples (LCS)
The laboratory control sample (LCS) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. All soil LCS results must fall within the control limits of 80-120% for ICPMS metals and mercury and 85-115% for cyanide. USACE Shell limits for metals are 80-120% (60-140% for sporadic marginal failures (SMF)).

- Sample BKS65767 was used as LCS for ICP metals analysis. All criteria were met. No qualifiers were applied.

- Sample BKS65819 was used as LCS for total mercury analysis. All criteria were met. No qualifiers were applied.

- Sample BKS1725 was used as LCS for total cyanide analysis. All criteria were met. No qualifiers were applied.

VI-Duplicate Sample Analysis
Duplicate sample determinations are used to demonstrate acceptable method precision by the laboratory at the time of analysis. Duplicate analysis are also performed to generate data in order to determine the long-term precision of the analytical method on various matrices. RPDs must be within established control limits. USACE Shell limits for metals are 25% RPD for ICP metals and 20% RPD for mercury and cyanide.

- Sample 51SB8B (404027-002) was used as sample duplicate for ICP metals analysis. This sample was analyzed in SDG 404027. Antimony (44.2%), cadmium (200%), lead (36.2%), and selenium (200%) were outside criteria. Antimony, cadmium, and selenium were outside due to low sample concentration, therefore no qualifiers were applied based upon this outliers. Lead was qualified as estimated "J" for detects for this sample 51SB8B (404027-002).

- Sample 51SB8B (404027-002) was used as sample duplicate for mercury analysis. This sample was analyzed in SDG 404027. All criteria were met. No qualifiers were applied.

- Sample 51SB4A (404021-001) was used for the sample duplicate analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VII-Matrix Spike
MS are generated to determine long-term accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. Specific criteria include the analyses of matrix spike and matrix spike duplicate samples at a frequency of one MS per 20 samples of similar matrix. MS recoveries and relative percent differences between MS recoveries should be within the specified limits. USACE Shell limits for metals are 75-125% for ICP metals and 80-120% for mercury and cyanide. Post digestion spikes limits are 75-125% for ICP metals and 85-115% for mercury and cyanide.

- Sample 51SB8B (404027-002) was used for the MS analysis for ICP analysis. This sample was analyzed in SDG 404027. Aluminum (1110%), antimony (53.7%), iron (130%), magnesium (136%), and potassium (136%) were outside of control limits. Post digestion spikes were within criteria for antimony, magnesium, and potassium. The sample concentration was >4 times the spike added for aluminum and iron, therefore no qualifiers were applied based upon this outlier. For antimony, the spiked sample was qualified bias "L". For magnesium and potassium, the spiked sample was qualified bias high "K".

- Sample 51SB8B (404027-002) was used for the MS analysis for mercury analysis. This sample was analyzed in SDG 404027. All criteria were met. No qualifiers were applied.

- Sample 51SB4A (404021-001) was used for the MS analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VIII-ICP Serial Dilution
An ICP serial dilution is performed to determine whether significant physical or chemical interferences exist due to sample matrix at high concentrations. An analysis of a 5-fold dilution should agree within 10% difference of the original result when the concentration in sample is a factor of 50 above MDL.

- The serial dilution for the ICP was analyzed for sample 51SB8B (404027-002). This sample was analyzed in SDG 404027. Antimony (100%), arsenic (51.3%), copper (53.5%), lead (15.3%), selenium (100%), and sodium (71.9%) were outside of criteria limits. Sample concentrations were <50 times MDL for antimony, arsenic, lead, selenium, and sodium, therefore no qualifiers were applied based upon these outliers. Copper was qualified estimated "J" for detects and no qualifier for non-detects based upon this outlier.

IX-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the aqueous samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB5D (404021-008) and TMSB5D (404021-009) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB5D	404021-008	Aluminum	10200	14800	36.8	None
51SB5D	404021-008	Antimony	0.80 BN	0.66 BN	19.2	None
51SB5D	404021-008	Arsenic	7.4	1.7 B	125	J
51SB5D	404021-008	Barium	52.9	49.7	6.2	None
51SB5D	404021-008	Beryllium	2.3	2.0	14.0	None
51SB5D	404021-008	Cadmium	0.23 B	0.17 B	30.0	None
51SB5D	404021-008	Calcium	309	415	29.3	None
51SB5D	404021-008	Chromium	11.5	20.0	54.0	J
51SB5D	404021-008	Cobalt	90.7	10.1	160	J
51SB5D	404021-008	Copper	12.5 E	6.0 E	70.3	J
51SB5D	404021-008	Iron	44400	27100	48.4	None
51SB5D	404021-008	Lead	18.3 *	5.7 *	105	J
51SB5D	404021-008	Magnesium	2150 N	5060 N	80.7	J
51SB5D	404021-008	Manganese	945 *	535 *	55.4	J
51SB5D	404021-008	Nickel	42.5	35.6	17.7	None
51SB5D	404021-008	Potassium	1800 N	3240 N	57.1	J
51SB5D	404021-008	Sodium	421	525	22.0	None
51SB5D	404021-008	Thallium	1.3 B	0.54 U	NA	None
51SB5D	404021-008	Vanadium	16.6	10.2	47.8	None
51SB5D	404021-008	Zinc	14.2	16.2	13.2	None
51SB5D	404021-008	Mercury	0.017 U	0.016 U	NA	None
51SB5D	404021-008	Cyanide	0.16 U	0.16 U	NA	None

B = Estimated value <MRL and >MDL.
E = Serial Dilution percent difference not within limits.
N = Laboratory spike sample recovery not within control limits.
* = Laboratory duplicate not within control limits.
U = Value non-detect at MRL.
NA = Not Applicable

X-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." The following calculations were performed for verification.

ICP Sample: 51SB4A (404021-001), Total Barium

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(704.3518 μg/L)*(0.100 L)*(1)} / {(1.22 g)*(0.8436)} = 68.4 μg/g = 68.4 mg/kg

Reported concentration = 68.4 mg/kg
%D = 0.0%
Values were within 10% difference.

CVAA Sample: 51SB4A (404021-001), Total Mercury

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(0.264 μg/L)*(0.100 L)*(1)} / {(0.73 g)*(0.8436)} = 0.043 μg/g = 0.043 mg/kg

Reported concentration = 0.043 mg/kg
%D = 0.0%
Values were within 10% difference.

Cyanide Sample: 51SB4B (404021-002), Total Cyanide

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(70.7 μg/L)*(0.050 L)*(5)} / {(1.83 g)*(0.4472)} = 22 μg/g = 22 mg/kg

Reported concentration = 22 mg/kg
%D = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I Cpy

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-001-007-3/4 **Client ID:** 51SB4A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.22 **Volume:** 100 **Percent Moisture:** 15.64

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	1.7	19.4	28100		1	ICPST	4/08/04	13:10
Antimony	206.84	0.49	1.9	0.82	BN	B 1	ICPST	4/08/04	13:10
Arsenic	189.04	0.19	1.9	3.8		1	ICPST	4/08/04	13:10
Barium	493.41	0.031	0.49	68.4		1	ICPST	4/08/04	13:10
Beryllium	313.04	0.0055	0.19	0.64		1	ICPST	4/08/04	13:10
Cadmium	226.50	0.043	0.58	0.13	B	BJ1	ICPST	4/08/04	13:10
Calcium	317.93	7.4	97.2	306		B 1	ICPST	4/08/04	13:10
Chromium	267.72	0.12	0.49	28.0		1	ICPST	4/08/04	13:10
Cobalt	228.62	0.078	0.49	10.1		1	ICPST	4/08/04	13:10
Copper	324.75	0.092	0.97	14.3	E	B 1	ICPST	4/08/04	13:10
Iron	271.44	3.8	14.6	30300		1	ICPST	4/08/04	13:10
Lead	220.35	0.20	0.97	13.0	*	1	ICPST	4/08/04	13:10
Magnesium	279.08	2.5	24.3	1280	N	1	ICPST	4/08/04	13:10
Manganese	257.61	0.024	0.49	381	*	1	ICPST	4/08/04	13:10
Nickel	231.60	0.14	0.97	11.5		1	ICPST	4/08/04	13:10
Potassium	766.49	4.1	24.3	1170	N	1	ICPST	4/08/04	13:10
Selenium	196.03	0.17	1.9	0.27	B	B 1	ICPST	4/08/04	13:10
Silver	328.07	0.13	0.29	0.13	U	1	ICPST	4/08/04	13:10
Sodium	330.23	32.7	243	76.0	B	B 1	ICPST	4/08/04	13:10
Thallium	190.86	0.56	2.9	0.63	B	B 1	ICPST	4/08/04	13:10
Vanadium	292.40	0.14	0.97	58.3		1	ICPST	4/08/04	13:10
Zinc	213.86	0.52	1.9	35.4		1	ICPST	4/08/04	13:10

Comments: Sample Date: 04/01/04 Sample Time: 02:05 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-001-007-3/4 **Client ID:** 51SB4A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.73 **Volume:** 100 **Percent Moisture:** 15.64

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.032	0.043		1	CVAA	4/10/04	13:48

Comments: Sample Date: 04/01/04 Sample Time: 02:05 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form I Equivalent

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Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB4A	Lab Sample ID:	404021-001-007-3/4
Sample Date/Time:	04/01/2004 14:05	Percent Moisture:	15.64
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/13/04 17:00

Form I Corp

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-002-015-3/4 **Client ID:** 51SB4B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.45 **Volume:** 100 **Percent Moisture:** 55.28

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	13.1	154	8610		5	ICPST	4/09/04	14:03
Antimony	206.84	3.9	15.4	4.3	BN	B 5	ICPST	4/09/04	14:03
Arsenic	189.04	0.31	3.1	13.4		1	ICPST	4/08/04	13:18
Barium	493.41	0.25	3.9	91.5		5	ICPST	4/09/04	14:03
Beryllium	313.04	0.0088	0.31	0.33		1	ICPST	4/08/04	13:18
Cadmium	226.50	0.34	4.6	0.70	B	B 5	ICPST	4/09/04	14:03
Calcium	317.93	11.7	154	2750		1	ICPST	4/08/04	13:18
Chromium	267.72	0.93	3.9	218		5	ICPST	4/09/04	14:03
Cobalt	228.62	0.12	0.77	3.2		1	ICPST	4/08/04	13:18
Copper	324.75	0.15	1.5	68.7	E	1	ICPST	4/08/04	13:18
Iron	271.44	30.4	116	160000		5	ICPST	4/09/04	14:03
Lead	220.35	1.6	7.7	1850	*	5	ICPST	4/09/04	14:03
Magnesium	279.08	19.6	193	1930	N	5	ICPST	4/09/04	14:03
Manganese	257.61	0.19	3.9	140	*	5	ICPST	4/09/04	14:03
Nickel	231.60	0.22	1.5	48.6		1	ICPST	4/08/04	13:18
Potassium	766.49	6.4	38.6	770	N	1	ICPST	4/08/04	13:18
Selenium	196.03	1.3	15.4	1.3	U	5	ICPST	4/09/04	14:03
Silver	328.07	0.20	0.46	0.23	B	J 1	ICPST	4/08/04	13:18
Sodium	330.23	260	1930	3060		B 5	ICPST	4/09/04	14:03
Thallium	190.86	4.5	23.1	9.9	B	B 5	ICPST	4/09/04	14:03
Vanadium	292.40	1.1	7.7	48.2		5	ICPST	4/09/04	14:03
Zinc	213.86	4.2	15.4	90.0		B 5	ICPST	4/09/04	14:03

Comments: Sample Date: 04/01/04 Sample Time: 02:20 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-002-015-3/4 **Client ID:** 51SB4B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.71 **Volume:** 100 **Percent Moisture:** 55.28

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.031	0.063	0.73		1	CVAA	4/10/04	13:51

Comments: Sample Date: 04/01/04 Sample Time: 02:20 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

R Result is between IDL and RL

Form 1 Equivalent

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Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB4B	Lab Sample ID:	404021-002-015-3/4
Sample Date/Time:	04/01/2004 14:20	Percent Moisture:	55.28
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	**Cyanide, Total**	**22**		**1.5**	**5**	**mg/kg**	**04/13/04 17:0(**

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-003-023-3/4 **Client ID:** 51SB4C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.21 **Volume:** 100 **Percent Moisture:** 13.60

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.6**	**19.1**	**15600**		1	**ICPST**	**4/08/04**	**13:27**
Antimony	206.84	0.48	1.9	0.48	UN	1	ICPST	4/08/04	13:27
Arsenic	**189.04**	**0.19**	**1.9**	**2.7**		1	**ICPST**	**4/08/04**	**13:27**
Barium	**493.41**	**0.031**	**0.48**	**64.3**		1	**ICPST**	**4/08/04**	**13:27**
Beryllium	**313.04**	**0.0055**	**0.19**	**0.90**		1	**ICPST**	**4/08/04**	**13:27**
Cadmium	**226.50**	**0.042**	**0.57**	**0.17**	**B**	J 1	**ICPST**	**4/08/04**	**13:27**
Calcium	**317.93**	**7.3**	**95.7**	**252**		1	**ICPST**	**4/08/04**	**13:27**
Chromium	**267.72**	**0.11**	**0.48**	**32.4**		1	**ICPST**	**4/08/04**	**13:27**
Cobalt	**228.62**	**0.077**	**0.48**	**15.2**		1	**ICPST**	**4/08/04**	**13:27**
Copper	**324.75**	**0.091**	**0.96**	**14.5**	**E**	1	**ICPST**	**4/08/04**	**13:27**
Iron	**271.44**	**3.8**	**14.3**	**20400**		1	**ICPST**	**4/08/04**	**13:27**
Lead	**220.35**	**0.20**	**0.96**	**24.4**	*	1	**ICPST**	**4/08/04**	**13:27**
Magnesium	**279.08**	**2.4**	**23.9**	**1030**	**N**	1	**ICPST**	**4/08/04**	**13:27**
Manganese	**257.61**	**0.024**	**0.48**	**506**	*	1	**ICPST**	**4/08/04**	**13:27**
Nickel	**231.60**	**0.13**	**0.96**	**13.7**		1	**ICPST**	**4/08/04**	**13:27**
Potassium	**766.49**	**4.0**	**23.9**	**830**	**N**	1	**ICPST**	**4/08/04**	**13:27**
Selenium	196.03	0.16	1.9	0.16	U	1	ICPST	4/08/04	13:27
Silver	328.07	0.12	0.29	0.12	U	1	ICPST	4/08/04	13:27
Sodium	**330.23**	**32.2**	**239**	**466**		1	**ICPST**	**4/08/04**	**13:27**
Thallium	190.86	0.55	2.9	0.55	U	1	ICPST	4/08/04	13:27
Vanadium	**292.40**	**0.13**	**0.96**	**21.5**		1	**ICPST**	**4/08/04**	**13:27**
Zinc	**213.86**	**0.52**	**1.9**	**29.4**		1	**ICPST**	**4/08/04**	**13:27**

Comments: Sample Date: 04/01/04 Sample Time: 02:50 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-003-023-3/4 **Client ID:** 51SB4C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.76 **Volume:** 100 **Percent Moisture:** 13.60

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.030	0.015	U	1	CVAA	4/10/04	16:12

Comments: Sample Date: 04/01/04 Sample Time: 02:50 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Pkg

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB4C	Lab Sample ID:	404021-003-023-3/4
Sample Date/Time:	04/01/2004 14:50	Percent Moisture:	13.6
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	**Cyanide, Total**	**0.56**		**0.15**	**1**	**mg/kg**	**04/13/04 17:0**

Form I Copy

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-004-031-3/4 **Client ID:** 51SB4D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.28 **Volume:** 100 **Percent Moisture:** 15.94

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.6**	**18.6**	**22600**		1	ICPST	4/08/04	13:35
Antimony	**206.84**	**0.46**	**1.9**	**0.52**	**BN**	B 1	ICPST	4/08/04	13:35
Arsenic	**189.04**	**0.19**	**1.9**	**0.96**	**B**	J 1	ICPST	4/08/04	13:35
Barium	**493.41**	**0.030**	**0.46**	**167**		1	ICPST	4/08/04	13:35
Beryllium	**313.04**	**0.0053**	**0.19**	**0.72**		1	ICPST	4/08/04	13:35
Cadmium	**226.50**	**0.041**	**0.56**	**0.22**	**B**	BJ 1	ICPST	4/08/04	13:35
Calcium	**317.93**	**7.0**	**92.9**	**1750**		1	ICPST	4/08/04	13:35
Chromium	**267.72**	**0.11**	**0.46**	**37.0**		1	ICPST	4/08/04	13:35
Cobalt	**228.62**	**0.074**	**0.46**	**4.6**		1	ICPST	4/08/04	13:35
Copper	**324.75**	**0.088**	**0.93**	**0.59**	**BE**	B 1	ICPST	4/08/04	13:35
Iron	**271.44**	**3.7**	**13.9**	**29200**		1	ICPST	4/08/04	13:35
Lead	**220.35**	**0.20**	**0.93**	**0.82**	**B***	BB 1	ICPST	4/08/04	13:35
Magnesium	**279.08**	**2.4**	**23.2**	**18300**	**N**	1	ICPST	4/08/04	13:35
Manganese	**257.61**	**0.023**	**0.46**	**221**	*	1	ICPST	4/08/04	13:35
Nickel	**231.60**	**0.13**	**0.93**	**53.3**		1	ICPST	4/08/04	13:35
Potassium	**766.49**	**3.9**	**23.2**	**2180**	**N**	1	ICPST	4/08/04	13:35
Selenium	196.03	0.16	1.9	0.16	U	1	ICPST	4/08/04	13:35
Silver	328.07	0.12	0.28	0.12	U	1	ICPST	4/08/04	13:35
Sodium	**330.23**	**31.3**	**232**	**442**		B 1	ICPST	4/08/04	13:35
Thallium	190.86	0.54	2.8	0.54	U	1	ICPST	4/08/04	13:35
Vanadium	**292.40**	**0.13**	**0.93**	**16.0**		1	ICPST	4/08/04	13:35
Zinc	**213.86**	**0.50**	**1.9**	**19.7**		1	ICPST	4/08/04	13:35

Comments: Sample Date: 04/01/04 Sample Time: 03:40 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

form I Corr

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-004-031-3/4 **Client ID:** 51SB4D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.74 **Volume:** 100 **Percent Moisture:** 15.94

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.032	0.016	U	1	CVAA	4/10/04	16:15

Comments: Sample Date: 04/01/04 Sample Time: 03:40 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalen

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Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB4D	Lab Sample ID:	404021-004-031-3/4
Sample Date/Time:	04/01/2004 15:40	Percent Moisture:	15.94
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.18	1	mg/kg	04/13/04 17:0(

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-005-039-3/4 **Client ID:** 51SB5A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.26 **Volume:** 100 **Percent Moisture:** 17.91

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	1.6	19.3	26800		1	ICPST	4/08/04	13:42
Antimony	206.84	0.48	1.9	0.55	BN	B 1	ICPST	4/08/04	13:42
Arsenic	189.04	0.19	1.9	5.7		1	ICPST	4/08/04	13:42
Barium	493.41	0.031	0.48	81.5		1	ICPST	4/08/04	13:42
Beryllium	313.04	0.0055	0.19	0.71		1	ICPST	4/08/04	13:42
Cadmium	226.50	0.043	0.58	0.19	B	B 1	ICPST	4/08/04	13:42
Calcium	317.93	7.3	96.7	364		B 1	ICPST	4/08/04	13:42
Chromium	267.72	0.12	0.48	34.6		1	ICPST	4/08/04	13:42
Cobalt	228.62	0.077	0.48	7.2		1	ICPST	4/08/04	13:42
Copper	324.75	0.092	0.97	17.4	E	B 1	ICPST	4/08/04	13:42
Iron	271.44	3.8	14.5	31600		1	ICPST	4/08/04	13:42
Lead	220.35	0.20	0.97	14.7	*	1	ICPST	4/08/04	13:42
Magnesium	279.08	2.5	24.2	1930	N	1	ICPST	4/08/04	13:42
Manganese	257.61	0.024	0.48	395	*	1	ICPST	4/08/04	13:42
Nickel	231.60	0.14	0.97	13.2		1	ICPST	4/08/04	13:42
Potassium	766.49	4.0	24.2	1610	N	1	ICPST	4/08/04	13:42
Selenium	196.03	0.16	1.9	0.44	B	B 1	ICPST	4/08/04	13:42
Silver	328.07	0.13	0.29	0.13	U	1	ICPST	4/08/04	13:42
Sodium	330.23	32.6	242	83.2	B	B 1	ICPST	4/08/04	13:42
Thallium	190.86	0.56	2.9	1.4	B	B 1	ICPST	4/08/04	13:42
Vanadium	292.40	0.14	0.97	64.1		1	ICPST	4/08/04	13:42
Zinc	213.86	0.52	1.9	37.6		1	ICPST	4/08/04	13:42

Comments: Sample Date: 04/01/04 Sample Time: 08:40 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Copy

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-005-039-3/4 **Client ID:** 51SB5A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.73 **Volume:** 100 **Percent Moisture:** 17.91

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.017	0.033	0.056		1	CVAA	4/10/04	14:00

Comments: Sample Date: 04/01/04 Sample Time: 08:40 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB5A	Lab Sample ID:	404021-005-039-3/4
Sample Date/Time:	04/01/2004 08:40	Percent Moisture:	17.91
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/13/04 17:00

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Metals Data Reporting Form

Sample Results

SDG: 404021

Lab Sample ID: S 404021-006-047-3/4 **Client ID:** 51SB5B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.27 **Volume:** 100 **Percent Moisture:** 63.33

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	7.3	85.9	15000		2	ICPST	4/09/04	14:11
Antimony	206.84	2.1	8.6	4.2	BN	B 2	ICPST	4/09/04	14:11
Arsenic	189.04	0.43	4.3	15.0		1	ICPST	4/08/04	14:10
Barium	493.41	0.14	2.1	148		2	ICPST	4/09/04	14:11
Beryllium	313.04	0.012	0.43	0.79		1	ICPST	4/08/04	14:10
Cadmium	226.50	0.19	2.6	6.2		2	ICPST	4/09/04	14:11
Calcium	317.93	16.3	215	17400		1	ICPST	4/08/04	14:10
Chromium	267.72	0.52	2.1	533		2	ICPST	4/09/04	14:11
Cobalt	228.62	0.17	1.1	3.3		1	ICPST	4/08/04	14:10
Copper	324.75	0.20	2.1	67.9	E	1	ICPST	4/08/04	14:10
Iron	271.44	16.9	64.4	156000		2	ICPST	4/09/04	14:11
Lead	220.35	0.90	4.3	3380	*	2	ICPST	4/09/04	14:11
Magnesium	279.08	10.9	107	2740	N	2	ICPST	4/09/04	14:11
Manganese	257.61	0.11	2.1	241	*	2	ICPST	4/09/04	14:11
Nickel	231.60	0.30	2.1	108		1	ICPST	4/08/04	14:10
Potassium	766.49	9.0	53.7	752	N	1	ICPST	4/08/04	14:10
Selenium	196.03	0.73	8.6	0.73	U	2	ICPST	4/09/04	14:11
Silver	328.07	0.28	0.64	0.69		1	ICPST	4/08/04	14:10
Sodium	330.23	145	1070	1010	B	B 2	ICPST	4/09/04	14:11
Thallium	190.86	2.5	12.9	5.8	B	B 2	ICPST	4/09/04	14:11
Vanadium	292.40	0.60	4.3	33.9		2	ICPST	4/09/04	14:11
Zinc	213.86	2.3	8.6	466		2	ICPST	4/09/04	14:11

Comments: Sample Date: 04/01/04 Sample Time: 09:00 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

Form I Equivalent

Form I Clay

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-006-047-3/4 **Client ID:** 51SB5B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.74 **Volume:** 100 **Percent Moisture:** 63.33

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.037	0.074	0.92		1	CVAA	4/10/04	14:03

Comments: Sample Date: 04/01/04 Sample Time: 09:00 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form I Equivalent

Form I Corg

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB5B	Lab Sample ID:	404021-006-047-3/4
Sample Date/Time:	04/01/2004 09:00	Percent Moisture:	63.33
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	**Cyanide, Total**	**10**		**0.70**	**2**	**mg/kg**	**04/13/04 17:0(**

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-007-055-3/4 **Client ID:** 51SB5C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.22 **Volume:** 100 **Percent Moisture:** 7.73

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.5**	**17.8**	**8650**		1	ICPST	4/08/04	14:18
Antimony	**206.84**	**0.44**	**1.8**	**0.80**	**BN**	B 1	ICPST	4/08/04	14:18
Arsenic	**189.04**	**0.18**	**1.8**	**1.5**	**B**	J 1	ICPST	4/08/04	14:18
Barium	**493.41**	**0.028**	**0.44**	**26.3**		1	ICPST	4/08/04	14:18
Beryllium	**313.04**	**0.0051**	**0.18**	**0.43**		1	ICPST	4/08/04	14:18
Cadmium	**226.50**	**0.039**	**0.53**	**0.040**	**B**	B 1	ICPST	4/08/04	14:18
Calcium	**317.93**	**6.7**	**88.8**	**37.3**	**B**	B 1	ICPST	4/08/04	14:18
Chromium	**267.72**	**0.11**	**0.44**	**10.8**		1	ICPST	4/08/04	14:18
Cobalt	**228.62**	**0.071**	**0.44**	**6.1**		1	ICPST	4/08/04	14:18
Copper	**324.75**	**0.084**	**0.89**	**4.1**	**E**	1	ICPST	4/08/04	14:18
Iron	**271.44**	**3.5**	**13.3**	**12500**		1	ICPST	4/08/04	14:18
Lead	**220.35**	**0.19**	**0.89**	**5.3**	*	1	ICPST	4/08/04	14:18
Magnesium	**279.08**	**2.3**	**22.2**	**548**	**N**	1	ICPST	4/08/04	14:18
Manganese	**257.61**	**0.022**	**0.44**	**254**	*	1	ICPST	4/08/04	14:18
Nickel	**231.60**	**0.12**	**0.89**	**4.1**		1	ICPST	4/08/04	14:18
Potassium	**766.49**	**3.7**	**22.2**	**528**	**N**	1	ICPST	4/08/04	14:18
Selenium	196.03	0.15	1.8	0.15	U	1	ICPST	4/08/04	14:18
Silver	328.07	0.12	0.27	0.12	U	1	ICPST	4/08/04	14:18
Sodium	**330.23**	**29.9**	**222**	**291**		B 1	ICPST	4/08/04	14:18
Thallium	190.86	0.52	2.7	0.52	U	1	ICPST	4/08/04	14:18
Vanadium	**292.40**	**0.12**	**0.89**	**16.5**		1	ICPST	4/08/04	14:18
Zinc	**213.86**	**0.48**	**1.8**	**15.3**		B 1	ICPST	4/08/04	14:18

Comments: Sample Date: 04/01/04 Sample Time: 09:40 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I CVAA

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-007-055-3/4 **Client ID:** 51SB5C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.71 **Volume:** 100 **Percent Moisture:** 7.73

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.031	0.015	U	1	CVAA	4/10/04	16:24

Comments: Sample Date: 04/01/04 Sample Time: 09:40 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

R Result is between IDL and RL

Form 1 Equivalent

Form I Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB5C	Lab Sample ID:	404021-007-055-3/4
Sample Date/Time:	04/01/2004 09:40	Percent Moisture:	7.73
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	**Cyanide, Total**	**0.65**		**0.15**	**1**	**mg/kg**	**04/13/04 17:0(**

Form I copy

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-008-063-3/4 **Client ID:** 51SB5D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.24 **Volume:** 100 **Percent Moisture:** 21.32

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	1.7	20.5	10200		1	ICPST	4/08/04	14:26
Antimony	206.84	0.51	2.0	0.80	BN	B 1	ICPST	4/08/04	14:26
Arsenic	189.04	0.20	2.0	7.4		J 1	ICPST	4/08/04	14:26
Barium	493.41	0.033	0.51	52.9		1	ICPST	4/08/04	14:26
Beryllium	313.04	0.0058	0.20	2.3		1	ICPST	4/08/04	14:26
Cadmium	226.50	0.045	0.61	0.23	B	BJ1	ICPST	4/08/04	14:26
Calcium	317.93	7.8	102	309		1	ICPST	4/08/04	14:26
Chromium	267.72	0.12	0.51	11.5		J 1	ICPST	4/08/04	14:26
Cobalt	228.62	0.082	0.51	90.7		J 1	ICPST	4/08/04	14:26
Copper	324.75	0.097	1.0	12.5	E	BJ1	ICPST	4/08/04	14:26
Iron	271.44	4.0	15.4	44400		1	ICPST	4/08/04	14:26
Lead	220.35	0.22	1.0	18.3	*	J 1	ICPST	4/08/04	14:26
Magnesium	279.08	2.6	25.6	2150	N	J 1	ICPST	4/08/04	14:26
Manganese	257.61	0.026	0.51	944	*	J 1	ICPST	4/08/04	14:26
Nickel	231.60	0.14	1.0	42.5		1	ICPST	4/08/04	14:26
Potassium	766.49	4.3	25.6	1800	N	J 1	ICPST	4/08/04	14:26
Selenium	196.03	0.17	2.0	0.17	U	1	ICPST	4/08/04	14:26
Silver	328.07	0.13	0.31	0.13	U	1	ICPST	4/08/04	14:26
Sodium	330.23	34.5	256	421		B 1	ICPST	4/08/04	14:26
Thallium	190.86	0.59	3.1	1.3	B	B 1	ICPST	4/08/04	14:26
Vanadium	292.40	0.14	1.0	16.6		1	ICPST	4/08/04	14:26
Zinc	213.86	0.55	2.0	14.2		B 1	ICPST	4/08/04	14:26

Comments: Sample Date: 04/01/04 Sample Time: 10:20 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form I Copy

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-008-063-3/4 **Client ID:** 51SB5D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.76 **Volume:** 100 **Percent Moisture:** 21.32

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.017	0.033	0.017	U	1	CVAA	4/10/04	14:09

Comments: Sample Date: 04/01/04 Sample Time: 10:20 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form I Only

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB5D	Lab Sample ID:	404021-008-063-3/4
Sample Date/Time:	04/01/2004 10:20	Percent Moisture:	21.32
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/13/04 17:00

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-009-071-3/4 **Client ID:** TMSB5D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.30 **Volume:** 100 **Percent Moisture:** 17.78

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.6**	**18.7**	**14800**		1	ICPST	4/08/04	14:33
Antimony	**206.84**	**0.47**	**1.9**	**0.66**	BN	B 1	ICPST	4/08/04	14:33
Arsenic	**189.04**	**0.19**	**1.9**	**1.7**	B	J 1	ICPST	4/08/04	14:33
Barium	**493.41**	**0.030**	**0.47**	**49.7**		1	ICPST	4/08/04	14:33
Beryllium	**313.04**	**0.0053**	**0.19**	**1.9**		1	ICPST	4/08/04	14:33
Cadmium	**226.50**	**0.041**	**0.56**	**0.17**	B	B J 1	ICPST	4/08/04	14:33
Calcium	**317.93**	**7.1**	**93.6**	**415**		B 1	ICPST	4/08/04	14:33
Chromium	**267.72**	**0.11**	**0.47**	**20.0**		J 1	ICPST	4/08/04	14:33
Cobalt	**228.62**	**0.075**	**0.47**	**10.1**		J 1	ICPST	4/08/04	14:33
Copper	**324.75**	**0.089**	**0.94**	**6.0**	E	B J 1	ICPST	4/08/04	14:33
Iron	**271.44**	**3.7**	**14.0**	**27100**		1	ICPST	4/08/04	14:33
Lead	**220.35**	**0.20**	**0.94**	**5.7**	*	J 1	ICPST	4/08/04	14:33
Magnesium	**279.08**	**2.4**	**23.4**	**5060**	N	J 1	ICPST	4/08/04	14:33
Manganese	**257.61**	**0.023**	**0.47**	**535**	*	J 1	ICPST	4/08/04	14:33
Nickel	**231.60**	**0.13**	**0.94**	**35.6**		1	ICPST	4/08/04	14:33
Potassium	**766.49**	**3.9**	**23.4**	**3240**	N	J 1	ICPST	4/08/04	14:33
Selenium	196.03	0.16	1.9	0.16	U	1	ICPST	4/08/04	14:33
Silver	328.07	0.12	0.28	0.12	U	1	ICPST	4/08/04	14:33
Sodium	**330.23**	**31.5**	**234**	**525**		B 1	ICPST	4/08/04	14:33
Thallium	190.86	0.54	2.8	0.54	U	1	ICPST	4/08/04	14:33
Vanadium	**292.40**	**0.13**	**0.94**	**10.2**		1	ICPST	4/08/04	14:33
Zinc	**213.86**	**0.51**	**1.9**	**16.2**		B 1	ICPST	4/08/04	14:33

Comments: Sample Date: 04/01/04 Sample Time: 10:20 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-009-071-3/4 **Client ID:** TMSB5D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.78 **Volume:** 100 **Percent Moisture:** 17.78

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.031	0.016	U	1	CVAA	4/10/04	14:17

Comments: Sample Date: 04/01/04 Sample Time: 10:20 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

R Result is between IDL and RL

Form 1 Equivalent

Ron's Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	TMSB5D	Lab Sample ID:	404021-009-071-3/4
Sample Date/Time:	04/01/2004 10:20	Percent Moisture:	17.78
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/13/04 17:00

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-010-079-3/4 **Client ID:** 51SB10A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.28 **Volume:** 100 **Percent Moisture:** 15.33

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	1.6	18.5	10600		1	ICPST	4/08/04	14:41
Antimony	206.84	0.46	1.8	0.60	BN	B 1	ICPST	4/08/04	14:41
Arsenic	189.04	0.18	1.8	3.0		1	ICPST	4/08/04	14:41
Barium	493.41	0.030	0.46	92.2		1	ICPST	4/08/04	14:41
Beryllium	313.04	0.0053	0.18	0.56		1	ICPST	4/08/04	14:41
Cadmium	226.50	0.041	0.55	0.12	B	BJ 1	ICPST	4/08/04	14:41
Calcium	317.93	7.0	92.3	297		B 1	ICPST	4/08/04	14:41
Chromium	267.72	0.11	0.46	17.2		1	ICPST	4/08/04	14:41
Cobalt	228.62	0.074	0.46	3.9		1	ICPST	4/08/04	14:41
Copper	324.75	0.088	0.92	4.7	E	B 1	ICPST	4/08/04	14:41
Iron	271.44	3.6	13.8	11500		1	ICPST	4/08/04	14:41
Lead	220.35	0.19	0.92	14.1	*	1	ICPST	4/08/04	14:41
Magnesium	279.08	2.3	23.1	483	N	1	ICPST	4/08/04	14:41
Manganese	257.61	0.023	0.46	385	*	1	ICPST	4/08/04	14:41
Nickel	231.60	0.13	0.92	4.6		1	ICPST	4/08/04	14:41
Potassium	766.49	3.9	23.1	367	N	1	ICPST	4/08/04	14:41
Selenium	196.03	0.16	1.8	0.39	B	B 1	ICPST	4/08/04	14:41
Silver	328.07	0.12	0.28	0.12	U	1	ICPST	4/08/04	14:41
Sodium	330.23	31.1	231	84.5	B	B 1	ICPST	4/08/04	14:41
Thallium	190.86	0.54	2.8	0.54	U	1	ICPST	4/08/04	14:41
Vanadium	292.40	0.13	0.92	27.5		1	ICPST	4/08/04	14:41
Zinc	213.86	0.50	1.8	23.2		1	ICPST	4/08/04	14:41

Comments: Sample Date: 04/01/04 Sample Time: 12:15 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Copy

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-010-079-3/4 **Client ID:** 51SB10A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.75 **Volume:** 100 **Percent Moisture:** 15.33

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.031	0.024	B	J 1	CVAA	4/10/04	14:20

Comments: Sample Date: 04/01/04 Sample Time: 12:15 PM

5.05.0

E Serial dilution percent difference not within limits

U Result is less than the IDL

R Result is between IDL and RL

Form 1 Equivalent

Form I Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB10A	Lab Sample ID:	404021-010-079-3/4
Sample Date/Time:	04/01/2004 12:15	Percent Moisture:	15.33
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.17	1	mg/kg	04/13/04 17:00

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-011-087-3/4 **Client ID:** 51SB10B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.28 **Volume:** 100 **Percent Moisture:** 11.88

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.5**	**17.7**	**13500**		1	**ICPST**	**4/08/04**	**14:49**
Antimony	**206.84**	**0.44**	**1.8**	**0.67**	**BN**	B 1	**ICPST**	**4/08/04**	**14:49**
Arsenic	**189.04**	**0.18**	**1.8**	**1.6**	**B**	J 1	**ICPST**	**4/08/04**	**14:49**
Barium	**493.41**	**0.028**	**0.44**	**40.4**		1	**ICPST**	**4/08/04**	**14:49**
Beryllium	**313.04**	**0.0051**	**0.18**	**0.45**		1	**ICPST**	**4/08/04**	**14:49**
Cadmium	226.50	0.039	0.53	0.039	U	1	ICPST	4/08/04	14:49
Calcium	**317.93**	**6.7**	**88.7**	**88.4**	**B**	B 1	**ICPST**	**4/08/04**	**14:49**
Chromium	**267.72**	**0.11**	**0.44**	**19.7**		1	**ICPST**	**4/08/04**	**14:49**
Cobalt	**228.62**	**0.071**	**0.44**	**14.9**		1	**ICPST**	**4/08/04**	**14:49**
Copper	**324.75**	**0.084**	**0.89**	**4.6**	**E**	E 1	**ICPST**	**4/08/04**	**14:49**
Iron	**271.44**	**3.5**	**13.3**	**15100**		1	**ICPST**	**4/08/04**	**14:49**
Lead	**220.35**	**0.19**	**0.89**	**4.2**	*	1	**ICPST**	**4/08/04**	**14:49**
Magnesium	**279.08**	**2.3**	**22.2**	**930**	**N**	1	**ICPST**	**4/08/04**	**14:49**
Manganese	**257.61**	**0.022**	**0.44**	**369**	*	1	**ICPST**	**4/08/04**	**14:49**
Nickel	**231.60**	**0.12**	**0.89**	**6.3**		1	**ICPST**	**4/08/04**	**14:49**
Potassium	**766.49**	**3.7**	**22.2**	**747**	**N**	1	**ICPST**	**4/08/04**	**14:49**
Selenium	196.03	0.15	1.8	0.15	U	1	ICPST	4/08/04	14:49
Silver	328.07	0.12	0.27	0.12	U	1	ICPST	4/08/04	14:49
Sodium	**330.23**	**29.9**	**222**	**163**	**B**	B 1	**ICPST**	**4/08/04**	**14:49**
Thallium	190.86	0.51	2.7	0.51	U	1	ICPST	4/08/04	14:49
Vanadium	**292.40**	**0.12**	**0.89**	**21.2**		1	**ICPST**	**4/08/04**	**14:49**
Zinc	**213.86**	**0.48**	**1.8**	**22.2**		1	**ICPST**	**4/08/04**	**14:49**

Comments: Sample Date: 04/01/04 Sample Time: 12:30 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-011-087-3/4 **Client ID:** 51SB10B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.76 **Volume:** 100 **Percent Moisture:** 11.88

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.030	0.015	U	1	CVAA	4/10/04	14:23

Comments: Sample Date: 04/01/04 Sample Time: 12:30 PM

5.05.0

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Fax & Orig

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB10B	Lab Sample ID:	404021-011-087-3/4
Sample Date/Time:	04/01/2004 12:30	Percent Moisture:	11.88
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/13/04 17:0C

Form I Copy

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Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-012-095-3/4 **Client ID:** 51SB10C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.33 **Volume:** 100 **Percent Moisture:** 13.61

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	1.5	17.4	16100		1	ICPST	4/08/04	14:57
Antimony	206.84	0.44	1.7	0.52	BN	B 1	ICPST	4/08/04	14:57
Arsenic	189.04	0.17	1.7	1.3	B	J 1	ICPST	4/08/04	14:57
Barium	493.41	0.028	0.44	61.7		1	ICPST	4/08/04	14:57
Beryllium	313.04	0.0050	0.17	1.7		1	ICPST	4/08/04	14:57
Cadmium	226.50	0.038	0.52	0.038	U	1	ICPST	4/08/04	14:57
Calcium	317.93	6.6	87.0	664		B 1	ICPST	4/08/04	14:57
Chromium	267.72	0.10	0.44	21.2		1	ICPST	4/08/04	14:57
Cobalt	228.62	0.070	0.44	6.9		1	ICPST	4/08/04	14:57
Copper	324.75	0.083	0.87	2.1	E	B 1	ICPST	4/08/04	14:57
Iron	271.44	3.4	13.1	23200		1	ICPST	4/08/04	14:57
Lead	220.35	0.18	0.87	2.6	*	1	ICPST	4/08/04	14:57
Magnesium	279.08	2.2	21.8	6920	N	1	ICPST	4/08/04	14:57
Manganese	257.61	0.022	0.44	406	*	1	ICPST	4/08/04	14:57
Nickel	231.60	0.12	0.87	38.1		1	ICPST	4/08/04	14:57
Potassium	766.49	3.6	21.8	2930	N	1	ICPST	4/08/04	14:57
Selenium	196.03	0.15	1.7	0.15	U	1	ICPST	4/08/04	14:57
Silver	328.07	0.11	0.26	0.11	U	1	ICPST	4/08/04	14:57
Sodium	330.23	29.3	218	164	B	B 1	ICPST	4/08/04	14:57
Thallium	190.86	0.50	2.6	0.56	B	B 1	ICPST	4/08/04	14:57
Vanadium	292.40	0.12	0.87	13.7		1	ICPST	4/08/04	14:57
Zinc	213.86	0.47	1.7	15.5		B 1	ICPST	4/08/04	14:57

Comments: Sample Date: 04/01/04 Sample Time: 01:00 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404021

Lab Sample ID: S 404021-012-095-3/4 **Client ID:** 51SB10C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.75 **Volume:** 100 **Percent Moisture:** 13.61

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.031	0.015	U	1	CVAA	4/10/04	14:26

Comments: Sample Date: 04/01/04 Sample Time: 01:00 PM

5.05.0

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form I Org

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB10C	Lab Sample ID:	404021-012-095-3/4
Sample Date/Time:	04/01/2004 13:00	Percent Moisture:	13.61
Receipt Date/Time:	04/02/2004 14:53	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.17	1	mg/kg	04/13/04 17:0(

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation - Volatiles
GPL Laboratories, Inc., SDG 404021

DATE: June 8, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. The samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs) using USEPA SW846 Method 5035/8260B. A total of fourteen soil samples were validated, some of which were dilutions. The sample IDs are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB4A	404021-001	51SB5B	404021-006DL
51SB4B	404021-002	51SB5C	404021-007
51SB4B	404021-002DL	51SB5D	404021-008
51SB4C	404021-003	TMSB5D	404021-009
51SB4D	404021-004	51SB10A	404021-010
51SB5A	404021-005	51SB10B	404021-011
51SB5B	404021-006	51SB10C	404021-012

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated under data validation procedure Level M3 are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Results
X		Initial Calibration
X		Continuing Calibration
X		Blank Analysis
X		Laboratory Control Sample
	X	Matrix Spike/ Spike Duplicate Sample
X		System Monitoring Compounds
	X	Internal Standards
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with the noted qualifications, except for the following. Compound 2-butanone (RRF=0.032) was qualified as rejected "R" for non-detects for samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), 51SB10C (404021-012), 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB5B (404021-006DL), and 51SB10B (404021-011) based upon had poor calibration response. Compound toluene was detected outside calibration range (i.e. "E-flag) for samples 51SB4B (404021-002) and 51SB5B (404021-006) and were qualified "R" rejected. Samples 51SB4B (404021-002DL) and 51SB5B (404021-006DL) should be used for toluene for these samples.

Eric Malarek, Chemist

6/8/04
Date

RFAAP VALIDATION REPORT
VOLATILES REVIEW
SDG 404021

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of analysis. Holding time criteria: For Encore soil samples cooled @ 4°C ± 2°C; the maximum holding time is 2 days for preparation, 14 days from sample collection to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 4.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, prepped on 04/02/04, and analyzed for TCL VOCs on 04/13/04 and 04/14/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, bromofluorobenzene (BFB), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be ≥ 0.05 for all other compounds. Percent relative standard deviation (%RSD) must be ≤ 15% for each target compound and must be ≤ 30% for each calibration check compound. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For initial calibration for VOCs performed on 04/02/04 on instrument HP#A, target compounds bromomethane (18.0%), 2-butanone (RRF=0.032), 4-methyl-2-pentanone (17.4%), 2-hexanone (18.4%), and styrene (24.6%) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compounds bromomethane, 4-methyl-2-pentanone, 2-hexanone, and styrene were qualified "J" for detects and no qualifier for non-detects based upon the high %RSD. All samples were analyzed using this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Continuing calibration establishes the 12-hour relative response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be $\geq$ 0.05 for all other compounds. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within 20% for all target compounds. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for VOCs performed on 04/13/04 @ 08:11 on instrument HP#A, target compounds bromomethane (32.8%) and 2-butanone (RRF=0.035) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Bromomethane was non-detect for all samples, therefore no qualifiers were applied based upon this outlier. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), and 51SB10C (404021-012) apply to this continuing calibration.

- For continuing calibration for VOCs performed on 04/14/04 @ 10:48 on instrument HP#A, target compounds bromomethane (52.9%; grossly exceeding), carbon disulfide (24.0%), and 2-butanone (RRF=0.030) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compound bromomethane was qualified "J" for detects and "UJ" for non-detects based upon the grossly exceeding high %D. Carbon disulfide was non-detect for all samples, therefore no qualifiers were applied based upon this outlier. Samples 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB5B (404021-006DL), and 51SB10B (404021-011) apply to this continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of BFB. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants methylene chloride, acetone, and 2-butanone). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is $\leq$ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants methylene chloride, acetone, and 2-butanone, or 5 times (5X) the maximum amount for other volatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 1). Rinse blank 040204R and associated trip blank 040204T apply to these samples and were analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/13/04	BLK65898	methylene chloride	1.5J	15	51SB4B, 51SB5B
04/14/04	BLK65944	acetone	3.8J	38	51SB4BDL, 51SB4C, 51SB10B
04/14/04	BLK65944	methylene chloride	1.3J	13	51SB10B
04/14/04	040204R	2-butanone	2.1J	21	None
04/14/04	040204R	acetone	34	340	51SB4A, 51SB4B, 51SB4BDL, 51SB4C, 51SB4D, 51SB5A, 51SB5B, 51SB5C, 51SB5D, 51SB10A, 51SB10B
04/14/04	040204R	benzene	1.1	5.5	51SB4BDL
04/14/04	040204R	ethylbenzene	0.58J	2.9	None
04/14/04	040204R	m,p-xylenes	2.5	12.5	51SB4BDL
04/14/04	040204R	o-xylene	0.90J	4.5	51SB4BDL
04/14/04	040204R	toluene	4.7	23.5	51SB4C, 51SB5BDL, 51SB10B
04/14/04	040204T	1,1,1-trichloroethane	0.83J	4.2	None
04/14/04	040204T	acetone	3.4J	34	51SB4D, 51SB4BDL, 51SB5C, 51SB5D, 51SB10A, 51SB10B
04/14/04	040204T	methylene chloride	0.93J	9.3	51SB4B, 51SB5B, 51SB10B
04/14/04	040204T	trichloroethene	4.9	24.5	51SB4B, 51SB5B

J = Estimated value <MRL and >MDL

VI-Laboratory Control Sample (LCS) and LCSD

Data for laboratory control samples (LCS) and LCSD are evaluated to determine long-term accuracy and precision of the analytical method on various matrices. Percent recoveries (%Rs) should be within the specified control limits. USACE Shell limits are 75-125%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- Sample BKSD65898 was used as the LCS and LCSD for the TCL VOC analysis. Compounds 2-hexanone (64%), 4-methyl-2-pentanone (72%), carbon disulfide (70%, 69%), and bromomethane (70%, 69%) were below USACE criteria and within the SMF criteria. Compound 2-butanone (320%, 313%) was outside USACE, SMF, and laboratory limits. There were a total of 70 spike recoveries with 8 sporadic marginal failures. Based on this, 2-hexanone, 4-methyl-2-pentanone, carbon disulfide, and bromomethane were qualified bias low "L" for detects and "UL" for non-detects based upon these outliers. Compound 2-butanone was non-detect for all samples, therefore no qualifiers were applied based upon these outliers. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), and 51SB10C (404021-012) apply to this LCS/LCSD.

- Sample BKSD65944 was used as the LCS for the TCL VOC analysis. Compounds 1,1-dichloroethene (70%), 4-methyl-2-pentanone (74%), carbon disulfide (66%), and trans-1,2-dichloroethene (72%) were outside USACE criteria and within the SMF criteria. Compounds 2-butanone (440%), acetone (56%), and bromomethane (36%) were outside USACE, laboratory, and SMF criteria. There were a total of 35 spike recoveries with 7 sporadic marginal failures. Compound 2-butanone was non-detect for all samples, therefore no qualifiers were applied based upon this outlier. Compounds 1,1-dichloroethene, 4-methyl-2-pentanone, carbon disulfide, trans-1,2-dichloroethene, acetone, and bromomethane were qualified bias low "L" for detects and "UL" for non-detects based upon these outliers. Samples 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB5B (404021-006DL), and 51SB10B (404021-011) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 70-130%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- No MS/MSD was analyzed with this SDG.

VIII-System Monitoring Compounds (Surrogates)
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Recoveries for system monitoring compounds in volatile samples and blanks must be within the specified control limits.

Criteria: 1,2-Dichlorobenzene-d4 (74-122%) – SMC1 (USACE Shell Criteria: 70-130%)
1,2-Dichloroethane-d4 (64-120%) – SMC2 (USACE Shell Criteria: 70-130%)
4-Bromofluorobenzene (76-116%) – SMC3 (USACE Shell Criteria: 70-130%)
Toluene-d8 (76-120%) – SMC4 (USACE Shell Criteria: 70-130%)

- For sample 51SB10B (404021-011), surrogate 1,2-Dichlorobenzene-d4 (125%) was above laboratory criteria limits. All detects were qualified estimated "J" and non-detects "UJ" based upon this outlier for sample 51SB10B (404021-011). For all other samples, the surrogates were within criteria.

IX-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: area counts (-50% to +100%) of the associated calibration standard, and retention time (± 30 seconds) from that of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB5D (404021-008) and TMSB5D (404021-009) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB5D	404021-008	Acetone	5.7 J	11 U	NA	None

J = Estimated value <MRL and >MDL.
U = Non-detect at MRL.
NA = Not Applicable. Acetone detected in blanks.

XI-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J". Toluene was detected outside calibration range (i.e. "E-flag) for samples 51SB4B (404021-002) and 51SB5B (404021-006) and were qualified "R" rejected. Samples 51SB4B (404021-002DL) and 51SB5B (404021-006DL) should be used for toluene for these samples.

Sample: 51SB4A (404021-001), Acetone

Conc. (µg/kg) = {(Ax)*(Is)*(DF)*(Vp)} / {(Ais)*(RRF)*(Ws)*Fs)}
where: Ax is the compound area
Is is the corresponding internal standard concentration (ng/mL)
DF is the dilution factor
Vp is the volume purged (mL)
Ais is the corresponding internal standard area
RRF is the relative response factor
Ws is the weight of the sample (g)
Fs is the fraction solids for the sample = 1.0 for Wet Weight

Conc. µg/kg = (216935* 50 ng/mL * 1 * 5 mL) / (1540097 * 0.119 * 5.73g * 0.8436) = 61 µg/kg
Reported Conc. = 61 µg/kg
%D = 0.0
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

RFAAP VALIDATION REPORT
VOLATILES REVIEW
SDG 404021

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of analysis. Holding time criteria: For Encore soil samples cooled @ 4°C ± 2°C; the maximum holding time is 2 days for preparation, 14 days from sample collection to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 4.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, prepped on 04/02/04, and analyzed for TCL VOCs on 04/13/04 and 04/14/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, bromofluorobenzene (BFB), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be ≥ 0.05 for all other compounds. Percent relative standard deviation (%RSD) must be ≤ 15% for each target compound and must be ≤ 30% for each calibration check compound. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For initial calibration for VOCs performed on 04/02/04 on instrument HP#A, target compounds bromomethane (18.0%), 2-butanone (RRF=0.032), 4-methyl-2-pentanone (17.4%), 2-hexanone (18.4%), and styrene (24.6%) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compounds bromomethane, 4-methyl-2-pentanone, 2-hexanone, and styrene were qualified "J" for detects and no qualifier for non-detects based upon the high %RSD. All samples were analyzed using this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Continuing calibration establishes the 12-hour relative response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be ≥ 0.05 for all other compounds. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within 20% for all target compounds. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for VOCs performed on 04/13/04 @ 08:11 on instrument HP#A, target compounds bromomethane (32.8%) and 2-butanone (RRF=0.035) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Bromomethane was non-detect for all samples, therefore no qualifiers were applied based upon this outlier. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), and 51SB10C (404021-012) apply to this continuing calibration.

- For continuing calibration for VOCs performed on 04/14/04 @ 10:48 on instrument HP#A, target compounds bromomethane (52.9%; grossly exceeding), carbon disulfide (24.0%), and 2-butanone (RRF=0.030) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compound bromomethane was qualified "J" for detects and "UJ" for non-detects based upon the grossly exceeding high %D. Carbon disulfide was non-detect for all samples, therefore no qualifiers were applied based upon this outlier. Samples 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB5B (404021-006DL), and 51SB10B (404021-011) apply to this continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of BFB. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants methylene chloride, acetone, and 2-butanone). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants methylene chloride, acetone, and 2-butanone, or 5 times (5X) the maximum amount for other volatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 1). Rinse blank 040204R and associated trip blank 040204T apply to these samples and were analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/13/04	BLK65898	methylene chloride	1.5J	15	51SB4B, 51SB5B
04/14/04	BLK65944	acetone	3.8J	38	51SB4BDL, 51SB4C, 51SB10B
04/14/04	BLK65944	methylene chloride	1.3J	13	51SB10B
04/14/04	040204R	2-butanone	2.1J	21	None
04/14/04	040204R	acetone	34	340	51SB4A, 51SB4B, 51SB4BDL, 51SB4C, 51SB4D, 51SB5A, 51SB5B, 51SB5C, 51SB5D, 51SB10A, 51SB10B
04/14/04	040204R	benzene	1.1	5.5	51SB4BDL
04/14/04	040204R	ethylbenzene	0.58J	2.9	None
04/14/04	040204R	m,p-xylenes	2.5	12.5	51SB4BDL
04/14/04	040204R	o-xylene	0.90J	4.5	51SB4BDL
04/14/04	040204R	toluene	4.7	23.5	51SB4C, 51SB5BDL, 51SB10B
04/14/04	040204T	1,1,1-trichloroethane	0.83J	4.2	None
04/14/04	040204T	acetone	3.4J	34	51SB4D, 51SB4BDL, 51SB5C, 51SB5D, 51SB10A, 51SB10B
04/14/04	040204T	methylene chloride	0.93J	9.3	51SB4B, 51SB5B, 51SB10B
04/14/04	040204T	trichloroethene	4.9	24.5	51SB4B, 51SB5B

J = Estimated value <MRL and >MDL

VI-Laboratory Control Sample (LCS) and LCSD

Data for laboratory control samples (LCS) and LCSD are evaluated to determine long-term accuracy and precision of the analytical method on various matrices. Percent recoveries (%Rs) should be within the specified control limits. USACE Shell limits are 75-125%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- Sample BKSD65898 was used as the LCS and LCSD for the TCL VOC analysis. Compounds 2-hexanone (64%), 4-methyl-2-pentanone (72%), carbon disulfide (70%, 69%), and bromomethane (70%, 69%) were below USACE criteria and within the SMF criteria. Compound 2-butanone (320%, 313%) was outside USACE, SMF, and laboratory limits. There were a total of 70 spike recoveries with 8 sporadic marginal failures. Based on this, 2-hexanone, 4-methyl-2-pentanone, carbon disulfide, and bromomethane were qualified bias low "L" for detects and "UL" for non-detects based upon these outliers. Compound 2-butanone was non-detect for all samples, therefore no qualifiers were applied based upon these outliers. Samples 51SB4A (404021-001), 51SB4B (404021-002), 51SB4D (404021-004), 51SB5A (404021-005), 51SB5B (404021-006), 51SB5C (404021-007), 51SB5D (404021-008), TMSB5D (404021-009), 51SB10A (404021-010), and 51SB10C (404021-012) apply to this LCS/LCSD.

- Sample BKSD65944 was used as the LCS for the TCL VOC analysis. Compounds 1,1-dichloroethene (70%), 4-methyl-2-pentanone (74%), carbon disulfide (66%), and trans-1,2-dichloroethene (72%) were outside USACE criteria and within the SMF criteria. Compounds 2-butanone (440%), acetone (56%), and bromomethane (36%) were outside USACE, laboratory, and SMF criteria. There were a total of 35 spike recoveries with 7 sporadic marginal failures. Compound 2-butanone was non-detect for all samples, therefore no qualifiers were applied based upon this outlier. Compounds 1,1-dichloroethene, 4-methyl-2-pentanone, carbon disulfide, trans-1,2-dichloroethene, acetone, and bromomethane were qualified bias low "L" for detects and "UL" for non-detects based upon these outliers. Samples 51SB4B (404021-002DL), 51SB4C (404021-003), 51SB5B (404021-006DL), and 51SB10B (404021-011) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 70-130%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- No MS/MSD was analyzed with this SDG.

VIII-System Monitoring Compounds (Surrogates)
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Recoveries for system monitoring compounds in volatile samples and blanks must be within the specified control limits.

Criteria: 1,2-Dichlorobenzene-d4 (74-122%) – SMC1 (USACE Shell Criteria: 70-130%)
1,2-Dichloroethane-d4 (64-120%) – SMC2 (USACE Shell Criteria: 70-130%)
4-Bromofluorobenzene (76-116%) – SMC3 (USACE Shell Criteria: 70-130%)
Toluene-d8 (76-120%) – SMC4 (USACE Shell Criteria: 70-130%)

- For sample 51SB10B (404021-011), surrogate 1,2-Dichlorobenzene-d4 (125%) were above laboratory criteria limits. All detects were qualified estimated "J" and non-detects "UJ" based upon this outlier for sample 51SB10B (404021-011). For all other samples, the surrogates were within criteria.

IX-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: area counts (-50% to +100%) of the associated calibration standard, and retention time (± 30 seconds) from that of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed with this SDG.

XI-Quantitation Verification
The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J". Toluene was detected outside calibration range (i.e. "E-flag) for samples 51SB4B (404021-002) and 51SB5B (404021-006) and were qualified "R" rejected. Samples 51SB4B (404021-002DL) and 51SB5B (404021-006DL) should be used for toluene for these samples.

Sample: 51SB4A (404021-001), Acetone

Conc. (µg/kg) = {(Ax)*(Is)*(DF)*(Vp)} / {(Ais)*(RRF)*(Ws)*Fs)}
where: Ax is the compound area
Is is the corresponding internal standard concentration (ng/mL)
DF is the dilution factor
Vp is the volume purged (mL)
Ais is the corresponding internal standard area
RRF is the relative response factor
Ws is the weight of the sample (g)
Fs is the fraction solids for the sample = 1.0 for Wet Weight

Conc. µg/kg = (216935* 50 ng/mL * 1 * 5 mL) / (1540097 * 0.119 * 5.73g * 0.8436) = 61 µg/kg
Reported Conc. = 61 µg/kg
%D = 0.0
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

GPL Laboratories

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-001-1/4
Sample Volume :	5.73	Lab File ID :	A43766.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	15.64	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.2	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.2	U	
79-00-5	1,1,2-Trichloroethane	5.2	U	
75-34-3	1,1-Dichloroethane	5.2	U	
75-35-4	1,1-Dichloroethene	5.2	U	
107-06-2	1,2-Dichloroethane	5.2	U	
78-87-5	1,2-Dichloropropane	5.2	U	
78-93-3	2-Butanone	10	U	R
591-78-6	2-Hexanone	10	U	UL
108-10-1	4-Methyl-2-Pentanone	10	U	UL
67-64-1	Acetone	61		B
71-43-2	Benzene	5.2	U	
75-27-4	Bromodichloromethane	5.2	U	
75-25-2	Bromoform	5.2	U	
74-83-9	Bromomethane	10	U	UL
75-15-0	Carbon Disulfide	5.2	U	UL
56-23-5	Carbon Tetrachloride	5.2	U	
108-90-7	Chlorobenzene	5.2	U	
75-00-3	Chloroethane	10	U	
67-66-3	Chloroform	5.2	U	
74-87-3	Chloromethane	10	U	
124-48-1	Dibromochloromethane	5.2	U	
100-41-4	Ethylbenzene	5.2	U	
75-09-2	Methylene Chloride	10	U	
100-42-5	Styrene	5.2	U	
127-18-4	Tetrachloroethylene	5.2	U	
108-88-3	Toluene	5.2	U	
79-01-6	Trichloroethene	5.2	U	
75-01-4	Vinyl Chloride	10	U	

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SAMPLE NO
51SB4A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-001-001-1/4
Sample Volume :	5.73	Lab File ID :	A43766.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	15.64	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.2	U
10061-01-5	cis-1,3-Dichloropropene	5.2	U
136777-61-2	m,p-Xylenes	5.2	U
95-47-6	o-Xylene	5.2	U
156-60-5	trans-1,2-dichloroethene	5.2	U
10061-02-6	trans-1,3-dichloropropene	5.2	U

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SAMPLE NO
51SB4B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-009-1/4
Sample Volume :	3.53	Lab File ID :	A43767.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	55.28	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	33		
79-34-5	1,1,2,2-Tetrachloroethane	16	U	
79-00-5	1,1,2-Trichloroethane	16	U	
75-34-3	1,1-Dichloroethane	16	U	
75-35-4	1,1-Dichloroethene	16	U	
107-06-2	1,2-Dichloroethane	16	U	
78-87-5	1,2-Dichloropropane	16	U	
78-93-3	2-Butanone	32	U	R
591-78-6	2-Hexanone	21	J	J
108-10-1	4-Methyl-2-Pentanone	100		J
67-64-1	Acetone	98		B
71-43-2	Benzene	130		
75-27-4	Bromodichloromethane	16	U	
75-25-2	Bromoform	16	U	
74-83-9	Bromomethane	32	U	VL
75-15-0	Carbon Disulfide	16	U	VL
56-23-5	Carbon Tetrachloride	16	U	
108-90-7	Chlorobenzene	16	U	
75-00-3	Chloroethane	32	U	
67-66-3	Chloroform	16	U	
74-87-3	Chloromethane	32	U	
124-48-1	Dibromochloromethane	16	U	
100-41-4	Ethylbenzene	31		
75-09-2	Methylene Chloride	8.8	JB	B
100-42-5	Styrene	16	U	
127-18-4	Tetrachloroethylene	12	J	J
108-88-3	Toluene	2300	E	R
79-01-6	Trichloroethene	19		B
75-01-4	Vinyl Chloride	32	U	

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SAMPLE NO
51SB4B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-009-1/4
Sample Volume :	3.53	Lab File ID :	A43767.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	55.28	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	16	U
10061-01-5	cis-1,3-Dichloropropene	16	U
136777-61-2	m,p-Xylenes	110	
95-47-6	o-Xylene	32	
156-60-5	trans-1,2-dichloroethene	16	U
10061-02-6	trans-1,3-dichloropropene	16	U

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SAMPLE NO
51SB4BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-010-2/4DL
Sample Volume :	2.78	Lab File ID :	A43804.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	55.28	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	180
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	2000	U	
79-34-5	1,1,2,2-Tetrachloroethane	2000	U	
79-00-5	1,1,2-Trichloroethane	2000	U	
75-34-3	1,1-Dichloroethane	2000	U	
75-35-4	1,1-Dichloroethene	2000	U	UL
107-06-2	1,2-Dichloroethane	2000	U	
78-87-5	1,2-Dichloropropane	2000	U	
78-93-3	2-Butanone	4000	U	R
591-78-6	2-Hexanone	4000	U	
108-10-1	4-Methyl-2-Pentanone	4000	U	UL
67-64-1	Acetone	1600	JB	B
71-43-2	Benzene	1100	J	B
75-27-4	Bromodichloromethane	2000	U	
75-25-2	Bromoform	2000	U	
74-83-9	Bromomethane	4000	U	UJ
75-15-0	Carbon Disulfide	2000	U	UL
56-23-5	Carbon Tetrachloride	2000	U	
108-90-7	Chlorobenzene	2000	U	
75-00-3	Chloroethane	4000	U	
67-66-3	Chloroform	2000	U	
74-87-3	Chloromethane	4000	U	
124-48-1	Dibromochloromethane	2000	U	
100-41-4	Ethylbenzene	2000	U	
75-09-2	Methylene Chloride	4000	U	
100-42-5	Styrene	2000	U	
127-18-4	Tetrachloroethylene	2000	U	
108-88-3	Toluene	20000		✓
79-01-6	Trichloroethene	2000	U	
75-01-4	Vinyl Chloride	4000	U	

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SAMPLE NO
51SB4BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-002-010-2/4DL
Sample Volume :	2.78	Lab File ID :	A43804.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	55.28	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	180
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
156-59-2	cis-1,2-Dichloroethene	2000	U	
10061-01-5	cis-1,3-Dichloropropene	2000	U	
136777-61-2	m,p-Xylenes	1400	J	B
95-47-6	o-Xylene	400	J	B
156-60-5	trans-1,2-dichloroethene	2000	U	UL
10061-02-6	trans-1,3-dichloropropene	2000	U	

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SAMPLE NO
51SB4C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-018-2/4
Sample Volume :	6.23	Lab File ID :	A43802.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	13.6	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.6	U	
79-34-5	1,1,2,2-Tetrachloroethane	4.6	U	
79-00-5	1,1,2-Trichloroethane	4.6	U	
75-34-3	1,1-Dichloroethane	4.6	U	
75-35-4	1,1-Dichloroethene	4.6	U	UL
107-06-2	1,2-Dichloroethane	4.6	U	
78-87-5	1,2-Dichloropropane	4.6	U	
78-93-3	2-Butanone	9.3	U	R
591-78-6	2-Hexanone	9.3	U	
108-10-1	4-Methyl-2-Pentanone	6.9	J	J
67-64-1	Acetone	60	B	B
71-43-2	Benzene	4.6	U	
75-27-4	Bromodichloromethane	4.6	U	
75-25-2	Bromoform	4.6	U	
74-83-9	Bromomethane	9.3	U	UJ
75-15-0	Carbon Disulfide	4.6	U	UL
56-23-5	Carbon Tetrachloride	4.6	U	
108-90-7	Chlorobenzene	4.6	U	
75-00-3	Chloroethane	9.3	U	
67-66-3	Chloroform	4.6	U	
74-87-3	Chloromethane	9.3	U	
124-48-1	Dibromochloromethane	4.6	U	
100-41-4	Ethylbenzene	4.6	U	
75-09-2	Methylene Chloride	9.3	U	
100-42-5	Styrene	4.6	U	
127-18-4	Tetrachloroethylene	4.6	U	
108-88-3	Toluene	3.0	J	B
79-01-6	Trichloroethene	4.6	U	
75-01-4	Vinyl Chloride	9.3	U	

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SAMPLE NO
51SB4C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-003-018-2/4
Sample Volume :	6.23	Lab File ID :	A43802.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	13.6	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
156-59-2	cis-1,2-Dichloroethene	4.6	U	
10061-01-5	cis-1,3-Dichloropropene	4.6	U	
136777-61-2	m,p-Xylenes	4.6	U	
95-47-6	o-Xylene	4.6	U	
156-60-5	trans-1,2-dichloroethene	4.6	U	VL
10061-02-6	trans-1,3-dichloropropene	4.6	U	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB4D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-004-025-1/4
Sample Volume :	5.3	Lab File ID :	A43769.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	15.94	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.6	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.6	U	
79-00-5	1,1,2-Trichloroethane	5.6	U	
75-34-3	1,1-Dichloroethane	5.6	U	
75-35-4	1,1-Dichloroethene	5.6	U	
107-06-2	1,2-Dichloroethane	5.6	U	
78-87-5	1,2-Dichloropropane	5.6	U	
78-93-3	2-Butanone	11	U	R
591-78-6	2-Hexanone	11	U	VL
108-10-1	4-Methyl-2-Pentanone	11	U	VL
67-64-1	Acetone	7.5	J	B
71-43-2	Benzene	5.6	U	
75-27-4	Bromodichloromethane	5.6	U	
75-25-2	Bromoform	5.6	U	
74-83-9	Bromomethane	11	U	VL
75-15-0	Carbon Disulfide	5.6	U	VL
56-23-5	Carbon Tetrachloride	5.6	U	
108-90-7	Chlorobenzene	5.6	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.6	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.6	U	
100-41-4	Ethylbenzene	5.6	U	
75-09-2	Methylene Chloride	11	U	
100-42-5	Styrene	5.6	U	
127-18-4	Tetrachloroethylene	5.6	U	
108-88-3	Toluene	5.6	U	
79-01-6	Trichloroethene	5.6	U	
75-01-4	Vinyl Chloride	11	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB4D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-004-025-1/4
Sample Volume :	5.3	Lab File ID :	A43769.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	15.94	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.6	U
10061-01-5	cis-1,3-Dichloropropene	5.6	U
136777-61-2	m,p-Xylenes	5.6	U
95-47-6	o-Xylene	5.6	U
156-60-5	trans-1,2-dichloroethene	5.6	U
10061-02-6	trans-1,3-dichloropropene	5.6	U

GPL Laboratories

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ANALYSIS DATA SHEET

SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-033-1/4
Sample Volume :	5.99	Lab File ID :	A43770.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	17.91	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.1	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.1	U	
79-00-5	1,1,2-Trichloroethane	5.1	U	
75-34-3	1,1-Dichloroethane	5.1	U	
75-35-4	1,1-Dichloroethene	5.1	U	
107-06-2	1,2-Dichloroethane	5.1	U	
78-87-5	1,2-Dichloropropane	5.1	U	
78-93-3	2-Butanone	10	U	R
591-78-6	2-Hexanone	10	U	VL
108-10-1	4-Methyl-2-Pentanone	10	U	VL
67-64-1	Acetone	110		B
71-43-2	Benzene	5.1	U	
75-27-4	Bromodichloromethane	5.1	U	
75-25-2	Bromoform	5.1	U	
74-83-9	Bromomethane	10	U	VL
75-15-0	Carbon Disulfide	5.1	U	VL
56-23-5	Carbon Tetrachloride	5.1	U	
108-90-7	Chlorobenzene	5.1	U	
75-00-3	Chloroethane	10	U	
67-66-3	Chloroform	5.1	U	
74-87-3	Chloromethane	10	U	
124-48-1	Dibromochloromethane	5.1	U	
100-41-4	Ethylbenzene	5.1	U	
75-09-2	Methylene Chloride	10	U	
100-42-5	Styrene	5.1	U	
127-18-4	Tetrachloroethylene	5.1	U	
108-88-3	Toluene	5.1	U	
79-01-6	Trichloroethene	5.1	U	
75-01-4	Vinyl Chloride	10	U	

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SAMPLE NO
51SB5A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-005-033-1/4
Sample Volume :	5.99	Lab File ID :	A43770.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	17.91	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.1	U
10061-01-5	cis-1,3-Dichloropropene	5.1	U
136777-61-2	m,p-Xylenes	5.1	U
95-47-6	o-Xylene	5.1	U
156-60-5	trans-1,2-dichloroethene	5.1	U
10061-02-6	trans-1,3-dichloropropene	5.1	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB5B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-041-1/4
Sample Volume :	3.19	Lab File ID :	A43771.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	63.33	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	41		
79-34-5	1,1,2,2-Tetrachloroethane	21	U	
79-00-5	1,1,2-Trichloroethane	21	U	
75-34-3	1,1-Dichloroethane	21	U	
75-35-4	1,1-Dichloroethene	21	U	
107-06-2	1,2-Dichloroethane	21	U	
78-87-5	1,2-Dichloropropane	21	U	
78-93-3	2-Butanone	43	U	R
591-78-6	2-Hexanone	18	J	J
108-10-1	4-Methyl-2-Pentanone	61		J
67-64-1	Acetone	67		B
71-43-2	Benzene	180		
75-27-4	Bromodichloromethane	21	U	
75-25-2	Bromoform	21	U	
74-83-9	Bromomethane	43	U	VL
75-15-0	Carbon Disulfide	21	U	VL
56-23-5	Carbon Tetrachloride	21	U	
108-90-7	Chlorobenzene	21	U	
75-00-3	Chloroethane	43	U	
67-66-3	Chloroform	21	U	
74-87-3	Chloromethane	43	U	
124-48-1	Dibromochloromethane	21	U	
100-41-4	Ethylbenzene	24		
75-09-2	Methylene Chloride	8.5	JB	B
100-42-5	Styrene	21	U	
127-18-4	Tetrachloroethylene	9.3	J	J
108-88-3	Toluene	2100	E	R
79-01-6	Trichloroethene	25		B
75-01-4	Vinyl Chloride	43	U	

GPL Laboratories

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GPL
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SAMPLE NO
51SB5B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-041-1/4
Sample Volume :	3.19	Lab File ID :	A43771.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	63.33	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	21	U
10061-01-5	cis-1,3-Dichloropropene	21	U
136777-61-2	m,p-Xylenes	70	
95-47-6	o-Xylene	20	J
156-60-5	trans-1,2-dichloroethene	21	U
10061-02-6	trans-1,3-dichloropropene	21	U

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GPL Laboratories

GPL
FORM 1
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SAMPLE NO
51SB5BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404021
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-042-2/4DL
Sample Volume :	3.58	Lab File ID :	A43805.D
Level :	Low	Date Received	04/02/2004
% Moisture: not dec	63.33	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	140
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	1900	U	
79-34-5	1,1,2,2-Tetrachloroethane	1900	U	
79-00-5	1,1,2-Trichloroethane	1900	U	
75-34-3	1,1-Dichloroethane	1900	U	
75-35-4	1,1-Dichloroethene	1900	U	UL
107-06-2	1,2-Dichloroethane	1900	U	
78-87-5	1,2-Dichloropropane	1900	U	
78-93-3	2-Butanone	3800	U	R
591-78-6	2-Hexanone	3800	U	
108-10-1	4-Methyl-2-Pentanone	3800	U	UL
67-64-1	Acetone	3800	U	UL
71-43-2	Benzene	1900	U	
75-27-4	Bromodichloromethane	1900	U	
75-25-2	Bromoform	1900	U	
74-83-9	Bromomethane	3800	U	UJ
75-15-0	Carbon Disulfide	1900	U	UL
56-23-5	Carbon Tetrachloride	1900	U	
108-90-7	Chlorobenzene	1900	U	
75-00-3	Chloroethane	3800	U	
67-66-3	Chloroform	1900	U	
74-87-3	Chloromethane	3800	U	
124-48-1	Dibromochloromethane	1900	U	
100-41-4	Ethylbenzene	1900	U	
75-09-2	Methylene Chloride	3800	U	
100-42-5	Styrene	1900	U	
127-18-4	Tetrachloroethylene	1900	U	
108-88-3	Toluene	2900		B
79-01-6	Trichloroethene	1900	U	
75-01-4	Vinyl Chloride	3800	U	

GPL Laboratories

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SAMPLE NO
51SB5BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404021
Case No.:		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-006-042-2/4DL
Sample Volume :	3.58	Lab File ID :	A43805.D
Level :	Low	Date Received	04/02/2004
% Moisture: not dec	63.33	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	140
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	1900	U
10061-01-5	cis-1,3-Dichloropropene	1900	U
136777-61-2	m,p-Xylenes	1900	U
95-47-6	o-Xylene	1900	U
156-60-5	trans-1,2-dichloroethene	1900	U
10061-02-6	trans-1,3-dichloropropene	1900	U

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GPL
FORM 1
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SAMPLE NO
51SB5C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-049-1/4
Sample Volume :	5.02	Lab File ID :	A43772.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	7.73	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.4	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.4	U	
79-00-5	1,1,2-Trichloroethane	5.4	U	
75-34-3	1,1-Dichloroethane	5.4	U	
75-35-4	1,1-Dichloroethene	5.4	U	
107-06-2	1,2-Dichloroethane	5.4	U	
78-87-5	1,2-Dichloropropane	5.4	U	
78-93-3	2-Butanone	11	U	R
591-78-6	2-Hexanone	11	U	UL
108-10-1	4-Methyl-2-Pentanone	4.4	J	J
67-64-1	Acetone	15		B
71-43-2	Benzene	5.4	U	
75-27-4	Bromodichloromethane	5.4	U	
75-25-2	Bromoform	5.4	U	
74-83-9	Bromomethane	11	U	UL
75-15-0	Carbon Disulfide	5.4	U	UL
56-23-5	Carbon Tetrachloride	5.4	U	
108-90-7	Chlorobenzene	5.4	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.4	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.4	U	
100-41-4	Ethylbenzene	5.4	U	
75-09-2	Methylene Chloride	11	U	
100-42-5	Styrene	5.4	U	
127-18-4	Tetrachloroethylene	5.4	U	
108-88-3	Toluene	5.4	U	
79-01-6	Trichloroethene	5.4	U	
75-01-4	Vinyl Chloride	11	U	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB5C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-007-049-1/4
Sample Volume :	5.02	Lab File ID :	A43772.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	7.73	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.4	U
10061-01-5	cis-1,3-Dichloropropene	5.4	U
136777-61-2	m,p-Xylenes	5.4	U
95-47-6	o-Xylene	5.4	U
156-60-5	trans-1,2-dichloroethene	5.4	U
10061-02-6	trans-1,3-dichloropropene	5.4	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-057-1/4
Sample Volume :	5.56	Lab File ID :	A43773.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	21.32	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.7	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.7	U	
79-00-5	1,1,2-Trichloroethane	5.7	U	
75-34-3	1,1-Dichloroethane	5.7	U	
75-35-4	1,1-Dichloroethene	5.7	U	
107-06-2	1,2-Dichloroethane	5.7	U	
78-87-5	1,2-Dichloropropane	5.7	U	
78-93-3	2-Butanone	11	U	R
591-78-6	2-Hexanone	11	U	VL
108-10-1	4-Methyl-2-Pentanone	11	U	VL
67-64-1	Acetone	5.7	J	B
71-43-2	Benzene	5.7	U	
75-27-4	Bromodichloromethane	5.7	U	
75-25-2	Bromoform	5.7	U	
74-83-9	Bromomethane	11	U	VL
75-15-0	Carbon Disulfide	5.7	U	VL
56-23-5	Carbon Tetrachloride	5.7	U	
108-90-7	Chlorobenzene	5.7	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.7	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.7	U	
100-41-4	Ethylbenzene	5.7	U	
75-09-2	Methylene Chloride	11	U	
100-42-5	Styrene	5.7	U	
127-18-4	Tetrachloroethylene	5.7	U	
108-88-3	Toluene	5.7	U	
79-01-6	Trichloroethene	5.7	U	
75-01-4	Vinyl Chloride	11	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-008-057-1/4
Sample Volume :	5.56	Lab File ID :	A43773.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	21.32	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.7	U
10061-01-5	cis-1,3-Dichloropropene	5.7	U
136777-61-2	m,p-Xylenes	5.7	U
95-47-6	o-Xylene	5.7	U
156-60-5	trans-1,2-dichloroethene	5.7	U
10061-02-6	trans-1,3-dichloropropene	5.7	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-065-1/4
Sample Volume :	5.73	Lab File ID :	A43774.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	17.78	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.3	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.3	U	
79-00-5	1,1,2-Trichloroethane	5.3	U	
75-34-3	1,1-Dichloroethane	5.3	U	
75-35-4	1,1-Dichloroethene	5.3	U	
107-06-2	1,2-Dichloroethane	5.3	U	
78-87-5	1,2-Dichloropropane	5.3	U	
78-93-3	2-Butanone	11	U	R
591-78-6	2-Hexanone	11	U	VL
108-10-1	4-Methyl-2-Pentanone	11	U	VL
67-64-1	Acetone	11	U	
71-43-2	Benzene	5.3	U	
75-27-4	Bromodichloromethane	5.3	U	
75-25-2	Bromoform	5.3	U	
74-83-9	Bromomethane	11	U	VL
75-15-0	Carbon Disulfide	5.3	U	VL
56-23-5	Carbon Tetrachloride	5.3	U	
108-90-7	Chlorobenzene	5.3	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.3	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.3	U	
100-41-4	Ethylbenzene	5.3	U	
75-09-2	Methylene Chloride	11	U	
100-42-5	Styrene	5.3	U	
127-18-4	Tetrachloroethylene	5.3	U	
108-88-3	Toluene	5.3	U	
79-01-6	Trichloroethene	5.3	U	
75-01-4	Vinyl Chloride	11	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB5D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-009-065-1/4
Sample Volume :	5.73	Lab File ID :	A43774.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	17.78	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.3	U
10061-01-5	cis-1,3-Dichloropropene	5.3	U
136777-61-2	m,p-Xylenes	5.3	U
95-47-6	o-Xylene	5.3	U
156-60-5	trans-1,2-dichloroethene	5.3	U
10061-02-6	trans-1,3-dichloropropene	5.3	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-010-073-1/4
Sample Volume :	6.45	Lab File ID :	A43775.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	15.33	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.6	U	
79-34-5	1,1,2,2-Tetrachloroethane	4.6	U	
79-00-5	1,1,2-Trichloroethane	4.6	U	
75-34-3	1,1-Dichloroethane	4.6	U	
75-35-4	1,1-Dichloroethene	4.6	U	
107-06-2	1,2-Dichloroethane	4.6	U	
78-87-5	1,2-Dichloropropane	4.6	U	
78-93-3	2-Butanone	9.2	U	R
591-78-6	2-Hexanone	9.2	U	VL
108-10-1	4-Methyl-2-Pentanone	9.2	U	VL
67-64-1	Acetone	30		B
71-43-2	Benzene	4.6	U	
75-27-4	Bromodichloromethane	4.6	U	
75-25-2	Bromoform	4.6	U	
74-83-9	Bromomethane	9.2	U	VL
75-15-0	Carbon Disulfide	4.6	U	VL
56-23-5	Carbon Tetrachloride	4.6	U	
108-90-7	Chlorobenzene	4.6	U	
75-00-3	Chloroethane	9.2	U	
67-66-3	Chloroform	4.6	U	
74-87-3	Chloromethane	9.2	U	
124-48-1	Dibromochloromethane	4.6	U	
100-41-4	Ethylbenzene	4.6	U	
75-09-2	Methylene Chloride	9.2	U	
100-42-5	Styrene	4.6	U	
127-18-4	Tetrachloroethylene	4.6	U	
108-88-3	Toluene	4.6	U	
79-01-6	Trichloroethene	4.6	U	
75-01-4	Vinyl Chloride	9.2	U	

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GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-010-073-1/4
Sample Volume :	6.45	Lab File ID :	A43775.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	15.33	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	4.6	U
10061-01-5	cis-1,3-Dichloropropene	4.6	U
136777-61-2	m,p-Xylenes	4.6	U
95-47-6	o-Xylene	4.6	U
156-60-5	trans-1,2-dichloroethene	4.6	U
10061-02-6	trans-1,3-dichloropropene	4.6	U

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FORM 1
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SAMPLE NO
51SB10B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404021
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-011-082-2/4
Sample Volume :	5.62	Lab File ID :	A43803.D
Level :	Low	Date Received	04/02/2004
% Moisture: not dec	11.88	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.0	U	UJ
79-34-5	1,1,2,2-Tetrachloroethane	5.0	U	UJ
79-00-5	1,1,2-Trichloroethane	5.0	U	UJ
75-34-3	1,1-Dichloroethane	5.0	U	UJ
75-35-4	1,1-Dichloroethene	5.0	U	UJ
107-06-2	1,2-Dichloroethane	5.0	U	UJ
78-87-5	1,2-Dichloropropane	5.0	U	UJ
78-93-3	2-Butanone	10	U	R
591-78-6	2-Hexanone	10	U	UJ
108-10-1	4-Methyl-2-Pentanone	10	U	UJ
67-64-1	Acetone	13	B	B
71-43-2	Benzene	5.0	U	UJ
75-27-4	Bromodichloromethane	5.0	U	UJ
75-25-2	Bromoform	5.0	U	UJ
74-83-9	Bromomethane	10	U	UJ
75-15-0	Carbon Disulfide	5.0	U	UJ
56-23-5	Carbon Tetrachloride	5.0	U	UJ
108-90-7	Chlorobenzene	5.0	U	UJ
75-00-3	Chloroethane	10	U	UJ
67-66-3	Chloroform	5.0	U	UJ
74-87-3	Chloromethane	10	U	UJ
124-48-1	Dibromochloromethane	5.0	U	UJ
100-41-4	Ethylbenzene	5.0	U	UJ
75-09-2	Methylene Chloride	2.6	JB	B
100-42-5	Styrene	5.0	U	UJ
127-18-4	Tetrachloroethylene	5.0	U	UJ
108-88-3	Toluene	1.4	J	B
79-01-6	Trichloroethene	5.0	U	UJ
75-01-4	Vinyl Chloride	10	U	UJ

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB10B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404021
Case No. :		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-011-082-2/4
Sample Volume :	5.62	Lab File ID :	A43803.D
Level :	Low	Date Received	04/02/2004
% Moisture: not dec	11.88	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
156-59-2	cis-1,2-Dichloroethene	5.0	U	UJ
10061-01-5	cis-1,3-Dichloropropene	5.0	U	UJ
136777-61-2	m,p-Xylenes	5.0	U	UJ
95-47-6	o-Xylene	5.0	U	UJ
156-60-5	trans-1,2-dichloroethene	5.0	U	UJ
10061-02-6	trans-1,3-dichloropropene	5.0	U	UJ

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-012-089-1/4
Sample Volume :	5.85	Lab File ID :	A43777.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	13.61	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.9	U	
79-34-5	1,1,2,2-Tetrachloroethane	4.9	U	
79-00-5	1,1,2-Trichloroethane	4.9	U	
75-34-3	1,1-Dichloroethane	4.9	U	
75-35-4	1,1-Dichloroethene	4.9	U	
107-06-2	1,2-Dichloroethane	4.9	U	
78-87-5	1,2-Dichloropropane	4.9	U	
78-93-3	2-Butanone	9.9	U	R
591-78-6	2-Hexanone	9.9	U	VL
108-10-1	4-Methyl-2-Pentanone	9.9	U	VL
67-64-1	Acetone	9.9	U	
71-43-2	Benzene	4.9	U	
75-27-4	Bromodichloromethane	4.9	U	
75-25-2	Bromoform	4.9	U	
74-83-9	Bromomethane	9.9	U	VL
75-15-0	Carbon Disulfide	4.9	U	VL
56-23-5	Carbon Tetrachloride	4.9	U	
108-90-7	Chlorobenzene	4.9	U	
75-00-3	Chloroethane	9.9	U	
67-66-3	Chloroform	4.9	U	
74-87-3	Chloromethane	9.9	U	
124-48-1	Dibromochloromethane	4.9	U	
100-41-4	Ethylbenzene	4.9	U	
75-09-2	Methylene Chloride	9.9	U	
100-42-5	Styrene	4.9	U	
127-18-4	Tetrachloroethylene	4.9	U	
108-88-3	Toluene	4.9	U	
79-01-6	Trichloroethene	4.9	U	
75-01-4	Vinyl Chloride	9.9	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB10C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	404021
Case No.		SDG NO :	404021
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404021-012-089-1/4
Sample Volume :	5.85	Lab File ID :	A43777.D
Level	Low	Date Received	04/02/2004
% Moisture: not dec	13.61	Date Analyzed	04/13/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume	(µ L)

Concentration Units (mg/L or mg/kg dry weight ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	4.9	U
10061-01-5	cis-1,3-Dichloropropene	4.9	U
136777-61-2	m,p-Xylenes	4.9	U
95-47-6	o-Xylene	4.9	U
156-60-5	trans-1,2-dichloroethene	4.9	U
10061-02-6	trans-1,3-dichloropropene	4.9	U

Shaw Environmental, Inc.

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Explosives
GPL Laboratories, Inc., SDG 404027

DATE: June 15, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. Samples were analyzed for explosives using USEPA SW-846 8330. A total of four soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB8A	404027-001	51SB8C	404027-003
51SB8B	404027-002	TMSB8A	404027-004

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
X		Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/15/04

Date

RFAAP VALIDATION REPORT
EXPLOSIVES REVIEW
SDG 404027

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For explosives soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 3.0°C and at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/07/04, and analyzed for explosives on 04/11/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for explosive target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/11/04	BLK65795	All target compounds < MRL	NA	NA	None
04/16/04	040204R	All target compounds < MRL	NA	NA	None

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 02/27-28/04 on instrument LCD, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/12/04 @22:51 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/13/04 @09:44 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/16/04 @18:35 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/17/04 @06:33 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/10/04 @18:27 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/11/04 @07:09 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this continuing calibration.

- For continuing calibration performed on 04/11/04 @19:50 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- All criteria were met. No qualifiers were applied.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for explosives are 60-120% (40-150% for sporadic marginal failures (SMF)).

- Sample BKS65795 was used as LCS for explosives analyzed on 04/13/04. Compounds 2,4,6-trinitrotoluene (73%), 4-amino-2,6-dinitrotoluene (127%), and tetryl (50%) were outside lab and/or USACE criteria and within SMF criteria. Since less than 3 compounds were outside USACE criteria and within SMF criteria, no qualifiers were applied based upon these outliers. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for explosives are 50-140%; RPD ≤ 50% (40-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB8B (404027-002) was performed as MS/MSD for explosives. Compounds 2,4-dinitrotoluene (111%) and 4-amino-2,6-dinitrotoluene (133%) were outside laboratory criteria, however within USACE criteria and within SMF criteria. Since less than 3 compounds were outside USACE criteria (i.e. no compounds) and within SMF criteria, no qualifiers were applied based upon these outliers.

VIII-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB8A (404027-001) and TMSB8A (404027-004) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB8A	404027-001	2,4-Dinitrotoluene	0.060 J	0.12	66.7	J
51SB8A	404027-001	o-Nitrotoluene	0.25	1.0	120	J
51SB8A	404027-001	p-Nitrotoluene	0.15 J	0.74	133	J
51SB8A	404027-001	2,6-Dinitrotoluene	0.060 J	0.10 U	NA	None
51SB8A	404027-001	m-Nitrotoluene	0.11 J	0.20 U	NA	None
51SB8A	404027-001	Nitrobenzene	0.040 J	0.10 U	NA	None

J = Estimated value.

IX-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D. The explosives for SW-846 method 8330 were air-dried prior to analysis because RDX and HMX are water soluble and moisture in the soil could affect the results.

- For sample 51SB8A (404027-001), compounds 4-nitrotoluene and 2-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB8B (404027-002), compounds 1,3,5-trinitrobenzene, 2,6-dinitrotoluene, RDX, 1,3-dinitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB8C (404027-003), compounds 1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, 2,6-dinitrotoluene, 4-nitrotoluene, RDX, and 2-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample TMSB8A (404027-004), compounds 2,6-dinitrotoluene, 4-nitrotoluene, nitrobenzene, 2-nitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

Sample: 51SB8A (404027-001), 2,4-dinitrotoluene

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D * 1000)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (2889101 * 20 * 1) / (521800 * 2 * 1 * 1000) = 0.055 mg/kg
Reported Value = 0.060 mg/kg
% Difference = 9.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-001-006-1/1
Sample Volume :	2	Lab File ID :	LCD23312.D
% Moisture:		Date Received	04/03/2004
Extraction:	EXT_SW8330	Date Extracted:	04/07/2004
Extract Volume:	20 mL	Date Analyzed	04/11/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.10	U	
121-14-2	2,4-Dinitrotoluene	0.060	J	J
606-20-2	2,6-Dinitrotoluene	0.10	U	
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	0.20	U	
88-72-2	o-Nitrotoluene	0.25		J
99-99-0	p-Nitrotoluene	0.15	J	J

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB8B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-002-007-1/2
Sample Volume :	2	Lab File ID :	LCD23313.D
% Moisture:		Date Received	04/03/2004
Extraction:	EXT_SW8330	Date Extracted:	04/07/2004
Extract Volume:	20 mL	Date Analyzed	04/11/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.14		J
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.070	J	J
121-14-2	2,4-Dinitrotoluene	0.040	J	J
606-20-2	2,6-Dinitrotoluene	0.10	U	
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	0.20	U	
88-72-2	o-Nitrotoluene	0.21		
99-99-0	p-Nitrotoluene	0.19	J	J

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SAMPLE NO
51SB8C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-003-009-1/1
Sample Volume :	2	Lab File ID :	LCD23316.D
% Moisture:		Date Received	04/03/2004
Extraction:	EXT_SW8330	Date Extracted:	04/07/2004
Extract Volume:	20 mL	Date Analyzed	04/11/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	6.0		J
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	1.2		J
121-14-2	2,4-Dinitrotoluene	4.3		
606-20-2	2,6-Dinitrotoluene	2.2		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	4.4		J
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	0.20	U	
88-72-2	o-Nitrotoluene	0.17	J	J
99-99-0	p-Nitrotoluene	0.24		J

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SAMPLE NO
TMSB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-004-010-1/1
Sample Volume :	2	Lab File ID :	LCD23317.D
% Moisture:		Date Received	04/03/2004
Extraction:	EXT_SW8330	Date Extracted:	04/07/2004
Extract Volume:	20 mL	Date Analyzed	04/11/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.10	U	
121-14-2	2,4-Dinitrotoluene	0.12		J
606-20-2	2,6-Dinitrotoluene	0.060	J	J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.040	J	J
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	0.11	J	J
88-72-2	o-Nitrotoluene	1.0		J
99-99-0	p-Nitrotoluene	0.74	.	J

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ANALYSIS DATA SHEET

SAMPLE NO
040204R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404027
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404027-005-039-1/2
Sample Volume :	770	Lab File ID :	LCD23444.D
% Moisture:		Date Received	04/03/2004
Extraction:	EXT_SW8330	Date Extracted:	04/09/2004
Extract Volume:	20 mL	Date Analyzed	04/16/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
99-35-4	1,3,5-Trinitrobenzene	0.26	U
99-65-0	1,3-Dinitrobenzene	0.26	U
118-96-7	2,4,6-Trinitrotoluene	0.26	U
121-14-2	2,4-Dinitrotoluene	0.26	U
606-20-2	2,6-Dinitrotoluene	0.26	U
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.26	U
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.26	U
2691-41-0	HMX	0.52	U
98-95-3	Nitrobenzene	0.26	U
121-82-4	RDX	0.52	U
479-45-8	Tetryl	0.52	U
99-08-1	m-Nitrotoluene	0.52	U
88-72-2	o-Nitrotoluene	0.52	U
99-99-0	p-Nitrotoluene	0.52	U

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I
RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Nitroglycerine
GPL Laboratories, Inc., SDG 404027

DATE: June 15, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. Samples were analyzed for nitroglycerine using USEPA SW-846 8332. A total of four soil samples were validated. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB8A	404027-001	51SB8C	404027-003
51SB8B	404027-002	TMSB8A	404027-004

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable.

Eric Malarek, Chemist

6/15/04
Date

RFAAP VALIDATION REPORT
NITROGLYCERINE REVIEW
SDG 404027

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For nitroglycerine soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 3.0°C and at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/07/04, and analyzed for nitroglycerine on 04/15/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.20). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/15/04	BLK65794	All target compounds < MRL	NA	NA	None
04/15/04	040204R	All target compounds < MRL	NA	NA	None

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 04/15/04 on instrument HPLC-E, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/15/04 @16:43 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @19:56 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @20:37 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/16/04 @01:19 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- All criteria were met. No qualifiers were applied.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for nitroglycerine are 60-120%.

- Sample BKS65794 was used as LCS for nitroglycerine analyzed on 04/15/04. All criteria were met. No qualifiers were applied. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for nitroglycerine are 50-140%; RPD ≤ 50%.

- Sample 51SB8B (404027-002) was performed as MS/MSD for nitroglycerine. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB8A (404027-001) and TMSB8A (404027-004) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB8A	404027-001	Nitroglycerine	5.9 U	5.9 U	NA	None

U = Value non-detect at MRL.
NA = Not Applicable.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004), nitroglycerine was non-detect. All criteria were met. No qualifiers were applied.

Sample: 51SB8BMS (404027-002MS), nitroglycerine

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (25687764 * 20 * 1) / (2542000 * 4 * 0.8911) = 57 mg/kg
Reported Value = 57 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I Corp

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-001-006-1/1
Sample Volume :	4	Lab File ID :	LCE0710.D
% Moisture:	15.14	Date Received	04/03/2004
Extraction:	EXT_8332	Date Extracte	04/07/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.9	U

GPL Laboratories

Form I Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-002-007-1/2
Sample Volume :	4	Lab File ID :	LCE0711.D
% Moisture:	10.89	Date Received	04/03/2004
Extraction:	EXT_8332	Date Extracte	04/07/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.6	U

GPL Laboratories

Form I Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-003-009-1/1
Sample Volume :	4	Lab File ID :	LCE0714.D
% Moisture:	25.56	Date Received	04/03/2004
Extraction:	EXT_8332	Date Extracte	04/07/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.7	U

Form I Cxy

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-004-010-1/1
Sample Volume :	4	Lab File ID :	LCE0715.D
% Moisture:	15.05	Date Received	04/03/2004
Extraction:	EXT_8332	Date Extracte	04/07/2004
Extract Volume	20 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.9	U

GPL Laboratories

Form 1 Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040204R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404027-005-039-1/2
Sample Volume :	1	Lab File ID :	LCE0719.D
% Moisture:		Date Received	04/03/2004
Extraction:	SW8332	Date Extracte	
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	1000	U

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – PAHs
GPL Laboratories, Inc., SDG 404027

DATE: June 14, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. Samples were analyzed for polynuclear aromatic hydrocarbons (PAHs) using USEPA SW846 Methods 3540C/8270C low level. A total of four soil samples were validated. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB8A	404027-001	51SB8C	404027-003
51SB8B	404027-002	TMSB8A	404027-004

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	Surrogate Spikes
	X	Internal Standards
	X	Laboratory Control Standard
X		Matrix Spike/Spike Duplicate
X		Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/14/04

Date

RFAAP VALIDATION REPORT
POLYNUCLEAR AROMATIC HYDROCARBONS REVIEW
SDG 404027

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For polynuclear aromatic hydrocarbons (PAHs) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 3.0°C and at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/08/04, and analyzed for PAHs on 04/12/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for PAH compounds by GC/MS low level. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for the PAHs by USEPA SW-846 8270C low level was performed on 04/12/04 on instrument HP#H. All RRFs were ≥ 0.05. All criteria were met for the target compounds. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be ≥ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within ± 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the PAHs by USEPA SW-846 8270C low level performed on 04/13/04 @16:18 on instrument HP#H, all target compounds were within criteria. No qualifiers were applied. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to his continuing calibration.

V-Blank Analysis
The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 26.8). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/12/04	BLK65817	All compounds < MRL	NA	NA	None
04/12/04	040204R	Naphthalene	24.3	122	None

VI-Surrogate Spikes
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria: Nitrobenzene-d5 (36-164%) – S1 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (54-124%) – S2 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (56-150%) – S3 (USACE Shell Criteria: 45-135%)

- For samples 51SB8A (404027-001), surrogate terphenyl – d14 (163%) was above lab and USACE criteria, respectively. Since the remaining two surrogates were within criteria, no qualifiers were applied based upon this outlier. For all other samples, surrogates were within criteria. No qualifiers were applied.

VII-Internal Standards
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for PAHs by 8270C low level are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65817 was used as the LCS for PAHs by USEPA SW-846 8270C low level. All criteria were met. No qualifiers were applied. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB8B (404027-002) was used for the MS/MSD analysis for PAHs and was analyzed in SDG 404027. Compounds anthracene (RPD=42%), fluoranthene (RPD=41%), and phenanthrene (RPD=42%) were outside lab criteria. Three compounds were outside USACE criteria and within SMF criteria. All detects were qualified "J" estimated for the spiked sample and non-detects no qualifier based upon these outliers.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB8A (404027-001) and TMSB8A (404027-004) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. For where the original result >2 MRL and duplicate pair non-detect, both samples were qualified as estimated.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB8A	404027-001	Benzo(a)anthracene	36	7.9 U	NA	J, UJ
51SB8A	404027-001	Benzo(a)pyrene	13	7.9 U	NA	J, UJ
51SB8A	404027-001	Benzo(b)fluoranthene	54	7.9 U	NA	J, UJ
51SB8A	404027-001	Benzo(g,h,i)perylene	48	7.9 U	NA	J, UJ
51SB8A	404027-001	Benzo(k)fluoranthene	70	7.9 U	NA	J, UJ
51SB8A	404027-001	Chrysene	75	7.9 U	NA	J, UJ
51SB8A	404027-001	Dibenz(a,h)Anthracene	85	7.9 U	NA	J, UJ
51SB8A	404027-001	Fluoranthene	20	15	28.6	None
51SB8A	404027-001	Indeno(1,2,3-c,d)Pyrene	59	7.9 U	NA	J, UJ
51SB8A	404027-001	Phenanthrene	11	15	30.8	None
51SB8A	404027-001	Pyrene	18	9.0	66.7	J

J = Estimated value.
U = Value non-detect at MRL.
NA = Not Applicable

XI-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB8A (404027-001), phenanthrene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Is = Amount of internal standard injected (ng).
Vt = Volume of total extract (µL).
Ais = Area of characteristic ion for the internal standard.
RRF = Average relative response factor for compound being measured (from ICAL)
Vi = Volume of extract injected (µL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (141576 * 4 * 1000 * 1) / (2204649 * 0.880 * 1 * 30 * 0.8486) = 11 µg/kg
Reported Value = 11 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

GPL Laboratories

Form I Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-001-001-1/1
Sample Volume :	30	Lab File ID :	H25627.D
% Moisture:	15.14	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/12/2004
Injection Volume :	µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
91-57-6	2-Methylnaphthalene	7.9	U	
83-32-9	Acenaphthene	7.9	U	
208-96-8	Acenaphthylene	7.9	U	
120-12-7	Anthracene	7.9	U	
56-55-3	Benzo(a)anthracene	36		J
50-32-8	Benzo(a)pyrene	13		J
205-99-2	Benzo(b)fluoranthene	54		J
191-24-2	Benzo(g,h,i)perylene	48		J
207-08-9	Benzo(k)fluoranthene	70		J
218-01-9	Chrysene	75		J
53-70-3	Dibenz(a,h)Anthracene	85		J
206-44-0	Fluoranthene	20		
86-73-7	Fluorene	7.9	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	59		J
91-20-3	Naphthalene	7.9	U	
85-01-8	Phenanthrene	11		
129-00-0	Pyrene	18		J

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-002-002-1/2
Sample Volume :	30	Lab File ID :	H25628.D
% Moisture:	10.89	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/12/2004
Injection Volume :	µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.5	U
83-32-9	Acenaphthene	7.5	U
208-96-8	Acenaphthylene	7.5	U
120-12-7	Anthracene	7.5	U
56-55-3	Benzo(a)anthracene	7.5	U
50-32-8	Benzo(a)pyrene	7.5	U
205-99-2	Benzo(b)fluoranthene	7.5	U
191-24-2	Benzo(g,h,i)perylene	7.5	U
207-08-9	Benzo(k)fluoranthene	7.5	U
218-01-9	Chrysene	7.5	U
53-70-3	Dibenz(a,h)Anthracene	7.5	U
206-44-0	Fluoranthene	7.5	U
86-73-7	Fluorene	7.5	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.5	U
91-20-3	Naphthalene	7.5	U
85-01-8	Phenanthrene	9.0	J
129-00-0	Pyrene	7.5	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-003-004-1/1
Sample Volume :	30	Lab File ID :	H25631.D
% Moisture:	25.56	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/12/2004
Injection Volume :	µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	9.0	U
83-32-9	Acenaphthene	9.0	U
208-96-8	Acenaphthylene	9.0	U
120-12-7	Anthracene	9.0	U
56-55-3	Benzo(a)anthracene	9.0	U
50-32-8	Benzo(a)pyrene	9.0	U
205-99-2	Benzo(b)fluoranthene	9.0	U
191-24-2	Benzo(g,h,i)perylene	9.0	U
207-08-9	Benzo(k)fluoranthene	9.0	U
218-01-9	Chrysene	9.0	U
53-70-3	Dibenz(a,h)Anthracene	9.0	U
206-44-0	Fluoranthene	9.0	U
86-73-7	Fluorene	9.0	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	9.0	U
91-20-3	Naphthalene	9.0	U
85-01-8	Phenanthrene	9.0	U
129-00-0	Pyrene	9.0	U

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ANALYSIS DATA SHEET

SAMPLE NO
TMSB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-004-005-1/1
Sample Volume :	30	Lab File ID :	H25632.D
% Moisture:	15.05	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/08/2004
Extract Volume	1 mL	Date Analyzed	04/12/2004
Injection Volume :	µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
91-57-6	2-Methylnaphthalene	7.9	U	
83-32-9	Acenaphthene	7.9	U	
208-96-8	Acenaphthylene	7.9	U	
120-12-7	Anthracene	7.9	U	
56-55-3	Benzo(a)anthracene	7.9	U	UJ
50-32-8	Benzo(a)pyrene	7.9	U	UJ
205-99-2	Benzo(b)fluoranthene	7.9	U	UJ
191-24-2	Benzo(g,h,i)perylene	7.9	U	UJ
207-08-9	Benzo(k)fluoranthene	7.9	U	UJ
218-01-9	Chrysene	7.9	U	UJ
53-70-3	Dibenz(a,h)Anthracene	7.9	U	UJ
206-44-0	Fluoranthene	15		
86-73-7	Fluorene	7.9	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.9	U	UJ
91-20-3	Naphthalene	7.9	U	
85-01-8	Phenanthrene	15		
129-00-0	Pyrene	9.0		J

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040204R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404027-005-037-1/2
Sample Volume :	770	Lab File ID :	H25624.D
% Moisture:		Date Received	04/03/2004
Extraction:	SW3520C-LL	Date Extracte	04/07/2004
Extract Volume	1 mL	Date Analyzed	04/12/2004
Injection Volume :	µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	0.26	U
83-32-9	Acenaphthene	0.26	U
208-96-8	Acenaphthylene	0.26	U
120-12-7	Anthracene	0.26	U
56-55-3	Benzo(a)anthracene	0.26	U
50-32-8	Benzo(a)pyrene	0.26	U
205-99-2	Benzo(b)fluoranthene	0.26	U
191-24-2	Benzo(g,h,i)perylene	0.26	U
207-08-9	Benzo(k)fluoranthene	0.26	U
218-01-9	Chrysene	0.26	U
53-70-3	Dibenz(a,h)Anthracene	0.26	U
206-44-0	Fluoranthene	0.26	U
86-73-7	Fluorene	0.26	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	0.26	U
91-20-3	Naphthalene	0.81	
85-01-8	Phenanthrene	0.26	U
129-00-0	Pyrene	0.26	U

Shaw Environmental, Inc.

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Pentaerythritol Tetranitrate GPL Laboratories, Inc., SDG 404027

DATE: June 15, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. Samples were analyzed for pentaerythritol tetranitrate (PETN) using USEPA SW-846 8330. A total of four soil samples were validated. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB8A	404027-001	51SB8C	404027-003
51SB8B	404027-002	TMSB8A	404027-004

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable.

Eric Malarek, Chemist

6/15/04

Date

RFAAP VALIDATION REPORT
PETN REVIEW
SDG 404027

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For PETN soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 3.0°C and at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/07/04, and analyzed for PETN on 04/12/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/12/04	BLK65796	All target compounds < MRL	NA	NA	None
04/12/04	040204R	All target compounds < MRL	NA	NA	None

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 03/03/04 on instrument LCC-UV, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/12/04 @15:16 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this continuing calibration.

- For continuing calibration performed on 04/12/04 @18:55 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples apply to this continuing calibration.

- For continuing calibration performed on 04/12/04 @21:49 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- All criteria were met. No qualifiers were applied.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for PETN are 60-120%.

- Sample BKS65796 was used as LCS for PETN analyzed on 04/13/04. All criteria were met. No qualifiers were applied. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for PETN are 50-140%; RPD ≤ 50%.

- Sample 51SB8B (404027-002) was performed as MS/MSD for PETN. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB8A (404027-001) and TMSB8A (404027-004) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB8A	404027-001	PETN	0.50 U	0.50 U	NA	None

U = Value non-detect at MRL.
NA = Not Applicable.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004), PETN was non-detect. All criteria were met. No qualifiers were applied.

Sample: 51SB8BMS (404027-002MS), PETN

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (32417597 * 20 * 1) / (162300 * 2 * 1 * 1000) = 2 mg/kg
Reported Value = 2 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-001-006-1/1
Sample Volume :	2	Lab File ID :	LC11003U.D
% Moisture:		Date Received	04/03/2004
Extraction:	EXT_SW8330	Date Extracte	04/07/2004
Extract Volume	20 mL	Date Analyzed	04/12/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB8B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-002-007-1/2
Sample Volume :	2	Lab File ID :	LC11004U.D
% Moisture:		Date Received	04/03/2004
Extraction:	EXT_SW8330	Date Extracte	04/07/2004
Extract Volume	20 mL	Date Analyzed	04/12/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM 1
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SAMPLE NO
51SB8C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-003-009-1/1
Sample Volume :	2	Lab File ID :	LC11007U.D
% Moisture:		Date Received	04/03/2004
Extraction:	EXT_SW8330	Date Extracte	04/07/2004
Extract Volume	20 mL	Date Analyzed	04/12/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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SAMPLE NO
TMSB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-004-010-1/1
Sample Volume :	2	Lab File ID :	LC11008U.D
% Moisture:		Date Received	04/03/2004
Extraction:	EXT_SW8330	Date Extracte	04/07/2004
Extract Volume	20 mL	Date Analyzed	04/12/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040204R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404027-005-039-1/2
Sample Volume :	770	Lab File ID :	LC11015U.D
% Moisture:		Date Received	04/03/2004
Extraction:	EXT_SW8330	Date Extracte	04/09/2004
Extract Volume	20 mL	Date Analyzed	04/12/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	1.3	U

Shaw Environmental, Inc.

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Edgewood, MD 21040-1037
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Semi-Volatiles
GPL Laboratories, Inc., SDG 404027

DATE: June 14, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. Samples were analyzed for semivolatile organic compounds (SVOCs) using USEPA SW846 Methods 3540C/8270C. A total of four soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB8A	404027-001	51SB8C	404027-003
51SB8B	404027-002	TMSB8A	404027-004

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
X		Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	Surrogate Spikes
	X	Internal Standards
	X	Laboratory Control Standard
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/14/04
Date

RFAAP VALIDATION REPORT
SEMIVOLATILES REVIEW
SDG 404027

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For semivolatile organic compound (SVOC) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 3.0°C and at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, extracted on 04/10/04, and analyzed for TCL SVOCs on 04/13/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for compounds on the semivolatile target compound list (TCL). Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for the TCL SVOCs was performed on 04/12/04 on instrument HP#D. Target compounds benzoic acid (38.2%; grossly exceeding), hexachlorocyclopentadiene (44.0%; grossly exceeding), 2,4-dinitrophenol (23.6%), 4-nitrophenol (21.5%), fluorene (17.4%), 4-chlorophenyl-phenylether (17.3%), 4-nitroaniline (16.1%), 3,3'-dichlorobenzidine (16.6%), benzo(b)fluoranthene (17.7%), and benzo(k)fluoranthene (17.9%) were outside criteria. All RRFs were ≥ 0.05. Compounds 2,4-dinitrophenol, 4-nitrophenol, fluorene, 4-chlorophenyl-phenylether, 4-nitroaniline, 3,3'-dichlorobenzidine, benzo(b)fluoranthene, and benzo(k)fluoranthene were qualified estimated "J" for detects and no qualifier for non-detects for the high %RSDs. For compounds benzoic acid and hexachlorocyclopentadiene, all detects were qualified estimated "J" and non-detects "UJ" based upon the grossly exceeding %RSD. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be $\geq$ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within $\pm$ 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the TCL SVOCs performed on 04/12/04 @23:21 on instrument HP#D, target compound hexachlorocyclopentadiene (30.1%), pyrene (23.8%), 3,3'-dichlorobenzidine (22.5%), bis(2-ethylhexyl)phthalate (28.2%) and di-n-octylphthalate (20.8%) were outside criteria. All samples were non-detect for hexachlorocyclopentadiene, pyrene, 3,3'-dichlorobenzidine, bis(2-ethylhexyl)phthalate, and di-n-octylphthalate, therefore, no qualifiers were applied based upon these outliers. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is $\leq$ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 33). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/13/04	BLK65838	All compounds < MRL	NA	NA	None
04/13/04	040204R	Di-n-butyl phthalate	NA	NA	None

J = Estimated value <MRL and >MDL

VI-Surrogate Spikes

Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria: 2-Fluorophenol (31-125%) – S1 (USACE Shell Criteria: 35-140%)
Phenol – d5 (25-121%) – S2 (USACE Shell Criteria: 35-140%)
2,4,6-Tribromophenol (31-137%) – S3 (USACE Shell Criteria: 35-140%)
Nitrobenzene-d5 (29-117%) – S4 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (20-106%) – S5 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (26-160%) – S6 (USACE Shell Criteria: 45-135%)

- All criteria were met. No qualifiers were applied.

VII-Internal Standards
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for SVOCs are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65838 was used as the LCS for select SVOCs by USEPA SW-846 8270C. All criteria were met. No qualifiers were applied. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB8B (404027-002) was used for the MS/MSD analysis for select SVOCs. Phenol (114, 119%) was outside lab criteria. All samples were non-detect, therefore no qualifiers were applied based upon these outliers.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB8A (404027-001) and TMSB8A (404027-004) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB8A	404027-001	2,4-Dinitrotoluene	190 J	390 U	NA	None
51SB8A	404027-001	2,6-Dinitrotoluene	59 J	390 U	NA	None

J = Estimated value <MRL and >MDL.
U = Value non-detect at MRL.
NA = Not Applicable

XI-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB8A (404027-001), 2,4-dinitrotoluene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Is = Amount of internal standard injected (ng).
Vt = Volume of total extract (µL).
Ais = Area of characteristic ion for the internal standard.
RRF = Average relative response factor for compound being measured (from ICAL)
Vi = Volume of extract injected (µL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (21612 * 40 * 1000 * 1) / (335199 * 0.520 * 1 * 30 * 0.8486) = 190 µg/kg
Reported Value = 190 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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Form I Org

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-001-001-1/1
Sample Volume :	30	Lab File ID :	D33566.D
% Moisture:	15.14	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	390	U	
95-50-1	1,2-Dichlorobenzene	390	U	
541-73-1	1,3-Dichlorobenzene	390	U	
106-46-7	1,4-Dichlorobenzene	390	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	390	U	
95-95-4	2,4,5-Trichlorophenol	390	U	
88-06-2	2,4,6-Trichlorophenol	390	U	
120-83-2	2,4-Dichlorophenol	390	U	
105-67-9	2,4-Dimethylphenol	390	U	
51-28-5	2,4-Dinitrophenol	790	U	
121-14-2	2,4-Dinitrotoluene	190	J	J
606-20-2	2,6-Dinitrotoluene	59	J	J
91-58-7	2-Chloronaphthalene	390	U	
95-57-8	2-Chlorophenol	390	U	
91-57-6	2-Methylnaphthalene	390	U	
88-74-4	2-Nitroaniline	390	U	
88-75-5	2-Nitrophenol	390	U	
95-48-7	2-methylphenol	390	U	
91-94-1	3,3-Dichlorobenzidine	790	U	
99-09-2	3-Nitroaniline	390	U	
534-52-1	4,6-dinitro-2-methyl phenol	790	U	
101-55-3	4-Bromophenyl-phenylether	390	U	
106-47-8	4-Chloroaniline	390	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	390	U	
100-01-6	4-Nitroaniline	390	U	
100-02-7	4-Nitrophenol	790	U	
59-50-7	4-chloro-3-methylphenol	390	U	
106-44-5	4-methylphenol	390	U	
83-32-9	Acenaphthene	390	U	

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Form 1 GPL

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SAMPLE NO
51SB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-001-001-1/1
Sample Volume :	30	Lab File ID :	D33566.D
% Moisture:	15.14	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	390	U	
120-12-7	Anthracene	390	U	
56-55-3	Benzo(a)anthracene	390	U	
50-32-8	Benzo(a)pyrene	390	U	
205-99-2	Benzo(b)fluoranthene	390	U	
191-24-2	Benzo(g,h,i)perylene	390	U	
207-08-9	Benzo(k)fluoranthene	390	U	
65-85-0	Benzoic Acid	790	U	UJ
100-51-6	Benzyl Alcohol	390	U	
85-68-7	Benzyl Butyl Phthalate	390	U	
86-74-8	Carbazole	390	U	
218-01-9	Chrysene	390	U	
53-70-3	Dibenz(a,h)Anthracene	390	U	
132-64-9	Dibenzofuran	390	U	
84-66-2	Diethyl Phthalate	390	U	
131-11-3	Dimethyl Phthalate	390	U	
206-44-0	Fluoranthene	390	U	
86-73-7	Fluorene	390	U	
118-74-1	Hexachlorobenzene	390	U	
87-68-3	Hexachlorobutadiene	390	U	
77-47-4	Hexachlorocyclopentadiene	390	U	UJ
67-72-1	Hexachloroethane	390	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	390	U	
78-59-1	Isophorone	390	U	
91-20-3	Naphthalene	390	U	
98-95-3	Nitrobenzene	390	U	
87-86-5	Pentachlorophenol	790	U	
85-01-8	Phenanthrene	390	U	
108-95-2	Phenol	390	U	

Form I Com

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-001-001-1/1
Sample Volume :	30	Lab File ID :	D33566.D
% Moisture:	15.14	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	390	U
110-86-1	Pyridine	390	U
111-91-1	bis(2-chloroethoxy) methane	390	U
111-44-4	bis(2-chloroethyl) ether	390	U
117-81-7	bis(2-ethylhexyl) phthalate	390	U
84-74-2	di-n-Butyl Phthalate	390	U
117-84-0	di-n-Octyl Phthalate	390	U
621-64-7	n-Nitrosodi-n-Propylamine	390	U
86-30-6	n-Nitrosodiphenylamine	390	U

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Form 1 Corr

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-002-002-1/2
Sample Volume :	30	Lab File ID :	D33567.D
% Moisture:	10.89	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	370	U
95-50-1	1,2-Dichlorobenzene	370	U
541-73-1	1,3-Dichlorobenzene	370	U
106-46-7	1,4-Dichlorobenzene	370	U
108-60-1	2,2-Oxybis(1-Chloropropane)	370	U
95-95-4	2,4,5-Trichlorophenol	370	U
88-06-2	2,4,6-Trichlorophenol	370	U
120-83-2	2,4-Dichlorophenol	370	U
105-67-9	2,4-Dimethylphenol	370	U
51-28-5	2,4-Dinitrophenol	750	U
121-14-2	2,4-Dinitrotoluene	370	U
606-20-2	2,6-Dinitrotoluene	370	U
91-58-7	2-Chloronaphthalene	370	U
95-57-8	2-Chlorophenol	370	U
91-57-6	2-Methylnaphthalene	370	U
88-74-4	2-Nitroaniline	370	U
88-75-5	2-Nitrophenol	370	U
95-48-7	2-methylphenol	370	U
91-94-1	3,3-Dichlorobenzidine	750	U
99-09-2	3-Nitroaniline	370	U
534-52-1	4,6-dinitro-2-methyl phenol	750	U
101-55-3	4-Bromophenyl-phenylether	370	U
106-47-8	4-Chloroaniline	370	U
7005-72-3	4-Chlorophenyl Phenyl Ether	370	U
100-01-6	4-Nitroaniline	370	U
100-02-7	4-Nitrophenol	750	U
59-50-7	4-chloro-3-methylphenol	370	U
106-44-5	4-methylphenol	370	U
83-32-9	Acenaphthene	370	U

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-002-002-1/2
Sample Volume :	30	Lab File ID :	D33567.D
% Moisture:	10.89	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	370	U	
120-12-7	Anthracene	370	U	
56-55-3	Benzo(a)anthracene	370	U	
50-32-8	Benzo(a)pyrene	370	U	
205-99-2	Benzo(b)fluoranthene	370	U	
191-24-2	Benzo(g,h,i)perylene	370	U	
207-08-9	Benzo(k)fluoranthene	370	U	
65-85-0	Benzoic Acid	750	U	UJ
100-51-6	Benzyl Alcohol	370	U	
85-68-7	Benzyl Butyl Phthalate	370	U	
86-74-8	Carbazole	370	U	
218-01-9	Chrysene	370	U	
53-70-3	Dibenz(a,h)Anthracene	370	U	
132-64-9	Dibenzofuran	370	U	
84-66-2	Diethyl Phthalate	370	U	
131-11-3	Dimethyl Phthalate	370	U	
206-44-0	Fluoranthene	370	U	
86-73-7	Fluorene	370	U	
118-74-1	Hexachlorobenzene	370	U	
87-68-3	Hexachlorobutadiene	370	U	
77-47-4	Hexachlorocyclopentadiene	370	U	UJ
67-72-1	Hexachloroethane	370	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	370	U	
78-59-1	Isophorone	370	U	
91-20-3	Naphthalene	370	U	
98-95-3	Nitrobenzene	370	U	
87-86-5	Pentachlorophenol	750	U	
85-01-8	Phenanthrene	370	U	
108-95-2	Phenol	370	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-002-002-1/2
Sample Volume :	30	Lab File ID :	D33567.D
% Moisture:	10.89	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	370	U
110-86-1	Pyridine	370	U
111-91-1	bis(2-chloroethoxy) methane	370	U
111-44-4	bis(2-chloroethyl) ether	370	U
117-81-7	bis(2-ethylhexyl) phthalate	370	U
84-74-2	di-n-Butyl Phthalate	370	U
117-84-0	di-n-Octyl Phthalate	370	U
621-64-7	n-Nitrosodi-n-Propylamine	370	U
86-30-6	n-Nitrosodiphenylamine	370	U

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SAMPLE NO
51SB8C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-003-004-1/1
Sample Volume :	30	Lab File ID :	D33570.D
% Moisture:	25.56	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	450	U
95-50-1	1,2-Dichlorobenzene	450	U
541-73-1	1,3-Dichlorobenzene	450	U
106-46-7	1,4-Dichlorobenzene	450	U
108-60-1	2,2-Oxybis(1-Chloropropane)	450	U
95-95-4	2,4,5-Trichlorophenol	450	U
88-06-2	2,4,6-Trichlorophenol	450	U
120-83-2	2,4-Dichlorophenol	450	U
105-67-9	2,4-Dimethylphenol	450	U
51-28-5	2,4-Dinitrophenol	900	U
121-14-2	2,4-Dinitrotoluene	2500	
606-20-2	2,6-Dinitrotoluene	2300	
91-58-7	2-Chloronaphthalene	450	U
95-57-8	2-Chlorophenol	450	U
91-57-6	2-Methylnaphthalene	450	U
88-74-4	2-Nitroaniline	450	U
88-75-5	2-Nitrophenol	450	U
95-48-7	2-methylphenol	450	U
91-94-1	3,3-Dichlorobenzidine	900	U
99-09-2	3-Nitroaniline	450	U
534-52-1	4,6-dinitro-2-methyl phenol	900	U
101-55-3	4-Bromophenyl-phenylether	450	U
106-47-8	4-Chloroaniline	450	U
7005-72-3	4-Chlorophenyl Phenyl Ether	450	U
100-01-6	4-Nitroaniline	450	U
100-02-7	4-Nitrophenol	900	U
59-50-7	4-chloro-3-methylphenol	450	U
106-44-5	4-methylphenol	450	U
83-32-9	Acenaphthene	450	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-003-004-1/1
Sample Volume :	30	Lab File ID :	D33570.D
% Moisture:	25.56	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	450	U	
120-12-7	Anthracene	450	U	
56-55-3	Benzo(a)anthracene	450	U	
50-32-8	Benzo(a)pyrene	450	U	
205-99-2	Benzo(b)fluoranthene	450	U	
191-24-2	Benzo(g,h,i)perylene	450	U	
207-08-9	Benzo(k)fluoranthene	450	U	
65-85-0	Benzoic Acid	900	U	UJ
100-51-6	Benzyl Alcohol	450	U	
85-68-7	Benzyl Butyl Phthalate	450	U	
86-74-8	Carbazole	450	U	
218-01-9	Chrysene	450	U	
53-70-3	Dibenz(a,h)Anthracene	450	U	
132-64-9	Dibenzofuran	450	U	
84-66-2	Diethyl Phthalate	450	U	
131-11-3	Dimethyl Phthalate	450	U	
206-44-0	Fluoranthene	450	U	
86-73-7	Fluorene	450	U	
118-74-1	Hexachlorobenzene	450	U	
87-68-3	Hexachlorobutadiene	450	U	
77-47-4	Hexachlorocyclopentadiene	450	U	UJ
67-72-1	Hexachloroethane	450	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	450	U	
78-59-1	Isophorone	450	U	
91-20-3	Naphthalene	450	U	
98-95-3	Nitrobenzene	450	U	
87-86-5	Pentachlorophenol	900	U	
85-01-8	Phenanthrene	450	U	
108-95-2	Phenol	450	U	

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SAMPLE NO
51SB8C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-003-004-1/1
Sample Volume :	30	Lab File ID :	D33570.D
% Moisture:	25.56	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	450	U
110-86-1	Pyridine	450	U
111-91-1	bis(2-chloroethoxy) methane	450	U
111-44-4	bis(2-chloroethyl) ether	450	U
117-81-7	bis(2-ethylhexyl) phthalate	450	U
84-74-2	di-n-Butyl Phthalate	450	U
117-84-0	di-n-Octyl Phthalate	450	U
621-64-7	n-Nitrosodi-n-Propylamine	450	U
86-30-6	n-Nitrosodiphenylamine	450	U

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SAMPLE NO
TMSB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-004-005-1/1
Sample Volume :	30	Lab File ID :	D33571.D
% Moisture:	15.05	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	390	U
95-50-1	1,2-Dichlorobenzene	390	U
541-73-1	1,3-Dichlorobenzene	390	U
106-46-7	1,4-Dichlorobenzene	390	U
108-60-1	2,2-Oxybis(1-Chloropropane)	390	U
95-95-4	2,4,5-Trichlorophenol	390	U
88-06-2	2,4,6-Trichlorophenol	390	U
120-83-2	2,4-Dichlorophenol	390	U
105-67-9	2,4-Dimethylphenol	390	U
51-28-5	2,4-Dinitrophenol	790	U
121-14-2	2,4-Dinitrotoluene	390	U
606-20-2	2,6-Dinitrotoluene	390	U
91-58-7	2-Chloronaphthalene	390	U
95-57-8	2-Chlorophenol	390	U
91-57-6	2-Methylnaphthalene	390	U
88-74-4	2-Nitroaniline	390	U
88-75-5	2-Nitrophenol	390	U
95-48-7	2-methylphenol	390	U
91-94-1	3,3-Dichlorobenzidine	790	U
99-09-2	3-Nitroaniline	390	U
534-52-1	4,6-dinitro-2-methyl phenol	790	U
101-55-3	4-Bromophenyl-phenylether	390	U
106-47-8	4-Chloroaniline	390	U
7005-72-3	4-Chlorophenyl Phenyl Ether	390	U
100-01-6	4-Nitroaniline	390	U
100-02-7	4-Nitrophenol	790	U
59-50-7	4-chloro-3-methylphenol	390	U
106-44-5	4-methylphenol	390	U
83-32-9	Acenaphthene	390	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-004-005-1/1
Sample Volume :	30	Lab File ID :	D33571.D
% Moisture:	15.05	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	390	U	
120-12-7	Anthracene	390	U	
56-55-3	Benzo(a)anthracene	390	U	
50-32-8	Benzo(a)pyrene	390	U	
205-99-2	Benzo(b)fluoranthene	390	U	
191-24-2	Benzo(g,h,i)perylene	390	U	
207-08-9	Benzo(k)fluoranthene	390	U	
65-85-0	Benzoic Acid	790	U	UJ
100-51-6	Benzyl Alcohol	390	U	
85-68-7	Benzyl Butyl Phthalate	390	U	
86-74-8	Carbazole	390	U	
218-01-9	Chrysene	390	U	
53-70-3	Dibenz(a,h)Anthracene	390	U	
132-64-9	Dibenzofuran	390	U	
84-66-2	Diethyl Phthalate	390	U	
131-11-3	Dimethyl Phthalate	390	U	
206-44-0	Fluoranthene	390	U	
86-73-7	Fluorene	390	U	
118-74-1	Hexachlorobenzene	390	U	
87-68-3	Hexachlorobutadiene	390	U	
77-47-4	Hexachlorocyclopentadiene	390	U	UJ
67-72-1	Hexachloroethane	390	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	390	U	
78-59-1	Isophorone	390	U	
91-20-3	Naphthalene	390	U	
98-95-3	Nitrobenzene	390	U	
87-86-5	Pentachlorophenol	790	U	
85-01-8	Phenanthrene	390	U	
108-95-2	Phenol	390	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-004-005-1/1
Sample Volume :	30	Lab File ID :	D33571.D
% Moisture:	15.05	Date Received	04/03/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	390	U
110-86-1	Pyridine	390	U
111-91-1	bis(2-chloroethoxy) methane	390	U
111-44-4	bis(2-chloroethyl) ether	390	U
117-81-7	bis(2-ethylhexyl) phthalate	390	U
84-74-2	di-n-Butyl Phthalate	390	U
117-84-0	di-n-Octyl Phthalate	390	U
621-64-7	n-Nitrosodi-n-Propylamine	390	U
86-30-6	n-Nitrosodiphenylamine	390	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040204R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404027-005-035-1/2
Sample Volume :	710	Lab File ID :	D33563.D
% Moisture:		Date Received	04/03/2004
Extraction:	SW3520C	Date Extracte	04/07/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	14	U
95-50-1	1,2-Dichlorobenzene	14	U
541-73-1	1,3-Dichlorobenzene	14	U
106-46-7	1,4-Dichlorobenzene	14	U
108-60-1	2,2-Oxybis(1-Chloropropane)	14	U
95-95-4	2,4,5-Trichlorophenol	14	U
88-06-2	2,4,6-Trichlorophenol	14	U
120-83-2	2,4-Dichlorophenol	14	U
105-67-9	2,4-Dimethylphenol	14	U
51-28-5	2,4-Dinitrophenol	28	U
121-14-2	2,4-Dinitrotoluene	14	U
606-20-2	2,6-Dinitrotoluene	14	U
91-58-7	2-Chloronaphthalene	14	U
95-57-8	2-Chlorophenol	14	U
91-57-6	2-Methylnaphthalene	14	U
88-74-4	2-Nitroaniline	14	U
88-75-5	2-Nitrophenol	14	U
95-48-7	2-methylphenol	14	U
91-94-1	3,3-Dichlorobenzidine	28	U
99-09-2	3-Nitroaniline	14	U
534-52-1	4,6-dinitro-2-methyl phenol	28	U
101-55-3	4-Bromophenyl-phenylether	14	U
106-47-8	4-Chloroaniline	14	U
7005-72-3	4-Chlorophenyl Phenyl Ether	14	U
100-01-6	4-Nitroaniline	14	U
100-02-7	4-Nitrophenol	28	U
59-50-7	4-chloro-3-methylphenol	14	U
106-44-5	4-methylphenol	14	U
83-32-9	Acenaphthene	14	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040204R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404027-005-035-1/2
Sample Volume :	710	Lab File ID :	D33563.D
% Moisture:		Date Received	04/03/2004
Extraction:	SW3520C	Date Extracte	04/07/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
208-96-8	Acenaphthylene	14	U
120-12-7	Anthracene	14	U
56-55-3	Benzo(a)anthracene	14	U
50-32-8	Benzo(a)pyrene	14	U
205-99-2	Benzo(b)fluoranthene	14	U
191-24-2	Benzo(g,h,i)perylene	14	U
207-08-9	Benzo(k)fluoranthene	14	U
65-85-0	Benzoic Acid	28	U
100-51-6	Benzyl Alcohol	14	U
85-68-7	Benzyl Butyl Phthalate	14	U
86-74-8	Carbazole	14	U
218-01-9	Chrysene	14	U
53-70-3	Dibenz(a,h)Anthracene	14	U
132-64-9	Dibenzofuran	14	U
84-66-2	Diethyl Phthalate	14	U
131-11-3	Dimethyl Phthalate	14	U
206-44-0	Fluoranthene	14	U
86-73-7	Fluorene	14	U
118-74-1	Hexachlorobenzene	14	U
87-68-3	Hexachlorobutadiene	14	U
77-47-4	Hexachlorocyclopentadiene	14	U
67-72-1	Hexachloroethane	14	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	14	U
78-59-1	Isophorone	14	U
91-20-3	Naphthalene	14	U
98-95-3	Nitrobenzene	14	U
87-86-5	Pentachlorophenol	28	U
85-01-8	Phenanthrene	14	U
108-95-2	Phenol	14	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040204R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404027
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404027-005-035-1/2
Sample Volume :	710	Lab File ID :	D33563.D
% Moisture:		Date Received	04/03/2004
Extraction:	SW3520C	Date Extracte	04/07/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
129-00-0	Pyrene	14	U
110-86-1	Pyridine	14	U
111-91-1	bis(2-chloroethoxy) methane	14	U
111-44-4	bis(2-chloroethyl) ether	14	U
117-81-7	bis(2-ethylhexyl) phthalate	14	U
84-74-2	di-n-Butyl Phthalate	4.5	J
117-84-0	di-n-Octyl Phthalate	14	U
621-64-7	n-Nitrosodi-n-Propylamine	14	U
86-30-6	n-Nitrosodiphenylamine	14	U

J

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – TAL Inorganics
GPL Laboratories, Inc., SDG 404027

DATE: June 16, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. Samples were analyzed for target analyte list (TAL) Inorganics using USEPA SW-846 3050B/6010B for ICP metals, USEPA SW-846 7471A for mercury, and USEPA SW-846 9014 for cyanide. A total of four soil samples were validated. All samples were analyzed for total TAL inorganics. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB8A	404027-001	51SB8C	404027-003
51SB8B	404027-002	TMSB8A	404027-004

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Inorganic Data Review* (April, 1993). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Initial and Continuing Calibration
X		Blank Analysis
	X	ICP Interference Check Sample (ICS)
	X	Laboratory Control Sample (LCS)
X		Lab Sample Duplicate
X		Matrix Spike
X		ICP Serial Dilution
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/16/04
Date

RFAAP VALIDATION REPORT
TAL INORGANICS REVIEW
SDG 404027

I-Holding Times

The primary objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample analysis. The soil samples are received and stored cool @4 °C ± 2 °C, with a maximum holding time of 180 days for ICP metals, 28 days for mercury, and 14 days for cyanide from collection (USEPA criteria).

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 3.0°C and at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: Samples were collected 04/01/04. They were digested on 04/07/04 and analyzed for ICP metals on 04/08/04 and 04/09/04. Samples were digested on 04/09/04 for mercury and were analyzed for mercury on 04/10/04. Samples were digested on 04/13/04 for cyanide and were analyzed for cyanide on 04/15/04. All holding time criteria were met. No qualifiers were applied.

II-Initial and Continuing Calibration

Requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of the analysis run, and continuing calibration verification documents that the initial calibration is still valid.

ICP: 1- blank (USACE <MDL)
3 – standards ($r \geq 0.995$)
ICV/CCV (90-110%) (USACE 90-110%)
MRL (70-130%) (USACE 80-120%)

Hg: 1 – blank (USACE <MDL)
5 – standards ($r \geq 0.995$)
ICV/CCV (80-120%) (USACE ICV 90-110% / CCV 80-120%)
MRL (80-120%)

CN: 1- blank (USACE <MDL)
5 – standards ($r \geq 0.995$)
ICV/CCV (85-115%)

- The samples were analyzed for ICP metals on 04/08/04 and 04/09/04. Mercury was analyzed on 04/10/04 with a correlation coefficient of 0.9999. Cyanide was analyzed on 04/15/04 with a correlation coefficient of 0.9998. All ICV/CCV standards were within criteria. No qualifiers were applied. **Table 2** summarizes the MRL standard analysis for metals. Samples with concentrations detected less than two times the MRL with out of criteria MRL recovery were qualified.

Table 2 MRL Analysis Summary

Analysis Date	Analysis	MRL (µg/L)	MRL (mg/kg)	MRL %Recovery	Qualified samples @ <2xMRL	Validation Qualifiers
04/08/04	ICP	Various	Various	All within criteria	None	None
04/09/04	ICP	Various	Various	All within criteria	None	None
04/10/04	Hg	0.2	0.033	All within criteria	None	None

III-Blanks

Blanks (preparation and calibration blanks) are assessed to determine the existence and magnitude of contamination problems. No contaminants should be detected (i.e. <MDL) in any of the associated blanks. USACE Shell limits are < ½MRL for the method blank. Samples are qualified "B" when they are less than 5X the absolute value of the maximum blank concentration. **Table 3** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factors = 10 for ICP; 6 for Hg; and 40 for CN). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 3 Blank Contamination Analysis Summary

Analysis Date	Analysis	QC Blank ID	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/08/04	ICP-Al	ICB/CCBs	9.19B	45.9	None
04/08/04	ICP-Be	ICB/CCBs	0.01B	0.05	None
04/08/04	ICP-Ca	ICB/CCBs	7.80B	39.0	51SB8B
04/08/04	ICP-Cu	ICB/CCBs	0.24B	1.2	None
04/08/04	ICP-Mg	ICB/CCBs	10.4B	52.0	None
04/08/04	ICP-Mn	ICB/CCBs	0.06B	0.30	None
04/08/04	ICP-Se	ICB/CCBs	0.18B	0.90	51SB8A, 51SB8B, TMSB8A
04/09/04	ICP-Al	ICB/CCBs	3.50B	17.5	None
04/09/04	ICP-Ba	ICB/CCBs	0.07B	0.35	None
04/09/04	ICP-Fe	ICB/CCBs	4.95B	24.7	None
04/09/04	ICP-Mg	ICB/CCBs	7.13B	35.7	None
04/09/04	ICP-Mn	ICB/CCBs	0.09B	0.45	None
04/10/04	Hg	ICB/CCBs	<MRL	NA	None
04/13/04	CN	ICB/CCBs	<MRL	NA	None
04/08/04	ICP-Sb	PBS	0.51B	2.6	51SB8A, 51SB8B, TMSB8A
04/08/04	ICP-Ba	PBS	0.039B	0.20	None
04/08/04	ICP-Be	PBS	0.0090B	0.045	None
04/08/04	ICP-Ca	PBS	21.0B	105	51SB8B
04/08/04	ICP-Cr	PBS	0.14B	0.70	None
04/08/04	ICP-Co	PBS	0.15B	0.75	None
04/08/04	ICP-Fe	PBS	5.9B	29.5	None
04/08/04	ICP-Pb	PBS	0.23B	1.15	None
04/08/04	ICP-Mg	PBS	5.2B	26.0	None
04/08/04	ICP-Mn	PBS	0.20B	1.0	None
04/08/04	ICP-Ni	PBS	0.44B	2.2	None
04/08/04	ICP-Na	PBS	92.6B	463	51SB8A, 51SB8B, 51SB8C, TMSB8A
04/08/04	ICP-Tl	PBS	1.5B	7.5	51SB8C, TMSB8A
04/10/04	Hg	PBS	<MRL	NA	None
04/13/04	CN	PBS	<MRL	NA	None
04/15/04	ICPMS-Al	040204R	0.10B	0.50	None
04/15/04	ICPMS-Ba	040204R	0.028B	0.14	None
04/15/04	ICPMS-Cd	040204R	0.017B	0.085	None
04/15/04	ICPMS-Ca	040204R	24.3B	120	51SB8B
04/15/04	ICPMS-Cr	040204R	0.13B	0.65	None
04/15/04	ICPMS-Co	040204R	0.0012B	0.0060	None
04/15/04	ICPMS-Cu	040204R	0.4E	2.0	None
04/15/04	ICPMS-Fe	040204R	1.87B	9.35	None
04/15/04	ICPMS-Pb	040204R	0.020B	0.10	None
04/15/04	ICPMS-Mg	040204R	3.86BE	19.3	None
04/15/04	ICPMS-Mn	040204R	0.22	1.10	None
04/15/04	ICPMS-Ni	040204R	0.035B	0.18	None
04/15/04	ICPMS-K	040204R	4.63BE	23.2	None
04/15/04	ICPMS-Na	040204R	16.9BE	84.5	51SB8A, TMSB8A
04/15/04	ICPMS-Tl	040204R	0.0076B	0.038	None
04/15/04	ICPMS-Zn	040204R	0.29BE	1.45	None
04/09/04	Hg	040204R	0.028BN	0.14	51SB8A, TMSB8A
04/15/04	CN	040204R	<MRL	NA	None

B = Value is estimated <MRL and >MDL.
E = Serial Dilution percent difference not within limits.
N = Laboratory spike sample recovery not within control limits.

IV-ICP Interference Check Sample (ICS)
The ICP interference check sample (ICS) verifies interelement and background correction factors. ICP Interference Check is performed at the beginning and end of each sample analysis run. Control limits are 80-120% (USACE limits 80-120%).

- All criteria were met. No qualifiers were applied.

V-Laboratory Control Samples (LCS)
The laboratory control sample (LCS) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. All soil LCS results must fall within the control limits of 80-120% for ICPMS metals and mercury and 85-115% for cyanide. USACE Shell limits for metals are 80-120% (60-140% for sporadic marginal failures (SMF)).

- Sample BKS65767 was used as LCS for ICP metals analysis. All criteria were met. No qualifiers were applied.

- Sample BKS65819 was used as LCS for total mercury analysis. All criteria were met. No qualifiers were applied.

- Sample BKS1727 was used as LCS for total cyanide analysis. All criteria were met. No qualifiers were applied.

VI-Duplicate Sample Analysis
Duplicate sample determinations are used to demonstrate acceptable method precision by the laboratory at the time of analysis. Duplicate analysis are also performed to generate data in order to determine the long-term precision of the analytical method on various matrices. RPDs must be within established control limits. USACE Shell limits for metals are 25% RPD for ICP metals and 20% RPD for mercury and cyanide.

- Sample 51SB8B (404027-002) was used as sample duplicate for ICP metals analysis. Antimony (44.2%), cadmium (200%), lead (36.2%), and selenium (200%) were outside criteria. Antimony, cadmium, and selenium were outside due to low sample concentration, therefore no qualifiers were applied based upon this outliers. Lead was qualified as estimated "J" for detects for this sample 51SB8B (404027-002).

- Sample 51SB8B (404027-002) was used as sample duplicate for mercury analysis. All criteria were met. No qualifiers were applied.

- Sample 51SB8B (404027-002) was used for the sample duplicate analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VII-Matrix Spike
MS are generated to determine long-term accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. Specific criteria include the analyses of matrix spike and matrix spike duplicate samples at a frequency of one MS per 20 samples of similar matrix. MS recoveries and relative percent differences between MS recoveries should be within the specified limits. USACE Shell limits for metals are 75-125% for ICP metals and 80-120% for mercury and cyanide. Post digestion spikes limits are 75-125% for ICP metals and 85-115% for mercury and cyanide.

- Sample 51SB8B (404027-002) was used for the MS analysis for ICP analysis. Aluminum (1110%), antimony (53.7%), iron (130%), magnesium (136%), and potassium (136%) were outside of control limits. Post digestion spikes were within criteria for antimony, magnesium, and potassium. The sample concentration was >4 times the spike added for aluminum and iron, therefore no qualifiers were applied based upon this outlier. For antimony, the spiked sample was qualified bias "L". For magnesium and potassium, the spiked sample was qualified bias high "K".

- Sample 51SB8B (404027-002) was used for the MS analysis for mercury analysis. All criteria were met. No qualifiers were applied.

- Sample 51SB8B (404027-002) was used for the MS analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VIII-ICP Serial Dilution

An ICP serial dilution is performed to determine whether significant physical or chemical interferences exist due to sample matrix at high concentrations. An analysis of a 5-fold dilution should agree within 10% difference of the original result when the concentration in sample is a factor of 50 above MDL.

- The serial dilution for the ICP was analyzed for sample 51SB8B (404027-002). Antimony (100%), arsenic (51.3%), copper (53.5%), lead (15.3%), selenium (100%), and sodium (71.9%) were outside of criteria limits. Sample concentrations were <50 times MDL for antimony, arsenic, lead, selenium, and sodium, therefore no qualifiers were applied based upon these outliers. Copper was qualified estimated "J" for detects and no qualifier for non-detects based upon this outlier.

IX-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the aqueous samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB8A (404027-001) and TMSB8A (404027-004) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB8A	404027-001	Aluminum	12000	15300	24.2	None
51SB8A	404027-001	Antimony	0.68 BN	0.64 BN	NA**	None
51SB8A	404027-001	Arsenic	3.3	3.6	8.7	None
51SB8A	404027-001	Barium	83.9	84.5	0.7	None
51SB8A	404027-001	Beryllium	0.56	0.54	3.6	None
51SB8A	404027-001	Calcium	286	321	11.5	None
51SB8A	404027-001	Chromium	25.5	24.8	2.8	None
51SB8A	404027-001	Cobalt	4.6	5.0	8.3	None
51SB8A	404027-001	Copper	5.0 E	6.5 E	26.1	None
51SB8A	404027-001	Iron	15000	17600	15.9	None
51SB8A	404027-001	Lead	15.9 *	15.5 *	2.6	None
51SB8A	404027-001	Magnesium	535 N	695 N	26.0	None
51SB8A	404027-001	Manganese	467 *	433 *	7.6	None
51SB8A	404027-001	Nickel	5.0	6.5	26.1	None
51SB8A	404027-001	Potassium	428 N	577 N	29.7	None
51SB8A	404027-001	Selenium	0.25 B	0.19 B	NA**	None
51SB8A	404027-001	Sodium	69.8 B	75.1 B	NA**	None
51SB8A	404027-001	Thallium	0.53 U	0.56 B	NA**	None
51SB8A	404027-001	Vanadium	35.8	40.0	11.1	None
51SB8A	404027-001	Zinc	21.9	26.1	17.5	None
51SB8A	404027-001	Mercury	0.039	0.024 B	NA**	None
51SB8A	404027-001	Cyanide	0.15 U	0.16 U	NA	None

B = Estimated value <MRL and >MDL.
E = Serial Dilution percent difference not within limits.
N = Laboratory spike sample recovery not within control limits.
* = Laboratory duplicate not within control limits.
** = Found in blank, therefore not evaluated.
U = Value non-detect at MRL.
NA = Not Applicable

X-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." The following calculations were performed for verification.

ICP Sample: 51SB8A (404027-001), Total Barium

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(918.2933 μg/L)*(0.100 L)*(1)} / {(1.29 g)*(0.8486)} = 83.9 μg/g = 83.9 mg/kg

Reported concentration = 83.9 mg/kg
%D = 0.0%
Values were within 10% difference.

CVAA Sample: 51SB8A (404027-001), Total Mercury

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(0.255 μg/L)*(0.100 L)*(1)} / {(0.78 g)*(0.8486)} = 0.039 μg/g = 0.039 mg/kg

Reported concentration = 0.039 mg/kg
%D = 0.0%
Values were within 10% difference.

Cyanide Sample: 51SB8BMS (404027-002MS), Total Cyanide

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(37.4 μg/L)*(0.050 L)*(1)} / {(1.71 g)*(0.8911)} = 1.23 μg/g = 1.23 mg/kg

Reported concentration = 1.23 mg/kg
%D = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I Cm

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404027

Lab Sample ID: S 404027-001-006-1/1 **Client ID:** 51SB8A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.29 **Volume:** 100 **Percent Moisture:** 15.14

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.6**	**18.3**	**12000**		1	**ICPST**	**4/08/04**	**15:48**
Antimony	**206.84**	**0.46**	**1.8**	**0.68**	**BN**	B 1	**ICPST**	**4/08/04**	**15:48**
Arsenic	**189.04**	**0.18**	**1.8**	**3.3**		1	**ICPST**	**4/08/04**	**15:48**
Barium	**493.41**	**0.029**	**0.46**	**83.9**		1	**ICPST**	**4/08/04**	**15:48**
Beryllium	**313.04**	**0.0052**	**0.18**	**0.56**		1	**ICPST**	**4/08/04**	**15:48**
Cadmium	226.50	0.040	0.55	0.040	U	1	ICPST	4/08/04	15:48
Calcium	**317.93**	**6.9**	**91.3**	**286**		1	**ICPST**	**4/08/04**	**15:48**
Chromium	**267.72**	**0.11**	**0.46**	**25.5**		1	**ICPST**	**4/08/04**	**15:48**
Cobalt	**228.62**	**0.073**	**0.46**	**4.6**		1	**ICPST**	**4/08/04**	**15:48**
Copper	**324.75**	**0.087**	**0.91**	**5.0**	**E**	1	**ICPST**	**4/08/04**	**15:48**
Iron	**271.44**	**3.6**	**13.7**	**15000**		1	**ICPST**	**4/08/04**	**15:48**
Lead	**220.35**	**0.19**	**0.91**	**15.9**	*	1	**ICPST**	**4/08/04**	**15:48**
Magnesium	**279.08**	**2.3**	**22.8**	**535**	**N**	1	**ICPST**	**4/08/04**	**15:48**
Manganese	**257.61**	**0.023**	**0.46**	**467**	*	1	**ICPST**	**4/08/04**	**15:48**
Nickel	**231.60**	**0.13**	**0.91**	**5.0**		1	**ICPST**	**4/08/04**	**15:48**
Potassium	**766.49**	**3.8**	**22.8**	**428**	**N**	1	**ICPST**	**4/08/04**	**15:48**
Selenium	**196.03**	**0.16**	**1.8**	**0.24**	**B**	B 1	**ICPST**	**4/08/04**	**15:48**
Silver	328.07	0.12	0.27	0.12	U	1	ICPST	4/08/04	15:48
Sodium	**330.23**	**30.8**	**228**	**69.8**	**B**	B 1	**ICPST**	**4/08/04**	**15:48**
Thallium	190.86	0.53	2.7	0.53	U	1	ICPST	4/08/04	15:48
Vanadium	**292.40**	**0.13**	**0.91**	**35.7**		1	**ICPST**	**4/08/04**	**15:48**
Zinc	**213.86**	**0.49**	**1.8**	**21.9**		1	**ICPST**	**4/08/04**	**15:48**

Comments: Sample Date: 04/01/04 Sample Time: 04:30 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL.

Form I Equivalent

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404027

Lab Sample ID: S 404027-001-006-1/1 **Client ID:** 51SB8A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.78 **Volume:** 100 **Percent Moisture:** 15.14

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.030	0.039		1	CVAA	4/10/04	14:29

Comments: Sample Date: 04/01/04 Sample Time: 04:30 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

R Result is between IDL and RL

Form 1 Equivalent

Kim I Cay

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB8A	Lab Sample ID:	404027-001-006-1/1
Sample Date/Time:	04/01/2004 16:30	Percent Moisture:	15.14
Receipt Date/Time:	04/03/2004 10:25	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.15	1	mg/kg	04/15/04 20:2(

Form 1 Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404027

Lab Sample ID: S 404027-002-007-1/2 **Client ID:** 51SB8B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.22 **Volume:** 100 **Percent Moisture:** 10.89

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.6**	**18.4**	**11200**		1	**ICPST**	**4/08/04**	**15:55**
Antimony	**206.84**	**0.46**	**1.8**	**0.88**	**BN**	B 1	**ICPST**	**4/08/04**	**15:55**
Arsenic	**189.04**	**0.18**	**1.8**	**1.7**	**B**	J 1	**ICPST**	**4/08/04**	**15:55**
Barium	**493.41**	**0.029**	**0.46**	**33.6**		1	**ICPST**	**4/08/04**	**15:55**
Beryllium	**313.04**	**0.0052**	**0.18**	**0.55**		1	**ICPST**	**4/08/04**	**15:55**
Cadmium	226.50	0.040	0.55	0.040	U	1	ICPST	4/08/04	15:55
Calcium	**317.93**	**7.0**	**92.0**	**32.2**	**B**	B 1	**ICPST**	**4/08/04**	**15:55**
Chromium	**267.72**	**0.11**	**0.46**	**17.5**		1	**ICPST**	**4/08/04**	**15:55**
Cobalt	**228.62**	**0.074**	**0.46**	**8.2**		1	**ICPST**	**4/08/04**	**15:55**
Copper	**324.75**	**0.087**	**0.92**	**5.5**	**E**	EJ1	**ICPST**	**4/08/04**	**15:55**
Iron	**271.44**	**3.6**	**13.8**	**16900**		1	**ICPST**	**4/08/04**	**15:55**
Lead	**220.35**	**0.19**	**0.92**	**4.8**	*	J 1	**ICPST**	**4/08/04**	**15:55**
Magnesium	**279.08**	**2.3**	**23.0**	**786**	**N**	K 1	**ICPST**	**4/08/04**	**15:55**
Manganese	**257.61**	**0.023**	**0.46**	**352**	*	1	**ICPST**	**4/08/04**	**15:55**
Nickel	**231.60**	**0.13**	**0.92**	**5.8**		1	**ICPST**	**4/08/04**	**15:55**
Potassium	**766.49**	**3.8**	**23.0**	**666**	**N**	K 1	**ICPST**	**4/08/04**	**15:55**
Selenium	**196.03**	**0.16**	**1.8**	**0.17**	**B**	B 1	**ICPST**	**4/08/04**	**15:55**
Silver	328.07	0.12	0.28	0.12	U	1	ICPST	4/08/04	15:55
Sodium	**330.23**	**31.0**	**230**	**135**	**B**	B 1	**ICPST**	**4/08/04**	**15:55**
Thallium	190.86	0.53	2.8	0.53	U	1	ICPST	4/08/04	15:55
Vanadium	**292.40**	**0.13**	**0.92**	**21.8**		1	**ICPST**	**4/08/04**	**15:55**
Zinc	**213.86**	**0.50**	**1.8**	**21.2**		1	**ICPST**	**4/08/04**	**15:55**

Comments: Sample Date: 04/01/04 Sample Time: 05:00 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404027

Lab Sample ID: S 404027-002-007-1/2 **Client ID:** 51SB8B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.75 **Volume:** 100 **Percent Moisture:** 10.89

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.030	0.015	U	1	CVAA	4/10/04	14:32

Comments: Sample Date: 04/01/04 Sample Time: 05:00 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

R Result is between IDL and RL

Form 1 Equivalent

Form 1 Cover

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB8B	Lab Sample ID:	404027-002-007-1/2
Sample Date/Time:	04/01/2004 17:00	Percent Moisture:	10.89
Receipt Date/Time:	04/03/2004 10:25	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/15/04 20:20

Form 1 Copy

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Metals Data Reporting Form

Sample Results **SDG:** 404027

Lab Sample ID: S 404027-003-009-1/1 **Client ID:** 51SB8C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/7/04 **Prep Batch:** 65767

Weight: 1.55 **Volume:** 100 **Percent Moisture:** 25.56

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**2.9**	**34.7**	**14300**		**2**	**ICPST**	**4/9/04**	**14:18**
Antimony	206.84	0.87	3.5	0.87	UN	2	ICPST	4/9/04	14:18
Arsenic	**189.04**	**0.17**	**1.7**	**6.0**		**1**	**ICPST**	**4/8/04**	**16:34**
Barium	**493.41**	**0.055**	**0.87**	**69.2**		**2**	**ICPST**	**4/9/04**	**14:18**
Beryllium	**313.04**	**0.0049**	**0.17**	**1.1**		**1**	**ICPST**	**4/8/04**	**16:34**
Cadmium	**226.50**	**0.076**	**1.0**	**0.80**	**B**	**5**	**ICPST**	**4/9/04**	**14:18**
Calcium	**317.93**	**6.6**	**86.7**	**511**		**1**	**ICPST**	**4/8/04**	**16:34**
Chromium	**267.72**	**0.21**	**0.87**	**21.8**		**2**	**ICPST**	**4/9/04**	**14:18**
Cobalt	**228.62**	**0.069**	**0.43**	**15.2**		**1**	**ICPST**	**4/8/04**	**16:34**
Copper	**324.75**	**0.082**	**0.87**	**28.7**	**E**	**1**	**ICPST**	**4/8/04**	**16:34**
Iron	**271.44**	**6.8**	**26.0**	**51100**		**2**	**ICPST**	**4/9/04**	**14:18**
Lead	**220.35**	**0.36**	**1.7**	**11.3**	*	**2**	**ICPST**	**4/9/04**	**14:18**
Magnesium	**279.08**	**4.4**	**43.3**	**7960**	**N**	**2**	**ICPST**	**4/9/04**	**14:18**
Manganese	**257.61**	**0.043**	**0.87**	**1330**	*	**2**	**ICPST**	**4/9/04**	**14:18**
Nickel	**231.60**	**0.12**	**0.87**	**46.5**		**1**	**ICPST**	**4/8/04**	**16:34**
Potassium	**766.49**	**3.6**	**21.7**	**1450**	**N**	**1**	**ICPST**	**4/8/04**	**16:34**
Selenium	196.03	0.29	3.5	0.29	U	2	ICPST	4/9/04	14:18
Silver	328.07	0.11	0.26	0.11	U	1	ICPST	4/8/04	16:34
Sodium	**330.23**	**58.4**	**433**	**777**		**5 2**	**ICPST**	**4/9/04**	**14:18**
Thallium	**190.86**	**1.0**	**5.2**	**2.2**	**B**	**5 2**	**ICPST**	**4/9/04**	**14:18**
Vanadium	**292.40**	**0.24**	**1.7**	**24.3**		**2**	**ICPST**	**4/9/04**	**14:18**
Zinc	**213.86**	**0.94**	**3.5**	**15.7**		**5 2**	**ICPST**	**4/9/04**	**14:18**

Comments: Sample Date: 04/01/04 Sample Time: 06:00 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404027

Lab Sample ID: S 404027-003-009-1/1 **Client ID:** 51SB8C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.76 **Volume:** 100 **Percent Moisture:** 25.56

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.018	0.035	0.018	U	1	CVAA	4/10/04	14:41

Comments: Sample Date: 04/01/04 Sample Time: 06:00 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

R Result is between IDL and RL

Form 1 Equivalent

Form I Cyn

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB8C	Lab Sample ID:	404027-003-009-1/1
Sample Date/Time:	04/01/2004 18:00	Percent Moisture:	25.56
Receipt Date/Time:	04/03/2004 10:25	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.19	1	mg/kg	04/15/04 20:2(

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404027

Lab Sample ID: S 404027-004-010-1/1 **Client ID:** TMSB8A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/07/04 **Prep Batch:** 65767

Weight: 1.32 **Volume:** 100 **Percent Moisture:** 15.05

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.5**	**17.8**	**15300**		**1**	**ICPST**	**4/08/04**	**16:42**
Antimony	**206.84**	**0.45**	**1.8**	**0.64**	**BN**	**1**	**ICPST**	**4/08/04**	**16:42**
Arsenic	**189.04**	**0.18**	**1.8**	**3.6**		**1**	**ICPST**	**4/08/04**	**16:42**
Barium	**493.41**	**0.029**	**0.45**	**84.5**		**1**	**ICPST**	**4/08/04**	**16:42**
Beryllium	**313.04**	**0.0051**	**0.18**	**0.54**		**1**	**ICPST**	**4/08/04**	**16:42**
Cadmium	226.50	0.039	0.54	0.039	U	1	ICPST	4/08/04	16:42
Calcium	**317.93**	**6.8**	**89.2**	**321**		**1**	**ICPST**	**4/08/04**	**16:42**
Chromium	**267.72**	**0.11**	**0.45**	**24.8**		**1**	**ICPST**	**4/08/04**	**16:42**
Cobalt	**228.62**	**0.071**	**0.45**	**5.0**		**1**	**ICPST**	**4/08/04**	**16:42**
Copper	**324.75**	**0.085**	**0.89**	**6.5**	**E**	**1**	**ICPST**	**4/08/04**	**16:42**
Iron	**271.44**	**3.5**	**13.4**	**17600**		**1**	**ICPST**	**4/08/04**	**16:42**
Lead	**220.35**	**0.19**	**0.89**	**15.5**	*	**1**	**ICPST**	**4/08/04**	**16:42**
Magnesium	**279.08**	**2.3**	**22.3**	**695**	**N**	**1**	**ICPST**	**4/08/04**	**16:42**
Manganese	**257.61**	**0.022**	**0.45**	**433**	*	**1**	**ICPST**	**4/08/04**	**16:42**
Nickel	**231.60**	**0.12**	**0.89**	**6.5**		**1**	**ICPST**	**4/08/04**	**16:42**
Potassium	**766.49**	**3.7**	**22.3**	**577**	**N**	**1**	**ICPST**	**4/08/04**	**16:42**
Selenium	**196.03**	**0.15**	**1.8**	**0.19**	**B**	**1**	**ICPST**	**4/08/04**	**16:42**
Silver	328.07	0.12	0.27	0.12	U	1	ICPST	4/08/04	16:42
Sodium	**330.23**	**30.1**	**223**	**75.1**	**B**	**1**	**ICPST**	**4/08/04**	**16:42**
Thallium	**190.86**	**0.52**	**2.7**	**0.56**	**B**	**1**	**ICPST**	**4/08/04**	**16:42**
Vanadium	**292.40**	**0.12**	**0.89**	**40.0**		**1**	**ICPST**	**4/08/04**	**16:42**
Zinc	**213.86**	**0.48**	**1.8**	**26.1**		**1**	**ICPST**	**4/08/04**	**16:42**

Comments: Sample Date: 04/01/04 Sample Time: 04:30 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form 1 Org

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404027

Lab Sample ID: S 404027-004-010-1/1 **Client ID:** TMSB8A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65819

Weight: 0.74 **Volume:** 100 **Percent Moisture:** 15.05

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.032	0.024	B	1	CVAA	4/10/04	14:43

Comments: Sample Date: 04/01/04 Sample Time: 04:30 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

R Result is between IDL and RL

Form 1 Equivalent

Form I Cover

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	TMSB8A	Lab Sample ID:	404027-004-010-1/1
Sample Date/Time:	04/01/2004 16:30	Percent Moisture:	15.05
Receipt Date/Time:	04/03/2004 10:25	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/15/04 20:20

Form I CN7

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404027W

Lab Sample ID: S 404027-005-045-1/1 **Client ID:** 040204R

Matrix: Water **Units:** ug/L **Prep Date:** 4/15/04 **Prep Batch:** 65877

Weight: 100.00 **Volume:** 100 **Percent Moisture:** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**27**	**0.30**	**100**	**1.0**	**B**	J 1	**ICPMS**	**4/15/04**	**22:16**
Antimony	121	0.081	4.0	0.081	U	1	ICPMS	4/15/04	22:16
Arsenic	75	0.12	5.0	0.12	U	1	ICPMS	4/15/04	22:16
Barium	**137**	**0.018**	**5.0**	**0.28**	**B**	J 1	**ICPMS**	**4/15/04**	**22:16**
Beryllium	9	0.0025	0.20	0.0025	U	1	ICPMS	4/15/04	22:16
Cadmium	**110**	**0.032**	**0.50**	**0.17**	**B**	J 1	**ICPMS**	**4/15/04**	**22:16**
Calcium	**44**	**1.5**	**1000**	**243**	**B**	J 1	**ICPMS**	**4/15/04**	**22:16**
Chromium	**52**	**0.068**	**2.0**	**1.3**	**B**	J 1	**ICPMS**	**4/15/04**	**22:16**
Cobalt	**59**	**0.0077**	**1.0**	**0.012**	**B**	J 1	**ICPMS**	**4/15/04**	**22:16**
Copper	**65**	**0.017**	**2.0**	**4.0**	**E**	1	**ICPMS**	**4/15/04**	**22:16**
Iron	**56**	**0.75**	**50.0**	**18.7**	**B**	J 1	**ICPMS**	**4/15/04**	**22:16**
Lead	**208**	**0.015**	**2.0**	**0.20**	**B**	J 1	**ICPMS**	**4/15/04**	**22:16**
Magnesium	**25**	**0.79**	**100**	**38.6**	**BE**	J 1	**ICPMS**	**4/15/04**	**22:16**
Manganese	**55**	**0.098**	**2.0**	**2.2**		1	**ICPMS**	**4/15/04**	**22:16**
Nickel	**60**	**0.013**	**1.0**	**0.35**	**B**	J 1	**ICPMS**	**4/15/04**	**22:16**
Potassium	**39**	**0.67**	**1000**	**46.3**	**BE**	J 1	**ICPMS**	**4/15/04**	**22:16**
Selenium	82	0.13	10.0	0.13	U	2	ICPMS	4/16/04	20:56
Silver	107	0.0023	0.30	0.0023	U	1	ICPMS	4/15/04	22:16
Sodium	**23**	**0.65**	**1000**	**169**	**BE**	J 1	**ICPMS**	**4/15/04**	**22:16**
Thallium	**203**	**0.064**	**2.0**	**0.076**	**B**	J 1	**ICPMS**	**4/15/04**	**22:16**
Vanadium	51	0.35	5.0	0.35	U	1	ICPMS	4/15/04	22:16
Zinc	**66**	**0.022**	**10.0**	**2.9**	**BE**	J 1	**ICPMS**	**4/15/04**	**22:16**

Comments: Sample Date: 04/02/04 Sample Time: 09:00 AM

U Result is less than the IDL

B Result is between IDL and RL

E Serial dilution percent difference not within limits

Form 1 Equivalent

Form I Org

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404027W

Lab Sample ID: S 404027-005-045-1/1 **Client ID:** 040204R

Matrix: Water **Units:** ug/L **Prep Date:** 4/08/04 **Prep Batch:** 65788

Weight: 100.00 **Volume:** 100 **Percent Moisture:** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.10	0.20	0.17	BN	J 1	CVAA	4/09/04	12:42

Comments: Sample Date: 04/02/04 Sample Time: 09:00 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form I Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	WATER
Client Sample ID:	040204R	Lab Sample ID:	404027-005-046-1/1
Sample Date/Time:	04/02/2004 09:00	Percent Moisture:	NA
Receipt Date/Time:	04/03/2004 10:25	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.010	1	mg/L	04/15/04 20:20

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation - Volatiles
GPL Laboratories, Inc., SDG 404027

DATE: June 14, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 01, 2004. The samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs) using USEPA SW846 Method 5035/8260B. A total of four soil samples were validated. The sample IDs are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB8A	404027-001	51SB8C	404027-003
51SB8B	404027-002	TMSB8A	404027-004

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated under data validation procedure Level M3 are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Results
	X	Initial Calibration
	X	Continuing Calibration
X		Blank Analysis
	X	Laboratory Control Sample
X		Matrix Spike/ Spike Duplicate Sample
X		System Monitoring Compounds
	X	Internal Standards
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with the noted qualifications.

Eric Malarek, Chemist

6/14/04
Date

RFAAP VALIDATION REPORT
VOLATILES REVIEW
SDG 404027

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of analysis. Holding time criteria: For Encore soil samples cooled @ 4°C ± 2°C; the maximum holding time is 2 days for preparation, 14 days from sample collection to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/01/04, coolers were received by the laboratory at 3.0°C and at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/01/04, prepped on 04/03/04, and analyzed for TCL VOCs on 04/14/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, bromofluorobenzene (BFB), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be ≥ 0.05 for all other compounds. Percent relative standard deviation (%RSD) must be ≤ 15% for each target compound and must be ≤ 30% for each calibration check compound. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For initial calibration for VOCs performed on 04/13/04 on instrument HP#F, target compounds chloroethane (18.4%), 2-butanone (22.0%, RRF=0.014), 2-hexanone (55.2%; grossly exceeding), and styrene (24.6%) were outside control limits. Compounds 2-butanone and 2-hexanone were quantified using linear regression with correlation coefficients greater than 0.99. Compound chloroethane was non-detect for all samples, therefore no qualifiers were applied based upon this outlier. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Continuing calibration establishes the 12-hour relative response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be $\geq$ 0.05 for all other compounds. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within 20% for all target compounds. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for VOCs performed on 04/14/04 @ 10:22 on instrument HP#F, target compounds 2-butanone (RRF=0.012) and 2-hexanone (23.8%) were outside control limits. Compounds 2-butanone and 2-hexanone were quantified using linear regression with correlation coefficients greater than 0.99, therefore no qualifiers were applied based upon these outliers. No samples apply to this continuing calibration.

- For continuing calibration for VOCs performed on 04/14/04 @ 13:30 on instrument HP#F, target compounds 2-butanone (RRF=0.014) and 2-hexanone (28.6%) were outside control limits. Compounds 2-butanone and 2-hexanone were quantified using linear regression with correlation coefficients greater than 0.99, therefore no qualifiers were applied based upon these outliers. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this continuing calibration.

V-Blank Analysis
The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of BFB. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants methylene chloride, acetone, and 2-butanone). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is $\leq$ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants methylene chloride, acetone, and 2-butanone, or 5 times (5X) the maximum amount for other volatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 1). Rinse blank 040204R and associated trip blank 040204T apply to these samples and were analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/14/04	BLK65946	methylene chloride	1.7J	17	51SB8A, 51SB8B, 51SB8C, TMSB8A
04/14/04	040204R	2-butanone	2.1J	21	None
04/14/04	040204R	acetone	34	340	51SB8A, 51SB8B, 51SB8C, TMSB8A
04/14/04	040204R	benzene	1.1	5.5	None
04/14/04	040204R	ethylbenzene	0.58J	2.9	None
04/14/04	040204R	m,p-xylenes	2.5	12.5	None
04/14/04	040204R	o-xylene	0.90J	4.5	None
04/14/04	040204R	toluene	4.7	23.5	None
04/14/04	040204T	1,1,1-trichloroethane	0.83J	4.2	None
04/14/04	040204T	acetone	3.4J	34	51SB8B, 51SB8C
04/14/04	040204T	methylene chloride	0.93J	9.3	51SB8A, 51SB8B, 51SB8C, TMSB8A
04/14/04	040204T	trichloroethene	4.9	24.5	None

J = Estimated value <MRL and >MDL

VI-Laboratory Control Sample (LCS) and LCSD

Data for laboratory control samples (LCS) and LCSD are evaluated to determine long-term accuracy and precision of the analytical method on various matrices. Percent recoveries (%Rs) should be within the specified control limits. USACE Shell limits are 75-125%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- Sample BKSD65946 was used as the LCS for the TCL VOC analysis. Compounds 2-hexanone (72%) and acetone (68%) were outside USACE criteria and within the SMF criteria. There were a total of 35 spike recoveries with 2 sporadic marginal failures. No qualifiers were applied based upon these outliers. Samples 51SB8A (404027-001), 51SB8B (404027-002), 51SB8C (404027-003), and TMSB8A (404027-004) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 70-130%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- Sample 51SB8B (404027-002) was used for the MS/MSD analysis for VOCs. Compounds 2-butanone (4%; RPD=180%), 2-hexanone (67%, 70%), acetone (65%, 62%), benzene (77%), dibromochloromethane (43%, RPD=74%), styrene (56%, RPD=39%), tetrachloroethylene (34%, RPD=70%), and trans-1,3-dichloropropene (64%, RPD=28%) were outside criteria limits. Compounds 2-butanone, 2-hexanone, acetone, benzene, dibromochloromethane, styrene, tetrachloroethylene, and trans-1,3-dichloropropene were qualified bias low "L" for detects and "UL" for non-detects for the spiked sample based upon these outliers.

VIII-System Monitoring Compounds (Surrogates)
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Recoveries for system monitoring compounds in volatile samples and blanks must be within the specified control limits.

Criteria: 1,2-Dichlorobenzene-d4 (74-122%) – SMC1 (USACE Shell Criteria: 70-130%)
1,2-Dichloroethane-d4 (64-120%) – SMC2 (USACE Shell Criteria: 70-130%)
4-Bromofluorobenzene (76-116%) – SMC3 (USACE Shell Criteria: 70-130%)
Toluene-d8 (76-120%) – SMC4 (USACE Shell Criteria: 70-130%)

- For sample 51SB8A (404027-001), all criteria were met. No qualifiers were applied.

- For sample 51SB8B (404027-002), surrogate 1,2-dichlorobenzene-d4 (129%) and 4-bromofluorobenzene (117%) were above laboratory criteria limits. All detects were qualified estimated "J" and non-detects "UJ" based upon this outlier for this sample.

- For sample 51SB8C (404027-003), surrogate 1,2-dichlorobenzene-d4 (132%) and 4-bromofluorobenzene (117%) were above laboratory criteria limits. All detects were qualified estimated "J" and non-detects "UJ" based upon this outlier for this sample.

- For sample TMSB8A (404027-004), surrogate 1,2-dichlorobenzene-d4 (133%) and 4-bromofluorobenzene (120%) were above laboratory criteria limits. All detects were qualified estimated "J" and non-detects "UJ" based upon this outlier for this sample.

IX-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: area counts (-50% to +100%) of the associated calibration standard, and retention time (± 30 seconds) from that of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB8A (404027-001) and TMSB8A (404027-004) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB8A	404027-001	acetone	81	78	NA	None
51SB8A	404027-001	methylene chloride	2.5 JB	3.4 JB	NA	None

J = Estimated value <MRL and >MDL.
B = Compound detected in blank.
NA = Not Applicable. Methylene chloride and acetone were detected in blanks.

XI-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB8A (404027-001), Acetone

Conc. (µg/kg) = {(Ax)*(Is)*(DF)*(Vp)} / {(Ais)*(RRF)*(Ws)*Fs)}

where: Ax is the compound area
Is is the corresponding internal standard concentration (ng/mL)
DF is the dilution factor
Vp is the volume purged (mL)
Ais is the corresponding internal standard area
RRF is the relative response factor
Ws is the weight of the sample (g)
Fs is the fraction solids for the sample = 1.0 for Wet Weight

Conc. µg/kg = (315321 * 50 ng/mL * 1 * 5 mL) / (1682488 * 0.114 * 5.97g * 0.8486) = 81 µg/kg
Reported Conc. = 81 µg/kg
%D = 0.0
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404027
Case No: :		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-001-011-1/3
Sample Volume :	5.97	Lab File ID :	F39771.D
Level :	Low	Date Received	04/03/2004
% Moisture: not dec	15.14	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.9	U	
79-34-5	1,1,2,2-Tetrachloroethane	4.9	U	
79-00-5	1,1,2-Trichloroethane	4.9	U	
75-34-3	1,1-Dichloroethane	4.9	U	
75-35-4	1,1-Dichloroethene	4.9	U	
107-06-2	1,2-Dichloroethane	4.9	U	
78-87-5	1,2-Dichloropropane	4.9	U	
78-93-3	2-Butanone	9.9	U	
591-78-6	2-Hexanone	9.9	U	
108-10-1	4-Methyl-2-Pentanone	9.9	U	
67-64-1	Acetone	81		B
71-43-2	Benzene	4.9	U	
75-27-4	Bromodichloromethane	4.9	U	
75-25-2	Bromoform	4.9	U	
74-83-9	Bromomethane	9.9	U	
75-15-0	Carbon Disulfide	4.9	U	
56-23-5	Carbon Tetrachloride	4.9	U	
108-90-7	Chlorobenzene	4.9	U	
75-00-3	Chloroethane	9.9	U	
67-66-3	Chloroform	4.9	U	
74-87-3	Chloromethane	9.9	U	
124-48-1	Dibromochloromethane	4.9	U	
100-41-4	Ethylbenzene	4.9	U	
75-09-2	Methylene Chloride	2.5	JB	B
100-42-5	Styrene	4.9	U	
127-18-4	Tetrachloroethylene	4.9	U	
108-88-3	Toluene	4.9	U	
79-01-6	Trichloroethene	4.9	U	
75-01-4	Vinyl Chloride	9.9	U	

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SAMPLE NO
51SB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404027
Case No: :		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-001-011-1/3
Sample Volume :	5.97	Lab File ID :	F39771.D
Level :	Low	Date Received	04/03/2004
% Moisture: not dec	15.14	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	4.9	U
10061-01-5	cis-1,3-Dichloropropene	4.9	U
136777-61-2	m,p-Xylenes	4.9	U
95-47-6	o-Xylene	4.9	U
156-60-5	trans-1,2-dichloroethene	4.9	U
10061-02-6	trans-1,3-dichloropropene	4.9	U

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SAMPLE NO
51SB8B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404027
Case No.:		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-002-014-1/6
Sample Volume :	5.76	Lab File ID :	F39770.D
Level :	Low	Date Received	04/03/2004
% Moisture: not dec	10.89	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.9	U	UJ
79-34-5	1,1,2,2-Tetrachloroethane	4.9	U	UJ
79-00-5	1,1,2-Trichloroethane	4.9	U	UJ
75-34-3	1,1-Dichloroethane	4.9	U	UJ
75-35-4	1,1-Dichloroethene	4.9	U	UJ
107-06-2	1,2-Dichloroethane	4.9	U	UJ
78-87-5	1,2-Dichloropropane	4.9	U	UJ
78-93-3	2-Butanone	9.7	U	UJ
591-78-6	2-Hexanone	9.7	U	UJ
108-10-1	4-Methyl-2-Pentanone	9.7	U	UJ
67-64-1	Acetone	6.8	J	B
71-43-2	Benzene	4.9	U	UJ
75-27-4	Bromodichloromethane	4.9	U	UJ
75-25-2	Bromoform	4.9	U	UJ
74-83-9	Bromomethane	9.7	U	UJ
75-15-0	Carbon Disulfide	4.9	U	UJ
56-23-5	Carbon Tetrachloride	4.9	U	UJ
108-90-7	Chlorobenzene	4.9	U	UJ
75-00-3	Chloroethane	9.7	U	UJ
67-66-3	Chloroform	4.9	U	UJ
74-87-3	Chloromethane	9.7	U	UJ
124-48-1	Dibromochloromethane	4.9	U	UJ
100-41-4	Ethylbenzene	4.9	U	UJ
75-09-2	Methylene Chloride	2.1	JB	B
100-42-5	Styrene	4.9	U	UJ
127-18-4	Tetrachloroethylene	4.9	U	UJ
108-88-3	Toluene	4.9	U	UJ
79-01-6	Trichloroethene	4.9	U	UJ
75-01-4	Vinyl Chloride	9.7	U	UJ

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SAMPLE NO
51SB8B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404027
Case No. :		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-002-014-1/6
Sample Volume :	5.76	Lab File ID :	F39770.D
Level :	Low	Date Received	04/03/2004
% Moisture: not dec	10.89	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
156-59-2	cis-1,2-Dichloroethene	4.9	U	UJ
10061-01-5	cis-1,3-Dichloropropene	4.9	U	UJ
136777-61-2	m,p-Xylenes	4.9	U	UJ
95-47-6	o-Xylene	4.9	U	UJ
156-60-5	trans-1,2-dichloroethene	4.9	U	UJ
10061-02-6	trans-1,3-dichloropropene	4.9	U	UJ

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SAMPLE NO
51SB8C

Lab Name : GPL Laboratories
Lab Code : GPL
Case No. :
Matrix : (Soil / Water) SOIL
Sample Volume : 5.54
Level : Low
% Moisture: not dec 25.56
GC Column : RTX_VOA ID. 0.53
Soil Extract Volume : (µ L)

Client. : Shaw Environmental & Infrastructure
SAS NO. : 404027
SDG NO : 404027
Lab Sample ID : 404027-003-020-1/3
Lab File ID : F39772.D
Date Received 04/03/2004
Date Analyzed 04/14/2004
Dilution Factor : 1
Soil Aliquot Volume : (µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	6.1	U	UJ
79-34-5	1,1,2,2-Tetrachloroethane	6.1	U	UJ
79-00-5	1,1,2-Trichloroethane	6.1	U	UJ
75-34-3	1,1-Dichloroethane	6.1	U	UJ
75-35-4	1,1-Dichloroethene	6.1	U	UJ
107-06-2	1,2-Dichloroethane	6.1	U	UJ
78-87-5	1,2-Dichloropropane	12	U	UJ
78-93-3	2-Butanone	12	U	UJ
591-78-6	2-Hexanone	12	U	UJ
108-10-1	4-Methyl-2-Pentanone	21		B
67-64-1	Acetone	6.1	U	UJ
71-43-2	Benzene	6.1	U	UJ
75-27-4	Bromodichloromethane	6.1	U	UJ
75-25-2	Bromoform	12	U	UJ
74-83-9	Bromomethane	6.1	U	UJ
75-15-0	Carbon Disulfide	6.1	U	UJ
56-23-5	Carbon Tetrachloride	6.1	U	UJ
108-90-7	Chlorobenzene	12	U	UJ
75-00-3	Chloroethane	6.1	U	UJ
67-66-3	Chloroform	12	U	UJ
74-87-3	Chloromethane	6.1	U	UJ
124-48-1	Dibromochloromethane	6.1	U	UJ
100-41-4	Ethylbenzene	2.4	JB	B
75-09-2	Methylene Chloride	6.1	U	UJ
100-42-5	Styrene	6.1	U	UJ
127-18-4	Tetrachloroethylene	6.1	U	UJ
108-88-3	Toluene	6.1	U	UJ
79-01-6	Trichloroethene	12	U	UJ
75-01-4	Vinyl Chloride			

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SAMPLE NO
51SB8C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404027
Case No. :		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-003-020-1/3
Sample Volume :	5.54	Lab File ID :	F39772.D
Level :	Low	Date Received	04/03/2004
% Moisture: not dec	25.56	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
156-59-2	cis-1,2-Dichloroethene	6.1	U	UJ
10061-01-5	cis-1,3-Dichloropropene	6.1	U	UJ
136777-61-2	m,p-Xylenes	6.1	U	UJ
95-47-6	o-Xylene	6.1	U	UJ
156-60-5	trans-1,2-dichloroethene	6.1	U	UJ
10061-02-6	trans-1,3-dichloropropene	6.1	U	UJ

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SAMPLE NO
TMSB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404027
Case No. :		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-004-023-1/3
Sample Volume :	6.12	Lab File ID :	F39773.D
Level :	Low	Date Received	04/03/2004
% Moisture: not dec	15.05	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.8	U	UJ
79-34-5	1,1,2,2-Tetrachloroethane	4.8	U	UJ
79-00-5	1,1,2-Trichloroethane	4.8	U	UJ
75-34-3	1,1-Dichloroethane	4.8	U	UJ
75-35-4	1,1-Dichloroethene	4.8	U	UJ
107-06-2	1,2-Dichloroethane	4.8	U	UJ
78-87-5	1,2-Dichloropropane	4.8	U	UJ
78-93-3	2-Butanone	9.6	U	UJ
591-78-6	2-Hexanone	9.6	U	UJ
108-10-1	4-Methyl-2-Pentanone	9.6	U	UJ
67-64-1	Acetone	78		B
71-43-2	Benzene	4.8	U	UJ
75-27-4	Bromodichloromethane	4.8	U	UJ
75-25-2	Bromoform	4.8	.U	UJ
74-83-9	Bromomethane	9.6	U	UJ
75-15-0	Carbon Disulfide	4.8	U	UJ
56-23-5	Carbon Tetrachloride	4.8	U	UJ
108-90-7	Chlorobenzene	4.8	U	UJ
75-00-3	Chloroethane	9.6	U	UJ
67-66-3	Chloroform	4.8	U	UJ
74-87-3	Chloromethane	9.6	U	UJ
124-48-1	Dibromochloromethane	4.8	U	UJ
100-41-4	Ethylbenzene	4.8	U	UJ
75-09-2	Methylene Chloride	3.4	JB	B
100-42-5	Styrene	4.8	U	UJ
127-18-4	Tetrachloroethylene	4.8	U	UJ
108-88-3	Toluene	4.8	U	UJ
79-01-6	Trichloroethene	4.8	U	UJ
75-01-4	Vinyl Chloride	9.6	U	UJ

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB8A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404027
Case No. :		SDG NO :	404027
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404027-004-023-1/3
Sample Volume :	6.12	Lab File ID :	F39773.D
Level :	Low	Date Received	04/03/2004
% Moisture: not dec	15.05	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
156-59-2	cis-1,2-Dichloroethene	4.8	U	UJ
10061-01-5	cis-1,3-Dichloropropene	4.8	U	UJ
136777-61-2	m,p-Xylenes	4.8	U	UJ
95-47-6	o-Xylene	4.8	U	UJ
156-60-5	trans-1,2-dichloroethene	4.8	U	UJ
10061-02-6	trans-1,3-dichloropropene	4.8	U	UJ

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant Data Validation – Dioxin Furans
Pace Laboratories, Inc. SDG 04-1087021 (GPL SDG 404043)

DATE: June 24, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004. The sample was analyzed for Dioxin Furan compounds using USEPA SW-846 Method 8290 High Resolution Gas Chromatography/High Resolution Mass Spectroscopy (HRGC/HRMS). A total of four soil samples were validated in this SDG. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB3A	404043-001	51SB3C	404043-003
51SB3B	404043-002	51SB3D	404043-004

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *USEPA Region III Dioxin/Furan Data Validation Guidance* (March, 1999). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
X		Blank Analysis
	X	Instrument Performance Check
	X	Initial Calibration
X		Continuing Calibration
X		Internal Standards
	X	Cleanup Standards
	X	Laboratory Control Standard/Ongoing Precision Result
	X	Matrix Spike and Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/24/04
Date

RADFORD ARMY AMMUNITION PLANT VALIDATION REPORT
DIOXIN FURAN REVIEW
SDG 04-1087021 (GPL SDG 404043)

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For dioxin furan compounds in cooled @4°C ± 2°C soil samples, the maximum holding time is 30 days from sample collection to preparative extraction and 45 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04, coolers were received by GPL Laboratories, Inc. at 3.0°C. The samples were then sent on to Pace Analytical for dioxin furan analysis and were received by the Pace Laboratories, Inc. at 4.9°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04, extracted on 04/08/04, 04/11/04, and 04/18/04, and analyzed for dioxin furans on 04/14/04, 04/15/04, and 04/21/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory (or field) blank analyses is to determine the existence and magnitude of contamination problems resulting from field and laboratory activities. No contamination should be found in any of the blanks > MDL. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 50). Rinse blank 040704R applies to these samples and was analyzed in GPL SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. ng/kg	Action Level ng/kg	B qualified samples
04/13/04	Blank-4657	OCDD	1.1J	11.0	None
04/14/04	Blank-4661	OCDD	4.2J	42.0	51SB3D
04/21/04	Blank-4676	All target compounds < MRL	NA	NA	None
04/18/04	040704R	All target compounds < MRL	NA	NA	None

J = Estimated value <MRL and >MDL.

III-Instrument Performance Check

Instrument must be tuned with perfluorokerosene (PFK) to achieve a static resolving power of at least 10,000 (10% valley). Documentation of the mass spectrometer resolving power is accomplished by recording the peak profile of the high-mass reference signal (typically m/z 330.9792) obtained during a peak examination by using the low-mass PFK ion at m/z 292.9825 or lower in mass as reference. At the beginning of the each 12-hour period, the chromatographic resolution is verified in the same fashion as in the initial calibration through the analysis of HRCC solution on the DB-5 (or equivalent) column or through the analysis of the column performance solution on the SP-2331 or SP-225 (or equivalent) column. A 25% valley must be achieved between the close eluters.

- All PFK forms were verified and found to be in compliance with method specification. No qualifiers were applied.

IV-Initial Calibration
Once the window defining mix has been analyzed and the descriptor switching times have been verified, the five point calibration solutions can be analyzed prior to sample analysis. Initial calibration criteria are as follows:

- The percent relative standard deviations for the mean response factors RRF(n) from the 17 unlabeled standards must not exceed ±20%, and those for the labeled reference compounds must not exceed ±30%
- Isotopic ratio must be within the specified control limits in Table 8 (SW846 Method 8290).

- For initial calibration performed on 04/06/04 for all target compounds on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002), 51SB3C (404043-003), and 51SB3D (404043-004) apply to this initial calibration.

V-Continuing Calibration
The continuing calibration consists of two parts: evaluation of the mass resolution and retention time check. The following stipulates the continuing calibration criteria.

- The signal signal-to-noise ratio (S/N) must be at least 10:1 for each selected ion current profile (SICP) and for each GC signal representing the elution of a target analyte or labeled standard for each analyte.
- The relative response factor of each analyte for the unlabeled standard must be within ±20% of the average RF obtained from the initial calibration, and the RRF of each labeled standard must be within ±30% of the average RRF established during initial calibration. This is expressed in term of percent difference %D.

- For continuing calibration performed on 04/13/04 @11:05 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/13/04 @23:40 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @11:30 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB3A (404043-001) and 51SB3C (404043-003) apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @01:39 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @14:15 on instrument 10MSHR05, OCDF (26.1%) was outside criteria. Sample 51SB3D (404043-004) applies to this continuing calibration. OCDF was qualified estimated non-detect "UJ" based upon this outlier for sample 51SB3D (404043-004).

- For continuing calibration performed on 04/21/04 @03:01 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB3B (404043-002) applies to this continuing calibration.

- For continuing calibration performed on 04/21/04 @15:38 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

VI-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: Recoveries of the isotopically-labeled extraction standards to fall within the 40 to 135 percent range for the tetra- through octachlorinated congeners, or as stated in the data package

- For sample 51SB3B (404043-002), 1,2,3,4,7,8-HxCDF-13C (38%), 1,2,3,6,7,8-HxCDF-13C (35%), and 1,2,3,6,7,8-HxCDD-13C (33%) were below criteria limits. All associated congeners were detected and qualified "J" based upon these outliers.

VII-Cleanup Standards
Cleanup standards are added to every sample, blank, quality control sample, and calibration solution. This compound is added to the samples after extraction but prior to cleanup and is used to verify the percent recovery obtained using the isotope dilution technique. The control limits are 40-135%.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Standard (LCS) or Ongoing Precision Result (OPR)
LCSs/OPRs are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. Acceptable performance is determined by:

1. Recoveries of the isotopically-labeled extraction standards to fall within 40-135% control limits for the tetra- through octachlorinated congeners, or as stated in the data package;

2. Recoveries (accuracy) of the unlabeled compounds should be within $\pm$ 35% when spiked at the method quantitation limit and within $\pm$ 30% when spiked above 20 times the method quantitation limit, or as stated in the data package;

3. When duplicate OPR are required, the relative percent difference (RPD) of the unlabeled analytes concentrations should be within 30% when spiked at the method quantitation limit and within $\pm$ 25% when spiked above 20 times the method quantitation limit.

- Sample LCS-4658 was used as LCS analyzed on 04/13/04. All criteria were met. No qualifiers were applied. Sample 51SB3A (404043-001) applies to this LCS.

- Sample LCS-4662 was used as LCS analyzed on 04/14/04. All criteria were met. No qualifiers were applied. Samples 51SB3C (404043-003) and 51SB3D (404043-004) apply to this LCS.

- Sample LCS-4677 was used as LCS analyzed on 04/21/04. All criteria were met. No qualifiers were applied. Sample 51SB3B (404043-002) applies to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits (40-135%; 50%RPD).

- Sample 51SB4C (404021-003) was performed as MS/MSD for dioxin furans. This sample was reported in SDG 404021. All criteria were met. No qualifiers were applied.

- Sample 51SB2C (404054-007) was performed as MS/MSD for dioxin furans. This sample was reported in SDG 404054. OCDD (183%, 229%) was outside criteria. The amount measured for OCDD in the spiked sample was significantly greater than the amount spiked. No qualifiers were applied based upon these outliers.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed with this SDG.

XI-Quantitation Verification
The accuracy of analytical results was verified through the calculation of at least one the several parameters such as the %D, %RSD, % recovery, and/or compound concentration. Values were found to be within 10%. Any value reported by the laboratory as estimated "J" based on an analyte to internal standard ratio below the calibration curve was qualified as such. The signal signal-to-noise ratio (S/N) must be greater than 2.5 for each selected ion current profile (SICP) and for each GC signal representing the elution of a target analyte or labeled standard. For where the ion ratio failed the 25% criteria (I-lab flag), the estimated maximum possible concentration was reported and flagged estimated "J". For where any detected value had ether interference (E-lab flag), the estimated maximum possible concentration was reported and flagged estimated "J".

Sample: 51SB3A (404043-001), OCDD

A(x) = sum of the integrated ion abundances of the quantitation ions for the unlabeled ions;

A(is) = sum of the integrated ion abundances of the quantitation ions for the labeled ions;

Q(is) = quantity, in pg, of the internal standard added to the sample before extraction; Here need to multiply concentration (pg/uL) by final extract volume (uL).

W = weight, in g, of the sample (solid or organic liquid) as dry weight, or volume in mL of an aqueous sample; and

Avg. RRF(n) = calculated mean relative response factor for the unlabeled analyte.

$$\text{Conc. (ng/kg)} = \frac{(A(x))*Q(is)}{A(is)*W*Avg.RRF} = \frac{(1750000000+1950000000)*(4.00)(1000)}{(127000000+139000000)*(11.8*0.8530)*1.1323} =$$

= 4900 ng/kg

Reported Value = 4900 ng/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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Pace Analytical™

Pace Analytical Services, Inc
1700 Elm Street - Suite 200
Minneapolis, MN 5541

Tel: 612-607-1700
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Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404043-001-013-1/1		
Lab Sample ID	105493191		
Filename	F40414A_12		
Injected By	MRO		
Total Amount Extracted	11.8 g	Matrix	Solid
% Moisture	14.7	Dilution	NA
Dry Weight Extracted	10.1 g	Collected	04/05/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40413B_15 & F40414A_16	Extracted	04/08/2004
Method Blank ID	BLANK-4657	Analyzed	04/14/2004 22:22

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.200	2,3,7,8-TCDF-13C	2.00	83
Total TCDF	ND	-----	0.200	2,3,7,8-TCDD-13C	2.00	84
				1,2,3,7,8-PeCDF-13C	2.00	83
2,3,7,8-TCDD	ND	-----	0.200	2,3,4,7,8-PeCDF-13C	2.00	81
Total TCDD	ND	-----	0.200	1,2,3,7,8-PeCDD-13C	2.00	85
				1,2,3,4,7,8-HxCDF-13C	2.00	92
1,2,3,7,8-PeCDF	ND	-----	0.990	1,2,3,6,7,8-HxCDF-13C	2.00	85
2,3,4,7,8-PeCDF	ND	-----	0.990	2,3,4,6,7,8-HxCDF-13C	2.00	81
Total PeCDF	ND	-----	0.990	1,2,3,7,8,9-HxCDF-13C	2.00	86
				1,2,3,4,7,8-HxCDD-13C	2.00	87
1,2,3,7,8-PeCDD	ND	-----	0.990	1,2,3,6,7,8-HxCDD-13C	2.00	87
Total PeCDD	ND	-----	0.990	1,2,3,4,6,7,8-HpCDF-13C	2.00	84
				1,2,3,4,7,8,9-HpCDF-13C	2.00	85
1,2,3,4,7,8-HxCDF	ND	-----	0.990	1,2,3,4,6,7,8-HpCDD-13C	2.00	86
1,2,3,6,7,8-HxCDF	ND	-----	0.990	OCDD-13C	4.00	94
2,3,4,6,7,8-HxCDF	ND	-----	0.990			
1,2,3,7,8,9-HxCDF	ND	-----	0.990	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.990	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.990	2,3,7,8-TCDD-37Cl4	0.40	83
1,2,3,6,7,8-HxCDD	ND	-----	0.990			
1,2,3,7,8,9-HxCDD	ND	-----	0.990			
Total HxCDD	3.5 J	-----	0.990 J			
1,2,3,4,6,7,8-HpCDF	1.2 J	-----	0.990 J	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.990	Equivalence: 5.2 ng/Kg		
Total HpCDF	1.2 J	-----	0.990 J	(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	30.0	-----	0.990			
Total HpCDD	59.0	-----	0.990			
OCDF	2.1 J	-----	2.000 J			
OCDD	4900.0	-----	2.000			

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087021

REPORT OF LABORATORY ANALYSIS

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Pace Analytical™

Pace Analytical Services, In
1700 Elm Street - Suite 20
Minneapolis, MN 5541

Tel: 612-607-170
Fax: 612- 607-644

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404043-002-014-1/1		
Lab Sample ID	105493209		
Filename	F40421A_12		
Injected By	MRO		
Total Amount Extracted	23.5 g	Matrix	Solid
% Moisture	56.7	Dilution	NA
Dry Weight Extracted	10.2 g	Collected	04/05/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40420B_19 & F40421A_17	Extracted	04/18/2004
Method Blank ID	BLANK-4676	Analyzed	04/21/2004 11:47

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	160.00	-----	0.22 A	2,3,7,8-TCDF-13C	2.00	90
Total TCDF	450.00	-----	0.20	2,3,7,8-TCDD-13C	2.00	98
				1,2,3,7,8-PeCDF-13C	2.00	95
2,3,7,8-TCDD	0.74 J	-----	0.20 J	2,3,4,7,8-PeCDF-13C	2.00	62
Total TCDD	3.90	-----	0.20	1,2,3,7,8-PeCDD-13C	2.00	88
				1,2,3,4,7,8-HxCDF-13C	2.00	38 P
1,2,3,7,8-PeCDF	37.00	-----	0.98	1,2,3,6,7,8-HxCDF-13C	2.00	35 P
2,3,4,7,8-PeCDF	90.00	-----	0.98	2,3,4,6,7,8-HxCDF-13C	2.00	82
Total PeCDF	270.00	-----	0.98	1,2,3,7,8,9-HxCDF-13C	2.00	92
				1,2,3,4,7,8-HxCDD-13C	2.00	41
1,2,3,7,8-PeCDD	5.50	-----	0.98	1,2,3,6,7,8-HxCDD-13C	2.00	33 P
Total PeCDD	15.00	-----	0.98	1,2,3,4,6,7,8-HpCDF-13C	2.00	40
				1,2,3,4,7,8,9-HpCDF-13C	2.00	88
1,2,3,4,7,8-HxCDF	91.00 J	-----	0.98	1,2,3,4,6,7,8-HpCDD-13C	2.00	79
1,2,3,6,7,8-HxCDF	31.00 J	-----	0.98	OCDD-13C	4.00	93
2,3,4,6,7,8-HxCDF	26.00	-----	0.98			
1,2,3,7,8,9-HxCDF	15.00	-----	0.98	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	390.00	-----	0.98	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	12.00	-----	0.98	2,3,7,8-TCDD-37Cl4	0.20	92
1,2,3,6,7,8-HxCDD	63.00 J	-----	0.98			
1,2,3,7,8,9-HxCDD	78.00	-----	0.98			
Total HxCDD	340.00	-----	0.98			
1,2,3,4,6,7,8-HpCDF	370.00	-----	0.98	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	42.00	-----	0.98	Equivalence: 130 ng/Kg		
Total HpCDF	1100.00	-----	0.98	(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	1600.00	-----	1.10 A			
Total HpCDD	2600.00	-----	0.98			
OCDF	930.00	-----	2.00			
OCDD	15000.00	-----	2.00			

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087021

REPORT OF LABORATORY ANALYSIS

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Tel: 612-607-170
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Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404043-003-015-1/1		
Lab Sample ID	105493217		
Filename	F40414A_13		
Injected By	MRO		
Total Amount Extracted	12.2 g	Matrix	Solid
% Moisture	13.2	Dilution	NA
Dry Weight Extracted	10.6 g	Collected	04/05/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40413B_15 & F40414A_16	Extracted	04/11/2004
Method Blank ID	BLANK-4661	Analyzed	04/14/2004 23:10

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	1.4	-----	0.190	2,3,7,8-TCDF-13C	2.00	91
Total TCDF	6.1	-----	0.190	2,3,7,8-TCDD-13C	2.00	95
				1,2,3,7,8-PeCDF-13C	2.00	89
2,3,7,8-TCDD	ND	-----	0.190	2,3,4,7,8-PeCDF-13C	2.00	87
Total TCDD	ND	-----	0.190	1,2,3,7,8-PeCDD-13C	2.00	92
				1,2,3,4,7,8-HxCDF-13C	2.00	99
1,2,3,7,8-PeCDF	ND	-----	0.940	1,2,3,6,7,8-HxCDF-13C	2.00	91
2,3,4,7,8-PeCDF	ND	-----	0.940	2,3,4,6,7,8-HxCDF-13C	2.00	89
Total PeCDF	1.4 J	-----	0.940 J	1,2,3,7,8,9-HxCDF-13C	2.00	94
				1,2,3,4,7,8-HxCDD-13C	2.00	99
1,2,3,7,8-PeCDD	ND	-----	0.940	1,2,3,6,7,8-HxCDD-13C	2.00	95
Total PeCDD	ND	-----	0.940	1,2,3,4,6,7,8-HpCDF-13C	2.00	96
				1,2,3,4,7,8,9-HpCDF-13C	2.00	87
1,2,3,4,7,8-HxCDF	ND	-----	0.940	1,2,3,4,6,7,8-HpCDD-13C	2.00	89
1,2,3,6,7,8-HxCDF	ND	-----	0.940	OCDD-13C	4.00	83
2,3,4,6,7,8-HxCDF	ND	-----	0.940			
1,2,3,7,8,9-HxCDF	ND	-----	0.940	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	4.1 J	-----	0.940 J	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.940	2,3,7,8-TCDD-37Cl4	0.20	93
1,2,3,6,7,8-HxCDD	ND	-----	0.940			
1,2,3,7,8,9-HxCDD	ND	-----	0.940			
Total HxCDD	1.5 J	-----	0.940 J			
1,2,3,4,6,7,8-HpCDF	3.5 J	-----	0.940 J	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.940	Equivalence: 1.1 ng/Kg		
Total HpCDF	12.0	-----	0.940	(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	22.0	-----	0.940			
Total HpCDD	36.0	-----	0.940			
OCDF	11.0	-----	1.900			
OCDD	690.0	-----	1.900			

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087021

REPORT OF LABORATORY ANALYSIS

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Pace Analytical™

Pace Analytical Services, Inc
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404043-004-016-1/1		
Lab Sample ID	105493225		
Filename	F40414B_10		
Injected By	MRO		
Total Amount Extracted	12.7 g	Matrix	Solid
% Moisture	19.8	Dilution	NA
Dry Weight Extracted	10.2 g	Collected	04/05/2004
ICAL Date	04/06/2004	Received	04/07/2004
CCal Filename(s)	F40414A_16 & F40414B_15	Extracted	04/11/2004
Method Blank ID	BLANK-4661	Analyzed	04/15/2004 10:45

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.200		2,3,7,8-TCDF-13C	2.00	78
Total TCDF	ND	-----	0.200		2,3,7,8-TCDD-13C	2.00	82
					1,2,3,7,8-PeCDF-13C	2.00	80
2,3,7,8-TCDD	ND	-----	0.200		2,3,4,7,8-PeCDF-13C	2.00	80
Total TCDD	ND	-----	0.200		1,2,3,7,8-PeCDD-13C	2.00	88
					1,2,3,4,7,8-HxCDF-13C	2.00	87
1,2,3,7,8-PeCDF	ND	-----	0.980		1,2,3,6,7,8-HxCDF-13C	2.00	86
2,3,4,7,8-PeCDF	ND	-----	0.980		2,3,4,6,7,8-HxCDF-13C	2.00	82
Total PeCDF	ND	-----	0.980		1,2,3,7,8,9-HxCDF-13C	2.00	84
					1,2,3,4,7,8-HxCDD-13C	2.00	90
1,2,3,7,8-PeCDD	ND	-----	0.980		1,2,3,6,7,8-HxCDD-13C	2.00	92
Total PeCDD	ND	-----	0.980		1,2,3,4,6,7,8-HpCDF-13C	2.00	94
					1,2,3,4,7,8,9-HpCDF-13C	2.00	89
1,2,3,4,7,8-HxCDF	ND	-----	0.980		1,2,3,4,6,7,8-HpCDD-13C	2.00	97
1,2,3,6,7,8-HxCDF	ND	-----	0.980		OCDD-13C	4.00	91
2,3,4,6,7,8-HxCDF	ND	-----	0.980				
1,2,3,7,8,9-HxCDF	ND	-----	0.980		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.980		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.980		2,3,7,8-TCDD-37Cl4	0.20	77
1,2,3,6,7,8-HxCDD	ND	-----	0.980				
1,2,3,7,8,9-HxCDD	ND	-----	0.980				
Total HxCDD	ND	-----	0.980				
1,2,3,4,6,7,8-HpCDF	ND	-----	0.980		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.980		Equivalence: 0.0022 ng/Kg		
Total HpCDF	ND	-----	0.980		(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	ND	-----	0.980				
Total HpCDD	ND	-----	0.980				
OCDF	ND	-----	2.000	UJ			
OCDD	2.2	-----	2.000	BJ B			

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087021

REPORT OF LABORATORY ANALYSIS

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Shaw Environmental, Inc.

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Explosives
GPL Laboratories, Inc., SDG 404043

DATE: June 22, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004. Samples were analyzed for explosives using USEPA SW-846 8330. A total of eleven soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB3A	404043-001	51SB3D	404043-004DL
51SB3B	404043-002DL	51SB11A	404043-005
51SB3B	404043-002DL2	51SB11B	404043-006
51SB3C	404043-003	51SB11C	404043-007
51SB3C	404043-003DL	51SB11C	404043-007DL
51SB3D	404043-004		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
X		Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
X		System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/22/04

Date

RFAAP VALIDATION REPORT
EXPLOSIVES REVIEW
SDG 404043

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For explosives soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04, extracted on 04/12/04, and analyzed for explosives on 04/15/04 and 04/16/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for explosive target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/13/04	BLK65879	All target compounds < MRL	NA	NA	None
04/13/04	040704R	2,6-Dinitrotoluene	0.29	1.46	51SB11A, 51SB11B, 51SB11C, 51SB3A

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 02/27-28/04 on instrument LCD, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002DL), 51SB3B (404043-002DL2), 51SB3C (404043-003), 51SB3C (404043-003DL), 51SB3D (404043-004), 51SB3D (404043-004DL), 51SB11A (404043-005), 51SB11B (404043-006), 51SB11C (404043-007), and 51SB11C (404043-007DL) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/13/04 @09:44 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/13/04 @23:06 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002DL), 51SB3C (404043-003), and 51SB3D (404043-004) apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @10:53 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @02:27 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB3A (404043-001) and 51SB11A (404043-005) apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @16:03 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB3B (404043-002DL2), 51SB3C (404043-003DL), 51SB3D (404043-004DL), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this continuing calibration.

- For continuing calibration performed on 04/16/04 @06:38 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/19/04 @09:01 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB3B (404043-002DL2) and 51SB11C (404043-007DL) apply to this continuing calibration.

- For continuing calibration performed on 04/19/04 @22:31 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- For samples 51SB11C (404043-007DL), 51SB3B (404043-002DL), 51SB3B (404043-002DL2), 51SB3C (404043-003DL), and 51SB3D (404043-004DL), all surrogates were diluted out. No qualifiers were applied based upon these outliers. For sample 51SB3C (404043-003), 4-nitroaniline (34%) was below USACE criteria. Sample 51SB3C (404043-003) was qualified bias low "L" for detects and "UL" for non-detects based upon these outliers. All other samples were within criteria limits.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for explosives are 60-120% (40-150% for sporadic marginal failures (SMF)).

- Sample BKS65879 was used as LCS for explosives analyzed on 04/13/04. Compounds 2,4,6-trinitrotoluene (65%) and tetryl (40%) were outside lab and USACE criteria and within SMF criteria. Since less than 3 compounds were outside USACE criteria and within SMF criteria, no qualifiers were applied based upon these outliers. Samples 51SB3A (404043-001), 51SB3B (404043-002DL), 51SB3B (404043-002DL2), 51SB3C (404043-003), 51SB3C (404043-003DL), 51SB3D (404043-004), 51SB3D (404043-004DL), 51SB11A (404043-005), 51SB11B (404043-006), 51SB11C (404043-007), and 51SB11C (404043-007DL) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for explosives are 50-140%; RPD ≤ 50% (40-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB4A (404021-001) was performed as MS/MSD for explosives. This sample was analyzed in SDG 404021. Compounds 2,4-dinitrotoluene (173%; RPD=47%), 2,6-dinitrotoluene (133%), 3-nitrotoluene (193%, 160%), 2-nitrotoluene (1667%, 1333%), and 4-nitrotoluene (567%, 433%; RPD=25%) were outside laboratory and/or USACE criteria. The sample concentration was greater than the spike added for 2,4-dinitrotoluene, 2,6-dinitrotoluene, 3-nitrotoluene, 2-nitrotoluene, and 4-nitrotoluene and LCS was within criteria in SDG 404021, therefore no qualifiers were applied based upon these outliers.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate pair was analyzed with this SDG.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D. The explosives for SW-846 method 8330 were air-dried prior to analysis because RDX and HMX are water soluble and moisture in the soil could affect the results.

- For sample 51SB3A (404043-001), compounds 2,6-dinitrotoluene, 4-nitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB3B (404043-002DL), compounds 2,6-dinitrotoluene, 4-nitrotoluene, 1,3-dinitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB3C (404043-003), compounds RDX and 1,3-dinitrobenzene exceeded criteria and were qualified as estimated "J".

- For sample 51SB3C (404043-003DL), compounds 2,6-dinitrotoluene, 4-nitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB3D (404043-004), compounds 1,3,5-trinitrotoluene, 2,6-dinitrotoluene, 4-nitrotoluene, RDX, 1,3-dinitrobenzene, 2-nitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB11A (404043-005), compounds 2,6-dinitrotoluene, 4-nitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB11B (404043-006), compounds 2,6-dinitrotoluene, 4-nitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB11C (404043-007), compounds 2,6-dinitrotoluene, 4-nitrotoluene, RDX, nitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

Sample: 51SB3A (404043-001), 2,4-dinitrotoluene

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D * 1000)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (41917295 * 20 * 1) / (521800 * 2 * 1 * 1000) = 0.80 mg/kg
Reported Value = 0.80 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-005-1/1
Sample Volume :	2	Lab File ID :	LCD23406.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.090	J	J
121-14-2	2,4-Dinitrotoluene	0.80		
606-20-2	2,6-Dinitrotoluene	0.44		B
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	2.5		J
88-72-2	o-Nitrotoluene	38		
99-99-0	p-Nitrotoluene	14		J

GPL Laboratories

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FORM I

ANALYSIS DATA SHEET

SAMPLE NO
51SB3BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-006-1/1
Sample Volume :	2	Lab File ID :	LCD23519.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/19/2004
Injection Volume :	100 µL	Dilution Factor :	1000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	440		
99-65-0	1,3-Dinitrobenzene	38	J	J
606-20-2	2,6-Dinitrotoluene	11000		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	100	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	100	U	
2691-41-0	HMX	200	U	
98-95-3	Nitrobenzene	100	U	
121-82-4	RDX	200	U	
479-45-8	Tetryl	200	U	
99-08-1	m-Nitrotoluene	2100		J
88-72-2	o-Nitrotoluene	25000		
99-99-0	p-Nitrotoluene	16000		J

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SAMPLE NO
51SB3BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-006-1/1
Sample Volume :	2	Lab File ID :	LCD23426.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/16/2004
Injection Volume :	100 µL	Dilution Factor :	5000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
118-96-7	2,4,6-Trinitrotoluene	58000	
121-14-2	2,4-Dinitrotoluene	44000	

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SAMPLE NO
51SB3C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-007-1/1
Sample Volume :	2	Lab File ID :	LCD23381.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	20		L
99-65-0	1,3-Dinitrobenzene	0.62		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	32		L
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	UL
2691-41-0	HMX	0.20	U	UL
98-95-3	Nitrobenzene	0.93		L
121-82-4	RDX	3.4		J
479-45-8	Tetryl	0.20	U	UL

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SAMPLE NO
51SB3CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-007-1/1
Sample Volume :	2	Lab File ID :	LCD23423.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µL	Dilution Factor :	50
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
118-96-7	2,4,6-Trinitrotoluene	1100		
121-14-2	2,4-Dinitrotoluene	1500		
606-20-2	2,6-Dinitrotoluene	480		J
99-08-1	m-Nitrotoluene	67		J
88-72-2	o-Nitrotoluene	380		
99-99-0	p-Nitrotoluene	60		J

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SAMPLE NO
51SB3D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-004-008-1/1
Sample Volume :	2	Lab File ID :	LCD23383.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	2.9		J
99-65-0	1,3-Dinitrobenzene	0.13		J
118-96-7	2,4,6-Trinitrotoluene	4.7		
606-20-2	2,6-Dinitrotoluene	11		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	7.2		J
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	1.7		J
88-72-2	o-Nitrotoluene	17		J
99-99-0	p-Nitrotoluene	9.4		J

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SAMPLE NO
51SB3DDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-004-008-1/1
Sample Volume :	2	Lab File ID :	LCD23424.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/16/2004
Injection Volume :	100 µ L	Dilution Factor :	2
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
121-14-2	2,4-Dinitrotoluene	42	

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SAMPLE NO
51SB11A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-005-045-1/1
Sample Volume :	2	Lab File ID :	LCD23407.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.23		
121-14-2	2,4-Dinitrotoluene	0.77		
606-20-2	2,6-Dinitrotoluene	0.47		B
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10	U	
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	1.2		J
88-72-2	o-Nitrotoluene	12		
99-99-0	p-Nitrotoluene	7.7		J

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FORM 1
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SAMPLE NO
51SB11B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-006-046-1/1
Sample Volume :	2	Lab File ID :	LCD23419.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.76		
121-14-2	2,4-Dinitrotoluene	1.7		
606-20-2	2,6-Dinitrotoluene	1.1		B
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.10		
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	4.3		J
88-72-2	o-Nitrotoluene	43		
99-99-0	p-Nitrotoluene	27		J

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SAMPLE NO
51SB11C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-007-047-1/1
Sample Volume :	2	Lab File ID :	LCD23421.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/15/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	5.2		
121-14-2	2,4-Dinitrotoluene	1.6		
606-20-2	2,6-Dinitrotoluene	1.2		B
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	
98-95-3	Nitrobenzene	0.070	J	J
121-82-4	RDX	0.30		J
479-45-8	Tetryl	0.20	U	
99-08-1	m-Nitrotoluene	6.3		J
99-99-0	p-Nitrotoluene	35		J

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SAMPLE NO
51SB11CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-007-047-1/1
Sample Volume :	2	Lab File ID :	LCD23518.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/19/2004
Injection Volume :	100 µ L	Dilution Factor :	2
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
88-72-2	o-Nitrotoluene	81	

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MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Herbicides
GPL Laboratories, Inc., SDG 404043

DATE: June 22, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004. Samples were analyzed for chlorinated herbicides using USEPA SW846 Method 8151A. A total of one soil sample was validated. The sample ID is:

Field Sample ID	Lab Sample ID
51SB3A	404043-001

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable.

Eric Malarek, Chemist

6/22/04
Date

RFAAP VALIDATION REPORT
CHLORINATED HERBICIDES REVIEW
SDG 404043

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For chlorinated herbicides in cooled @4°C±2°C soil samples, the maximum holding time is 14 days from sample collection to extraction and 40 days from extraction to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04, extracted on 04/07/04, and analyzed for herbicides on 04/12/04. All criteria were met. No qualifiers were applied.

II-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. Percent relative standard deviation (%RSD) for a 5-point standard calibration should be ≤20% for each target compound.

- For initial calibration performed on 04/06/04 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Sample 51SB3A (404043-001) applies to this initial calibration.

III-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration establishes the response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. Percent difference (%D) between the initial calibration CF and the continuing calibration CF must be ≤15%.

- For continuing calibration performed on 04/12/04 @13:26 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Sample 51SB3A (404043-001) applies to this continuing calibration.

- For continuing calibration performed on 04/12/04 @14:08 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Sample 51SB3A (404043-001) applies to this continuing calibration.

- For continuing calibration performed on 04/12/04 @17:54 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Sample 51SB3A (404043-001) applies to this continuing calibration.

- For continuing calibration performed on 04/12/04 @18:19 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Sample 51SB3A (404043-001) applies to this continuing calibration.

IV-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field or laboratory activities. No contaminants should be detected in any of the associated blanks. Positive sample results are qualified "B" if the concentration of the analyte is ≤ five times (5X) the absolute maximum blank concentration. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 100). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/12/04	BLK65835	All target compounds < MRL	NA	NA	None
04/09/04	040204R	All target compounds < MRL	NA	NA	None

V-System Monitoring Compounds (Surrogates)

Laboratory performance on individual samples is established by means of spiking activities. All samples are spiked with surrogate compounds prior to sample preparation. Spike recoveries must be within the specified control limits.

Control Limit: 2,4-DCAA (29-143%) (USACE Shell Criteria: 70-130%)

- All criteria were met. No qualifiers were applied.

VI-Laboratory Control Samples

Data for laboratory control samples (LCS) are generated to determine long-term precision and accuracy of the analytical method. Percent recoveries must be within the specified control limits.

- Sample BKS65835 was used as the LCS. All criteria were met. No qualifiers were applied. Sample 51SB3A (404043-001) applies to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits.

- Sample 404008-001 was used for the MS/MSD analysis. Since this is not a RFAAP sample, it was not evaluated in this report.

VIII-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed in this SDG.

IX-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. Percent difference (%D) between the calculated value and the reported value must be within 10%. All positive values must have less than or equal to 40% %D between the primary and secondary columns. Any sample value > MDL and < MRL is qualified as estimated, "J." All criteria were met. No qualifiers were applied.

Sample: BKS65835, 2,4-D

Conc. µg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (726425 * 10 * 1) / (2270 * 10 * 1) = 320 µg/kg
Reported Value = 320 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
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SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-001-1/1
Sample Volume :	10	Lab File ID :	I27337.D
% Moisture:	14.93	Date Received	04/06/2004
Extraction:	EXT_SW8151	Date Extracted:	04/07/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
93-76-5	2,4,5-T	120	U
93-72-1	2,4,5-TP (Silvex)	120	U
94-75-7	2,4-D	120	U
94-82-6	2,4-DB	120	U
75-99-0	Dalapon	120	U
1918-00-9	Dicamba	120	U
120-36-5	Dichloroprop	120	U
88-85-7	Dinoseb	120	U
94-74-6	MCPA	12000	U
93-65-2	MCPP	12000	U

Shaw Environmental, Inc.

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I
RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Nitroglycerine
GPL Laboratories, Inc., SDG 404043

DATE: June 23, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004. Samples were analyzed for nitroglycerine using USEPA SW-846 8332. A total of eight soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB3A	404043-001	51SB3D	404043-004
51SB3B	404043-002	51SB11A	404043-005
51SB3B	404043-002DL	51SB11B	404043-006
51SB3C	404043-003	51SB11C	404043-007

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
X		System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable except for the following. For sample 51SB3B (404043-002), surrogate 4-nitroaniline (1644%) was grossly outside of criteria due to matrix interferences. This sample was qualified as rejected "R" due to these matrix interferences. Sample 51SB3B (404043-002DL) should be used for the RFI.

Eric Malarek, Chemist

6/23/04
Date

RFAAP VALIDATION REPORT
NITROGLYCERINE REVIEW
SDG 404043

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For nitroglycerine soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04, extracted on 04/12/04, and analyzed for nitroglycerine on 04/20/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.20). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/20/04	BLK65881	All target compounds < MRL	NA	NA	None
04/15/04	040704R	All target compounds < MRL	NA	NA	None

III-Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 04/20/04 on instrument HPLC-E, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002), 51SB3B (404043-002DL), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/20/04 @18:36 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this continuing calibration.

- For continuing calibration performed on 04/20/04 @21:53 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/21/04 @08:15 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/21/04 @09:44 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB3B (404043-002DL) applies to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- Surrogate 4-nitroaniline was diluted out for sample 51SB3B (404043-002DL) (0%). No qualifiers were applied based upon this outlier. For sample 51SB3B (404043-002), surrogate 4-nitroaniline (1644%) was grossly outside of criteria due to matrix interferences. This sample was qualified as rejected "R" due to these matrix interferences. Sample 51SB3B (404043-002DL) should be used for the RFI. All criteria were met for remaining samples.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for nitroglycerine are 60-120%.

- Sample BKS65881 was used as LCS for nitroglycerine analyzed on 04/20/04. All criteria were met. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002), 51SB3B (404043-002DL), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for nitroglycerine are 50-140%; RPD ≤ 50%.

- Sample 51SB4A (404021-001) was performed as MS/MSD for nitroglycerine. This sample was analyzed in SDG 404021. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed with this SDG.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB3A (404043-001), 51SB3B (404043-002DL), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007), nitroglycerine was non-detect. All criteria were met. No qualifiers were applied.

- Sample 51SB3B (404043-002) exhibited matrix interferences (See Section V). This sample was rejected "R" due to these matrix interferences. Sample 51SB3B (404043-002DL) should be used for the RFI

Sample: BKS65881, nitroglycerine

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (25563718 * 20 * 1) / (2392000 * 4 * 1.0) = 53 mg/kg
Reported Value = 53 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I Org

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-005-1/1
Sample Volume :	4	Lab File ID :	LCE0901.D
% Moisture:	14.93	Date Received	04/06/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/20/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.9	U

Form I Org

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-006-1/1
Sample Volume :	4	Lab File ID :	LCE0910.D
% Moisture:	62.83	Date Received	04/06/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/20/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
55-63-0	Nitroglycerine	14	U	R

Form I Org

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3B DL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-006-1/1
Sample Volume :	4	Lab File ID :	LCE0902.D
% Moisture:	62.83	Date Received	04/06/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/20/2004
Injection Volume :	25 µ L	Dilution Factor	2000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	27000	U

GPL Laboratories

Form I Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-007-1/1
Sample Volume :	4	Lab File ID :	LCE0907.D
% Moisture:	10.88	Date Received	04/06/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/20/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.6	U

GPL Laboratories

for 1 Cpy

GPL
FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB3D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-004-008-1/1
Sample Volume :	4	Lab File ID :	LCE0903.D
% Moisture:	18.07	Date Received	04/06/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/20/2004
Injection Volume :	25 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.1	U

GPL Laboratories

- Form I Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-005-045-1/1
Sample Volume :	4	Lab File ID :	LCE0904.D
% Moisture:	13.51	Date Received	04/06/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/20/2004
Injection Volume :	25 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.8	U

Form I Corr

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-006-046-1/1
Sample Volume :	4	Lab File ID :	LCE0905.D
% Moisture:	14.71	Date Received	04/06/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/20/2004
Injection Volume :	25 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.9	U

Form I Only

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-007-047-1/1
Sample Volume :	4	Lab File ID :	LCE0906.D
% Moisture:	13.11	Date Received	04/06/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/20/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.8	U

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – PAHs
GPL Laboratories, Inc., SDG 404043

DATE: June 21, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004. Samples were analyzed for polynuclear aromatic hydrocarbons (PAHs) using USEPA SW846 Methods 3540C/8270C low level. A total of five soil samples were validated. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB3A	404043-001	51SB11B	404043-006
51SB3D	404043-004	51SB11C	404043-007
51SB11A	404043-005		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
X		Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	Surrogate Spikes
	X	Internal Standards
	X	Laboratory Control Standard
X		Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/21/04

Date

RFAAP VALIDATION REPORT
POLYNUCLEAR AROMATIC HYDROCARBONS REVIEW
SDG 404043

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For polynuclear aromatic hydrocarbons (PAHs) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04, extracted on 04/12/04, and analyzed for PAHs on 04/14/04 and 04/15/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for PAH compounds by GC/MS low level. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for the PAHs by USEPA SW-846 8270C low level was performed on 04/14/04 on instrument HP#T. All RRFs were ≥ 0.05. Compounds naphthalene (17.6%), acenaphthylene (16.9%), and phenanthrene (16.6%) were outside criteria. For noted compounds, all detects were qualified estimated "J" and non-detects no qualifier based upon these outliers. Samples 51SB3A (404043-001), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be ≥ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within ± 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the PAHs by USEPA SW-846 8270C low level performed on 04/14/04 @16:04 on instrument HP#H, all target compounds were within criteria. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3D (404043-004), and 51SB11A (404043-005) apply to his continuing calibration.

- For continuing calibration for the PAHs by USEPA SW-846 8270C low level performed on 04/15/04 @15:35 on instrument HP#T, all target compounds were within criteria. No qualifiers were applied. Samples 51SB11B (404043-006) and 51SB11C (404043-007) apply to his continuing calibration.

V-Blank Analysis
The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 30). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/14/04	BLK65895	All compounds < MRL	NA	NA	None
04/15/04	040704R	Naphthalene	17.4	87.0	None

VI-Surrogate Spikes
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria: Nitrobenzene-d5 (36-164%) – S1 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (54-124%) – S2 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (56-150%) – S3 (USACE Shell Criteria: 45-135%)

- All criteria were met. No qualifiers were applied.

VII-Internal Standards
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for PAHs by 8270C low level are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65895 was used as the LCS for PAHs by USEPA SW-846 8270C low level. dibenz(a,h)anthracene (138%) was above USACE criteria and within SMF criteria. There were a total of 17 spike recoveries with 1 sporadic marginal failure. No qualifiers were applied based upon this outlier. In addition, all samples were non-detect for dibenz(a,h)anthracene. Samples 51SB3A (404043-001), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB1B (404068-004) was used for the MS/MSD analysis for PAHs and was analyzed in SDG 404068. Compounds benzo(g,h,i)perylene (126%, 126%), dibenz(a,h)anthracene (155%, 155%), and indeno(1,2,3-cd)pyrene (126%, 126%) were outside lab criteria. Three compounds were outside USACE criteria and within SMF criteria. All detects were qualified bias high "K" for the spiked sample and non-detects no qualifier based upon these outliers.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate pair was analyzed with this SDG.

XI-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB3A (404043-001), phenanthrene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Is = Amount of internal standard injected (ng).
Vt = Volume of total extract (µL).
Ais = Area of characteristic ion for the internal standard.
RRF = Average relative response factor for compound being measured (from ICAL)
Vi = Volume of extract injected (µL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (83614 * 4 * 1000 * 1) / (922415 * 0.893 * 1 * 30 * 0.8507) = 16 µg/kg
Reported Value = 16 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I Copy

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-001-1/1
Sample Volume :	30	Lab File ID :	T18812.D
% Moisture:	14.93	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/14/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.8	U
83-32-9	Acenaphthene	7.8	U
208-96-8	Acenaphthylene	7.8	U
120-12-7	Anthracene	7.8	U
56-55-3	Benzo(a)anthracene	7.8	U
50-32-8	Benzo(a)pyrene	7.8	U
205-99-2	Benzo(b)fluoranthene	7.8	U
191-24-2	Benzo(g,h,i)perylene	7.8	U
207-08-9	Benzo(k)fluoranthene	7.8	U
218-01-9	Chrysene	7.8	U
53-70-3	Dibenz(a,h)Anthracene	7.8	U
206-44-0	Fluoranthene	7.8	U
86-73-7	Fluorene	7.8	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.8	U
91-20-3	Naphthalene	7.8	U
85-01-8	Phenanthrene	16	J
129-00-0	Pyrene	7.8	U

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Form 1 Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-004-004-1/1
Sample Volume :	30	Lab File ID :	T18813.D
% Moisture:	18.07	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/14/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	8.1	U
83-32-9	Acenaphthene	8.1	U
208-96-8	Acenaphthylene	8.1	U
120-12-7	Anthracene	8.1	U
56-55-3	Benzo(a)anthracene	8.1	U
50-32-8	Benzo(a)pyrene	8.1	U
205-99-2	Benzo(b)fluoranthene	8.1	U
191-24-2	Benzo(g,h,i)perylene	8.1	U
207-08-9	Benzo(k)fluoranthene	8.1	U
218-01-9	Chrysene	8.1	U
53-70-3	Dibenz(a,h)Anthracene	8.1	U
206-44-0	Fluoranthene	8.1	U
86-73-7	Fluorene	8.1	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	8.1	U
91-20-3	Naphthalene	8.1	U
85-01-8	Phenanthrene	10	J
129-00-0	Pyrene	8.1	U

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-005-042-1/1
Sample Volume :	30	Lab File ID :	T18814.D
% Moisture:	13.51	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/14/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.7	U
83-32-9	Acenaphthene	7.7	U
208-96-8	Acenaphthylene	7.7	U
120-12-7	Anthracene	7.7	U
56-55-3	Benzo(a)anthracene	7.7	U
50-32-8	Benzo(a)pyrene	7.7	U
205-99-2	Benzo(b)fluoranthene	7.7	U
191-24-2	Benzo(g,h,i)perylene	7.7	U
207-08-9	Benzo(k)fluoranthene	7.7	U
218-01-9	Chrysene	7.7	U
53-70-3	Dibenz(a,h)Anthracene	7.7	U
206-44-0	Fluoranthene	7.7	U
86-73-7	Fluorene	7.7	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.7	U
91-20-3	Naphthalene	7.7	U
85-01-8	Phenanthrene	20	J
129-00-0	Pyrene	7.7	U

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Form I Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-006-043-1/1
Sample Volume :	30	Lab File ID :	T18835.D
% Moisture:	14.71	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.8	U
83-32-9	Acenaphthene	7.8	U
208-96-8	Acenaphthylene	7.8	U
120-12-7	Anthracene	7.8	U
56-55-3	Benzo(a)anthracene	7.8	U
50-32-8	Benzo(a)pyrene	7.8	U
205-99-2	Benzo(b)fluoranthene	7.8	U
191-24-2	Benzo(g,h,i)perylene	7.8	U
207-08-9	Benzo(k)fluoranthene	7.8	U
218-01-9	Chrysene	7.8	U
53-70-3	Dibenz(a,h)Anthracene	7.8	U
206-44-0	Fluoranthene	7.8	U
86-73-7	Fluorene	7.8	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.8	U
91-20-3	Naphthalene	7.8	U
85-01-8	Phenanthrene	15	J
129-00-0	Pyrene	7.8	U

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FORM 1

ANALYSIS DATA SHEET

SAMPLE NO
51SB11C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-007-044-1/1
Sample Volume :	30	Lab File ID :	T18836.D
% Moisture:	13.11	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.7	U
83-32-9	Acenaphthene	7.7	U
208-96-8	Acenaphthylene	7.7	U
120-12-7	Anthracene	7.7	U
56-55-3	Benzo(a)anthracene	7.7	U
50-32-8	Benzo(a)pyrene	7.7	U
205-99-2	Benzo(b)fluoranthene	7.7	U
191-24-2	Benzo(g,h,i)perylene	7.7	U
207-08-9	Benzo(k)fluoranthene	7.7	U
218-01-9	Chrysene	7.7	U
53-70-3	Dibenz(a,h)Anthracene	7.7	U
206-44-0	Fluoranthene	7.7	U
86-73-7	Fluorene	7.7	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.7	U
91-20-3	Naphthalene	7.7	U
85-01-8	Phenanthrene	13	J
129-00-0	Pyrene	7.7	U

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Pesticides and PCBs
GPL Laboratories, Inc., SDG 404043

DATE: June 22, 2004

The purpose of this memorandum is to present the data validation report for the sample collected for the SWMU 51 RFI at the RFAAP on April 05, 2004. Sample was analyzed for pesticides and PCBs using USEPA Method 3540C/8081A and 3540C/8082, respectively. A total of one soil sample was validated for pesticides and four soil samples analyzed for PCBs. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB3A*	404043-001	51SB3C	404043-003
51SB3B	404043-002	51SB3D	404043-004

*Analyzed for pesticides and PCBs.

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (USEPA, September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
X		System Monitoring Compounds
X		Laboratory Control Samples
X		Matrix Spike/Spike Duplicate
	X	Field Sample Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/22/04

Date

RFAAP VALIDATION REPORT
PESTICIDE/PCB REVIEW
SDG 404043

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For pesticide and PCB soil samples, cooled @4°C ±2°C, the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis (USEPA criteria).

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The samples were collected 04/05/04 for pesticides and PCB compounds. They were extracted on 04/10/04 and analyzed for pesticides and PCBs on 04/12/04 and 04/13/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check (Degradation Standard)
Performance checks on the gas chromatograph with electron capture detector (GC/ECD) system are performed to ensure adequate resolution and instrument sensitivity. The performance evaluation mixture (PEM) must be analyzed at the beginning of the analytical sequence. The breakdown of Endrin and 4,4'-DDT must be ≤ 15% on both columns (USEPA and USACE criteria) and ≤ 30% combined Endrin and 4,4'-DDT on both columns (USEPA criteria).

- For analysis performed on 03/31/04, endrin and 4,4'-DDT breakdowns were 5.7% and 2.1% on column #1 and 8.5% and 2.6% on column #2, respectively. All criteria were met. No qualifiers were applied.

- For analysis performed on 04/12/04, endrin and 4,4'-DDT breakdowns were 10.4% and 5.6% on column #1 and 12.0% and 6.6% on column #2, respectively. All criteria were met. No qualifiers were applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The percent relative standard deviation (%RSD) for all single peak target analytes, and aroclors 1016 and 1260 must be < 20% or the mean %RSD for all analytes in the standard must be ≤ 20%. If linear regression is used, the correlation coefficient must be ≥0.990 (USEPA and USACE criteria).

- For the pesticide initial calibration performed on 03/31/04 on instrument GC-K, all criteria were met. All compounds were determined using calibration factors with RSDs ≤20% for single peak pesticides. No qualifiers were applied. Sample 51SB3A (404043-001) applies to this initial calibration.

- For the PCB initial calibration performed on 03/31/04 on instrument GC-L, all criteria were met. All compounds were determined using calibration factors with RSDs ≤20% for PCB 1016 and PCB 1260. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002), 51SB3C (404043-003), and 51SB3D (404043-004) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for pesticide/PCB target compounds. Continuing calibration standards containing both target compounds and surrogates are analyzed at the beginning of each 12-hour analytical shift and after every 20 samples. The percent difference (%D) or the mean %RSD for all analytes in the standard from the initial calibration should be no greater than ± 15%.

- For pesticide continuing calibration performed on 04/12/04 @15:00 on instrument GC-K, all criteria were met on column #1 for all target compounds. For column #2, endrin (24.7%) was outside criteria. All samples were non-detect for this compound, therefore no qualifiers were applied based upon these outliers. Sample 51SB3A (404043-001) applies to this continuing calibration.

- For pesticide continuing calibration performed on 04/12/04 @21:18 on instrument GC-K, all criteria were met on column #1 for all target compounds. For column #2, endrin (32.4%) and endrin keytone (16.0%) were outside criteria. All samples were non-detect for this compound, therefore no qualifiers were applied based upon these outliers. No samples apply to this continuing calibration.

- For PCB continuing calibration performed on 04/12/04 @14:54 on instrument GC-L, all criteria were met on column #1 and column #2 for all target compounds. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002), 51SB3C (404043-003), and 51SB3D (404043-004) apply to his continuing calibration.

- For PCB continuing calibration performed on 04/13/04 @01:59 on instrument GC-L, the following %Ds were determined. For column #1, arochlor 1016 #2 (15.1%) and arochlor 1016 #3 (21.3%) were outside criteria. The average of the peaks for arochlor 1016 was within criteria and all samples were non-detect. For column #2, arochlor 1016 was within criteria. For column #1, arochlor 1260 #1 (19.6%), arochlor 1260 #2 (16.9%), arochlor 1260 #3 (18.8%), arochlor 1260 #4 (16.4%), and arochlor 1260 #5 (24.7%) were outside criteria. For column #2, Arochlor 1260 #2 (17.1%), arochlor 1260 #4 (15.2%), and arochlor 1260 #5 (21.6%) were outside criteria. All samples were non-detect for this compound. Therefore, no qualifiers were applied based upon these outliers. No samples apply to this continuing calibration.

- For PCB continuing calibration performed on 04/13/04 @05:51 on instrument GC-L, the following %Ds were determined. For column #1, arochlor 1260 #2 (18.5%), arochlor 1260 #4 (15.1%), and arochlor 1260 #5 (23.1) were outside criteria. The average of the peaks for arochlor 1260 (16.6%) was outside criteria and all samples were non-detect. For column #1, arochlor 1016 was within criteria. For column #2, arochlor 1260 was within criteria. For column #2, Arochlor 1016 #1 (20.6%) was outside criteria. The average of the peaks for arochlor 1016 was within criteria and all samples were non-detect. Therefore, no qualifiers were applied based upon these outliers. No samples apply to this continuing calibration.

V-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks > MDL or MRL (USEPA criteria) or all target compounds < one-half the MRL (USACE criteria). Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 30). For pesticides, rinse blank 040204R applies to these samples and was analyzed in SDG 0404027. For PCBs, rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Parameter	Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
Pesticides	04/12/04	BKS65858	All < MRL	NA	NA	None
Pesticides	04/15/04	040204R	All < MRL	NA	NA	None
PCBs	04/12/04	BKS65862	All < MRL	NA	NA	None
PCBs	04/18/04	040704R	All < MRL	NA	NA	None

VI-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the specified laboratory control limits.

Criteria: Decachlorobiphenyl: Pesticides: 55-151% (USACE criteria 50-130%)
Tetrachloro-m-xylene: Pesticides: 34-100% (USACE criteria 50-130%)
Decachlorobiphenyl: PCBs: 47-161% (USACE criteria 50-130%)
Tetrachloro-m-xylene: PCBs: 54-168% (USACE criteria 50-130%)

- For pesticide analysis, all criteria were met. No qualifiers were applied.
- For PCB analysis sample 51SB3A (404043-001), all criteria were met. No qualifiers were applied.
- For PCB analysis for sample 51SB3B (404043-002), surrogates decachlorobiphenyl (32%) and tetrachloro-m-xylene (0%, 0% => matrix) were outside criteria. Since both surrogates were below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.
- For PCB analysis for sample 51SB3C (404043-003), surrogates decachlorobiphenyl (137%) and tetrachloro-m-xylene (0%, 0% => matrix) were outside criteria. Since both surrogates were below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.
- For PCB analysis for sample 51SB3D (404043-004), surrogate tetrachloro-m-xylene (0%, 0% => matrix) was outside criteria. Since the surrogate was below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.

VII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor long-term precision and accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within the specified control limits. USACE Shell limits for pesticides/PCBs are 50-130% (30-150% for sporadic marginal failures (SMF)).

- Sample BKS65858 was used for the LCS for TCL pesticide compounds. Delta-BHC (19%) was outside USACE and SMF criteria. Sample 51SB3A (404043-001) was non-detect for all target compounds. Delta-BHC was qualified bias low "UL" non-detect based upon the low recovery.
- Sample BKS65862 was used for the LCS for TCL PCB aroclors. All criteria were met. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002), 51SB3C (404043-003), and 51SB3D (404043-004) apply to this LCS.

VIII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits for pesticides/PCBs are 40-140%; RPD<50% (30-150%; RPD<60% for sporadic marginal failures (SMF) for pesticides).

- Sample 51SB5A (404021-005) was used for the MS/MSD analysis for pesticide compounds. This sample was analyzed in SDG 404021. Compounds 4,4-DDD (60%, 59%), 4,4-DDE (53%, 54%), 4,4-DDT (55%, 55%), aldrin (57%, 61%), alpha-BHC (53%, 53%), alpha-chlordane (49%, 49%), beta-BHC (119%, 118%), delta-BHC (18%, 17%), endosulfan I (52%, 50%), endosulfan II (65%, 65%), endosulfan sulfate (58%, 56%), gamma-BHC (57%, 56%), and gamma-chlordane (58%, 57%) were outside lab criteria. All RPDs were within criteria. Sample 51SB5A (404021-005) was non-detect for all target compounds. All non-detects for the spiked sample were qualified "UL" for these compounds (except beta-BHC) based upon the low recoveries. Beta-BHC was non-detect for the spiked sample and recovered high. Therefore, no qualifiers were applied based upon this outlier.

- Sample 51SB5A (404021-005) was used for the MS/MSD analysis for PCB compounds. This sample was analyzed in SDG 404021. All criteria were met. No qualifiers were applied.

IX-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. The project precision control criterion was established at 50% RPD for the solid samples.

- No field duplicate was analyzed with this SDG.

X-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The difference between the calculated value and the reported value must be within 10% difference. All samples were non-detect for PCBs, therefore the quantification verification not included here. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." The difference between the primary column and the confirmatory column must be ≤ 40% difference (USEPA and USACE criteria).

- For this SDG, all pesticides/PCBs were non-detect for all samples. No qualifiers were applied.

Sample: 51SB5AMS (404021-005MS), endrin

Conc. µg/kg = (Ax * Vt * DF) / (CF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area/response for compound being measured.
Vt = Volume of total extract, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean V(t) = 10000 µL.
CF = Ave calibration response factor for compound being measured from ICAL (Area/pg)
Vi = Volume of extract injected (mL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100 = 1.0 for Wet Weight
DF = Dilution factor

Conc. µg/kg = (1551791 Area*10000µL*1) / (42620Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 15 µg/kg

Reported Value = 15 µg/kg
% Difference = 0.0%
Values were within 10% difference

Sample: 51SB5AMS (404021-005MS), Aroclor 1260

Conc. µg/kg = (Ax * Vt * DF) / (CF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area/response for compound being measured.
Vt = Volume of total extract, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean V(t) = 10000 µL.
CF = Ave calibration response factor for compound being measured from ICAL (Area/pg)
Vi = Volume of extract injected (mL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100 = 1.0 for Wet Weight
DF = Dilution factor

Signal #1
Conc1 µg/kg = (140694Area*10000µL*1) / (382.3Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 149.44 µg/kg
Conc2 µg/kg = (213944Area*10000µL*1) / (545.1Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 159.37 µg/kg
Conc3 µg/kg = (249460Area*10000µL*1) / (622.1Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 162.83 µg/kg
Conc4 µg/kg = (94744Area*10000µL*1) / (269.3Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 142.86 µg/kg
Conc5 µg/kg = (231104Area*10000µL*1) / (702.4Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 133.60 µg/kg
Average concentration = 150 µg/kg

Signal #2
Conc1 µg/kg = (786176Area*10000µL*1) / (1917Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 166.53 µg/kg
Conc2 µg/kg = (756020Area*10000µL*1) / (1987Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 154.50 µg/kg
Conc3 µg/kg = (397020Area*10000µL*1) / (973Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 165.69 µg/kg
Conc4 µg/kg = (580532Area*10000µL*1) / (1507Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 156.42 µg/kg
Conc5 µg/kg = (976496Area*10000µL*1) / (2810Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 141.11 µg/kg
Average concentration = 160 µg/kg

Reported Value = 160 µg/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

Form I Org

SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-001-1/1
Sample Volume :	30	Lab File ID :	K125417.D
% Moisture:	14.93	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
72-54-8	4,4-DDD	2.0	U	
72-55-9	4,4-DDE	2.0	U	
50-29-3	4,4-DDT	2.0	U	
309-00-2	Aldrin	2.0	U	
319-84-6	Alpha-BHC	2.0	U	
5103-71-9	Alpha-Chlordane	2.0	U	
319-85-7	Beta-BHC	2.0	U	
319-86-8	Delta-BHC	2.0	U	VL
959-98-8	Endosulfan I	2.0	U	
33213-65-9	Endosulfan II	2.0	U	
1031-07-8	Endosulfan Sulfate	2.0	U	
72-20-8	Endrin	2.0	U	
7421-93-4	Endrin Aldehyde	2.0	U	
53494-70-5	Endrin Ketone	2.0	U	
58-89-9	Gamma-BHC (Lindane)	2.0	U	
5566-34-7	Gamma-Chlordane	2.0	U	
76-44-8	Heptachlor	2.0	U	
1024-57-3	Heptachlor Epoxide	2.0	U	
72-43-5	Methoxychlor	2.0	U	
8001-35-2	Toxaphene	39	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-001-1/1
Sample Volume :	30	Lab File ID :	L33057.D
% Moisture:	14.93	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
12674-11-2	PCB-1016	39	U
11104-28-2	PCB-1221	39	U
11141-16-5	PCB-1232	39	U
53469-21-9	PCB-1242	39	U
12672-29-6	PCB-1248	39	U
11097-69-1	PCB-1254	39	U
11096-82-5	PCB-1260	39	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-002-1/1
Sample Volume :	30	Lab File ID :	L33058.D
% Moisture:	62.83	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ~~ug/kg~~

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	90	U	UL
11104-28-2	PCB-1221	90	U	UL
11141-16-5	PCB-1232	90	U	UL
53469-21-9	PCB-1242	90	U	UL
12672-29-6	PCB-1248	90	U	UL
11097-69-1	PCB-1254	90	U	UL
11096-82-5	PCB-1260	90	U	UL

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FORM 1

ANALYSIS DATA SHEET

SAMPLE NO

51SB3C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-003-1/1
Sample Volume :	30	Lab File ID :	L33059.D
% Moisture:	10.88	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	37	U	UL
11104-28-2	PCB-1221	37	U	UL
11141-16-5	PCB-1232	37	U	UL
53469-21-9	PCB-1242	37	U	UL
12672-29-6	PCB-1248	37	U	UL
11097-69-1	PCB-1254	37	U	UL
11096-82-5	PCB-1260	37	U	UL

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-004-004-1/1
Sample Volume :	30	Lab File ID :	L33060.D
% Moisture:	18.07	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	41	U	UL
11104-28-2	PCB-1221	41	U	UL
11141-16-5	PCB-1232	41	U	UL
53469-21-9	PCB-1242	41	U	UL
12672-29-6	PCB-1248	41	U	UL
11097-69-1	PCB-1254	41	U	UL
11096-82-5	PCB-1260	41	U	UL

Shaw Environmental, Inc.

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410.612.6350
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Pentaerythritol Tetranitrate GPL Laboratories, Inc., SDG 404043

DATE: June 23, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004. Samples were analyzed for pentaerythritol tetranitrate (PETN) using USEPA SW-846 8330. A total of seven soil samples were validated. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB3A	404043-001	51SB11A	404043-005
51SB3B	404043-002	51SB11B	404043-006
51SB3C	404043-003	51SB11C	404043-007
51SB3D	404043-004		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable.

Eric Malarek, Chemist

6/23/04

Date

RFAAP VALIDATION REPORT
PETN REVIEW
SDG 404043

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For PETN soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04, extracted on 04/12/04, and analyzed for PETN on 04/13/04 and 04/14/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/13/04	BLK65880	All target compounds < MRL	NA	NA	None
04/12/04	040704R	All target compounds < MRL	NA	NA	None

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 03/03/04 on instrument LCC-UV, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/13/04 @12:54 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

- For continuing calibration performed on 04/13/04 @17:42 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB3A (404043-001) applies to this continuing calibration.

- For continuing calibration performed on 04/13/04 @22:32 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB3B (404043-002), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @04:01 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. No samples apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- For sample 51SB3B (404043-002), 4-nitroaniline (228%) was outside criteria. Since this sample was non-detect for PETN, no qualifiers were applied based upon the high recovery outlier. Surrogate 4-nitroaniline was within criteria for all other samples.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for PETN are 60-120%.

- Sample BKS65880 was used as LCS for PETN analyzed on 04/13/04. All criteria were met. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for PETN are 50-140%; RPD ≤ 50%.

- Sample 51SB4A (404021-001) was performed as MS/MSD for PETN. This sample was analyzed in SDG 404021. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed with this SDG.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB3A (404043-001), 51SB3B (404043-002), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007), PETN was non-detect. All criteria were met. No qualifiers were applied.

Sample: 51SB4AMS (404021-001MS), PETN

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (28767592 * 20 * 1) / (162300 * 2 * 1 * 1000) = 1.8 mg/kg
Reported Value = 1.8 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

GPL Laboratories

Form I Com

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-005-1/1
Sample Volume :	2	Lab File ID :	LC11048U.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

Form I Copy

GPL Laboratories

GPL
FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB3B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-006-1/1
Sample Volume :	2	Lab File ID :	LC11052U.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

GPL Laboratories

for 1 copy

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-007-1/1
Sample Volume :	2	Lab File ID :	LC11055U.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB3D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-004-008-1/1
Sample Volume :	2	Lab File ID :	LC11057U.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-005-045-1/1
Sample Volume :	2	Lab File ID :	LC11058U.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-006-046-1/1
Sample Volume :	2	Lab File ID :	LC11059U.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

Form I Corr

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-007-047-1/1
Sample Volume :	2	Lab File ID :	LC11060U.D
% Moisture:		Date Received	04/06/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Semi-Volatiles
GPL Laboratories, Inc., SDG 404043

DATE: July 26, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004. Samples were analyzed for semivolatile organic compounds (SVOCs) using USEPA SW846 Methods 3540C/8270C. A total of nine soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB3A	404043-001	51SB3D	404043-004
51SB3B	404043-002DL	51SB11A	404043-005
51SB3B	404043-002DL2	51SB11B	404043-006
51SB3C	404043-003	51SB11C	404043-007
51SB3C	404043-003DL		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
X		Initial Calibration
	X	Continuing Calibration
X		Blank Analysis
	X	Surrogate Spikes
X		Internal Standards
	X	Laboratory Control Standard
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications except for the following. For samples 51SB3B (404043-002DL) and 51SB3C (404043-003), compound 2,4-dinitrotoluene exceeded the calibration range and were rejected "R". For sample 51SB3C (404043-003), 2,6-dinitrotoluene exceeded the calibration range and were rejected "R". The diluted samples 51SB3B (404043-002DL2), and 51SB3C (404043-003DL) should be used for these compounds. For sample 51SB3D (404043-004), compounds 2,4-dinitrotoluene and 2,6-dinitrotoluene exceeded the calibration range, without further dilutions. Sample 51SB3D (404043-004) was qualified "J" estimated for these compounds.

E. Malarek

Eric Malarek, Chemist

7/26/04

Date

RFAAP VALIDATION REPORT
SEMIVOLATILES REVIEW
SDG 404043

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For semivolatile organic compound (SVOC) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04, extracted on 04/12/04, and analyzed for TCL SVOCs on 04/15/04, 04/20/04, and 04/21/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for compounds on the semivolatile target compound list (TCL). Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for pyridine was performed on 04/09/04 on instrument HP#D. All criteria were met. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this initial calibration.

- Initial calibration for the TCL SVOCs was performed on 04/14/04 on instrument HP#D. Target compounds benzoic acid (30.4%; grossly exceeding), hexachlorocyclopentadiene (37.7%; grossly exceeding), 2,4-dinitrophenol (27.3%), 4-nitrophenol (22.3%), 4,6-dinitro-2-methylphenol (19.9%), and dibenz(a,h)anthracene (17.7%) were outside criteria. All RRFs were ≥ 0.05. Compounds 2,4-dinitrophenol, 4-nitrophenol, 4,6-dinitro-2-methylphenol, and dibenz(a,h)anthracene were qualified estimated "J" for detects and no qualifier for non-detects for the high %RSDs. For compounds benzoic acid and hexachlorocyclopentadiene, all non-detects were qualified estimated "UJ" based upon the grossly exceeding %RSD. Samples 51SB3A (404043-001), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this initial calibration.

- Initial calibration for the TCL SVOCs was performed on 04/17/04 on instrument HP#T. Target compounds benzoic acid (27.2%), 2,4-dinitrophenol (33.7%; grossly exceeding), 4-nitrophenol (15.6%), 4,6-dinitro-2-methylphenol (22.1%), di-n-butylphthalate (22.6%), and 3,3'-dichlorobenzidine (17.4%) were outside criteria. All RRFs were ≥ 0.05. Compounds benzoic acid, 4-nitrophenol, 4,6-dinitro-2-methylphenol, di-n-butylphthalate, and 3,3'-dichlorobenzidine were qualified estimated "J" for detects and no qualifier for non-detects for the high %RSDs. For compound 2,4-dinitrophenol, all detects were qualified estimated "J" and non-detects were qualified estimated "UJ" based upon the grossly exceeding %RSD. Samples 51SB3B (404043-002DL), 51SB3B (404043-002DL2), and 51SB3C (404043-003DL) apply to this initial calibration.

- Initial calibration for pyridine was performed on 04/17/04 on instrument HP#T. All criteria were met. No qualifiers were applied. Samples 51SB3B (404043-002DL), 51SB3B (404043-002DL2), and 51SB3C (404043-003DL) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be ≥ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within ± 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the TCL SVOCs performed on 04/15/04 @12:53 on instrument HP#D, all criteria were met. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this continuing calibration.

- For continuing calibration for pyridine performed on 04/15/04 @14:54 on instrument HP#D, target compound pyridine (21.5%) was outside criteria. All samples were non-detect for pyridine, therefore, no qualifiers were applied based upon this outlier. Samples 51SB3A (404043-001), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this continuing calibration.

- For continuing calibration for the TCL SVOCs performed on 04/20/04 @16:02 on instrument HP#T, all criteria were met. No qualifiers were applied. Sample 51SB3B (404043-002DL) applies to this continuing calibration.

- For continuing calibration for pyridine performed on 04/20/04 @16:59 on instrument HP#T, all criteria were met. No qualifiers were applied. Sample 51SB3B (404043-002DL) applies to this continuing calibration.

- For continuing calibration for the TCL SVOCs performed on 04/21/04 @10:04 on instrument HP#T, all criteria were met. No qualifiers were applied. Samples 51SB3B (404043-002DL2) and 51SB3C (404043-003DL) apply to this continuing calibration.

- For continuing calibration for pyridine performed on 04/21/04 @10:48 on instrument HP#T, all criteria were met. No qualifiers were applied. Samples 51SB3B (404043-002DL2) and 51SB3C (404043-003DL) apply to this continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 33). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/15/04	BLK65908	All compounds < MRL	NA	NA	None
04/20/04	BLK65908	All compounds < MRL	NA	NA	None
04/20/04	040704R	2,4-Dinitrotoluene	1320	6600	51SB3A, 51SB3CDL, 51SB11A, 51SB11B, 51SB11C
04/20/04	040704R	2,6-Dinitrotoluene	460	2300	51SB3CDL, 51SB11B, 51SB11C
04/20/04	040704R	Benzoic Acid	290J	1450	None
04/20/04	040704R	bis(2-ethylhexyl) phthalate	160J	1600	51SB3C
04/20/04	040704R	Diethyl Phthalate	830	8300	None
04/20/04	040704R	di-n-Butyl Phthalate	460	4600	51SB3C
04/20/04	040704R	Phenol	99J	495	None

J = Estimated value <MRL and >MDL

VI-Surrogate Spikes

Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria:
2-Fluorophenol (31-125%) – S1 (USACE Shell Criteria: 35-140%)
Phenol – d5 (25-121%) – S2 (USACE Shell Criteria: 35-140%)
2,4,6-Tribromophenol (31-137%) – S3 (USACE Shell Criteria: 35-140%)
Nitrobenzene-d5 (29-117%) – S4 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (20-106%) – S5 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (26-160%) – S6 (USACE Shell Criteria: 45-135%)

- For samples 51SB3B (404043-002DL), 51SB3B (404043-002DL2), and 51SB3C (404043-003DL), all surrogates were diluted out. No qualifiers were applied based upon these outliers. All criteria were met for all other samples. No qualifiers were applied.

VII-Internal Standards
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- For samples 51SB3B (404043-002DL2) and 51SB3C (404043-003DL), internal standard perylene-d12 was below criteria. All associated compounds were qualified "J" for detects and "UJ for non-detects based upon these outliers for these samples. All other samples were within criteria.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for SVOCs are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65908 was used as the LCS for select SVOCs by USEPA SW-846 8270C. All criteria were met. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002DL), 51SB3B (404043-002DL2), 51SB3C (404043-003), 51SB3C (404043-003DL), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB3C (404043-003DL) was used for the MS/MSD analysis for select SVOCs. Compounds 2,4-dinitrotoluene (0,0%), 4-nitrophenol (0,0%), and phenol (114, 122%) were outside criteria. The sample concentration (2,4-dinitrotoluene) was significantly greater than the spike added, therefore no qualifiers were applied based upon this outlier based upon these outliers. Phenol was non-detect for the spiked sample, therefore no qualifiers were applied based upon this outlier.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate pair was analyzed with this SDG.

XI-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J". For samples 51SB3B (404043-002DL) and 51SB3C (404043-003), compound 2,4-dinitrotoluene exceeded the calibration range and were rejected "R". For sample 51SB3C (404043-003), 2,6-dinitrotoluene exceeded the calibration range and were rejected "R". The diluted samples 51SB3B (404043-002DL2), and 51SB3C (404043-003DL) should be used for these compounds. For sample 51SB3D (404043-004), compounds 2,4-dinitrotoluene and 2,6-dinitrotoluene exceeded the calibration range, without further dilutions. Sample 51SB3D (404043-004) was qualified "J" estimated for these compounds.

Sample: 51SB3A (404043-001), 2,4-dinitrotoluene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where:
- Conc. = Sample concentration in µg/kg
- Ax = Area of characteristic ion for compound being measured.
- Is = Amount of internal standard injected (ng).
- Vt = Volume of total extract (µL).
- Ais = Area of characteristic ion for the internal standard.
- RRF = Average relative response factor for compound being measured (from ICAL)
- Vi = Volume of extract injected (µL).
- W(s) = Weight of sample extracted or diluted in grams.
- D = Percent dry weight (100 - % moisture in sample)/100
- DF = Dilution factor

Conc. µg/kg = (73951 * 40 * 1000 * 1) / (682236 * 0.449 * 1 * 30 * 0.8507) = 380 µg/kg
Reported Value = 380 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-001-1/1
Sample Volume :	30	Lab File ID :	D33629.D
% Moisture:	14.93	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	390	U	
95-50-1	1,2-Dichlorobenzene	390	U	
541-73-1	1,3-Dichlorobenzene	390	U	
106-46-7	1,4-Dichlorobenzene	390	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	390	U	
95-95-4	2,4,5-Trichlorophenol	390	U	
88-06-2	2,4,6-Trichlorophenol	390	U	
120-83-2	2,4-Dichlorophenol	390	U	
105-67-9	2,4-Dimethylphenol	390	U	
51-28-5	2,4-Dinitrophenol	780	U	
121-14-2	2,4-Dinitrotoluene	380	J	B
606-20-2	2,6-Dinitrotoluene	390	U	
91-58-7	2-Chloronaphthalene	390	U	
95-57-8	2-Chlorophenol	390	U	
91-57-6	2-Methylnaphthalene	390	U	
88-74-4	2-Nitroaniline	390	U	
88-75-5	2-Nitrophenol	390	U	
95-48-7	2-methylphenol	390	U	
91-94-1	3,3-Dichlorobenzidine	780	U	
99-09-2	3-Nitroaniline	390	U	
534-52-1	4,6-dinitro-2-methyl phenol	780	U	
101-55-3	4-Bromophenyl-phenylether	390	U	
106-47-8	4-Chloroaniline	390	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	390	U	
100-01-6	4-Nitroaniline	390	U	
100-02-7	4-Nitrophenol	780	U	
59-50-7	4-chloro-3-methylphenol	390	U	
106-44-5	4-methylphenol	390	U	
83-32-9	Acenaphthene	390	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-001-1/1
Sample Volume :	30	Lab File ID :	D33629.D
% Moisture:	14.93	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	390	U	
120-12-7	Anthracene	390	U	
56-55-3	Benzo(a)anthracene	390	U	
50-32-8	Benzo(a)pyrene	390	U	
205-99-2	Benzo(b)fluoranthene	390	U	
191-24-2	Benzo(g,h,i)perylene	390	U	
207-08-9	Benzo(k)fluoranthene	390	U	
65-85-0	Benzoic Acid	780	U	UJ
100-51-6	Benzyl Alcohol	390	U	
85-68-7	Benzyl Butyl Phthalate	390	U	
86-74-8	Carbazole	390	U	
218-01-9	Chrysene	390	U	
53-70-3	Dibenz(a,h)Anthracene	390	U	
132-64-9	Dibenzofuran	390	U	
84-66-2	Diethyl Phthalate	390	U	
131-11-3	Dimethyl Phthalate	390	U	
206-44-0	Fluoranthene	390	U	
86-73-7	Fluorene	390	U	
118-74-1	Hexachlorobenzene	390	U	
87-68-3	Hexachlorobutadiene	390	U	
77-47-4	Hexachlorocyclopentadiene	390	U	UJ
67-72-1	Hexachloroethane	390	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	390	U	
78-59-1	Isophorone	390	U	
91-20-3	Naphthalene	390	U	
98-95-3	Nitrobenzene	390	U	
87-86-5	Pentachlorophenol	780	U	
85-01-8	Phenanthrene	390	U	
108-95-2	Phenol	390	U	

GPL Laboratories

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GPL
FORM 1
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SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-001-1/1
Sample Volume :	30	Lab File ID :	D33629.D
% Moisture:	14.93	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	390	U
110-86-1	Pyridine	390	U
111-91-1	bis(2-chloroethoxy) methane	390	U
111-44-4	bis(2-chloroethyl) ether	390	U
117-81-7	bis(2-ethylhexyl) phthalate	390	U
84-74-2	di-n-Butyl Phthalate	390	U
117-84-0	di-n-Octyl Phthalate	390	U
621-64-7	n-Nitrosodi-n-Propylamine	390	U
86-30-6	n-Nitrosodiphenylamine	390	U

Form I (Dry)

GPL Laboratories

GPL
FORM 1
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SAMPLE NO
51SB3BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-002-1/1
Sample Volume :	30	Lab File ID :	T18908.D
% Moisture:	62.83	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	10 mL	Date Analyzed	04/20/2004
Injection Volume:	1 µ L	Dilution Factor	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	900000	U	
95-50-1	1,2-Dichlorobenzene	900000	U	
541-73-1	1,3-Dichlorobenzene	900000	U	
106-46-7	1,4-Dichlorobenzene	900000	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	900000	U	
95-95-4	2,4,5-Trichlorophenol	900000	U	
88-06-2	2,4,6-Trichlorophenol	900000	U	
120-83-2	2,4-Dichlorophenol	900000	U	
105-67-9	2,4-Dimethylphenol	900000	U	
51-28-5	2,4-Dinitrophenol	1800000	U	UJ
121-14-2	2,4-Dinitrotoluene		E	R
606-20-2	2,6-Dinitrotoluene	11000000		
91-58-7	2-Chloronaphthalene	900000	U	
95-57-8	2-Chlorophenol	900000	U	
91-57-6	2-Methylnaphthalene	900000	U	
88-74-4	2-Nitroaniline	900000	U	
88-75-5	2-Nitrophenol	900000	U	
95-48-7	2-methylphenol	900000	U	
91-94-1	3,3-Dichlorobenzidine	1800000	U	
99-09-2	3-Nitroaniline	900000	U	
534-52-1	4,6-dinitro-2-methyl phenol	1800000	U	
101-55-3	4-Bromophenyl-phenylether	900000	U	
106-47-8	4-Chloroaniline	900000	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	900000	U	
100-01-6	4-Nitroaniline	900000	U	
100-02-7	4-Nitrophenol	1800000	U	
59-50-7	4-chloro-3-methylphenol	900000	U	
106-44-5	4-methylphenol	900000	U	
83-32-9	Acenaphthene	900000	U	

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-002-1/1
Sample Volume :	30	Lab File ID :	T18908.D
% Moisture:	62.83	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	10 mL	Date Analyzed	04/20/2004
Injection Volume:	1 µL	Dilution Factor	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
208-96-8	Acenaphthylene	900000	U
120-12-7	Anthracene	900000	U
56-55-3	Benzo(a)anthracene	900000	U
50-32-8	Benzo(a)pyrene	900000	U
205-99-2	Benzo(b)fluoranthene	900000	U
191-24-2	Benzo(g,h,i)perylene	900000	U
207-08-9	Benzo(k)fluoranthene	900000	U
65-85-0	Benzoic Acid	1800000	U
100-51-6	Benzyl Alcohol	900000	U
85-68-7	Benzyl Butyl Phthalate	900000	U
86-74-8	Carbazole	900000	U
218-01-9	Chrysene	900000	U
53-70-3	Dibenz(a,h)Anthracene	900000	U
132-64-9	Dibenzofuran	900000	U
84-66-2	Diethyl Phthalate	900000	U
131-11-3	Dimethyl Phthalate	900000	U
206-44-0	Fluoranthene	900000	U
86-73-7	Fluorene	900000	U
118-74-1	Hexachlorobenzene	900000	U
87-68-3	Hexachlorobutadiene	900000	U
77-47-4	Hexachlorocyclopentadiene	900000	U
67-72-1	Hexachloroethane	900000	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	900000	U
78-59-1	Isophorone	900000	U
91-20-3	Naphthalene	900000	U
98-95-3	Nitrobenzene	900000	U
87-86-5	Pentachlorophenol	1800000	U
85-01-8	Phenanthrene	900000	U
108-95-2	Phenol	900000	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB3BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-002-1/1
Sample Volume :	30	Lab File ID :	T18908.D
% Moisture:	62.83	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	10 mL	Date Analyzed	04/20/2004
Injection Volume:	1 µ L	Dilution Factor	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	900000	U
110-86-1	Pyridine	900000	U
111-91-1	bis(2-chloroethoxy) methane	900000	U
111-44-4	bis(2-chloroethyl) ether	900000	U
117-81-7	bis(2-ethylhexyl) phthalate	900000	U
84-74-2	di-n-Butyl Phthalate	900000	U
117-84-0	di-n-Octyl Phthalate	900000	U
621-64-7	n-Nitrosodi-n-Propylamine	900000	U
86-30-6	n-Nitrosodiphenylamine	900000	U

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SAMPLE NO
51SB3BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-002-1/1
Sample Volume :	30	Lab File ID :	T18921.D
% Moisture:	62.83	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	10 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	4500000	U
95-50-1	1,2-Dichlorobenzene	4500000	U
541-73-1	1,3-Dichlorobenzene	4500000	U
106-46-7	1,4-Dichlorobenzene	4500000	U
108-60-1	2,2-Oxybis(1-Chloropropane)	4500000	U
95-95-4	2,4,5-Trichlorophenol	4500000	U
88-06-2	2,4,6-Trichlorophenol	4500000	U
120-83-2	2,4-Dichlorophenol	4500000	U
105-67-9	2,4-Dimethylphenol	4500000	U
51-28-5	2,4-Dinitrophenol	9000000	U
121-14-2	2,4-Dinitrotoluene	48000000	J
606-20-2	2,6-Dinitrotoluene	11000000	
91-58-7	2-Chloronaphthalene	4500000	U
95-57-8	2-Chlorophenol	4500000	U
91-57-6	2-Methylnaphthalene	4500000	U
88-74-4	2-Nitroaniline	4500000	U
88-75-5	2-Nitrophenol	4500000	U
95-48-7	2-methylphenol	4500000	U
91-94-1	3,3-Dichlorobenzidine	9000000	U
99-09-2	3-Nitroaniline	4500000	U
534-52-1	4,6-dinitro-2-methyl phenol	9000000	U
101-55-3	4-Bromophenyl-phenylether	4500000	U
106-47-8	4-Chloroaniline	4500000	U
7005-72-3	4-Chlorophenyl Phenyl Ether	4500000	U
100-01-6	4-Nitroaniline	4500000	U
100-02-7	4-Nitrophenol	9000000	U
59-50-7	4-chloro-3-methylphenol	4500000	U
106-44-5	4-methylphenol	4500000	U
83-32-9	Acenaphthene	4500000	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-002-1/1
Sample Volume :	30	Lab File ID :	T18921.D
% Moisture:	62.83	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	10 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	4500000	U	
120-12-7	Anthracene	4500000	U	
56-55-3	Benzo(a)anthracene	4500000	U	
50-32-8	Benzo(a)pyrene	4500000	U	UJ
205-99-2	Benzo(b)fluoranthene	4500000	U	UJ
191-24-2	Benzo(g,h,i)perylene	4500000	U	UJ
207-08-9	Benzo(k)fluoranthene	4500000	U	UJ
65-85-0	Benzoic Acid	9000000	U	
100-51-6	Benzyl Alcohol	4500000	U	
85-68-7	Benzyl Butyl Phthalate	4500000	U	
86-74-8	Carbazole	4500000	U	
218-01-9	Chrysene	4500000	U	
53-70-3	Dibenz(a,h)Anthracene	4500000	U	UJ
132-64-9	Dibenzofuran	4500000	U	
84-66-2	Diethyl Phthalate	4500000	U	
131-11-3	Dimethyl Phthalate	4500000	U	
206-44-0	Fluoranthene	4500000	U	
86-73-7	Fluorene	4500000	U	
118-74-1	Hexachlorobenzene	4500000	U	
87-68-3	Hexachlorobutadiene	4500000	U	
77-47-4	Hexachlorocyclopentadiene	4500000	U	
67-72-1	Hexachloroethane	4500000	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	4500000	U	UJ
78-59-1	Isophorone	4500000	U	
91-20-3	Naphthalene	4500000	U	
98-95-3	Nitrobenzene	4500000	U	
87-86-5	Pentachlorophenol	9000000	U	
85-01-8	Phenanthrene	4500000	U	
108-95-2	Phenol	4500000	U	

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SAMPLE NO
51SB3BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-002-1/1
Sample Volume :	30	Lab File ID :	T18921.D
% Moisture:	62.83	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	10 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	4500000	U	
110-86-1	Pyridine	4500000	U	
111-91-1	bis(2-chloroethoxy) methane	4500000	U	
111-44-4	bis(2-chloroethyl) ether	4500000	U	
117-81-7	bis(2-ethylhexyl) phthalate	4500000	U	
84-74-2	di-n-Butyl Phthalate	4500000	U	
117-84-0	di-n-Octyl Phthalate	4500000	U	UJ
621-64-7	n-Nitrosodi-n-Propylamine	4500000	U	
86-30-6	n-Nitrosodiphenylamine	4500000	U	

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SAMPLE NO
51SB3C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-003-1/1
Sample Volume :	30	Lab File ID :	D33640.D
% Moisture:	10.88	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	370	U	
95-50-1	1,2-Dichlorobenzene	370	U	
541-73-1	1,3-Dichlorobenzene	370	U	
106-46-7	1,4-Dichlorobenzene	370	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	370	U	
95-95-4	2,4,5-Trichlorophenol	370	U	
88-06-2	2,4,6-Trichlorophenol	370	U	
120-83-2	2,4-Dichlorophenol	370	U	
105-67-9	2,4-Dimethylphenol	370	U	
51-28-5	2,4-Dinitrophenol	750	U	
121-14-2	2,4-Dinitrotoluene	930000	E	R
606-20-2	2,6-Dinitrotoluene	390000	E	R
91-58-7	2-Chloronaphthalene	370	U	
95-57-8	2-Chlorophenol	370	U	
91-57-6	2-Methylnaphthalene	370	U	
88-74-4	2-Nitroaniline	370	U	
88-75-5	2-Nitrophenol	370	U	
95-48-7	2-methylphenol	370	U	
91-94-1	3,3-Dichlorobenzidine	750	U	
99-09-2	3-Nitroaniline	370	U	
534-52-1	4,6-dinitro-2-methyl phenol	2700		J
101-55-3	4-Bromophenyl-phenylether	370	U	
106-47-8	4-Chloroaniline	370	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	370	U	
100-01-6	4-Nitroaniline	370	U	
100-02-7	4-Nitrophenol	750	U	
59-50-7	4-chloro-3-methylphenol	370	U	
106-44-5	4-methylphenol	370	U	
83-32-9	Acenaphthene	370	U	

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GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-003-1/1
Sample Volume :	30	Lab File ID :	D33640.D
% Moisture:	10.88	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume:	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	370	U	
120-12-7	Anthracene	370	U	
56-55-3	Benzo(a)anthracene	370	U	
50-32-8	Benzo(a)pyrene	370	U	UJ
205-99-2	Benzo(b)fluoranthene	370	U	UJ
191-24-2	Benzo(g,h,i)perylene	370	U	UJ
207-08-9	Benzo(k)fluoranthene	370	U	UJ
65-85-0	Benzoic Acid	750	U	UJ
100-51-6	Benzyl Alcohol	370	U	
85-68-7	Benzyl Butyl Phthalate	370	U	
86-74-8	Carbazole	370	U	
218-01-9	Chrysene	370	U	
53-70-3	Dibenz(a,h)Anthracene	370	U	UJ
132-64-9	Dibenzofuran	370	U	
84-66-2	Diethyl Phthalate	370	U	
131-11-3	Dimethyl Phthalate	370	U	
206-44-0	Fluoranthene	370	U	
86-73-7	Fluorene	370	U	
118-74-1	Hexachlorobenzene	370	U	
87-68-3	Hexachlorobutadiene	370	U	
77-47-4	Hexachlorocyclopentadiene	370	U	UJ
67-72-1	Hexachloroethane	370	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	370	U	
78-59-1	Isophorone	370	U	UJ
91-20-3	Naphthalene	370	U	
98-95-3	Nitrobenzene	370	U	
87-86-5	Pentachlorophenol	750	U	
85-01-8	Phenanthrene	370	U	
108-95-2	Phenol	370	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-003-1/1
Sample Volume :	30	Lab File ID :	D33640.D
% Moisture:	10.88	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	370	U	
110-86-1	Pyridine	370	U	
111-91-1	bis(2-chloroethoxy) methane	370	U	
111-44-4	bis(2-chloroethyl) ether	370	U	
117-81-7	bis(2-ethylhexyl) phthalate	760		B
84-74-2	di-n-Butyl Phthalate	200	J	B
117-84-0	di-n-Octyl Phthalate	370	U	UQ
621-64-7	n-Nitrosodi-n-Propylamine	370	U	
86-30-6	n-Nitrosodiphenylamine	370	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-003-1/1
Sample Volume :	30	Lab File ID :	T18920.D
% Moisture:	10.88	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	190000	U	
95-50-1	1,2-Dichlorobenzene	190000	U	
541-73-1	1,3-Dichlorobenzene	190000	U	
106-46-7	1,4-Dichlorobenzene	190000	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	190000	U	
95-95-4	2,4,5-Trichlorophenol	190000	U	
88-06-2	2,4,6-Trichlorophenol	190000	U	
120-83-2	2,4-Dichlorophenol	190000	U	
105-67-9	2,4-Dimethylphenol	190000	U	
51-28-5	2,4-Dinitrophenol	370000	U	
121-14-2	2,4-Dinitrotoluene	1600000		B
606-20-2	2,6-Dinitrotoluene	430000		B
91-58-7	2-Chloronaphthalene	190000	U	
95-57-8	2-Chlorophenol	190000	U	
91-57-6	2-Methylnaphthalene	190000	U	
88-74-4	2-Nitroaniline	190000	U	
88-75-5	2-Nitrophenol	190000	U	
95-48-7	2-methylphenol	190000	U	
91-94-1	3,3-Dichlorobenzidine	370000	U	
99-09-2	3-Nitroaniline	190000	U	
534-52-1	4,6-dinitro-2-methyl phenol	370000	U	
101-55-3	4-Bromophenyl-phenylether	190000	U	
106-47-8	4-Chloroaniline	190000	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	190000	U	
100-01-6	4-Nitroaniline	190000	U	
100-02-7	4-Nitrophenol	370000	U	
59-50-7	4-chloro-3-methylphenol	190000	U	
106-44-5	4-methylphenol	190000	U	
83-32-9	Acenaphthene	190000	U	

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GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-003-1/1
Sample Volume :	30	Lab File ID :	T18920.D
% Moisture:	10.88	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
208-96-8	Acenaphthylene	190000	U
120-12-7	Anthracene	190000	U
56-55-3	Benzo(a)anthracene	190000	U
50-32-8	Benzo(a)pyrene	190000	U
205-99-2	Benzo(b)fluoranthene	190000	U
191-24-2	Benzo(g,h,i)perylene	190000	U
207-08-9	Benzo(k)fluoranthene	190000	U
65-85-0	Benzoic Acid	370000	U
100-51-6	Benzyl Alcohol	190000	U
85-68-7	Benzyl Butyl Phthalate	190000	U
86-74-8	Carbazole	190000	U
218-01-9	Chrysene	190000	U
53-70-3	Dibenz(a,h)Anthracene	190000	U
132-64-9	Dibenzofuran	190000	U
84-66-2	Diethyl Phthalate	190000	U
131-11-3	Dimethyl Phthalate	190000	U
206-44-0	Fluoranthene	190000	U
86-73-7	Fluorene	190000	U
118-74-1	Hexachlorobenzene	190000	U
87-68-3	Hexachlorobutadiene	190000	U
77-47-4	Hexachlorocyclopentadiene	190000	U
67-72-1	Hexachloroethane	190000	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	190000	U
78-59-1	Isophorone	190000	U
91-20-3	Naphthalene	190000	U
98-95-3	Nitrobenzene	190000	U
87-86-5	Pentachlorophenol	370000	U
85-01-8	Phenanthrene	190000	U
108-95-2	Phenol	190000	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-003-1/1
Sample Volume :	30	Lab File ID :	T18920.D
% Moisture:	10.88	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	190000	U
110-86-1	Pyridine	190000	U
111-91-1	bis(2-chloroethoxy) methane	190000	U
111-44-4	bis(2-chloroethyl) ether	190000	U
117-81-7	bis(2-ethylhexyl) phthalate	190000	U
84-74-2	di-n-Butyl Phthalate	190000	U
117-84-0	di-n-Octyl Phthalate	190000	U
621-64-7	n-Nitrosodi-n-Propylamine	190000	U
86-30-6	n-Nitrosodiphenylamine	190000	U

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SAMPLE NO
51SB3D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-004-004-1/1
Sample Volume :	30	Lab File ID :	D33630.D
% Moisture:	18.07	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	410	U	
95-50-1	1,2-Dichlorobenzene	410	U	
541-73-1	1,3-Dichlorobenzene	410	U	
106-46-7	1,4-Dichlorobenzene	410	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	410	U	
95-95-4	2,4,5-Trichlorophenol	410	U	
88-06-2	2,4,6-Trichlorophenol	410	U	
120-83-2	2,4-Dichlorophenol	410	U	
105-67-9	2,4-Dimethylphenol	410	U	
51-28-5	2,4-Dinitrophenol	810	U	
121-14-2	2,4-Dinitrotoluene	32000	E	J
606-20-2	2,6-Dinitrotoluene	11000	E	J
91-58-7	2-Chloronaphthalene	410	U	
95-57-8	2-Chlorophenol	410	U	
91-57-6	2-Methylnaphthalene	410	U	
88-74-4	2-Nitroaniline	410	U	
88-75-5	2-Nitrophenol	410	U	
95-48-7	2-methylphenol	410	U	
91-94-1	3,3-Dichlorobenzidine	810	U	
99-09-2	3-Nitroaniline	410	U	
534-52-1	4,6-dinitro-2-methyl phenol	330	J	J
101-55-3	4-Bromophenyl-phenylether	410	U	
106-47-8	4-Chloroaniline	410	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	410	U	
100-01-6	4-Nitroaniline	410	U	
100-02-7	4-Nitrophenol	810	U	
59-50-7	4-chloro-3-methylphenol	410	U	
106-44-5	4-methylphenol	410	U	
83-32-9	Acenaphthene	410	U	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB3D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-004-004-1/1
Sample Volume :	30	Lab File ID :	D33630.D
% Moisture:	18.07	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	410	U	
120-12-7	Anthracene	410	U	
56-55-3	Benzo(a)anthracene	410	U	
50-32-8	Benzo(a)pyrene	410	U	
205-99-2	Benzo(b)fluoranthene	410	U	
191-24-2	Benzo(g,h,i)perylene	410	U	
207-08-9	Benzo(k)fluoranthene	410	U	
65-85-0	Benzoic Acid	810	U	UJ
100-51-6	Benzyl Alcohol	410	U	
85-68-7	Benzyl Butyl Phthalate	410	U	
86-74-8	Carbazole	410	U	
218-01-9	Chrysene	410	U	
53-70-3	Dibenz(a,h)Anthracene	410	U	
132-64-9	Dibenzofuran	410	U	
84-66-2	Diethyl Phthalate	410	U	
131-11-3	Dimethyl Phthalate	410	U	
206-44-0	Fluoranthene	410	U	
86-73-7	Fluorene	410	U	
118-74-1	Hexachlorobenzene	410	U	
87-68-3	Hexachlorobutadiene	410	U	
77-47-4	Hexachlorocyclopentadiene	410	U	UJ
67-72-1	Hexachloroethane	410	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	410	U	
78-59-1	Isophorone	410	U	
91-20-3	Naphthalene	410	U	
98-95-3	Nitrobenzene	410	U	
87-86-5	Pentachlorophenol	810	U	
85-01-8	Phenanthrene	410	U	
108-95-2	Phenol	410	U	

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SAMPLE NO
51SB3D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-004-004-1/1
Sample Volume :	30	Lab File ID :	D33630.D
% Moisture:	18.07	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	410	U
110-86-1	Pyridine	410	U
111-91-1	bis(2-chloroethoxy) methane	410	U
111-44-4	bis(2-chloroethyl) ether	410	U
117-81-7	bis(2-ethylhexyl) phthalate	410	U
84-74-2	di-n-Butyl Phthalate	410	U
117-84-0	di-n-Octyl Phthalate	410	U
621-64-7	n-Nitrosodi-n-Propylamine	410	U
86-30-6	n-Nitrosodiphenylamine	410	U

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SAMPLE NO
51SB11A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-005-042-1/1
Sample Volume :	30	Lab File ID :	D33631.D
% Moisture:	13.51	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	390	U
95-50-1	1,2-Dichlorobenzene	390	U
541-73-1	1,3-Dichlorobenzene	390	U
106-46-7	1,4-Dichlorobenzene	390	U
108-60-1	2,2-Oxybis(1-Chloropropane)	390	U
95-95-4	2,4,5-Trichlorophenol	390	U
88-06-2	2,4,6-Trichlorophenol	390	U
120-83-2	2,4-Dichlorophenol	390	U
105-67-9	2,4-Dimethylphenol	390	U
51-28-5	2,4-Dinitrophenol	770	U
121-14-2	2,4-Dinitrotoluene	130	J B
606-20-2	2,6-Dinitrotoluene	390	U
91-58-7	2-Chloronaphthalene	390	U
95-57-8	2-Chlorophenol	390	U
91-57-6	2-Methylnaphthalene	390	U
88-74-4	2-Nitroaniline	390	U
88-75-5	2-Nitrophenol	390	U
95-48-7	2-methylphenol	390	U
91-94-1	3,3-Dichlorobenzidine	770	U
99-09-2	3-Nitroaniline	390	U
534-52-1	4,6-dinitro-2-methyl phenol	770	U
101-55-3	4-Bromophenyl-phenylether	390	U
106-47-8	4-Chloroaniline	390	U
7005-72-3	4-Chlorophenyl Phenyl Ether	390	U
100-01-6	4-Nitroaniline	390	U
100-02-7	4-Nitrophenol	770	U
59-50-7	4-chloro-3-methylphenol	390	U
106-44-5	4-methylphenol	390	U
83-32-9	Acenaphthene	390	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-005-042-1/1
Sample Volume :	30	Lab File ID :	D33631.D
% Moisture:	13.51	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	390	U	
120-12-7	Anthracene	390	U	
56-55-3	Benzo(a)anthracene	390	U	
50-32-8	Benzo(a)pyrene	390	U	
205-99-2	Benzo(b)fluoranthene	390	U	
191-24-2	Benzo(g,h,i)perylene	390	U	
207-08-9	Benzo(k)fluoranthene	390	U	
65-85-0	Benzoic Acid	770	U	UJ
100-51-6	Benzyl Alcohol	390	U	
85-68-7	Benzyl Butyl Phthalate	390	U	
86-74-8	Carbazole	390	U	
218-01-9	Chrysene	390	U	
53-70-3	Dibenz(a,h)Anthracene	390	U	
132-64-9	Dibenzofuran	390	U	
84-66-2	Diethyl Phthalate	390	U	
131-11-3	Dimethyl Phthalate	390	U	
206-44-0	Fluoranthene	390	U	
86-73-7	Fluorene	390	U	
118-74-1	Hexachlorobenzene	390	U	
87-68-3	Hexachlorobutadiene	390	U	
77-47-4	Hexachlorocyclopentadiene	390	U	UJ
67-72-1	Hexachloroethane	390	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	390	U	
78-59-1	Isophorone	390	U	
91-20-3	Naphthalene	390	U	
98-95-3	Nitrobenzene	390	U	
87-86-5	Pentachlorophenol	770	U	
85-01-8	Phenanthrene	390	U	
108-95-2	Phenol	390	U	

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-005-042-1/1
Sample Volume :	30	Lab File ID :	D33631.D
% Moisture:	13.51	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	390	U
110-86-1	Pyridine	390	U
111-91-1	bis(2-chloroethoxy) methane	390	U
111-44-4	bis(2-chloroethyl) ether	390	U
117-81-7	bis(2-ethylhexyl) phthalate	390	U
84-74-2	di-n-Butyl Phthalate	390	U
117-84-0	di-n-Octyl Phthalate	390	U
621-64-7	n-Nitrosodi-n-Propylamine	390	U
86-30-6	n-Nitrosodiphenylamine	390	U

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-006-043-1/1
Sample Volume :	30	Lab File ID :	D33632.D
% Moisture:	14.71	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	390	U	
95-50-1	1,2-Dichlorobenzene	390	U	
541-73-1	1,3-Dichlorobenzene	390	U	
106-46-7	1,4-Dichlorobenzene	390	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	390	U	
95-95-4	2,4,5-Trichlorophenol	390	U	
88-06-2	2,4,6-Trichlorophenol	390	U	
120-83-2	2,4-Dichlorophenol	390	U	
105-67-9	2,4-Dimethylphenol	390	U	
51-28-5	2,4-Dinitrophenol	780	U	
121-14-2	2,4-Dinitrotoluene	1400		B
606-20-2	2,6-Dinitrotoluene	340	J	B
91-58-7	2-Chloronaphthalene	390	U	
95-57-8	2-Chlorophenol	390	U	
91-57-6	2-Methylnaphthalene	390	U	
88-74-4	2-Nitroaniline	390	U	
88-75-5	2-Nitrophenol	390	U	
95-48-7	2-methylphenol	390	U	
91-94-1	3,3-Dichlorobenzidine	780	U	
99-09-2	3-Nitroaniline	390	U	
534-52-1	4,6-dinitro-2-methyl phenol	780	U	
101-55-3	4-Bromophenyl-phenylether	390	U	
106-47-8	4-Chloroaniline	390	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	390	U	
100-01-6	4-Nitroaniline	390	U	
100-02-7	4-Nitrophenol	780	U	
59-50-7	4-chloro-3-methylphenol	390	U	
106-44-5	4-methylphenol	390	U	
83-32-9	Acenaphthene	390	U	

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GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-006-043-1/1
Sample Volume :	30	Lab File ID :	D33632.D
% Moisture:	14.71	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	390	U	
120-12-7	Anthracene	390	U	
56-55-3	Benzo(a)anthracene	390	U	
50-32-8	Benzo(a)pyrene	390	U	
205-99-2	Benzo(b)fluoranthene	390	U	
191-24-2	Benzo(g,h,i)perylene	390	U	
207-08-9	Benzo(k)fluoranthene	390	U	
65-85-0	Benzoic Acid	780	U	UJ
100-51-6	Benzyl Alcohol	390	U	
85-68-7	Benzyl Butyl Phthalate	390	U	
86-74-8	Carbazole	390	U	
218-01-9	Chrysene	390	U	
53-70-3	Dibenz(a,h)Anthracene	390	U	
132-64-9	Dibenzofuran	390	U	
84-66-2	Diethyl Phthalate	390	U	
131-11-3	Dimethyl Phthalate	390	U	
206-44-0	Fluoranthene	390	U	
86-73-7	Fluorene	390	U	
118-74-1	Hexachlorobenzene	390	U	
87-68-3	Hexachlorobutadiene	390	U	
77-47-4	Hexachlorocyclopentadiene	390	U	UJ
67-72-1	Hexachloroethane	390	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	390	U	
78-59-1	Isophorone	390	U	
91-20-3	Naphthalene	390	U	
98-95-3	Nitrobenzene	390	U	
87-86-5	Pentachlorophenol	780	U	
85-01-8	Phenanthrene	390	U	
108-95-2	Phenol	390	U	

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GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-006-043-1/1
Sample Volume :	30	Lab File ID :	D33632.D
% Moisture:	14.71	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume:	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	390	U
110-86-1	Pyridine	390	U
111-91-1	bis(2-chloroethoxy) methane	390	U
111-44-4	bis(2-chloroethyl) ether	390	U
117-81-7	bis(2-ethylhexyl) phthalate	390	U
84-74-2	di-n-Butyl Phthalate	390	U
117-84-0	di-n-Octyl Phthalate	390	U
621-64-7	n-Nitrosodi-n-Propylamine	390	U
86-30-6	n-Nitrosodiphenylamine	390	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-007-044-1/1
Sample Volume :	30	Lab File ID :	D33633.D
% Moisture:	13.11	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	380	U	
95-50-1	1,2-Dichlorobenzene	380	U	
541-73-1	1,3-Dichlorobenzene	380	U	
106-46-7	1,4-Dichlorobenzene	380	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	380	U	
95-95-4	2,4,5-Trichlorophenol	380	U	
88-06-2	2,4,6-Trichlorophenol	380	U	
120-83-2	2,4-Dichlorophenol	380	U	
105-67-9	2,4-Dimethylphenol	380	U	
51-28-5	2,4-Dinitrophenol	770	U	
121-14-2	2,4-Dinitrotoluene	270	J	B
606-20-2	2,6-Dinitrotoluene	57	J	B
91-58-7	2-Chloronaphthalene	380	U	
95-57-8	2-Chlorophenol	380	U	
91-57-6	2-Methylnaphthalene	380	U	
88-74-4	2-Nitroaniline	380	U	
88-75-5	2-Nitrophenol	380	U	
95-48-7	2-methylphenol	380	U	
91-94-1	3,3-Dichlorobenzidine	770	U	
99-09-2	3-Nitroaniline	380	U	
534-52-1	4,6-dinitro-2-methyl phenol	770	U	
101-55-3	4-Bromophenyl-phenylether	380	U	
106-47-8	4-Chloroaniline	380	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	380	U	
100-01-6	4-Nitroaniline	380	U	
100-02-7	4-Nitrophenol	770	U	
59-50-7	4-chloro-3-methylphenol	380	U	
106-44-5	4-methylphenol	380	U	
83-32-9	Acenaphthene	380	U	

GPL Laboratories

Form I Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-007-044-1/1
Sample Volume :	30	Lab File ID :	D33633.D
% Moisture:	13.11	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	380	U	
120-12-7	Anthracene	380	U	
56-55-3	Benzo(a)anthracene	380	U	
50-32-8	Benzo(a)pyrene	380	U	
205-99-2	Benzo(b)fluoranthene	380	U	
191-24-2	Benzo(g,h,i)perylene	380	U	
207-08-9	Benzo(k)fluoranthene	380	U	
65-85-0	Benzoic Acid	770	U	UJ
100-51-6	Benzyl Alcohol	380	U	
85-68-7	Benzyl Butyl Phthalate	380	U	
86-74-8	Carbazole	380	U	
218-01-9	Chrysene	380	U	
53-70-3	Dibenz(a,h)Anthracene	380	U	
132-64-9	Dibenzofuran	380	U	
84-66-2	Diethyl Phthalate	380	U	
131-11-3	Dimethyl Phthalate	380	U	
206-44-0	Fluoranthene	380	U	
86-73-7	Fluorene	380	U	
118-74-1	Hexachlorobenzene	380	U	
87-68-3	Hexachlorobutadiene	380	U	
77-47-4	Hexachlorocyclopentadiene	380	U	UJ
67-72-1	Hexachloroethane	380	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	380	U	
78-59-1	Isophorone	380	U	
91-20-3	Naphthalene	380	U	
98-95-3	Nitrobenzene	380	U	
87-86-5	Pentachlorophenol	770	U	
85-01-8	Phenanthrene	380	U	
108-95-2	Phenol	380	U	

GPL Laboratories

Form I Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-007-044-1/1
Sample Volume :	30	Lab File ID :	D33633.D
% Moisture:	13.11	Date Received	04/06/2004
Extraction:	SW3540C	Date Extracte	04/12/2004
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	380	U
110-86-1	Pyridine	380	U
111-91-1	bis(2-chloroethoxy) methane	380	U
111-44-4	bis(2-chloroethyl) ether	380	U
117-81-7	bis(2-ethylhexyl) phthalate	380	U
84-74-2	di-n-Butyl Phthalate	380	U
117-84-0	di-n-Octyl Phthalate	380	U
621-64-7	n-Nitrosodi-n-Propylamine	380	U
86-30-6	n-Nitrosodiphenylamine	380	U

Shaw Environmental, Inc.

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – TAL Inorganics
GPL Laboratories, Inc., SDG 404043

DATE: June 23, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004. Samples were analyzed for target analyte list (TAL) Inorganics using USEPA SW-846 3050B/6010B for ICP metals, USEPA SW-846 7471A for mercury, and USEPA SW-846 9014 for cyanide. A total of seven soil samples were validated. All samples were analyzed for total TAL inorganics. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB3A	404043-001	51SB11A	404043-005
51SB3B	404043-002	51SB11B	404043-006
51SB3C	404043-003	51SB11C	404043-007
51SB3D	404043-004		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Inorganic Data Review* (April, 1993). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
X		Initial and Continuing Calibration
X		Blank Analysis
	X	ICP Interference Check Sample (ICS)
	X	Laboratory Control Sample (LCS)
	X	Lab Sample Duplicate
X		Matrix Spike
	X	ICP Serial Dilution
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/23/04

Date

RFAAP VALIDATION REPORT
TAL INORGANICS REVIEW
SDG 404043

I-Holding Times

The primary objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample analysis. The soil samples are received and stored cool @4 °C ± 2 °C, with a maximum holding time of 180 days for ICP metals, 28 days for mercury, and 14 days for cyanide from collection (USEPA criteria).

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: Samples were collected 04/05/04. They were digested on 04/09/04 and analyzed for ICP metals on 04/09/04 and 04/12/04. Samples were digested on 04/09/04 for mercury and were analyzed for mercury on 04/10/04. Samples were digested on 04/13/04 for cyanide and were analyzed for cyanide on 04/15/04. All holding time criteria were met. No qualifiers were applied.

II-Initial and Continuing Calibration

Requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of the analysis run, and continuing calibration verification documents that the initial calibration is still valid.

ICP: 1- blank (USACE <MDL)
3 – standards (r≥0.995)
ICV/CCV (90-110%) (USACE 90-110%)
MRL (70-130%) (USACE 80-120%)

Hg: 1 – blank (USACE <MDL)
5 – standards (r≥0.995)
ICV/CCV (80-120%) (USACE ICV 90-110% / CCV 80-120%)
MRL (80-120%)

CN: 1- blank (USACE <MDL)
5 – standards (r≥0.995)
ICV/CCV (85-115%)

- The samples were analyzed for ICP metals on 04/09/04 and 04/12/04. Mercury was analyzed on 04/10/04 with a correlation coefficient of 0.9999. Cyanide was analyzed on 04/15/04 with a correlation coefficient of 0.9991. All ICV/CCV standards were within criteria. No qualifiers were applied. **Table 2** summarizes the MRL standard analysis for metals. Samples with concentrations detected less than two times the MRL with out of criteria MRL recovery were qualified.

Table 2 MRL Analysis Summary

Analysis Date	Analysis	MRL (µg/L)	MRL (mg/kg)	MRL %Recovery	Qualified samples @ <2xMRL	Validation Qualifiers
04/09/04	ICP-Ag	3.0	0.30	123	51SB3B	K
04/12/04	ICP	Various	Various	All within criteria	None	None
04/10/04	Hg	0.2	0.033	All within criteria	None	None

III-Blanks

Blanks (preparation and calibration blanks) are assessed to determine the existence and magnitude of contamination problems. No contaminants should be detected (i.e. <MDL) in any of the associated blanks. USACE Shell limits are < ½MRL for the method blank. Samples are qualified "B" when they are less than 5X the absolute value of the maximum blank concentration. **Table 3** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factors = 10 for ICP; 6 for Hg; and 40 for CN). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 3 Blank Contamination Analysis Summary

Analysis Date	Analysis	QC Blank ID	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/09/04	ICP-Al	ICB/CCBs	3.50B	17.5	None
04/09/04	ICP-Ba	ICB/CCBs	0.07B	0.35	None
04/09/04	ICP-Fe	ICB/CCBs	4.95B	24.7	None
04/09/04	ICP-Mg	ICB/CCBs	7.13B	35.7	None
04/09/04	ICP-Mn	ICB/CCBs	0.09B	0.45	None
04/12/04	ICP-Mg	ICB/CCBs	4.85B	24.3	None
04/10/04	Hg	ICB/CCBs	<MRL	NA	None
04/13/04	CN	ICB/CCBs	<MRL	NA	None
04/09/04	ICP-As	PBS	0.23B	1.2	51SB3C, 51SB3D, 51SB11B
04/09/04	ICP-Ba	PBS	0.049B	0.25	None
04/09/04	ICP-Ca	PBS	11.7B	58.5	51SB11B
04/09/04	ICP-Cr	PBS	0.22B	1.1	None
04/09/04	ICP-Fe	PBS	7.5B	37.5	None
04/09/04	ICP-Pb	PBS	0.36B	1.8	51SB3D
04/09/04	ICP-Mg	PBS	3.2B	16.0	None
04/09/04	ICP-Mn	PBS	0.17B	0.85	None
04/09/04	ICP-Ni	PBS	0.53B	2.65	None
04/09/04	ICP-K	PBS	5.6B	28.0	None
04/09/04	ICP-Na	PBS	93.0B	465	51SB3A, 51SB3B, 51SB3C, 51SB11A, 51SB11B, 51SB11C
04/10/04	Hg	PBS	<MRL	NA	None
04/13/04	CN	PBS	<MRL	NA	None
04/15/04	ICPMS-Ba	040704R	0.11B	0.55	None
04/15/04	ICPMS-Cd	040704R	0.021B	0.11	51SB11A
04/15/04	ICPMS-Ca	040704R	53.1B	266	51SB11B
04/15/04	ICPMS-Cr	040704R	0.38	1.9	None
04/15/04	ICPMS-Co	040704R	0.0012B	0.006	None
04/15/04	ICPMS-Cu	040704R	0.30E	1.5	None
04/15/04	ICPMS-Fe	040704R	1.86B	9.3	None
04/15/04	ICPMS-Pb	040704R	0.023B	0.12	None
04/15/04	ICPMS-Mg	040704R	9.81BE	49.1	None
04/15/04	ICPMS-Mn	040704R	0.22	1.1	None
04/15/04	ICPMS-Ni	040704R	0.041B	0.21	None
04/15/04	ICPMS-K	040704R	6.73BE	33.7	None
04/15/04	ICPMS-Na	040704R	21.0BE	105	51SB3A, 51SB3C, 51SB11A, 51SB11B, 51SB11C
04/15/04	ICPMS-Zn	040704R	0.40BE	2.0	None
04/14/04	Hg	040704R	<MRL	NA	None
04/19/04	CN	040704R	<MRL	NA	None

B = Value is estimated <MRL and >MDL.
E = Serial Dilution percent difference not within limits.
N = Laboratory spike sample recovery not within control limits.

IV-ICP Interference Check Sample (ICS)

The ICP interference check sample (ICS) verifies interelement and background correction factors. ICP Interference Check is performed at the beginning and end of each sample analysis run. Control limits are 80-120% (USACE limits 80-120%).

- All criteria were met. No qualifiers were applied.

V-Laboratory Control Samples (LCS)
The laboratory control sample (LCS) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. All soil LCS results must fall within the control limits of 80-120% for ICPMS metals and mercury and 85-115% for cyanide. USACE Shell limits for metals are 80-120% (60-140% for sporadic marginal failures (SMF)).

- Sample BKS65806 was used as LCS for ICP metals analysis. All criteria were met. No qualifiers were applied.

- Sample BKS65820 was used as LCS for total mercury analysis. All criteria were met. No qualifiers were applied.

- Sample BKS1728 was used as LCS for total cyanide analysis. All criteria were met. No qualifiers were applied.

VI-Duplicate Sample Analysis
Duplicate sample determinations are used to demonstrate acceptable method precision by the laboratory at the time of analysis. Duplicate analysis are also performed to generate data in order to determine the long-term precision of the analytical method on various matrices. RPDs must be within established control limits. USACE Shell limits for metals are 25% RPD for ICP metals and 20% RPD for mercury and cyanide.

- Sample 51SB3A (404043-001) was used as sample duplicate for ICP metals analysis. Cadmium (106%) was outside criteria. Cadmium was outside due to low sample concentration, therefore no qualifiers were applied based upon this outliers.

- Sample 51SB3D (404043-004) was used as sample duplicate for mercury analysis. All criteria were met. No qualifiers were applied.

- Sample 51SB11C (404043-007) was used for the sample duplicate analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VII-Matrix Spike
MS are generated to determine long-term accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. Specific criteria include the analyses of matrix spike and matrix spike duplicate samples at a frequency of one MS per 20 samples of similar matrix. MS recoveries and relative percent differences between MS recoveries should be within the specified limits. USACE Shell limits for metals are 75-125% for ICP metals and 80-120% for mercury and cyanide. Post digestion spikes limits are 75-125% for ICP metals and 85-115% for mercury and cyanide.

- Sample 51SB3A (404043-001) was used for the MS analysis for ICP analysis. Aluminum (1805%), antimony (55.9%), barium (134%), chromium (126%), iron (378%), magnesium (173%), manganese (154%), potassium (172%), and vanadium (132%) were outside of control limits. Post digestion spikes were within criteria for antimony, magnesium, and potassium and out of criteria for barium (-33.4%), chromium (66.5%), and vanadium (15.3%). The sample concentration was >4 times the spike added for aluminum, manganese, and iron, therefore no qualifiers were applied based upon this outlier. For antimony, the spiked sample was qualified bias low non-detect "UL". For barium, chromium, magnesium, potassium, and vanadium, the spiked sample was qualified bias high "K".

- Sample 51SB3D (404043-004) was used for the MS analysis for mercury analysis. All criteria were met. No qualifiers were applied.

- Sample 51SB11C (404043-007) was used for the MS analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VIII-ICP Serial Dilution
An ICP serial dilution is performed to determine whether significant physical or chemical interferences exist due to sample matrix at high concentrations. An analysis of a 5-fold dilution should agree within 10% difference of the original result when the concentration in sample is a factor of 50 above MDL.

- The serial dilution for the ICP was analyzed for sample 51SB3A (404043-001). Arsenic (32.0%), cadmium (16.0%), sodium (100%), and thallium (332%) were outside of criteria limits. Sample concentrations were <50 times MDL for arsenic, cadmium, sodium, and thallium, therefore no qualifiers were applied based upon these outliers.

IX-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the aqueous samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed with this SDG.

X-Quantitation Verification
The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." The following calculations were performed for verification.

ICP Sample: 51SB3A (404043-001), Total Barium

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(739.1041 μg/L)*(0.100 L)*(1)} / {(1.19 g)*(0.8507)} = 73.0 μg/g = 73.0 mg/kg

Reported concentration = 73.0 mg/kg
%D = 0.0%
Values were within 10% difference.

CVAA Sample: 51SB3A (404043-001), Total Mercury

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(0.619 μg/L)*(0.100 L)*(1)} / {(0.73 g)*(0.8507)} = 0.10 μg/g = 0.10 mg/kg

Reported concentration = 0.10 mg/kg
%D = 0.0%
Values were within 10% difference.

Cyanide Sample: 51SB3B (404043-002), Total Cyanide

Conc. (mg/kg) = {(conc. µg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(25.2 µg/L)*(0.050 L)*(10)} / {(1.63 g)*(0.3717)} = 21 µg/g = 21 mg/kg

Reported concentration = 21 mg/kg
%D = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form 1 only

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-001-005-1/1 **Client ID:** 51SB3A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65806

Weight: 1.19 **Volume:** 100 **Percent Moisture:** 14.93

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.7**	**19.8**	**20800**		**1**	**ICPST**	**4/9/04**	**14:52**
Antimony	206.84	0.49	2.0	0.49	UN	VL 1	ICPST	4/9/04	14:52
Arsenic	**189.04**	**0.20**	**2.0**	**4.0**		**1**	**ICPST**	**4/9/04**	**14:52**
Barium	**493.41**	**0.032**	**0.49**	**73.0**	**N**	**K 1**	**ICPST**	**4/9/04**	**14:52**
Beryllium	**313.04**	**0.0056**	**0.20**	**0.56**		**1**	**ICPST**	**4/9/04**	**14:52**
Cadmium	**226.50**	**0.043**	**0.59**	**0.36**	**B**	**J 1**	**ICPST**	**4/9/04**	**14:52**
Calcium	**317.93**	**7.5**	**98.8**	**284**		**1**	**ICPST**	**4/9/04**	**14:52**
Chromium	**267.72**	**0.12**	**0.49**	**27.4**	**N**	**K 1**	**ICPST**	**4/9/04**	**14:52**
Cobalt	**228.62**	**0.079**	**0.49**	**8.4**		**1**	**ICPST**	**4/9/04**	**14:52**
Copper	**324.75**	**0.094**	**0.99**	**10.7**		**1**	**ICPST**	**4/9/04**	**14:52**
Iron	**271.44**	**3.9**	**14.8**	**27800**		**1**	**ICPST**	**4/9/04**	**14:52**
Lead	**220.35**	**0.21**	**0.99**	**15.7**		**1**	**ICPST**	**4/9/04**	**14:52**
Magnesium	**279.08**	**2.5**	**24.7**	**890**	**N**	**K 1**	**ICPST**	**4/9/04**	**14:52**
Manganese	**257.61**	**0.025**	**0.49**	**627**		**1**	**ICPST**	**4/9/04**	**14:52**
Nickel	**231.60**	**0.14**	**0.99**	**8.4**		**1**	**ICPST**	**4/9/04**	**14:52**
Potassium	**766.49**	**4.1**	**24.7**	**843**	**N**	**K 1**	**ICPST**	**4/9/04**	**14:52**
Selenium	196.03	0.17	2.0	0.17	U	1	ICPST	4/9/04	14:52
Silver	328.07	0.13	0.30	0.13	U	1	ICPST	4/9/04	14:52
Sodium	**330.23**	**33.3**	**247**	**81.7**	**B**	**B 1**	**ICPST**	**4/9/04**	**14:52**
Thallium	**190.86**	**0.57**	**3.0**	**1.1**	**B**	**J 1**	**ICPST**	**4/9/04**	**14:52**
Vanadium	**292.40**	**0.14**	**0.99**	**57.0**	**N**	**K 1**	**ICPST**	**4/9/04**	**14:52**
Zinc	**213.86**	**0.53**	**2.0**	**29.0**		**1**	**ICPST**	**4/9/04**	**14:52**

Comments: Sample Date: 04/05/04 Sample Time: 08:00 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Org

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-001-005-1/1 **Client ID:** 51SB3A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65820

Weight: 0.73 **Volume:** 100 **Percent Moisture:** 14.93

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.032	0.10		1	CVAA	4/10/04	14:58

Comments: Sample Date: 04/05/04 Sample Time: 08:00 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form I Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB3A	Lab Sample ID:	404043-001-005-1/1
Sample Date/Time:	04/05/2004 08:00	Percent Moisture:	14.93
Receipt Date/Time:	04/06/2004 10:47	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.15	1	mg/kg	04/15/04 20:20

Form I Corr

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-002-006-1/1 **Client ID:** 51SB3B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65806

Weight: 1.36 **Volume:** 100 **Percent Moisture:** 62.83

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	6.7	79.1	15700		2	ICPST	4/12/04	16:29
Antimony	206.84	2.0	7.9	5.4	BN	J 2	ICPST	4/12/04	16:29
Arsenic	189.04	0.40	4.0	15.3		1	ICPST	4/9/04	15:50
Barium	493.41	0.063	0.99	177	N	1	ICPST	4/9/04	15:50
Beryllium	313.04	0.011	0.40	0.84		1	ICPST	4/9/04	15:50
Cadmium	226.50	0.17	2.4	6.0		2	ICPST	4/12/04	16:29
Calcium	317.93	15.0	198	25200		1	ICPST	4/9/04	15:50
Chromium	267.72	0.47	2.0	469	N	2	ICPST	4/12/04	16:29
Cobalt	228.62	0.16	0.99	4.6		1	ICPST	4/9/04	15:50
Copper	324.75	0.19	2.0	76.4		1	ICPST	4/9/04	15:50
Iron	271.44	15.6	59.3	160000		2	ICPST	4/12/04	16:29
Lead	220.35	0.83	4.0	3890		2	ICPST	4/12/04	16:29
Magnesium	279.08	10.0	98.9	3140	N	2	ICPST	4/12/04	16:29
Manganese	257.61	0.099	2.0	295		2	ICPST	4/12/04	16:29
Nickel	231.60	0.28	2.0	121		1	ICPST	4/9/04	15:50
Potassium	766.49	8.3	49.5	925	N	1	ICPST	4/9/04	15:50
Selenium	196.03	0.67	7.9	0.67	U	2	ICPST	4/12/04	16:29
Silver	328.07	0.26	0.59	0.73		K 1	ICPST	4/9/04	15:50
Sodium	330.23	133	989	1180		B 2	ICPST	4/12/04	16:29
Thallium	190.86	2.3	11.9	5.8	B	J 2	ICPST	4/12/04	16:29
Vanadium	292.40	0.55	4.0	34.3	N	2	ICPST	4/12/04	16:29
Zinc	213.86	2.1	7.9	481		2	ICPST	4/12/04	16:29

Comments: Sample Date: 04/05/04 Sample Time: 08:30 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

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Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-002-006-1/1 **Client ID:** 51SB3B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65820

Weight: 0.71 **Volume:** 100 **Percent Moisture:** 62.83

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.038	0.076	1.1		1	CVAA	4/10/04	15:01

Comments: Sample Date: 04/05/04 Sample Time: 08:30 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

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Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB3B	Lab Sample ID:	404043-002-006-1/1
Sample Date/Time:	04/05/2004 08:30	Percent Moisture:	62.83
Receipt Date/Time:	04/06/2004 10:47	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	**Cyanide, Total**	**21**		**4.1**	**10**	**mg/kg**	**04/15/04 20:2**

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Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-003-007-1/1 **Client ID:** 51SB3C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65806

Weight: 1.39 **Volume:** 100 **Percent Moisture:** 10.88

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.4**	**16.1**	**11200**		1	ICPST	4/9/04	15:58
Antimony	206.84	0.40	1.6	0.40	UN	1	ICPST	4/9/04	15:58
Arsenic	**189.04**	**0.16**	**1.6**	**1.0**	**B**	B 1	ICPST	4/9/04	15:58
Barium	**493.41**	**0.026**	**0.40**	**33.8**	**N**	1	ICPST	4/9/04	15:58
Beryllium	**313.04**	**0.0046**	**0.16**	**0.37**		1	ICPST	4/9/04	15:58
Cadmium	226.50	0.036	0.48	0.036	U	1	ICPST	4/9/04	15:58
Calcium	**317.93**	**6.1**	**80.7**	**178**		1	ICPST	4/9/04	15:58
Chromium	**267.72**	**0.097**	**0.40**	**16.6**	**N**	1	ICPST	4/9/04	15:58
Cobalt	**228.62**	**0.065**	**0.40**	**5.2**		1	ICPST	4/9/04	15:58
Copper	**324.75**	**0.077**	**0.81**	**5.3**		1	ICPST	4/9/04	15:58
Iron	**271.44**	**3.2**	**12.1**	**15900**		1	ICPST	4/9/04	15:58
Lead	**220.35**	**0.17**	**0.81**	**10.4**		1	ICPST	4/9/04	15:58
Magnesium	**279.08**	**2.1**	**20.2**	**723**	**N**	1	ICPST	4/9/04	15:58
Manganese	**257.61**	**0.020**	**0.40**	**210**		1	ICPST	4/9/04	15:58
Nickel	**231.60**	**0.11**	**0.81**	**5.4**		1	ICPST	4/9/04	15:58
Potassium	**766.49**	**3.4**	**20.2**	**624**	**N**	1	ICPST	4/9/04	15:58
Selenium	196.03	0.14	1.6	0.14	U	1	ICPST	4/9/04	15:58
Silver	328.07	0.10	0.24	0.10	U	1	ICPST	4/9/04	15:58
Sodium	**330.23**	**27.2**	**202**	**192**	**B**	B 1	ICPST	4/9/04	15:58
Thallium	**190.86**	**0.47**	**2.4**	**0.98**	**B**	J 1	ICPST	4/9/04	15:58
Vanadium	**292.40**	**0.11**	**0.81**	**30.3**	**N**	1	ICPST	4/9/04	15:58
Zinc	**213.86**	**0.44**	**1.6**	**18.9**		1	ICPST	4/9/04	15:58

Comments: Sample Date: 04/05/04 Sample Time: 08:45 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

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Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-003-007-1/1 **Client ID:** 51SB3C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65820

Weight: 0.75 **Volume:** 100 **Percent Moisture:** 10.88

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.030	0.015	U	1	CVAA	4/10/04	16:27

Comments: Sample Date: 04/05/04 Sample Time: 08:45 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form I Equivalent

Form I Corr

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB3C	Lab Sample ID:	404043-003-007-1/1
Sample Date/Time:	04/05/2004 08:45	Percent Moisture:	10.88
Receipt Date/Time:	04/06/2004 10:47	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	**Cyanide, Total**	**0.58**		**0.17**	**1**	**mg/kg**	**04/15/04 20:20**

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Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-004-008-1/1 **Client ID:** 51SB3D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65806

Weight: 1.28 **Volume:** 100 **Percent Moisture:** 18.07

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.6**	**19.1**	**18800**		1	**ICPST**	**4/9/04**	**16:06**
Antimony	206.84	0.48	1.9	0.48	UN	1	ICPST	4/9/04	16:06
Arsenic	**189.04**	**0.19**	**1.9**	**1.2**	**B**	B 1	**ICPST**	**4/9/04**	**16:06**
Barium	**493.41**	**0.031**	**0.48**	**106**	**N**	1	**ICPST**	**4/9/04**	**16:06**
Beryllium	**313.04**	**0.0054**	**0.19**	**1.1**		1	**ICPST**	**4/9/04**	**16:06**
Cadmium	**226.50**	**0.042**	**0.57**	**0.32**	**B**	J 1	**ICPST**	**4/9/04**	**16:06**
Calcium	**317.93**	**7.2**	**95.4**	**1100**		1	**ICPST**	**4/9/04**	**16:06**
Chromium	**267.72**	**0.11**	**0.48**	**39.1**	**N**	1	**ICPST**	**4/9/04**	**16:06**
Cobalt	**228.62**	**0.076**	**0.48**	**95.1**		1	**ICPST**	**4/9/04**	**16:06**
Copper	**324.75**	**0.091**	**0.95**	**92.9**		1	**ICPST**	**4/9/04**	**16:06**
Iron	**271.44**	**3.8**	**14.3**	**31100**		1	**ICPST**	**4/9/04**	**16:06**
Lead	**220.35**	**0.20**	**0.95**	**1.4**		B 1	**ICPST**	**4/9/04**	**16:06**
Magnesium	**279.08**	**2.4**	**23.8**	**15200**	**N**	1	**ICPST**	**4/9/04**	**16:06**
Manganese	**257.61**	**0.024**	**0.48**	**331**		1	**ICPST**	**4/9/04**	**16:06**
Nickel	**231.60**	**0.13**	**0.95**	**109**		1	**ICPST**	**4/9/04**	**16:06**
Potassium	**766.49**	**4.0**	**23.8**	**3090**	**N**	1	**ICPST**	**4/9/04**	**16:06**
Selenium	196.03	0.16	1.9	0.16	U	1	ICPST	4/9/04	16:06
Silver	328.07	0.12	0.29	0.12	U	1	ICPST	4/9/04	16:06
Sodium	**330.23**	**32.1**	**238**	**578**		1	**ICPST**	**4/9/04**	**16:06**
Thallium	**190.86**	**0.55**	**2.9**	**1.5**	**B**	B 1	**ICPST**	**4/9/04**	**16:06**
Vanadium	**292.40**	**0.13**	**0.95**	**13.7**	**N**	1	**ICPST**	**4/9/04**	**16:06**
Zinc	**213.86**	**0.51**	**1.9**	**15.2**		1	**ICPST**	**4/9/04**	**16:06**

Comments: Sample Date: 04/05/04 Sample Time: 10:45 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form I Equivalent

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Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-004-008-1/1 **Client ID:** 51SB3D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65820

Weight: 0.74 **Volume:** 100 **Percent Moisture:** 18.07

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.033	0.016	U	1	CVAA	4/10/04	16:30

Comments: Sample Date: 04/05/04 Sample Time: 10:45 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

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Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB3D	Lab Sample ID:	404043-004-008-1/1
Sample Date/Time:	04/05/2004 10:45	Percent Moisture:	18.07
Receipt Date/Time:	04/06/2004 10:47	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/15/04 20:20

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Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-005-045-1/1 **Client ID:** 51SB11A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65806

Weight: 1.31 **Volume:** 100 **Percent Moisture:** 13.51

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.5**	**17.7**	**10800**		**1**	**ICPST**	**4/9/04**	**16:13**
Antimony	206.84	0.44	1.8	0.44	UN	1	ICPST	4/9/04	16:13
Arsenic	**189.04**	**0.18**	**1.8**	**2.8**		**1**	**ICPST**	**4/9/04**	**16:13**
Barium	**493.41**	**0.028**	**0.44**	**93.7**	**N**	**1**	**ICPST**	**4/9/04**	**16:13**
Beryllium	**313.04**	**0.0050**	**0.18**	**0.51**		**1**	**ICPST**	**4/9/04**	**16:13**
Cadmium	**226.50**	**0.039**	**0.53**	**0.11**	**B**	**ß 1**	**ICPST**	**4/9/04**	**16:13**
Calcium	**317.93**	**6.7**	**88.3**	**228**		**1**	**ICPST**	**4/9/04**	**16:13**
Chromium	**267.72**	**0.11**	**0.44**	**18.2**	**N**	**1**	**ICPST**	**4/9/04**	**16:13**
Cobalt	**228.62**	**0.071**	**0.44**	**3.3**		**1**	**ICPST**	**4/9/04**	**16:13**
Copper	**324.75**	**0.084**	**0.88**	**5.2**		**1**	**ICPST**	**4/9/04**	**16:13**
Iron	**271.44**	**3.5**	**13.2**	**14200**		**1**	**ICPST**	**4/9/04**	**16:13**
Lead	**220.35**	**0.19**	**0.88**	**13.3**		**1**	**ICPST**	**4/9/04**	**16:13**
Magnesium	**279.08**	**2.2**	**22.1**	**485**	**N**	**1**	**ICPST**	**4/9/04**	**16:13**
Manganese	**257.61**	**0.022**	**0.44**	**289**		**1**	**ICPST**	**4/9/04**	**16:13**
Nickel	**231.60**	**0.12**	**0.88**	**4.4**		**1**	**ICPST**	**4/9/04**	**16:13**
Potassium	**766.49**	**3.7**	**22.1**	**360**	**N**	**1**	**ICPST**	**4/9/04**	**16:13**
Selenium	196.03	0.15	1.8	0.15	U	1	ICPST	4/9/04	16:13
Silver	328.07	0.11	0.26	0.11	U	1	ICPST	4/9/04	16:13
Sodium	**330.23**	**29.7**	**221**	**61.9**	**B**	**ß 1**	**ICPST**	**4/9/04**	**16:13**
Thallium	**190.86**	**0.51**	**2.6**	**0.65**	**B**	**J 1**	**ICPST**	**4/9/04**	**16:13**
Vanadium	**292.40**	**0.12**	**0.88**	**32.7**	**N**	**1**	**ICPST**	**4/9/04**	**16:13**
Zinc	**213.86**	**0.48**	**1.8**	**19.5**		**1**	**ICPST**	**4/9/04**	**16:13**

Comments: Sample Date: 04/05/04 Sample Time: 02:25 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

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Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-005-045-1/1 **Client ID:** 51SB11A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65820

Weight: 0.73 **Volume:** 100 **Percent Moisture:** 13.51

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.032	0.016	U	1	CVAA	4/10/04	15:10

Comments: Sample Date: 04/05/04 Sample Time: 02:25 PM

E Serial dilution percent difference not within limits
U Result is less than the IDL
B Result is between IDL and RL

Form 1 Equivalent

Form I Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB11A	Lab Sample ID:	404043-005-045-1/1
Sample Date/Time:	04/05/2004 14:25	Percent Moisture:	13.51
Receipt Date/Time:	04/06/2004 10:47	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.15	1	mg/kg	04/15/04 20:2(

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Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-006-046-1/1 **Client ID:** 51SB11B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65806

Weight: 1.30 **Volume:** 100 **Percent Moisture:** 14.71

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.5**	**18.0**	**17100**		1	**ICPST**	**4/9/04**	**16:21**
Antimony	206.84	0.45	1.8	0.45	UN	1	ICPST	4/9/04	16:21
Arsenic	**189.04**	**0.18**	**1.8**	**1.1**	**B**	B 1	**ICPST**	**4/9/04**	**16:21**
Barium	**493.41**	**0.029**	**0.45**	**48.2**	**N**	1	**ICPST**	**4/9/04**	**16:21**
Beryllium	**313.04**	**0.0051**	**0.18**	**0.50**		1	**ICPST**	**4/9/04**	**16:21**
Cadmium	**226.50**	**0.040**	**0.54**	**0.17**	**B**	BJ 1	**ICPST**	**4/9/04**	**16:21**
Calcium	**317.93**	**6.8**	**90.2**	**29.5**	**B**	B 1	**ICPST**	**4/9/04**	**16:21**
Chromium	**267.72**	**0.11**	**0.45**	**13.3**	**N**	1	**ICPST**	**4/9/04**	**16:21**
Cobalt	**228.62**	**0.072**	**0.45**	**8.7**		1	**ICPST**	**4/9/04**	**16:21**
Copper	**324.75**	**0.086**	**0.90**	**6.9**		1	**ICPST**	**4/9/04**	**16:21**
Iron	**271.44**	**3.6**	**13.5**	**22100**		1	**ICPST**	**4/9/04**	**16:21**
Lead	**220.35**	**0.19**	**0.90**	**7.9**		1	**ICPST**	**4/9/04**	**16:21**
Magnesium	**279.08**	**2.3**	**22.5**	**1160**	**N**	1	**ICPST**	**4/9/04**	**16:21**
Manganese	**257.61**	**0.023**	**0.45**	**275**		1	**ICPST**	**4/9/04**	**16:21**
Nickel	**231.60**	**0.13**	**0.90**	**7.8**		1	**ICPST**	**4/9/04**	**16:21**
Potassium	**766.49**	**3.8**	**22.5**	**1080**	**N**	1	**ICPST**	**4/9/04**	**16:21**
Selenium	196.03	0.15	1.8	0.15	U	1	ICPST	4/9/04	16:21
Silver	328.07	0.12	0.27	0.12	U	1	ICPST	4/9/04	16:21
Sodium	**330.23**	**30.4**	**225**	**111**	**B**	B 1	**ICPST**	**4/9/04**	**16:21**
Thallium	**190.86**	**0.52**	**2.7**	**0.88**	**B**	J 1	**ICPST**	**4/9/04**	**16:21**
Vanadium	**292.40**	**0.13**	**0.90**	**46.6**	**N**	1	**ICPST**	**4/9/04**	**16:21**
Zinc	**213.86**	**0.49**	**1.8**	**29.5**		1	**ICPST**	**4/9/04**	**16:21**

Comments: Sample Date: 04/05/04 Sample Time: 02:35 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-006-046-1/1 **Client ID:** 51SB11B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65820

Weight: 0.76 **Volume:** 100 **Percent Moisture:** 14.71

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.031	0.015	U	1	CVAA	4/10/04	15:13

Comments: Sample Date: 04/05/04 Sample Time: 02:35 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form I CLP

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB11B	Lab Sample ID:	404043-006-046-1/1
Sample Date/Time:	04/05/2004 14:35	Percent Moisture:	14.71
Receipt Date/Time:	04/06/2004 10:47	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	**Cyanide, Total**	**0.21**		**0.15**	**1**	**mg/kg**	**04/15/04 20:2**

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-007-047-1/1 **Client ID:** 51SB11C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65806

Weight: 1.33 **Volume:** 100 **Percent Moisture:** 13.11

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.5**	**17.3**	**19700**		1	**ICPST**	**4/9/04**	**16:29**
Antimony	206.84	0.43	1.7	0.43	UN	1	ICPST	4/9/04	16:29
Arsenic	**189.04**	**0.17**	**1.7**	**3.1**		1	**ICPST**	**4/9/04**	**16:29**
Barium	**493.41**	**0.028**	**0.43**	**66.7**	**N**	1	**ICPST**	**4/9/04**	**16:29**
Beryllium	**313.04**	**0.0049**	**0.17**	**2.5**		1	**ICPST**	**4/9/04**	**16:29**
Cadmium	**226.50**	**0.038**	**0.52**	**0.53**		1	**ICPST**	**4/9/04**	**16:29**
Calcium	**317.93**	**6.6**	**86.5**	**1260**		1	**ICPST**	**4/9/04**	**16:29**
Chromium	**267.72**	**0.10**	**0.43**	**41.6**	**N**	1	**ICPST**	**4/9/04**	**16:29**
Cobalt	**228.62**	**0.069**	**0.43**	**16.9**		1	**ICPST**	**4/9/04**	**16:29**
Copper	**324.75**	**0.082**	**0.87**	**8.3**		1	**ICPST**	**4/9/04**	**16:29**
Iron	**271.44**	**3.4**	**13.0**	**35200**		1	**ICPST**	**4/9/04**	**16:29**
Lead	**220.35**	**0.18**	**0.87**	**6.6**		1	**ICPST**	**4/9/04**	**16:29**
Magnesium	**279.08**	**2.2**	**21.6**	**17700**	**N**	1	**ICPST**	**4/9/04**	**16:29**
Manganese	**257.61**	**0.022**	**0.43**	**434**		1	**ICPST**	**4/9/04**	**16:29**
Nickel	**231.60**	**0.12**	**0.87**	**53.4**		1	**ICPST**	**4/9/04**	**16:29**
Potassium	**766.49**	**3.6**	**21.6**	**1150**	**N**	1	**ICPST**	**4/9/04**	**16:29**
Selenium	196.03	0.15	1.7	0.15	U	1	ICPST	4/9/04	16:29
Silver	328.07	0.11	0.26	0.11	U	1	ICPST	4/9/04	16:29
Sodium	**330.23**	**29.2**	**216**	**114**	**B**	B 1	**ICPST**	**4/9/04**	**16:29**
Thallium	**190.86**	**0.50**	**2.6**	**1.4**	**B**	J 1	**ICPST**	**4/9/04**	**16:29**
Vanadium	**292.40**	**0.12**	**0.87**	**28.6**	**N**	1	**ICPST**	**4/9/04**	**16:29**
Zinc	**213.86**	**0.47**	**1.7**	**23.6**		1	**ICPST**	**4/9/04**	**16:29**

Comments: Sample Date: 04/05/04 Sample Time: 03:30 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form 1 Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404043

Lab Sample ID: S 404043-007-047-1/1 **Client ID:** 51SB11C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65820

Weight: 0.72 **Volume:** 100 **Percent Moisture:** 13.11

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.032	0.016	U	1	CVAA	4/10/04	15:16

Comments: Sample Date: 04/05/04 Sample Time: 03:30 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form I Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB11C	Lab Sample ID:	404043-007-047-1/1
Sample Date/Time:	04/05/2004 15:30	Percent Moisture:	13.11
Receipt Date/Time:	04/06/2004 10:47	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.18	1	mg/kg	04/15/04 20:20

Shaw Environmental, Inc.

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Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation - Volatiles
GPL Laboratories, Inc., SDG 404043

DATE: June 17, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004. The samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs) using USEPA SW846 Method 5035/8260B. A total of eight soil samples including diluted samples were validated. The sample IDs are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB3A	404043-001	51SB3D	404043-004
51SB3B	404043-002	51SB11A	404043-005
51SB3B	404043-002DL	51SB11B	404043-006
51SB3C	404043-003	51SB11C	404043-007

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated under data validation procedure Level M3 are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Results
X		Initial Calibration
X		Continuing Calibration
X		Blank Analysis
	X	Laboratory Control Sample
X		Matrix Spike/ Spike Duplicate Sample
X		System Monitoring Compounds
	X	Internal Standards
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with the noted qualifications, except for the following. Compound 2-butanone was rejected "R" for samples 51SB3A (404043-001), 51SB3B (404043-002DL), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) based upon low calibration response recoveries. Compound toluene was detected outside calibration range (i.e. "E-flag) for sample 51SB3B (404043-002) and was qualified "R" rejected. Sample 51SB3B (404043-002DL) should be used for toluene for this sample.

Eric Malarek, Chemist

6/17/04

Date

RFAAP VALIDATION REPORT
VOLATILES REVIEW
SDG 404043

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of analysis. Holding time criteria: For Encore soil samples cooled @ 4°C ± 2°C; the maximum holding time is 2 days for preparation, 14 days from sample collection to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04, prepped on 04/06/04, and analyzed for TCL VOCs on 04/14/04 and 04/17/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, bromofluorobenzene (BFB), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be ≥ 0.05 for all other compounds. Percent relative standard deviation (%RSD) must be ≤ 15% for each target compound and must be ≤ 30% for each calibration check compound. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For initial calibration for VOCs performed on 04/13/04 on instrument HP#F, target compounds chloroethane (18.4%), 2-butanone (22.0%, RRF=0.014), 2-hexanone (55.2%; grossly exceeding), and styrene (24.6%) were outside control limits. Compounds 2-butanone and 2-hexanone were quantified using linear regression with correlation coefficients greater than 0.99. Compound chloroethane was non-detect for all samples, therefore no qualifiers were applied based upon this outlier. Sample 51SB3B (404043-002) applies to this initial calibration.

- For initial calibration for VOCs performed on 04/16/04 on instrument HP#F, target compounds bromomethane (32.0%; grossly exceeding), chloroethane (26.2%), acetone (26.7%), 2-butanone (18.2%, RRF=0.019), and 2-hexanone (46.7%; grossly exceeding) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compounds chloroethane, and acetone were qualified "J" for detects and no qualifier for non-detects based upon the high %RSD. Compound 2-hexanone and bromomethane were qualified "J" for detects and "UJ" for non-detects based upon the grossly exceeding %RSD. Samples 51SB3A (404043-001), 51SB3B (404043-002DL), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Continuing calibration establishes the 12-hour relative response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be $\geq$ 0.05 for all other compounds. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within 20% for all target compounds. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for VOCs performed on 04/14/04 @10:22 on instrument HP#F, target compounds 2-butanone (RRF=0.012) and 2-hexanone (23.8%) were outside control limits. Compounds 2-butanone and 2-hexanone were quantified using linear regression with correlation coefficients greater than 0.99, therefore no qualifiers were applied based upon these outliers. No samples apply to this continuing calibration.

- For continuing calibration for VOCs performed on 04/14/04 @13:30 on instrument HP#F, target compounds 2-butanone (RRF=0.014) and 2-hexanone (28.6%) were outside control limits. Compounds 2-butanone and 2-hexanone were quantified using linear regression with correlation coefficients greater than 0.99, therefore no qualifiers were applied based upon these outliers. Sample 51SB3B (404043-002) applies to this continuing calibration.

- For continuing calibration for VOCs performed on 04/16/04 @15:58 on instrument HP#F, target compounds 2-butanone (RRF=0.017) and 2-hexanone (21.8%) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compound 2-hexanone was qualified "J" for detects and no qualifier for non-detects based upon this outlier. No samples apply to this continuing calibration.

- For continuing calibration for VOCs performed on 04/16/04 @17:07 on instrument HP#F, target compounds chloroethane (22.3%), 2-butanone (RRF=0.019), and 2-hexanone (25.3%) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compounds 2-hexanone and chloroethane were qualified "J" for detects and no qualifier for non-detects based upon this outlier. Samples 51SB3A (404043-001), 51SB3B (404043-002DL), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of BFB. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants methylene chloride, acetone, and 2-butanone). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants methylene chloride, acetone, and 2-butanone, or 5 times (5X) the maximum amount for other volatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 1). Rinse blank 040704R and associated trip blank 040704T apply to these samples and were analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/14/04	BLK65946	methylene chloride	1.7J	17	51SB3B
04/16/04	BLK66006	methylene chloride	3.4J	34	51SB3A, 51SB3BDL, 51SB3C, 51SB3D, 51SB11A, 51SB11B, 51SB11C
04/14/04	040704R	2-butanone	2.1J	21	51SB3C
04/14/04	040704R	acetone	18	180	51SB3A, 51SB3B, 51SB3BDL, 51SB3C, 51SB3D, 51SB11A, 51SB11B
04/14/04	040704R	benzene	0.95J	4.8	51SB3BDL, 51SB3C
04/14/04	040704R	ethylbenzene	0.45J	2.3	51SB3BDL
04/14/04	040704R	m,p-xylenes	1.8	9.0	51SB3BDL
04/14/04	040704R	o-xylene	0.76J	3.8	51SB3BDL
04/14/04	040704R	toluene	3.7	18.5	None
04/14/04	040704T	2-butanone	1.9J	4.2	None
04/14/04	040704T	acetone	4.2J	42	51SB3A, 51SB3B, 51SB3BDL, 51SB3C, 51SB3D, 51SB11A, 51SB11B
04/14/04	040704T	methylene chloride	0.90J	9.0	51SB3A, 51SB3B, 51SB3BDL, 51SB3C, 51SB3D, 51SB11A, 51SB11B, 51SB11C

J = Estimated value <MRL and >MDL

VI-Laboratory Control Sample (LCS) and LCSD

Data for laboratory control samples (LCS) and LCSD are evaluated to determine long-term accuracy and precision of the analytical method on various matrices. Percent recoveries (%Rs) should be within the specified control limits. USACE Shell limits are 75-125%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- Sample BKSD65946 was used as the LCS for the TCL VOC analysis. Compounds 2-hexanone (72%) and acetone (68%) were outside USACE criteria and within the SMF criteria. There were a total of 35 spike recoveries with 2 sporadic marginal failures. No qualifiers were applied based upon these outliers. Sample 51SB3B (404043-002) applies to this LCS.

- Sample BKSD66006 was used as the LCS for the TCL VOC analysis. All criteria were met. No qualifiers were applied. Samples 51SB3A (404043-001), 51SB3B (404043-002DL), 51SB3C (404043-003), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 70-130%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- Sample 51SB8B (404027-002) was used for the MS/MSD analysis for VOCs. This sample was analyzed in SDG 404027. Compounds 2-butanone (4%; RPD=180%), 2-hexanone (67%, 70%), acetone (65%, 62%), benzene (77%), dibromochloromethane (43%, RPD=74%), styrene (56%, RPD=39%), tetrachloroethylene (34%, RPD=70%), and trans-1,3-dichloropropene (64%, RPD=28%) were outside criteria limits. Compounds 2-butanone, 2-hexanone, acetone, benzene, dibromochloromethane, styrene, tetrachloroethylene, and trans-1,3-dichloropropene were qualified bias low "L" for detects and "UL" for non-detects for the spiked sample based upon these outliers.

VIII-System Monitoring Compounds (Surrogates)
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Recoveries for system monitoring compounds in volatile samples and blanks must be within the specified control limits.

Criteria: 1,2-Dichlorobenzene-d4 (74-122%) – SMC1 (USACE Shell Criteria: 70-130%)
1,2-Dichloroethane-d4 (64-120%) – SMC2 (USACE Shell Criteria: 70-130%)
4-Bromofluorobenzene (76-116%) – SMC3 (USACE Shell Criteria: 70-130%)
Toluene-d8 (76-120%) – SMC4 (USACE Shell Criteria: 70-130%)

- For samples 51SB3A (404043-001), 51SB3B (404043-002), 51SB3B (404043-002DL), 51SB3D (404043-004), 51SB11A (404043-005), 51SB11B (404043-006), and 51SB11C (404043-007), all surrogates were within criteria. No qualifiers were applied.

- For sample 51SB3C (404043-003), surrogate 1,2-dichlorobenzene-d4 (68%) was below laboratory criteria limits. All detects were qualified estimated "J" and non-detects "UJ" based upon this outlier for this sample.

IX-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: area counts (-50% to +100%) of the associated calibration standard, and retention time (± 30 seconds) from that of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed with this SDG.

XI-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J". Compound toluene was detected outside calibration range (i.e. "E-flag) for sample 51SB3B (404043-002) and was qualified "R" rejected. Sample 51SB3B (404043-002DL) should be used for toluene for this sample.

Sample: 51SB3A (404043-001), Acetone

Conc. (µg/kg) = {(Ax)*(Is)*(DF)*(Vp)} / {(Ais)*(RRF)*(Ws)*Fs)}

where: Ax is the compound area
Is is the corresponding internal standard concentration (ng/mL)
DF is the dilution factor
Vp is the volume purged (mL)
Ais is the corresponding internal standard area
RRF is the relative response factor
Ws is the weight of the sample (g)
Fs is the fraction solids for the sample = 1.0 for Wet Weight

Conc. µg/kg = (37469 * 50 ng/mL * 1 * 5 mL) / (673361 * 0.069 * 5.85g * 0.8507) = 40 µg/kg
Reported Conc. = 40 µg/kg
%D = 0.0
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

GPL Laboratories

GPL FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No.:		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-021-1/3
Sample Volume :	5.85	Lab File ID :	F39823.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	14.93	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.0	U	
79-00-5	1,1,2-Trichloroethane	5.0	U	
75-34-3	1,1-Dichloroethane	5.0	U	
75-35-4	1,1-Dichloroethene	5.0	U	
107-06-2	1,2-Dichloroethane	5.0	U	
78-87-5	1,2-Dichloropropane	5.0	U	
78-93-3	2-Butanone	10	U	R
591-78-6	2-Hexanone	10	U	UJ
108-10-1	4-Methyl-2-Pentanone	10	U	
67-64-1	Acetone	40		B
71-43-2	Benzene	5.0	U	
75-27-4	Bromodichloromethane	5.0	U	
75-25-2	Bromoform	5.0	U	
74-83-9	Bromomethane	10	U	UJ
75-15-0	Carbon Disulfide	5.0	U	
56-23-5	Carbon Tetrachloride	5.0	U	
108-90-7	Chlorobenzene	5.0	U	
75-00-3	Chloroethane	10	U	
67-66-3	Chloroform	5.0	U	
74-87-3	Chloromethane	10	U	
124-48-1	Dibromochloromethane	5.0	U	
100-41-4	Ethylbenzene	5.0	U	
75-09-2	Methylene Chloride	2.8	JB	B
100-42-5	Styrene	5.0	U	
127-18-4	Tetrachloroethylene	5.0	U	
108-88-3	Toluene	5.0	U	
79-01-6	Trichloroethene	5.0	U	
75-01-4	Vinyl Chloride	10	U	

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-001-021-1/3
Sample Volume :	5.85	Lab File ID :	F39823.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	14.93	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.0	U
10061-01-5	cis-1,3-Dichloropropene	5.0	U
136777-61-2	m,p-Xylenes	5.0	U
95-47-6	o-Xylene	5.0	U
156-60-5	trans-1,2-dichloroethene	5.0	U
10061-02-6	trans-1,3-dichloropropene	5.0	U

GPL Laboratories

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-024-1/3
Sample Volume :	3.61	Lab File ID :	F39775.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	62.83	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	49		
79-34-5	1,1,2,2-Tetrachloroethane	19	U	
79-00-5	1,1,2-Trichloroethane	19	U	
75-34-3	1,1-Dichloroethane	19	U	
75-35-4	1,1-Dichloroethene	19	U	
107-06-2	1,2-Dichloroethane	19	U	
78-87-5	1,2-Dichloropropane	19	U	
78-93-3	2-Butanone	37	U	
591-78-6	2-Hexanone	37	U	
108-10-1	4-Methyl-2-Pentanone	160		
67-64-1	Acetone	93		B
71-43-2	Benzene	190		
75-27-4	Bromodichloromethane	19	U	
75-25-2	Bromoform	19	U	
74-83-9	Bromomethane	37	U	
75-15-0	Carbon Disulfide	19	U	
56-23-5	Carbon Tetrachloride	19	U	
108-90-7	Chlorobenzene	19	U	
75-00-3	Chloroethane	37	U	
67-66-3	Chloroform	6.9	J	J
74-87-3	Chloromethane	37	U	
124-48-1	Dibromochloromethane	19	U	
100-41-4	Ethylbenzene	46		
75-09-2	Methylene Chloride	16	JB	B
100-42-5	Styrene	19	U	
127-18-4	Tetrachloroethylene	15	J	J
108-88-3	Toluene	4400	E	E
79-01-6	Trichloroethene	32		
75-01-4	Vinyl Chloride	37	U	

GPL Laboratories

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB3B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-024-1/3
Sample Volume :	3.61	Lab File ID :	F39775.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	62.83	Date Analyzed	04/14/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	19	U
10061-01-5	cis-1,3-Dichloropropene	19	U
136777-61-2	m,p-Xylenes	140	
95-47-6	o-Xylene	39	
156-60-5	trans-1,2-dichloroethene	19	U
10061-02-6	trans-1,3-dichloropropene	19	U

GPL
Laboratories

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB3BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-026-3/3DL
Sample Volume :	3.92	Lab File ID :	F39829.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	62.83	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	127.5
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	1700	U	
79-34-5	1,1,2,2-Tetrachloroethane	1700	U	
79-00-5	1,1,2-Trichloroethane	1700	U	
75-34-3	1,1-Dichloroethane	1700	U	
75-35-4	1,1-Dichloroethene	1700	U	
107-06-2	1,2-Dichloroethane	1700	U	
78-87-5	1,2-Dichloropropane	1700	U	
78-93-3	2-Butanone	3400	U	R
591-78-6	2-Hexanone	3400	U	UJ
108-10-1	4-Methyl-2-Pentanone	3400	U	
67-64-1	Acetone	2100	J	B
71-43-2	Benzene	1400	J	B
75-27-4	Bromodichloromethane	1700	U	
75-25-2	Bromoform	1700	U	
74-83-9	Bromomethane	3400	U	UJ
75-15-0	Carbon Disulfide	1700	U	
56-23-5	Carbon Tetrachloride	1700	U	
108-90-7	Chlorobenzene	1700	U	
75-00-3	Chloroethane	3400	U	
67-66-3	Chloroform	1700	U	
74-87-3	Chloromethane	3400	U	
124-48-1	Dibromochloromethane	1700	U	
100-41-4	Ethylbenzene	930	J	B
75-09-2	Methylene Chloride	2400	JB	B
100-42-5	Styrene	1700	U	
127-18-4	Tetrachloroethylene	1700	U	
108-88-3	Toluene	51000		✓
79-01-6	Trichloroethene	1200	J	J
75-01-4	Vinyl Chloride	3400	U	

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SAMPLE NO
51SB3BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-002-026-3/3DL
Sample Volume :	3.92	Lab File ID :	F39829.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	62.83	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	127.5
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
156-59-2	cis-1,2-Dichloroethene	1700	U	
10061-01-5	cis-1,3-Dichloropropene	1700	U	
136777-61-2	m,p-Xylenes	3200		B
95-47-6	o-Xylene	900	J	B
156-60-5	trans-1,2-dichloroethene	1700	U	
10061-02-6	trans-1,3-dichloropropene	1700	U	

GPL Laboratories

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB3C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-027-1/3
Sample Volume :	5.64	Lab File ID :	F39824.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	10.88	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	1.7	J	B J
79-34-5	1,1,2,2-Tetrachloroethane	5.0	U	UJ
79-00-5	1,1,2-Trichloroethane	5.0	U	UJ
75-34-3	1,1-Dichloroethane	5.0	U	UJ
75-35-4	1,1-Dichloroethene	5.0	U	UJ
107-06-2	1,2-Dichloroethane	5.0	U	UJ
78-87-5	1,2-Dichloropropane	5.0	U	UJ
78-93-3	2-Butanone	8.3	J	B
591-78-6	2-Hexanone	8.0	J	J
108-10-1	4-Methyl-2-Pentanone	25		J
67-64-1	Acetone	25		B
71-43-2	Benzene	2.7	J	B
75-27-4	Bromodichloromethane	5.0	U	UJ
75-25-2	Bromoform	5.0	U	UJ
74-83-9	Bromomethane	9.9	U	UJ
75-15-0	Carbon Disulfide	5.0	U	UJ
56-23-5	Carbon Tetrachloride	5.0	U	UJ
108-90-7	Chlorobenzene	5.0	U	UJ
75-00-3	Chloroethane	9.9	U	UJ
67-66-3	Chloroform	5.0	U	UJ
74-87-3	Chloromethane	9.9	U	UJ
124-48-1	Dibromochloromethane	5.0	U	UJ
100-41-4	Ethylbenzene	5.0	U	UJ
75-09-2	Methylene Chloride	2.9	JB	B
100-42-5	Styrene	5.0	U	UJ
127-18-4	Tetrachloroethylene	5.0	U	UJ
108-88-3	Toluene	85		J
79-01-6	Trichloroethene	1.9	J	B J
75-01-4	Vinyl Chloride	9.9	U	UJ

GPL Laboratories

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ANALYSIS DATA SHEET

SAMPLE NO
51SB3C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-003-027-1/3
Sample Volume :	5.64	Lab File ID :	F39824.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	10.88	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
156-59-2	cis-1,2-Dichloroethene	5.0	U	UJ
10061-01-5	cis-1,3-Dichloropropene	5.0	U	UJ
136777-61-2	m,p-Xylenes	18		J
95-47-6	o-Xylene	8.2		J
156-60-5	trans-1,2-dichloroethene	5.0	U	UJ
10061-02-6	trans-1,3-dichloropropene	5.0	U	UJ

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-004-030-1/3
Sample Volume :	5.89	Lab File ID :	F39825.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	18.07	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.2	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.2	U	
79-00-5	1,1,2-Trichloroethane	5.2	U	
75-34-3	1,1-Dichloroethane	5.2	U	
75-35-4	1,1-Dichloroethene	5.2	U	
107-06-2	1,2-Dichloroethane	5.2	U	
78-87-5	1,2-Dichloropropane	5.2	U	
78-93-3	2-Butanone	10	U	R
591-78-6	2-Hexanone	10	U	UJ
108-10-1	4-Methyl-2-Pentanone	10	U	
67-64-1	Acetone	9.6	J	B
71-43-2	Benzene	5.2	U	
75-27-4	Bromodichloromethane	5.2	U	
75-25-2	Bromoform	5.2	U	
74-83-9	Bromomethane	10	U	UJ
75-15-0	Carbon Disulfide	5.2	U	
56-23-5	Carbon Tetrachloride	5.2	U	
108-90-7	Chlorobenzene	5.2	U	
75-00-3	Chloroethane	10	U	
67-66-3	Chloroform	5.2	U	
74-87-3	Chloromethane	10	U	
124-48-1	Dibromochloromethane	5.2	U	
100-41-4	Ethylbenzene	5.2	U	
75-09-2	Methylene Chloride	2.8	JB	B
100-42-5	Styrene	5.2	U	
127-18-4	Tetrachloroethylene	5.2	U	
108-88-3	Toluene	5.2	U	
79-01-6	Trichloroethene	5.2	U	
75-01-4	Vinyl Chloride	10	U	

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB3D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-004-030-1/3
Sample Volume :	5.89	Lab File ID :	F39825.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	18.07	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.2	U
10061-01-5	cis-1,3-Dichloropropene	5.2	U
136777-61-2	m,p-Xylenes	5.2	U
95-47-6	o-Xylene	5.2	U
156-60-5	trans-1,2-dichloroethene	5.2	U
10061-02-6	trans-1,3-dichloropropene	5.2	U

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-005-033-1/3
Sample Volume :	5.72	Lab File ID :	F39826.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	13.51	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.1	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.1	U	
79-00-5	1,1,2-Trichloroethane	5.1	U	
75-34-3	1,1-Dichloroethane	5.1	U	
75-35-4	1,1-Dichloroethene	5.1	U	
107-06-2	1,2-Dichloroethane	5.1	U	
78-87-5	1,2-Dichloropropane	5.1	U	
78-93-3	2-Butanone	10	U	R
591-78-6	2-Hexanone	10	U	UJ
108-10-1	4-Methyl-2-Pentanone	10	U	
67-64-1	Acetone	20		B
71-43-2	Benzene	5.1	U	
75-27-4	Bromodichloromethane	5.1	U	
75-25-2	Bromoform	5.1	U	
74-83-9	Bromomethane	10	U	UJ
75-15-0	Carbon Disulfide	5.1	U	
56-23-5	Carbon Tetrachloride	5.1	U	
108-90-7	Chlorobenzene	5.1	U	
75-00-3	Chloroethane	10	U	
67-66-3	Chloroform	5.1	U	
74-87-3	Chloromethane	10	U	
124-48-1	Dibromochloromethane	5.1	U	
100-41-4	Ethylbenzene	5.1	U	
75-09-2	Methylene Chloride	2.4	JB	B
100-42-5	Styrene	5.1	U	
127-18-4	Tetrachloroethylene	5.1	U	
108-88-3	Toluene	5.1	U	
79-01-6	Trichloroethene	5.1	U	
75-01-4	Vinyl Chloride	10	U	

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-005-033-1/3
Sample Volume :	5.72	Lab File ID :	F39826.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	13.51	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.1	U
10061-01-5	cis-1,3-Dichloropropene	5.1	U
136777-61-2	m,p-Xylenes	5.1	U
95-47-6	o-Xylene	5.1	U
156-60-5	trans-1,2-dichloroethene	5.1	U
10061-02-6	trans-1,3-dichloropropene	5.1	U

GPL Laboratories

Form I rev
GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No: :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-006-036-1/3
Sample Volume :	5.57	Lab File ID :	F39827.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	14.71	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.3	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.3	U	
79-00-5	1,1,2-Trichloroethane	5.3	U	
75-34-3	1,1-Dichloroethane	5.3	U	
75-35-4	1,1-Dichloroethene	5.3	U	
107-06-2	1,2-Dichloroethane	5.3	U	
78-87-5	1,2-Dichloropropane	5.3	U	
78-93-3	2-Butanone	11	U	R
591-78-6	2-Hexanone	11	U	UJ
108-10-1	4-Methyl-2-Pentanone	11	U	
67-64-1	Acetone	5.5	J	B
71-43-2	Benzene	5.3	U	
75-27-4	Bromodichloromethane	5.3	U	
75-25-2	Bromoform	5.3	U	
74-83-9	Bromomethane	11	U	UJ
75-15-0	Carbon Disulfide	5.3	U	
56-23-5	Carbon Tetrachloride	5.3	U	
108-90-7	Chlorobenzene	5.3	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.3	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.3	U	
100-41-4	Ethylbenzene	5.3	U	
75-09-2	Methylene Chloride	3.2	JB	B
100-42-5	Styrene	5.3	U	
127-18-4	Tetrachloroethylene	5.3	U	
108-88-3	Toluene	5.3	U	
79-01-6	Trichloroethene	5.3	U	
75-01-4	Vinyl Chloride	11	U	

GPL Laboratories

Form I Copy

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-006-036-1/3
Sample Volume :	5.57	Lab File ID :	F39827.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	14.71	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.3	U
10061-01-5	cis-1,3-Dichloropropene	5.3	U
136777-61-2	m,p-Xylenes	5.3	U
95-47-6	o-Xylene	5.3	U
156-60-5	trans-1,2-dichloroethene	5.3	U
10061-02-6	trans-1,3-dichloropropene	5.3	U

GPL Laboratories

Form I Low
GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-007-039-1/3
Sample Volume :	5.87	Lab File ID :	F39828.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	13.11	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.9	U	
79-34-5	1,1,2,2-Tetrachloroethane	4.9	U	
79-00-5	1,1,2-Trichloroethane	4.9	U	
75-34-3	1,1-Dichloroethane	4.9	U	
75-35-4	1,1-Dichloroethene	4.9	U	
107-06-2	1,2-Dichloroethane	4.9	U	
78-87-5	1,2-Dichloropropane	4.9	U	
78-93-3	2-Butanone	9.8	U	R
591-78-6	2-Hexanone	9.8	U	VJ
108-10-1	4-Methyl-2-Pentanone	9.8	U	
67-64-1	Acetone	9.8	U	
71-43-2	Benzene	4.9	U	
75-27-4	Bromodichloromethane	4.9	U	
75-25-2	Bromoform	4.9	U	
74-83-9	Bromomethane	9.8	U	VJ
75-15-0	Carbon Disulfide	4.9	U	
56-23-5	Carbon Tetrachloride	4.9	U	
108-90-7	Chlorobenzene	4.9	U	
75-00-3	Chloroethane	9.8	U	
67-66-3	Chloroform	4.9	U	
74-87-3	Chloromethane	9.8	U	
124-48-1	Dibromochloromethane	4.9	U	
100-41-4	Ethylbenzene	4.9	U	
75-09-2	Methylene Chloride	2.3	JB	B
100-42-5	Styrene	4.9	U	
127-18-4	Tetrachloroethylene	4.9	U	
108-88-3	Toluene	4.9	U	
79-01-6	Trichloroethene	4.9	U	
75-01-4	Vinyl Chloride	9.8	U	

GPL Laboratories

Form I Corr

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB11C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404043
Case No. :		SDG NO :	404043
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404043-007-039-1/3
Sample Volume :	5.87	Lab File ID :	F39828.D
Level :	Low	Date Received	04/06/2004
% Moisture: not dec	13.11	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	4.9	U
10061-01-5	cis-1,3-Dichloropropene	4.9	U
136777-61-2	m,p-Xylenes	4.9	U
95-47-6	o-Xylene	4.9	U
156-60-5	trans-1,2-dichloroethene	4.9	U
10061-02-6	trans-1,3-dichloropropene	4.9	U

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant Data Validation – Dioxin Furans
Pace Laboratories, Inc. SDG 04-1087082 (GPL SDG 404054)

DATE: July 26, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 06, 2004. The sample was analyzed for Dioxin Furan compounds using USEPA SW-846 Method 8290 High Resolution Gas Chromatography/High Resolution Mass Spectroscopy (HRGC/HRMS). A total of four soil samples were validated in this SDG. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB2A	404054-005	51SB2C	404054-007
51SB2B	404054-006	51SB2D	404054-008

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *USEPA Region III Dioxin/Furan Data Validation Guidance* (March, 1999). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
X		Internal Standards
	X	Cleanup Standards
	X	Laboratory Control Standard/Ongoing Precision Result
	X	Matrix Spike and Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

E. Malarek

Eric Malarek, Chemist

7/26/24

Date

RADFORD ARMY AMMUNITION PLANT VALIDATION REPORT
DIOXIN FURAN REVIEW
SDG 04-1087082 (GPL SDG 404054)

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For dioxin furan compounds in cooled @4°C ± 2°C soil samples, the maximum holding time is 30 days from sample collection to preparative extraction and 45 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/06/04, coolers were received by GPL Laboratories, Inc. at 3.0°C. The samples were then sent on to Pace Analytical for dioxin furan analysis and were received by the Pace Laboratories, Inc. at 5.6°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/06/04, extracted on 04/11/04, and analyzed for dioxin furans on 04/16/04 and 04/18/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory (or field) blank analyses is to determine the existence and magnitude of contamination problems resulting from field and laboratory activities. No contamination should be found in any of the blanks > MDL. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 50). Rinse blank 040704R applies to these samples and was analyzed in GPL SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. ng/kg	Action Level ng/kg	B qualified samples
04/14/04	Blank-4661	OCDD	4.2J	42.0	None
04/18/04	040704R	All target compounds < MRL	NA	NA	None

J = Estimated value <MRL and >MDL.

III-Instrument Performance Check

Instrument must be tuned with perfluorokerosene (PFK) to achieve a static resolving power of at least 10,000 (10% valley). Documentation of the mass spectrometer resolving power is accomplished by recording the peak profile of the high-mass reference signal (typically m/z 330.9792) obtained during a peak examination by using the low-mass PFK ion at m/z 292.9825 or lower in mass as reference. At the beginning of the each 12-hour period, the chromatographic resolution is verified in the same fashion as in the initial calibration through the analysis of HRCC solution on the DB-5 (or equivalent) column or through the analysis of the column performance solution on the SP-2331 or SP-225 (or equivalent) column. A 25% valley must be achieved between the close eluters.

- All PFK forms were verified and found to be in compliance with method specification. No qualifiers were applied.

IV-Initial Calibration
Once the window defining mix has been analyzed and the descriptor switching times have been verified, the five point calibration solutions can be analyzed prior to sample analysis. Initial calibration criteria are as follows:

- The percent relative standard deviations for the mean response factors RRF(n) from the 17 unlabeled standards must not exceed ±20%, and those for the labeled reference compounds must not exceed ±30%
- Isotopic ratio must be within the specified control limits in Table 8 (SW846 Method 8290).

- For initial calibration performed on 04/06/04 for all target compounds on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB2A (404054-005), 51SB2B (404054-006), and 51SB2C (404054-007) apply to this initial calibration.

- For initial calibration performed on 10/03/03 for all target compounds on instrument 10MSHR06, all criteria were met. No qualifiers were applied. Sample 51SB2D (404054-008) applies to this initial calibration.

V-Continuing Calibration
The continuing calibration consists of two parts: evaluation of the mass resolution and retention time check. The following stipulates the continuing calibration criteria.

- The signal signal-to-noise ratio (S/N) must be at least 10:1 for each selected ion current profile (SICP) and for each GC signal representing the elution of a target analyte or labeled standard for each analyte.
- The relative response factor of each analyte for the unlabeled standard must be within ±20% of the average RF obtained from the initial calibration, and the RRF of each labeled standard must be within ±30% of the average RRF established during initial calibration. This is expressed in term of percent difference %D.

- For continuing calibration performed on 04/13/04 @23:40 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @11:30 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @18:22 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Sample 51SB2A (404054-005) applies to this continuing calibration.

- For continuing calibration performed on 04/16/04 @06:06 on instrument 10MSHR05, 1,2,3,7,8-PeCDF-13C (34.9%) and 2,3,4,7,8-PeCDF-13C (31.3%) were outside criteria. No samples reported apply to this continuing calibration. No qualifiers were applied based upon these outliers.

- For continuing calibration performed on 04/16/04 @14:47 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Samples 51SB2B (404054-006) and 51SB2C (404054-007) apply to this continuing calibration to this continuing calibration.

- For continuing calibration performed on 04/17/04 @03:16 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/18/04 @08:49 on instrument 10MSHR06, all criteria were met. No qualifiers were applied. Sample 51SB2D (404054-008) applies to this continuing calibration.

- For continuing calibration performed on 04/18/04 @20:53 on instrument 10MSHR06, all criteria were met. No qualifiers were applied. No samples apply to this continuing calibration.

VI-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: Recoveries of the isotopically-labeled extraction standards to fall within the 40 to 135 percent range for the tetra- through octachlorinated congeners, or as stated in the data package

- For sample 51SB2A (404054-005), 1,2,3,4,7,8-HxCDF-13C (144%) was above criteria limits. The sample was non-detect and qualified "UJ" for 1,2,3,4,7,8-HxCDF-13C based upon this outlier.

VII-Cleanup Standards
Cleanup standards are added to every sample, blank, quality control sample, and calibration solution. This compound is added to the samples after extraction but prior to cleanup and is used to verify the percent recovery obtained using the isotope dilution technique. The control limits are 40-135%.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Standard (LCS) or Ongoing Precision Result (OPR)
LCSs/OPRs are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. Acceptable performance is determined by:

1. Recoveries of the isotopically-labeled extraction standards to fall within 40-135% control limits for the tetra- through octachlorinated congeners, or as stated in the data package;

2. Recoveries (accuracy) of the unlabeled compounds should be within $\pm$ 35% when spiked at the method quantitation limit and within $\pm$ 30% when spiked above 20 times the method quantitation limit, or as stated in the data package;

3. When duplicate OPR are required, the relative percent difference (RPD) of the unlabeled analytes concentrations should be within 30% when spiked at the method quantitation limit and within $\pm$ 25% when spiked above 20 times the method quantitation limit.

- Sample LCS-4662 was used as LCS analyzed on 04/14/04. All criteria were met. No qualifiers were applied. Samples 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits (40-135%; 50%RPD).

- Sample 51SB2C (404054-007) was performed as MS/MSD for dioxin furans. OCDD (183%, 229%) was outside criteria. The amount measured for OCDD in the spiked sample was significantly greater than the amount spiked. No qualifiers were applied based upon these outliers.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed with this SDG.

XI-Quantitation Verification
The accuracy of analytical results was verified through the calculation of at least one the several parameters such as the %D, %RSD, % recovery, and/or compound concentration. Values were found to be within 10%. Any value reported by the laboratory as estimated "J" based on an analyte to internal standard ratio below the calibration curve was qualified as such. The signal signal-to-noise ratio (S/N) must be greater than 2.5 for each selected ion current profile (SICP) and for each GC signal representing the elution of a target analyte or labeled standard. For where the ion ratio failed the 25% criteria (I-lab flag), the estimated maximum possible concentration was reported and flagged estimated "J". For where any detected value had ether interference (E-lab flag), the estimated maximum possible concentration was reported and flagged estimated "J".

Sample: 51SB2A (404054-005), OCDD

A(x) = sum of the integrated ion abundances of the quantitation ions for the unlabeled ions;

A(is) = sum of the integrated ion abundances of the quantitation ions for the labeled ions;

Q(is) = quantity, in pg, of the internal standard added to the sample before extraction; Here need to multiply concentration (pg/uL) by final extract volume (uL).

W = weight, in g, of the sample (solid or organic liquid) as dry weight, or volume in mL of an aqueous sample; and

Avg. RRF(n) = calculated mean relative response factor for the unlabeled analyte.

$$\text{Conc. (ng/kg)} = \frac{(A(x))*Q(is)}{A(is)*W*Avg.RRF} = \frac{(1620000000+1780000000)*(4.00)(1000)}{(170000000+181000000)*(12.7*0.8390) * 1.1323} =$$

= 3200 ng/kg

Reported Value = 3200 ng/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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Pace Analytical Services, Inc
1700 Elm Street - Suite 20
Minneapolis, MN 5541

Tel: 612-607-170
Fax: 612- 607-644

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404054-005-045-1/1		
Lab Sample ID	105500813		
Filename	F40415A_13		
Injected By	BAL		
Total Amount Extracted	12.7 g	Matrix	Solid
% Moisture	16.1	Dilution	NA
Dry Weight Extracted	10.7 g	Collected	04/06/2004
ICAL Date	04/06/2004	Received	04/08/2004
CCal Filename(s)	F40415A_03 & F40415A_17	Extracted	04/11/2004
Method Blank ID	BLANK-4661	Analyzed	04/16/2004 02:48

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery	
2,3,7,8-TCDF	ND	-----	0.19		2,3,7,8-TCDF-13C	2.00	116	
Total TCDF	ND	-----	0.19		2,3,7,8-TCDD-13C	2.00	93	
					1,2,3,7,8-PeCDF-13C	2.00	89	
2,3,7,8-TCDD	ND	-----	0.24	A	2,3,4,7,8-PeCDF-13C	2.00	84	
Total TCDD	ND	-----	0.19		1,2,3,7,8-PeCDD-13C	2.00	81	
					1,2,3,4,7,8-HxCDF-13C	2.00	144	P
1,2,3,7,8-PeCDF	ND	-----	0.94		1,2,3,6,7,8-HxCDF-13C	2.00	132	
2,3,4,7,8-PeCDF	ND	-----	0.94		2,3,4,6,7,8-HxCDF-13C	2.00	124	
Total PeCDF	ND	-----	0.94		1,2,3,7,8,9-HxCDF-13C	2.00	130	
					1,2,3,4,7,8-HxCDD-13C	2.00	106	
1,2,3,7,8-PeCDD	ND	-----	0.94		1,2,3,6,7,8-HxCDD-13C	2.00	100	
Total PeCDD	ND	-----	0.94		1,2,3,4,6,7,8-HpCDF-13C	2.00	81	
					1,2,3,4,7,8,9-HpCDF-13C	2.00	76	
1,2,3,4,7,8-HxCDF	ND	-----	0.94	U J	1,2,3,4,6,7,8-HpCDD-13C	2.00	58	
1,2,3,6,7,8-HxCDF	ND	-----	0.94		OCDD-13C	4.00	90	
2,3,4,6,7,8-HxCDF	ND	-----	0.94					
1,2,3,7,8,9-HxCDF	ND	-----	0.94		1,2,3,4-TCDD-13C	2.00	NA	
Total HxCDF	ND	-----	0.94		1,2,3,7,8,9-HxCDD-13C	2.00	NA	
1,2,3,4,7,8-HxCDD	ND	-----	0.94		2,3,7,8-TCDD-37Cl4	0.20	88	
1,2,3,6,7,8-HxCDD	ND	-----	0.94					
1,2,3,7,8,9-HxCDD	ND	-----	0.94					
Total HxCDD	2.8	-----	0.94	J J				
1,2,3,4,6,7,8-HpCDF	ND	-----	0.94		Total 2,3,7,8-TCDD			
1,2,3,4,7,8,9-HpCDF	ND	-----	0.94		Equivalence: 3.5 ng/Kg			
Total HpCDF	ND	-----	0.94		(Using ITE Factors)			
1,2,3,4,6,7,8-HpCDD	33.0	-----	0.94					
Total HpCDD	66.0	-----	0.94					
OCDF	ND	-----	1.90					
OCDD	3200.0	-----	1.90					

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087082

REPORT OF LABORATORY ANALYSIS

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Pace Analytical™

Pace Analytical Services, Inc
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612-607-6444

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404054-006-046-1/1		
Lab Sample ID	105500821		
Filename	F40416B_12		
Injected By	MRO		
Total Amount Extracted	23.2 g	Matrix	Solid
% Moisture	55.4	Dilution	10
Dry Weight Extracted	10.4 g	Collected	04/06/2004
ICAL Date	04/06/2004	Received	04/08/2004
CCal Filename(s)	F40416B_02 & F40416B_17	Extracted	04/11/2004
Method Blank ID	BLANK-4661	Analyzed	04/16/2004 23:08

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	120	-----	2.1	A	2,3,7,8-TCDF-13C	2.00	93
Total TCDF	690	-----	1.9		2,3,7,8-TCDD-13C	2.00	84
					1,2,3,7,8-PeCDF-13C	2.00	83
2,3,7,8-TCDD	ND	-----	4.5	A	2,3,4,7,8-PeCDF-13C	2.00	77
Total TCDD	ND	-----	1.9		1,2,3,7,8-PeCDD-13C	2.00	68
					1,2,3,4,7,8-HxCDF-13C	2.00	107
1,2,3,7,8-PeCDF	31	-----	9.7	J J	1,2,3,6,7,8-HxCDF-13C	2.00	100
2,3,4,7,8-PeCDF	72	-----	9.7		2,3,4,6,7,8-HxCDF-13C	2.00	95
Total PeCDF	350	-----	9.7		1,2,3,7,8,9-HxCDF-13C	2.00	91
					1,2,3,4,7,8-HxCDD-13C	2.00	100
1,2,3,7,8-PeCDD	ND	-----	9.7		1,2,3,6,7,8-HxCDD-13C	2.00	79
Total PeCDD	ND	-----	9.7		1,2,3,4,6,7,8-HpCDF-13C	2.00	69
					1,2,3,4,7,8,9-HpCDF-13C	2.00	68
1,2,3,4,7,8-HxCDF	74	-----	9.7		1,2,3,4,6,7,8-HpCDD-13C	2.00	74
1,2,3,6,7,8-HxCDF	22	-----	9.7	J J	OCDD-13C	4.00	79
2,3,4,6,7,8-HxCDF	28	-----	9.7	J J			
1,2,3,7,8,9-HxCDF	14	-----	9.7	J J	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	550	-----	9.7		1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	-----	10	9.7	I J	2,3,7,8-TCDD-37Cl4	0.20	74
1,2,3,6,7,8-HxCDD	51	-----	9.7				
1,2,3,7,8,9-HxCDD	24	-----	9.7	J J			
Total HxCDD	230	-----	9.7				
1,2,3,4,6,7,8-HpCDF	310	-----	9.7		Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	31	-----	9.7	J J	Equivalence: 100 ng/Kg		
Total HpCDF	1000	-----	9.7		(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	1300	-----	9.7				
Total HpCDD	2200	-----	9.7				
OCDF	930	-----	19.0				
OCDD	15000	-----	19.0				

Results reported on a dry weight basis

Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

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Pace Analytical Services, Inc
1700 Elm Street - Suite 20(
Minneapolis, MN 5541

Tel: 612-607-170(
Fax: 612- 607-644

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404054-007-047-1/1		
Lab Sample ID	105500839		
Filename	F40416B_13		
Injected By	MRO		
Total Amount Extracted	12.5 g	Matrix	Solid
% Moisture	13.5	Dilution	10
Dry Weight Extracted	10.8 g	Collected	04/06/2004
ICAL Date	04/06/2004	Received	04/08/2004
CCal Filename(s)	F40416B_02 & F40416B_17	Extracted	04/11/2004
Method Blank ID	BLANK-4661	Analyzed	04/16/2004 23:57

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	8.2	-----	2.00	AJ J	2,3,7,8-TCDF-13C	2.00	109
Total TCDF	31.0	-----	1.90		2,3,7,8-TCDD-13C	2.00	98
					1,2,3,7,8-PeCDF-13C	2.00	103
2,3,7,8-TCDD	ND	-----	1.90		2,3,4,7,8-PeCDF-13C	2.00	97
Total TCDD	ND	-----	1.90		1,2,3,7,8-PeCDD-13C	2.00	92
					1,2,3,4,7,8-HxCDF-13C	2.00	78
1,2,3,7,8-PeCDF	ND	-----	9.30		1,2,3,6,7,8-HxCDF-13C	2.00	76
2,3,4,7,8-PeCDF	ND	-----	9.30		2,3,4,6,7,8-HxCDF-13C	2.00	71
Total PeCDF	ND	-----	9.30		1,2,3,7,8,9-HxCDF-13C	2.00	69
					1,2,3,4,7,8-HxCDD-13C	2.00	68
1,2,3,7,8-PeCDD	ND	-----	9.30		1,2,3,6,7,8-HxCDD-13C	2.00	64
Total PeCDD	ND	-----	9.30		1,2,3,4,6,7,8-HpCDF-13C	2.00	56
					1,2,3,4,7,8,9-HpCDF-13C	2.00	50
1,2,3,4,7,8-HxCDF	ND	-----	9.30		1,2,3,4,6,7,8-HpCDD-13C	2.00	56
1,2,3,6,7,8-HxCDF	ND	-----	9.30		OCDD-13C	4.00	53
2,3,4,6,7,8-HxCDF	ND	-----	9.30				
1,2,3,7,8,9-HxCDF	ND	-----	9.30		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	13.0	-----	9.30	J J	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	9.30		2,3,7,8-TCDD-37Cl4	0.20	99
1,2,3,6,7,8-HxCDD	ND	-----	9.30				
1,2,3,7,8,9-HxCDD	ND	-----	9.30				
Total HxCDD	ND	-----	9.30				
1,2,3,4,6,7,8-HpCDF	20.0	-----	9.30	J J	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	9.30		Equivalence: 3.3 ng/Kg		
Total HpCDF	63.0	-----	9.30	J J	(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	91.0	-----	9.30				
Total HpCDD	160.0	-----	9.30				
OCDF	67.0	-----	19.00	J J			
OCDD	1300.0	-----	19.00				

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

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Pace Analytical Services, Inc
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Pace Analytical™

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404054-008-048-1/1		
Lab Sample ID	105500847		
Filename	U40418A_05		
Injected By	BAL		
Total Amount Extracted	12.3 g	Matrix	Solid
% Moisture	16.7	Dilution	NA
Dry Weight Extracted	10.3 g	Collected	04/06/2004
ICAL Date	10/03/2003	Received	04/08/2004
CCal Filename(s)	U40418A_02 & U40418A_17	Extracted	04/11/2004
Method Blank ID	BLANK-4661	Analyzed	04/18/2004 11:16

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.200	2,3,7,8-TCDF-13C	2.00	104
Total TCDF	ND	-----	0.200	2,3,7,8-TCDD-13C	2.00	99
				1,2,3,7,8-PeCDF-13C	2.00	101
2,3,7,8-TCDD	ND	-----	0.200	2,3,4,7,8-PeCDF-13C	2.00	95
Total TCDD	ND	-----	0.200	1,2,3,7,8-PeCDD-13C	2.00	91
				1,2,3,4,7,8-HxCDF-13C	2.00	92
1,2,3,7,8-PeCDF	ND	-----	0.980	1,2,3,6,7,8-HxCDF-13C	2.00	105
2,3,4,7,8-PeCDF	ND	-----	0.980	2,3,4,6,7,8-HxCDF-13C	2.00	100
Total PeCDF	ND	-----	0.980	1,2,3,7,8,9-HxCDF-13C	2.00	100
				1,2,3,4,7,8-HxCDD-13C	2.00	99
1,2,3,7,8-PeCDD	ND	-----	0.980	1,2,3,6,7,8-HxCDD-13C	2.00	105
Total PeCDD	ND	-----	0.980	1,2,3,4,6,7,8-HpCDF-13C	2.00	100
				1,2,3,4,7,8,9-HpCDF-13C	2.00	89
1,2,3,4,7,8-HxCDF	ND	-----	0.980	1,2,3,4,6,7,8-HpCDD-13C	2.00	81
1,2,3,6,7,8-HxCDF	ND	-----	0.980	OCDD-13C	4.00	76
2,3,4,6,7,8-HxCDF	ND	-----	0.980			
1,2,3,7,8,9-HxCDF	ND	-----	0.980	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.980	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.980	2,3,7,8-TCDD-37Cl4	0.20	100
1,2,3,6,7,8-HxCDD	ND	-----	0.980			
1,2,3,7,8,9-HxCDD	ND	-----	0.980			
Total HxCDD	ND	-----	0.980			
1,2,3,4,6,7,8-HpCDF	ND	-----	0.980	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.980	Equivalence: 0.00 ng/Kg		
Total HpCDF	ND	-----	0.980	(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	ND	-----	0.980			
Total HpCDD	ND	-----	0.980			
OCDF	ND	-----	2.000			
OCDD	ND	-----	2.000			

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
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ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

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Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Explosives
GPL Laboratories, Inc., SDG 404054

DATE: June 28, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004 and April 06, 2004. Samples were analyzed for explosives using USEPA SW-846 8330. A total of ten soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB9A	404054-001	51SB2B	404054-006DL
51SB9B	404054-002	51SB2B	404054-006DL2
51SB9C	404054-003	51SB2C	404054-007DL
TMSB9B	404054-004	51SB2C	404054-007DL2
51SB2A	404054-005	51SB2D	404054-008

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
X		Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
X		Laboratory Control Sample
X		Matrix Spike/Spike Duplicate
X		Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/28/04

Date

RFAAP VALIDATION REPORT
EXPLOSIVES REVIEW
SDG 404054

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For explosives soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04 and 04/06/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04 and 04/06/04, extracted on 04/12/04, and analyzed for explosives on 04/19/04 and 04/20/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for explosive target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/20/04	BLK65882	All target compounds < MRL	NA	NA	None
04/13/04	040704R	2,6-Dinitrotoluene	0.29	1.46	51SB9A, 51SB9B, 51SB9C, TMSB9B, 51SB2A, 51SB2BDL

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 02/27-28/04 on instrument LCD, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006DL), 51SB2C (404054-007DL), and 51SB2D (404054-008) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/19/04 @09:01 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), and TMSB9B (404054-004) apply to this continuing calibration.

- For continuing calibration performed on 04/19/04 @22:31 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB2A (404054-005), 51SB2B (404054-006DL), and 51SB2C (404054-007DL) apply to this continuing calibration.

- For continuing calibration performed on 04/20/04 @14:52 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB2B (404054-006DL2) and 51SB2C (404054-007DL2) apply to this continuing calibration.

- For continuing calibration performed on 04/21/04 @02:57 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB2D (404054-008) applies to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- For samples 51SB2B (404054-006DL), 51SB2B (404054-006DL2), 51SB2C (404054-007DL), and 51SB2C (404054-007DL2), all surrogates were diluted out. No qualifiers were applied based upon these outliers. All other samples were within criteria limits.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for explosives are 60-120% (40-150% for sporadic marginal failures (SMF)).

- Sample BKS65879 was used as LCS for explosives analyzed on 04/13/04. Compounds 1,3,5-trinitrobenzene (45%), 2,4,6-trinitrotoluene (56%), HMX (83%), and tetryl (23%) were outside lab and/or USACE criteria. Compounds 1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, HMX, and tetryl were qualified bias low "L" for detects and "UL" for non-detects based upon these outliers. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006DL), 51SB2C (404054-007DL), and 51SB2D (404054-008) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for explosives are 50-140%; RPD ≤ 50% (40-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB1B (404068-004) was performed as MS/MSD for explosives. Compounds 1,3-dinitrobenzene (RPD=28%), 2,4-dinitrotoluene (13%; RPD=151%), and RDX (73%) were outside laboratory and/or USACE criteria. The sample concentration was greater than the spike added for 2,4-dinitrotoluene, therefore no qualifiers were applied based upon this outlier. RDX was qualified bias low "L" for the spiked sample based upon this outlier. Compound 1,3-dinitrobenzene was non-detect, therefore no qualifiers were applied based upon the high RPD.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB9B (404054-002) and TMSB9B (404054-004) was collected. The field duplicate evaluation is noted in **Table 3.** For where values exceeding calibration range, the diluted values were evaluated. If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB9B	404054-002	1,3,5-Trinitrobenzene	0.090 J	0.090 J	0.0	None
51SB9B	404054-002	1,3-Dinitrobenzene	0.25	0.37	38.7	None
51SB9B	404054-002	2,4,6-Trinitrotoluene	0.27	0.37	31.3	None
51SB9B	404054-002	2,4-Dinitrotoluene	0.38	2.3	143	J
51SB9B	404054-002	2,6-Dinitrotoluene	0.22	1.4	NA	None
51SB9B	404054-002	m-Nitrotoluene	0.27	1.2	126	J
51SB9B	404054-002	Nitrobenzene	0.17	0.23	30.0	None
51SB9B	404054-002	o-Nitrotoluene	1.9	6.4	108	J
51SB9B	404054-002	p-Nitrotoluene	1.4	5.0	113	J

J = Estimated value.
NA = Not Applicable, compound detected in blanks.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D. The explosives for SW-846 method 8330 were air-dried prior to analysis because RDX and HMX are water soluble and moisture in the soil could affect the results.

- For sample 51SB9A (404054-001), compounds 2,6-dinitrotoluene, 4-nitrotoluene, 1,3-dinitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB9B (404054-002), compounds 2,6-dinitrotoluene, 4-nitrotoluene, 1,3-dinitrobenzene, 2-nitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB9C (404054-003), compounds 1,3,5-trinitrobenzene, 2,6-dinitrotoluene, 4-nitrotoluene, RDX, 1,3-dinitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample TMSB9B (404054-004), compounds 2,6-dinitrotoluene, 4-nitrotoluene, 1,3-dinitrobenzene, 2-nitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB2A (404054-005), compounds 2,6-dinitrotoluene, 4-nitrotoluene, 1,3-dinitrobenzene, nitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB2B (404054-006DL), compounds 2,6-dinitrotoluene, 4-nitrotoluene, 1,3-dinitrobenzene, 2-nitrotoluene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB2C (404054-007DL), compounds 1,3,5-trinitrobenzene, 2,6-dinitrotoluene, 4-nitrotoluene, 1,3-dinitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

- For sample 51SB2D (404054-008), compounds 1,3,5-trinitrobenzene, 2,6-dinitrotoluene, 4-nitrotoluene, RDX, nitrobenzene, 1,3-dinitrobenzene, and 3-nitrotoluene exceeded criteria and were qualified as estimated "J".

Sample: 51SB9A (404054-001), 2,4-dinitrotoluene

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D * 1000)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (38243511 * 20 * 1) / (521800 * 2 * 1 * 1000) = 0.73 mg/kg
Reported Value = 0.73 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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SAMPLE NO
51SB9A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-001-029-1/1
Sample Volume :	2	Lab File ID :	LCD23521.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/19/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	UL
99-65-0	1,3-Dinitrobenzene	0.20		J
118-96-7	2,4,6-Trinitrotoluene	0.50		L
121-14-2	2,4-Dinitrotoluene	0.73		
606-20-2	2,6-Dinitrotoluene	0.31		B
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	UL
98-95-3	Nitrobenzene	0.080	J	J
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	UL
99-08-1	m-Nitrotoluene	0.42		J
88-72-2	o-Nitrotoluene	4.4		
99-99-0	p-Nitrotoluene	2.5		J

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SAMPLE NO
51SB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-002-030-1/1
Sample Volume :	2	Lab File ID :	LCD23522.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/19/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.090	J	J
99-65-0	1,3-Dinitrobenzene	0.25		J
118-96-7	2,4,6-Trinitrotoluene	0.27		L
121-14-2	2,4-Dinitrotoluene	0.38		J
606-20-2	2,6-Dinitrotoluene	0.22		B
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	VL
98-95-3	Nitrobenzene	0.17		
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	VL
99-08-1	m-Nitrotoluene	0.27		J
88-72-2	o-Nitrotoluene	1.9		J
99-99-0	p-Nitrotoluene	1.4		J

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SAMPLE NO
51SB9C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-003-031-1/1
Sample Volume :	2	Lab File ID :	LCD23523.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/19/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	1.4		J
99-65-0	1,3-Dinitrobenzene	0.26		J
118-96-7	2,4,6-Trinitrotoluene	0.39		L
121-14-2	2,4-Dinitrotoluene	0.23		
606-20-2	2,6-Dinitrotoluene	0.34		B
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	VL
98-95-3	Nitrobenzene	0.14		
121-82-4	RDX	0.88		J
479-45-8	Tetryl	0.20	U	VL
99-08-1	m-Nitrotoluene	0.25		J
88-72-2	o-Nitrotoluene	1.7		
99-99-0	p-Nitrotoluene	0.93		J

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SAMPLE NO
TMSB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-004-032-1/1
Sample Volume :	2	Lab File ID :	LCD23524.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/19/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.090	J	J
99-65-0	1,3-Dinitrobenzene	0.37		J
118-96-7	2,4,6-Trinitrotoluene	0.37		L
121-14-2	2,4-Dinitrotoluene	2.3		J
606-20-2	2,6-Dinitrotoluene	1.4		B
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	UL
98-95-3	Nitrobenzene	0.23		
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	UL
99-08-1	m-Nitrotoluene	1.2		J
88-72-2	o-Nitrotoluene	6.4		J
99-99-0	p-Nitrotoluene	5.0		J

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SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-037-1/1
Sample Volume :	2	Lab File ID :	LCD23527.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/20/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	VL
99-65-0	1,3-Dinitrobenzene	0.77		J
118-96-7	2,4,6-Trinitrotoluene	0.060	J	J
121-14-2	2,4-Dinitrotoluene	0.66		
606-20-2	2,6-Dinitrotoluene	0.29		B
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	VL
98-95-3	Nitrobenzene	0.10		J
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	VL
99-08-1	m-Nitrotoluene	0.34		J
88-72-2	o-Nitrotoluene	3.0		
99-99-0	p-Nitrotoluene	1.4		J

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SAMPLE NO
51SB2BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-038-1/1
Sample Volume :	2	Lab File ID :	LCD23528.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/20/2004
Injection Volume :	100 µ L	Dilution Factor :	1000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	530		L
99-65-0	1,3-Dinitrobenzene	460		J
606-20-2	2,6-Dinitrotoluene	6000		B
35572-78-2	2-Amino-4,6-Dinitrotoluene	100	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	100	U	
2691-41-0	HMX	200	U	VL
98-95-3	Nitrobenzene	100	U	
121-82-4	RDX	200	U	
479-45-8	Tetryl	200	U	VL
99-08-1	m-Nitrotoluene	960		J
88-72-2	o-Nitrotoluene	9800		J
99-99-0	p-Nitrotoluene	8000		J

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SAMPLE NO
51SB2BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-038-1/1
Sample Volume :	2	Lab File ID :	LCD23544.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/20/2004
Injection Volume :	100 µ L	Dilution Factor :	2000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
118-96-7	2,4,6-Trinitrotoluene	28000		L
121-14-2	2,4-Dinitrotoluene	28000		

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SAMPLE NO
51SB2CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-039-1/1
Sample Volume :	2	Lab File ID :	LCD23530.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/20/2004
Injection Volume :	100 µ L	Dilution Factor :	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	75		J
99-65-0	1,3-Dinitrobenzene	89		J
606-20-2	2,6-Dinitrotoluene	2200		J
35572-78-2	2-Amino-4,6-Dinitrotoluene	10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	10	U	
2691-41-0	HMX	20	U	UL
98-95-3	Nitrobenzene	10	U	
121-82-4	RDX	20	U	
479-45-8	Tetryl	20	U	UL
99-08-1	m-Nitrotoluene	290		J
88-72-2	o-Nitrotoluene	2000		
99-99-0	p-Nitrotoluene	990		J

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SAMPLE NO
51SB2CDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-039-1/1
Sample Volume :	2	Lab File ID :	LCD23545.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/20/2004
Injection Volume :	100 µ L	Dilution Factor :	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
118-96-7	2,4,6-Trinitrotoluene	6500		L
121-14-2	2,4-Dinitrotoluene	8600		

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SAMPLE NO
51SB2D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-008-040-1/1
Sample Volume :	2	Lab File ID :	LCD23532.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/20/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	3.7		J
99-65-0	1,3-Dinitrobenzene	0.32		J
118-96-7	2,4,6-Trinitrotoluene	1.5		L
121-14-2	2,4-Dinitrotoluene	2.3		
606-20-2	2,6-Dinitrotoluene	4.6		BJ
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	UL
98-95-3	Nitrobenzene	0.13		J
121-82-4	RDX	4.0		J
479-45-8	Tetryl	0.20	U	UL
99-08-1	m-Nitrotoluene	0.22		J
88-72-2	o-Nitrotoluene	1.4		
99-99-0	p-Nitrotoluene	0.91		J

Shaw Environmental, Inc.

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Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Herbicides
GPL Laboratories, Inc., SDG 404054

DATE: June 28, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 06, 2004. Samples were analyzed for chlorinated herbicides using USEPA SW846 Method 8151A. A total of one soil sample was validated. The sample ID is:

Field Sample ID	Lab Sample ID
51SB2A	404054-005

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable.

	6/28/04
Eric Malarek, Chemist	Date

RFAAP VALIDATION REPORT
CHLORINATED HERBICIDES REVIEW
SDG 404054

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For chlorinated herbicides in cooled @4°C±2°C soil samples, the maximum holding time is 14 days from sample collection to extraction and 40 days from extraction to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/06/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/06/04, extracted on 04/07/04, and analyzed for herbicides on 04/12/04. All criteria were met. No qualifiers were applied.

II-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. Percent relative standard deviation (%RSD) for a 5-point standard calibration should be ≤20% for each target compound.

- For initial calibration performed on 04/06/04 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Sample 51SB2A (404054-005) applies to this initial calibration.

III-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration establishes the response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. Percent difference (%D) between the initial calibration CF and the continuing calibration CF must be ≤15%.

- For continuing calibration performed on 04/12/04 @13:26 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Sample 51SB2A (404054-005) applies to this continuing calibration.

- For continuing calibration performed on 04/12/04 @14:08 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Sample 51SB2A (404054-005) applies to this continuing calibration.

- For continuing calibration performed on 04/12/04 @17:54 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Sample 51SB2A (404054-005) applies to this continuing calibration.

- For continuing calibration performed on 04/12/04 @18:19 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Sample 51SB2A (404054-005) applies to this continuing calibration.

IV-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field or laboratory activities. No contaminants should be detected in any of the associated blanks. Positive sample results are qualified "B" if the concentration of the analyte is ≤ five times (5X) the absolute maximum blank concentration. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 100). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/12/04	BLK65835	All target compounds < MRL	NA	NA	None
04/09/04	040204R	All target compounds < MRL	NA	NA	None

V-System Monitoring Compounds (Surrogates)

Laboratory performance on individual samples is established by means of spiking activities. All samples are spiked with surrogate compounds prior to sample preparation. Spike recoveries must be within the specified control limits.

Control Limit: 2,4-DCAA (29-143%) (USACE Shell Criteria: 70-130%)

- All criteria were met. No qualifiers were applied.

VI-Laboratory Control Samples

Data for laboratory control samples (LCS) are generated to determine long-term precision and accuracy of the analytical method. Percent recoveries must be within the specified control limits.

- Sample BKS65835 was used as the LCS. All criteria were met. No qualifiers were applied. Sample 51SB2A (404054-005) applies to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits.

- Sample 404008-001 was used for the MS/MSD analysis. Since this is not a RFAAP sample, it was not evaluated in this report.

VIII-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed in this SDG.

IX-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. Percent difference (%D) between the calculated value and the reported value must be within 10%. All positive values must have less than or equal to 40% %D between the primary and secondary columns. Any sample value > MDL and < MRL is qualified as estimated, "J." All criteria were met. No qualifiers were applied.

Sample: BKS65835, 2,4-D

Conc. µg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (726425 * 10 * 1) / (2270 * 10 * 1) = 320 µg/kg
Reported Value = 320 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-041-1/1
Sample Volume :	10	Lab File ID :	I27338.D
% Moisture:	15.93	Date Received	04/07/0004
Extraction:	EXT_SW8151	Date Extracted:	04/07/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
93-76-5	2,4,5-T	120	U
93-72-1	2,4,5-TP (Silvex)	120	U
94-75-7	2,4-D	120	U
94-82-6	2,4-DB	120	U
75-99-0	Dalapon	120	U
1918-00-9	Dicamba	120	U
120-36-5	Dichloroprop	120	U
88-85-7	Dinoseb	120	U
94-74-6	MCPA	12000	U
93-65-2	MCPP	12000	U

Shaw Environmental, Inc.

2113 Emmorton Park Road
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I
RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Nitroglycerine
GPL Laboratories, Inc., SDG 404054

DATE: June 29, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004 and April 06, 2004. Samples were analyzed for nitroglycerine using USEPA SW-846 8332. A total of ten soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB9A	404054-001	51SB2B	404054-006
51SB9B	404054-002	51SB2B	404054-006DL
51SB9C	404054-003	51SB2C	404054-007
TMSB9B	404054-004	51SB2C	404054-007DL
51SB2A	404054-005	51SB2D	404054-008

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
X		System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable except for the following. Samples 51SB2B (404054-006) and 51SB2C (404054-007) exhibited matrix interferences. These samples were rejected "R" due to these matrix interferences. Samples 51SB2B (404054-006DL) and 51SB2C (404054-007DL) should be used for the RFI.

Eric Malarek, Chemist

6/29/04
Date

RFAAP VALIDATION REPORT
NITROGLYCERINE REVIEW
SDG 404054

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For nitroglycerine soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04 and 04/06/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04 and 04/06/04, extracted on 04/12/04, and analyzed for nitroglycerine on 04/17/04, 04/18/04, and 04/19/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.20). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/16/04	BLK65911	All target compounds < MRL	NA	NA	None
04/15/04	040704R	All target compounds < MRL	NA	NA	None

III-Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 04/15/04 on instrument HPLC-E, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006), 51SB2B (404054-006DL), 51SB2C (404054-007), 51SB2C (404054-007DL), and 51SB2D (404054-008) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/15/04 @22:37 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/16/04 @01:19 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/17/04 @21:04 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB9A (404054-001) applies to this continuing calibration.

- For continuing calibration performed on 04/17/04 @23:24 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), and 51SB2D (404054-008) apply to this continuing calibration.

- For continuing calibration performed on 04/18/04 @01:23 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB2B (404054-006) and 51SB2C (404054-007) apply to this continuing calibration.

- For continuing calibration performed on 04/18/04 @02:38 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/19/04 @10:13 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB2B (404054-006DL) and 51SB2C (404054-007DL) apply to this continuing calibration.

- For continuing calibration performed on 04/19/04 @13:12 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- Surrogate 4-nitroaniline was diluted out for samples 51SB2B (404054-006DL) (0%) and 51SB2C (404054-007DL) (0%). No qualifiers were applied based upon these outliers. For sample 51SB2B (404054-006), surrogate 4-nitroaniline (153%) was outside of criteria due to matrix interferences. This sample was qualified as rejected "R" due to these matrix interferences. Sample 51SB2B (404054-006DL) should be used for the RFI. All criteria were met for remaining samples.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for nitroglycerine are 60-120%.

- Sample BKS65911 was used as LCS for nitroglycerine analyzed on 04/16/04. All criteria were met. No qualifiers were applied. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006), 51SB2B (404054-006DL), 51SB2C (404054-007), 51SB2C (404054-007DL), and 51SB2D (404054-008) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for nitroglycerine are 50-140%; RPD ≤ 50%.

- Sample 51SB1B (404068-004) was performed as MS/MSD for nitroglycerine. This sample was analyzed in SDG 404068. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB9B (404054-002) and TMSB9B (404054-004) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB9B	404054-002	nitroglycerine	5.7 U	5.7 U	NA	None

U = Value non-detect at MRL.
NA = Not Applicable.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006DL), 51SB2C (404054-007DL), and 51SB2D (404054-008), nitroglycerine was non-detect. All criteria were met. No qualifiers were applied.

- Samples 51SB2B (404054-006) and 51SB2C (404054-007) exhibited matrix interferences (See Section V). These samples were rejected "R" due to these matrix interferences. Samples 51SB2B (404054-006DL) and 51SB2C (404054-007DL) should be used for the RFI.

Sample: BKS659511, nitroglycerine

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (25018944 * 20 * 1) / (2542000 * 4 * 1.0) = 50 mg/kg
Reported Value = 49 mg/kg
% Difference = 2.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB9A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-001-029-1/1
Sample Volume :	4	Lab File ID :	LCE0824.D
% Moisture:	15.74	Date Received	04/07/0004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/17/2004
Injection Volume :	25 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.9	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-002-030-1/1
Sample Volume :	4	Lab File ID :	LCE0828.D
% Moisture:	12.17	Date Received	04/07/0004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/17/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.7	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB9C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-003-031-1/1
Sample Volume :	4	Lab File ID :	LCE0829.D
% Moisture:	15.95	Date Received	04/07/0004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/17/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.0	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-004-032-1/1
Sample Volume :	4	Lab File ID :	LCE0830.D
% Moisture:	12.17	Date Received	04/07/0004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/18/2004
Injection Volume :	25 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.7	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-037-1/1
Sample Volume :	4	Lab File ID :	LCE0831.D
% Moisture:	15.93	Date Received	04/07/0004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/18/2004
Injection Volume :	25 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.0	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-038-1/1
Sample Volume :	4	Lab File ID :	LCE0841.D
% Moisture:	67.61	Date Received	04/07/0004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/18/2004
Injection Volume :	25 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
55-63-0	Nitroglycerine	15	U	R

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB2B DL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-038-1/1
Sample Volume :	4	Lab File ID :	LCE0849.D
% Moisture:	67.61	Date Received	04/07/0004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/19/2004
Injection Volume :	25 µL	Dilution Factor	1000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	15000	U

FORM I SW8332

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-039-1/1
Sample Volume :	4	Lab File ID :	LCE0838.D
% Moisture:	11.42	Date Received	04/07/0004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/18/2004
Injection Volume :	25 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
55-63-0	Nitroglycerine	5.6	U	R

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2C DL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-039-1/1
Sample Volume :	4	Lab File ID :	LCE0851.D
% Moisture:	11.42	Date Received	04/07/0004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/19/2004
Injection Volume :	25 µL	Dilution Factor	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	560	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-008-040-1/1
Sample Volume :	4	Lab File ID :	LCE0832.D
% Moisture:	16.58	Date Received	04/07/0004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/18/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	6.0	U

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – PAHs
GPL Laboratories, Inc., SDG 404054

DATE: June 25, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004 and April 06, 2004. Samples were analyzed for polynuclear aromatic hydrocarbons (PAHs) using USEPA SW846 Methods 3540C/8270C low level. A total of seven soil samples were validated, including one re-analysis sample. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB9A	404054-001	TMSB9B	404054-004RI
51SB9B	404054-002	51SB2A	404054-005
51SB9C	404054-003	51SB2D	404054-008
TMSB9B	404054-004		

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
X		Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	Surrogate Spikes
X		Internal Standards
	X	Laboratory Control Standard
X		Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/25/04

Date

RFAAP VALIDATION REPORT
POLYNUCLEAR AROMATIC HYDROCARBONS REVIEW
SDG 404054

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For polynuclear aromatic hydrocarbons (PAHs) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04 and 04/06/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04 and 04/06/04, extracted on 04/12/04, and analyzed for PAHs on 04/15/04 and 04/16/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for PAH compounds by GC/MS low level. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for the PAHs by USEPA SW-846 8270C low level was performed on 04/14/04 on instrument HP#T. All RRFs were ≥ 0.05. Compounds naphthalene (17.6%), acenaphthylene (16.9%), and phenanthrene (16.6%) were outside criteria. For noted compounds, all detects were qualified estimated "J" and non-detects no qualifier based upon these outliers. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), TMSB9B (404054-004RI), 51SB2A (404054-005), and 51SB2D (404054-008) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be ≥ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within ± 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the PAHs by USEPA SW-846 8270C low level performed on 04/14/04 @16:04 on instrument HP#H, all target compounds were within criteria. No qualifiers were applied. No samples reported apply to his continuing calibration.

- For continuing calibration for the PAHs by USEPA SW-846 8270C low level performed on 04/15/04 @15:35 on instrument HP#T, all target compounds were within criteria. No qualifiers were applied. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), and 51SB2D (404054-008) apply to his continuing calibration.

- For continuing calibration for the PAHs by USEPA SW-846 8270C low level performed on 04/16/04 @10:31 on instrument HP#T, all target compounds were within criteria. No qualifiers were applied. Sample TMSB9B (404054-004RI) applies to his continuing calibration.

V-Blank Analysis
The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 30). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/14/04	BLK65895	All compounds < MRL	NA	NA	None
04/15/04	040704R	Naphthalene	17.4	87.0	None

VI-Surrogate Spikes
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria: Nitrobenzene-d5 (36-164%) – S1 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (54-124%) – S2 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (56-150%) – S3 (USACE Shell Criteria: 45-135%)

- All criteria were met. No qualifiers were applied.

VII-Internal Standards
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- For samples TMSB9B (404054-004) and TMSB9B (404054-004RI), internal standard phenanthrene-d10 was below criteria. All associated compounds were qualified "J" for detects and "UJ for non-detects based upon these outliers for these samples. All other samples were within criteria.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for PAHs by 8270C low level are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65895 was used as the LCS for PAHs by USEPA SW-846 8270C low level. dibenz(a,h)anthracene (138%) was above USACE criteria and within SMF criteria. There were a total of 17 spike recoveries with 1 sporadic marginal failure. No qualifiers were applied based upon this outlier. In addition, all samples were non-detect for dibenz(a,h)anthracene. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), TMSB9B (404054-004RI), 51SB2A (404054-005), and 51SB2D (404054-008) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB1B (404068-004) was used for the MS/MSD analysis for PAHs and was analyzed in SDG 404068. Compounds benzo(g,h,i)perylene (126%, 126%), dibenz(a,h)anthracene (155%, 155%), and indeno(1,2,3-cd)pyrene (126%, 126%) were outside lab criteria. Three compounds were outside USACE criteria and within SMF criteria. All detects were qualified bias high "K" for the spiked sample and non-detects no qualifier based upon these outliers.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB9B (404054-002) and TMSB9B (404054-004) was collected. The field duplicate evaluation is noted in **Table 3.** For where values exceeding calibration range, the diluted values were evaluated. If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB9B	404054-002	phenanthrene	13	7.6 U	NA	None

U = Value non-detect at MRL.
NA = Not Applicable

XI-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB9B (404054-002), phenanthrene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Is = Amount of internal standard injected (ng).
Vt = Volume of total extract (µL).
Ais = Area of characteristic ion for the internal standard.
RRF = Average relative response factor for compound being measured (from ICAL)
Vi = Volume of extract injected (µL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (122206 * 4 * 1000 * 1) / (1595700 * 0.893 * 1 * 30 * 0.8783) = 13 µg/kg
Reported Value = 13 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB9A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :-		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-001-025-1/1
Sample Volume :	30	Lab File ID :	T18837.D
% Moisture:	15.74	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.9	U
83-32-9	Acenaphthene	7.9	U
208-96-8	Acenaphthylene	7.9	U
120-12-7	Anthracene	7.9	U
56-55-3	Benzo(a)anthracene	7.9	U
50-32-8	Benzo(a)pyrene	7.9	U
205-99-2	Benzo(b)fluoranthene	7.9	U
191-24-2	Benzo(g,h,i)perylene	7.9	U
207-08-9	Benzo(k)fluoranthene	7.9	U
218-01-9	Chrysene	7.9	U
53-70-3	Dibenz(a,h)Anthracene	7.9	U
206-44-0	Fluoranthene	27	
86-73-7	Fluorene	7.9	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.9	U
91-20-3	Naphthalene	7.9	U
85-01-8	Phenanthrene	7.9	U
129-00-0	Pyrene	9.9	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :-		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-002-026-1/1
Sample Volume :	30	Lab File ID :	T18838.D
% Moisture:	12.17	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.6	U
83-32-9	Acenaphthene	7.6	U
208-96-8	Acenaphthylene	7.6	U
120-12-7	Anthracene	7.6	U
56-55-3	Benzo(a)anthracene	7.6	U
50-32-8	Benzo(a)pyrene	7.6	U
205-99-2	Benzo(b)fluoranthene	7.6	U
191-24-2	Benzo(g,h,i)perylene	7.6	U
207-08-9	Benzo(k)fluoranthene	7.6	U
218-01-9	Chrysene	7.6	U
53-70-3	Dibenz(a,h)Anthracene	7.6	U
206-44-0	Fluoranthene	7.6	U
86-73-7	Fluorene	7.6	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.6	U
91-20-3	Naphthalene	7.6	U
85-01-8	Phenanthrene	13	J
129-00-0	Pyrene	7.6	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB9C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :-		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-003-027-1/1
Sample Volume :	30	Lab File ID :	T18839.D
% Moisture:	15.95	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.9	U
83-32-9	Acenaphthene	7.9	U
208-96-8	Acenaphthylene	7.9	U
120-12-7	Anthracene	7.9	U
56-55-3	Benzo(a)anthracene	7.9	U
50-32-8	Benzo(a)pyrene	7.9	U
205-99-2	Benzo(b)fluoranthene	7.9	U
191-24-2	Benzo(g,h,i)perylene	7.9	U
207-08-9	Benzo(k)fluoranthene	7.9	U
218-01-9	Chrysene	7.9	U
53-70-3	Dibenz(a,h)Anthracene	7.9	U
206-44-0	Fluoranthene	7.9	U
86-73-7	Fluorene	7.9	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.9	U
91-20-3	Naphthalene	7.9	U
85-01-8	Phenanthrene	9.1	J
129-00-0	Pyrene	7.9	U

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SAMPLE NO
TMSB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :-		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-004-028-1/1
Sample Volume :	30	Lab File ID :	T18840.D
% Moisture:	12.17	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
91-57-6	2-Methylnaphthalene	7.6	U	
83-32-9	Acenaphthene	7.6	U	
208-96-8	Acenaphthylene	7.6	U	
120-12-7	Anthracene	7.6	U	UJ
56-55-3	Benzo(a)anthracene	7.6	U	
50-32-8	Benzo(a)pyrene	7.6	U	
205-99-2	Benzo(b)fluoranthene	7.6	U	
191-24-2	Benzo(g,h,i)perylene	7.6	U	
207-08-9	Benzo(k)fluoranthene	7.6	U	
218-01-9	Chrysene	7.6	U	
53-70-3	Dibenz(a,h)Anthracene	7.6	U	
206-44-0	Fluoranthene	7.6	U	UJ
86-73-7	Fluorene	7.6	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.6	U	
91-20-3	Naphthalene	7.6	U	
85-01-8	Phenanthrene	7.6	U	UJ
129-00-0	Pyrene	7.6	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB9BRI

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :-		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-004-028-1/1
Sample Volume :	30	Lab File ID :	T18847.D
% Moisture:	12.17	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/16/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
91-57-6	2-Methylnaphthalene	7.6	U	
83-32-9	Acenaphthene	7.6	U	
208-96-8	Acenaphthylene	7.6	U	
120-12-7	Anthracene	7.6	U	UJ
56-55-3	Benzo(a)anthracene	7.6	U	
50-32-8	Benzo(a)pyrene	7.6	U	
205-99-2	Benzo(b)fluoranthene	7.6	U	
191-24-2	Benzo(g,h,i)perylene	7.6	U	
207-08-9	Benzo(k)fluoranthene	7.6	U	
218-01-9	Chrysene	7.6	U	
53-70-3	Dibenz(a,h)Anthracene	7.6	U	
206-44-0	Fluoranthene	7.6	U	UJ
86-73-7	Fluorene	7.6	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.6	U	
91-20-3	Naphthalene	7.6	U	
85-01-8	Phenanthrene	7.6	U	UJ
129-00-0	Pyrene	7.6	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :-		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-033-1/1
Sample Volume :	30	Lab File ID :	T18841.D
% Moisture:	15.93	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.9	U
83-32-9	Acenaphthene	7.9	U
208-96-8	Acenaphthylene	7.9	U
120-12-7	Anthracene	7.9	U
56-55-3	Benzo(a)anthracene	7.9	U
50-32-8	Benzo(a)pyrene	7.9	U
205-99-2	Benzo(b)fluoranthene	7.9	U
191-24-2	Benzo(g,h,i)perylene	7.9	U
207-08-9	Benzo(k)fluoranthene	7.9	U
218-01-9	Chrysene	7.9	U
53-70-3	Dibenz(a,h)Anthracene	7.9	U
206-44-0	Fluoranthene	7.9	U
86-73-7	Fluorene	7.9	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.9	U
91-20-3	Naphthalene	7.9	U
85-01-8	Phenanthrene	15	J
129-00-0	Pyrene	7.9	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB2D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :-		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-008-036-1/1
Sample Volume :	30	Lab File ID :	T18842.D
% Moisture:	16.58	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/16/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	8.0	U
83-32-9	Acenaphthene	8.0	U
208-96-8	Acenaphthylene	8.0	U
120-12-7	Anthracene	8.0	U
56-55-3	Benzo(a)anthracene	8.0	U
50-32-8	Benzo(a)pyrene	8.0	U
205-99-2	Benzo(b)fluoranthene	8.0	U
191-24-2	Benzo(g,h,i)perylene	8.0	U
207-08-9	Benzo(k)fluoranthene	8.0	U
218-01-9	Chrysene	8.0	U
53-70-3	Dibenz(a,h)Anthracene	8.0	U
206-44-0	Fluoranthene	8.0	U
86-73-7	Fluorene	8.0	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	8.0	U
91-20-3	Naphthalene	8.0	U
85-01-8	Phenanthrene	14	J
129-00-0	Pyrene	8.0	U

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Pesticides and PCBs
GPL Laboratories, Inc., SDG 404054

DATE: June 28, 2004

The purpose of this memorandum is to present the data validation report for the sample collected for the SWMU 51 RFI at the RFAAP on April 06, 2004. Sample was analyzed for pesticides and PCBs using USEPA Method 3540C/8081A and 3540C/8082, respectively. A total of one soil sample was validated for pesticides and four soil samples validated for PCBs. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB2A*	404054-005*	51SB2C	404054-007
51SB2B	404054-006	51SB2D	404054-008

*Analyzed for pesticides and PCBs.

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (USEPA, September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
X		System Monitoring Compounds
X		Laboratory Control Samples
X		Matrix Spike/Spike Duplicate
	X	Field Sample Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

6/28/04

Date

RFAAP VALIDATION REPORT
PESTICIDE/PCB REVIEW
SDG 404054

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For pesticide and PCB soil samples, cooled @4°C ±2°C, the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis (USEPA criteria).

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/06/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The samples were collected 04/06/04 for pesticides and PCB compounds. They were extracted on 04/10/04 and analyzed for pesticides and PCBs on 04/12/04 and 04/13/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check (Degradation Standard)
Performance checks on the gas chromatograph with electron capture detector (GC/ECD) system are performed to ensure adequate resolution and instrument sensitivity. The performance evaluation mixture (PEM) must be analyzed at the beginning of the analytical sequence. The breakdown of Endrin and 4,4'-DDT must be ≤ 15% on both columns (USEPA and USACE criteria) and ≤ 30% combined Endrin and 4,4'-DDT on both columns (USEPA criteria).

- For analysis performed on 03/31/04, endrin and 4,4'-DDT breakdowns were 5.7% and 2.1% on column #1 and 8.5% and 2.6% on column #2, respectively. All criteria were met. No qualifiers were applied.

- For analysis performed on 04/12/04, endrin and 4,4'-DDT breakdowns were 10.4% and 5.6% on column #1 and 12.0% and 6.6% on column #2, respectively. All criteria were met. No qualifiers were applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The percent relative standard deviation (%RSD) for all single peak target analytes, and aroclors 1016 and 1260 must be < 20% or the mean %RSD for all analytes in the standard must be ≤ 20%. If linear regression is used, the correlation coefficient must be ≥0.990 (USEPA and USACE criteria).

- For the pesticide initial calibration performed on 03/31/04 on instrument GC-K, all criteria were met. All compounds were determined using calibration factors with RSDs ≤20% for single peak pesticides. No qualifiers were applied. Sample 51SB2A (404054-005) applies to this initial calibration.

- For the PCB initial calibration performed on 03/31/04 on instrument GC-L, all criteria were met. All compounds were determined using calibration factors with RSDs ≤20% for PCB 1016 and PCB 1260. No qualifiers were applied. Samples 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for pesticide/PCB target compounds. Continuing calibration standards containing both target compounds and surrogates are analyzed at the beginning of each 12-hour analytical shift and after every 20 samples. The percent difference (%D) or the mean %RSD for all analytes in the standard from the initial calibration should be no greater than ± 15%.

- For pesticide continuing calibration performed on 04/12/04 @15:00 on instrument GC-K, all criteria were met on column #1 for all target compounds. For column #2, endrin (24.7%) was outside criteria. All samples were non-detect for this compound, therefore no qualifiers were applied based upon these outliers. Sample 51SB2A (404054-005) applies to this continuing calibration.

- For pesticide continuing calibration performed on 04/12/04 @21:18 on instrument GC-K, all criteria were met on column #1 for all target compounds. For column #2, endrin (32.4%) and endrin keytone (16.0%) were outside criteria. All samples were non-detect for this compound, therefore no qualifiers were applied based upon these outliers. No samples apply to this continuing calibration.

- For PCB continuing calibration performed on 04/12/04 @14:54 on instrument GC-L, all criteria were met on column #1 and column #2 for all target compounds. No qualifiers were applied. No samples apply to his continuing calibration.

- For PCB continuing calibration performed on 04/13/04 @01:59 on instrument GC-L, the following %Ds were determined. For column #1, arochlor 1016 #2 (15.1%) and arochlor 1016 #3 (21.3%) were outside criteria. The average of the peaks for arochlor 1016 was within criteria and all samples were non-detect. For column #2, arochlor 1016 was within criteria. For column #1, arochlor 1260 #1 (19.6%), arochlor 1260 #2 (16.9%), arochlor 1260 #3 (18.8%), arochlor 1260 #4 (16.4%), and arochlor 1260 #5 (24.7%) were outside criteria. For column #2, Arochlor 1260 #2 (17.1%), arochlor 1260 #4 (15.2%), and arochlor 1260 #5 (21.6%) were outside criteria. All samples were non-detect for this compound. Therefore, no qualifiers were applied based upon these outliers. Samples 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008) apply to this continuing calibration.

- For PCB continuing calibration performed on 04/13/04 @05:51 on instrument GC-L, the following %Ds were determined. For column #1, arochlor 1260 #2 (18.5%), arochlor 1260 #4 (15.1%), and arochlor 1260 #5 (23.1) were outside criteria. The average of the peaks for arochlor 1260 (16.6%) was outside criteria and all samples were non-detect. For column #1, arochlor 1016 was within criteria. For column #2, arochlor 1260 was within criteria. For column #2, Arochlor 1016 #1 (20.6%) was outside criteria. The average of the peaks for arochlor 1016 was within criteria and all samples were non-detect. Therefore, no qualifiers were applied based upon these outliers. No samples apply to this continuing calibration.

V-Blank Analysis
The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks > MDL or MRL (USEPA criteria) or all target compounds < one-half the MRL (USACE criteria). Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 30). For pesticides, rinse blank 040204R applies to these samples and was analyzed in SDG 0404027. For PCBs, rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Parameter	Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
Pesticides	04/12/04	BKS65858	All < MRL	NA	NA	None
Pesticides	04/15/04	040204R	All < MRL	NA	NA	None
PCBs	04/12/04	BKS65862	All < MRL	NA	NA	None
PCBs	04/18/04	040704R	All < MRL	NA	NA	None

VI-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the specified laboratory control limits.

Criteria: Decachlorobiphenyl: Pesticides: 55-151% (USACE criteria 50-130%)
Tetrachloro-m-xylene: Pesticides: 34-100% (USACE criteria 50-130%)
Decachlorobiphenyl: PCBs: 47-161% (USACE criteria 50-130%)
Tetrachloro-m-xylene: PCBs: 54-168% (USACE criteria 50-130%)

- For pesticide analysis, all criteria were met. No qualifiers were applied.
- For PCB analysis sample 51SB2A (404054-005), all criteria were met. No qualifiers were applied.
- For PCB analysis for sample 51SB2B (404054-006), surrogates decachlorobiphenyl (33%) and tetrachloro-m-xylene (0%, 0% => matrix) were outside criteria. Since both surrogates were below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.
- For PCB analysis for sample 51SB2C (404054-007), surrogates decachlorobiphenyl (44%) and tetrachloro-m-xylene (0%, 0% => matrix) were outside criteria. Since both surrogates were below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.
- For PCB analysis for sample 51SB2D (404054-008), surrogate tetrachloro-m-xylene (0%, 0% => matrix) was outside criteria. Since the surrogate was below criteria and <10%, the sample was qualified bias low "UL" for all PCBs based upon these outliers.

VII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor long-term precision and accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within the specified control limits. USACE Shell limits for pesticides/PCBs are 50-130% (30-150% for sporadic marginal failures (SMF)).

- Sample BKS65858 was used for the LCS for TCL pesticide compounds. Delta-BHC (19%) was outside USACE and SMF criteria. Sample 51SB2A (404054-005) was non-detect for all target compounds. Delta-BHC was qualified bias low "UL" non-detect based upon the low recovery.
- Sample BKS65862 was used for the LCS for PCB aroclors. All criteria were met. No qualifiers were applied. Samples 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008) apply to this LCS.

VIII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits for pesticides/PCBs are 40-140%; RPD<50% (30-150%; RPD<60% for sporadic marginal failures (SMF) for pesticides).

- Sample 51SB5A (404021-005) was used for the MS/MSD analysis for pesticide compounds. This sample was analyzed in SDG 404021. Compounds 4,4-DDD (60%, 59%), 4,4-DDE (53%, 54%), 4,4-DDT (55%, 55%), aldrin (57%, 61%), alpha-BHC (53%, 53%), alpha-chlordane (49%, 49%), beta-BHC (119%, 118%), delta-BHC (18%, 17%), endosulfan I (52%, 50%), endosulfan II (65%, 65%), endosulfan sulfate (58%, 56%), gamma-BHC (57%, 56%), and gamma-chlordane (58%, 57%) were outside lab criteria. All RPDs were within criteria. Sample 51SB5A (404021-005) was non-detect for all target compounds. All non-detects for the spiked sample were qualified "UL" for these compounds (except beta-BHC) based upon the low recoveries. Beta-BHC was non-detect for the spiked sample and recovered high. Therefore, no qualifiers were applied based upon this outlier.

- Sample 51SB5A (404021-005) was used for the MS/MSD analysis for PCB compounds. This sample was analyzed in SDG 404021. All criteria were met. No qualifiers were applied.

IX-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. The project precision control criterion was established at 50% RPD for the solid samples.

- No field duplicate was analyzed with this SDG.

X-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The difference between the calculated value and the reported value must be within 10% difference. All samples were non-detect for PCBs, therefore the quantification verification not included here. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." The difference between the primary column and the confirmatory column must be ≤ 40% difference (USEPA and USACE criteria).

- For this SDG, all pesticides/PCBs were non-detect for all samples. No qualifiers were applied.

Sample: 51SB5AMS (404021-005MS), endrin

Conc. µg/kg = (Ax * Vt * DF) / (CF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area/response for compound being measured.
Vt = Volume of total extract, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean V(t) = 10000 µL.
CF = Ave calibration response factor for compound being measured from ICAL (Area/pg)
Vi = Volume of extract injected (mL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100 = 1.0 for Wet Weight
DF = Dilution factor

Conc. µg/kg = (1551791 Area*10000µL*1) / (42620Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 15 µg/kg

Reported Value = 15 µg/kg
% Difference = 0.0%
Values were within 10% difference

Sample: 51SB5AMS (404021-005MS), Aroclor 1260

Conc. µg/kg = (Ax * Vt * DF) / (CF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area/response for compound being measured.
Vt = Volume of total extract, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean V(t) = 10000 µL.
CF = Ave calibration response factor for compound being measured from ICAL (Area/pg)
Vi = Volume of extract injected (mL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100 = 1.0 for Wet Weight
DF = Dilution factor

Signal #1
Conc1 µg/kg = (140694Area*10000µL*1) / (382.3Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 149.44 µg/kg
Conc2 µg/kg = (213944Area*10000µL*1) / (545.1Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 159.37 µg/kg
Conc3 µg/kg = (249460Area*10000µL*1) / (622.1Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 162.83 µg/kg
Conc4 µg/kg = (94744Area*10000µL*1) / (269.3Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 142.86 µg/kg
Conc5 µg/kg = (231104Area*10000µL*1) / (702.4Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 133.60 µg/kg
Average concentration = 150 µg/kg

Signal #2
Conc1 µg/kg = (786176Area*10000µL*1) / (1917Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 166.53 µg/kg
Conc2 µg/kg = (756020Area*10000µL*1) / (1987Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 154.50 µg/kg
Conc3 µg/kg = (397020Area*10000µL*1) / (973Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 165.69 µg/kg
Conc4 µg/kg = (580532Area*10000µL*1) / (1507Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 156.42 µg/kg
Conc5 µg/kg = (976496Area*10000µL*1) / (2810Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 141.11 µg/kg
Average concentration = 160 µg/kg

Reported Value = 160 µg/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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GPL Form I Con't
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-041-1/1
Sample Volume :	30	Lab File ID :	K125418.D
% Moisture:	15.93	Date Received	04/07/0004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
72-54-8	4,4-DDD	2.0	U
72-55-9	4,4-DDE	2.0	U
50-29-3	4,4-DDT	2.0	U
309-00-2	Aldrin	2.0	U
319-84-6	Alpha-BHC	2.0	U
5103-71-9	Alpha-Chlordane	2.0	U
319-85-7	Beta-BHC	2.0	U
319-86-8	Delta-BHC	2.0	U UL
959-98-8	Endosulfan I	2.0	U
33213-65-9	Endosulfan II	2.0	U
1031-07-8	Endosulfan Sulfate	2.0	U
72-20-8	Endrin	2.0	U
7421-93-4	Endrin Aldehyde	2.0	U
53494-70-5	Endrin Ketone	2.0	U
58-89-9	Gamma-BHC (Lindane)	2.0	U
5566-34-7	Gamma-Chlordane	2.0	U
76-44-8	Heptachlor	2.0	U
1024-57-3	Heptachlor Epoxide	2.0	U
72-43-5	Methoxychlor	2.0	U
8001-35-2	Toxaphene	40	U

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GPL Form I Corr

FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-041-1/1
Sample Volume :	30	Lab File ID :	L33063.D
% Moisture:	15.93	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
12674-11-2	PCB-1016	40	U
11104-28-2	PCB-1221	40	U
11141-16-5	PCB-1232	40	U
53469-21-9	PCB-1242	40	U
12672-29-6	PCB-1248	40	U
11097-69-1	PCB-1254	40	U
11096-82-5	PCB-1260	40	U

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GPL Form 1 Org
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-042-1/1
Sample Volume :	30	Lab File ID :	L33064.D
% Moisture:	67.61	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	100	U	UL
11104-28-2	PCB-1221	100	U	UL
11141-16-5	PCB-1232	100	U	UL
53469-21-9	PCB-1242	100	U	UL
12672-29-6	PCB-1248	100	U	UL
11097-69-1	PCB-1254	100	U	UL
11096-82-5	PCB-1260	100	U	UL

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GPL Form I Copy
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-043-1/1
Sample Volume :	30	Lab File ID :	L33065.D
% Moisture:	11.42	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration ~~Units (ug/L~~ or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	38	U	UL
11104-28-2	PCB-1221	38	U	UL
11141-16-5	PCB-1232	38	U	UL
53469-21-9	PCB-1242	38	U	UL
12672-29-6	PCB-1248	38	U	UL
11097-69-1	PCB-1254	38	U	UL
11096-82-5	PCB-1260	38	U	UL

GPL Laboratories

GPL Form I Con't
FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB2D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-008-044-1/1
Sample Volume :	30	Lab File ID :	L33066.D
% Moisture:	16.58	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units ~~(ug/L or ug/kg~~ dry weight) : ug/kg

CAS NO	COMPOUND		Q	
12674-11-2	PCB-1016	40	U	VL
11104-28-2	PCB-1221	40	U	VL
11141-16-5	PCB-1232	40	U	VL
53469-21-9	PCB-1242	40	U	VL
12672-29-6	PCB-1248	40	U	VL
11097-69-1	PCB-1254	40	U	VL
11096-82-5	PCB-1260	40	U	VL

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MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Pentaerythritol Tetranitrate GPL Laboratories, Inc., SDG 404054

DATE: June 28, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004 and April 06, 2004. Samples were analyzed for pentaerythritol tetranitrate (PETN) using USEPA SW-846 8330. A total of eight soil samples were validated. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB9A	404054-001	51SB2A	404054-005
51SB9B	404054-002	51SB2B	404054-006
51SB9C	404054-003	51SB2C	404054-007
TMSB9B	404054-004	51SB2D	404054-008

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable.

Eric Malarek, Chemist

6/28/04

Date

RFAAP VALIDATION REPORT
PETN REVIEW
SDG 404054

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For PETN soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04 and 04/06/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04 and 04/06/04, extracted on 04/12/04, and analyzed for PETN on 04/14/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/14/04	BLK65883	All target compounds < MRL	NA	NA	None
04/12/04	040704R	All target compounds < MRL	NA	NA	None

III-Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 03/03/04 on instrument LCC-UV, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/13/04 @22:32 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @04:01 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB9A (404054-001), 51SB9B (404054-002), and 51SB9C (404054-003) apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @07:14 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008) apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @12:53 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- For sample 51SB2B (404054-006), 4-nitroaniline (138%) was outside criteria. Since this sample was non-detect for PETN, no qualifiers were applied based upon the high recovery outlier. Surrogate 4-nitroaniline was within criteria for all other samples.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for PETN are 60-120%.

- Sample BKS65883 was used as LCS for PETN analyzed on 04/14/04. All criteria were met. No qualifiers were applied. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for PETN are 50-140%; RPD ≤ 50%.

- Sample 51SB1B (404068-004) was performed as MS/MSD for PETN. This sample was analyzed in SDG 404068. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB9B (404054-002) and TMSB9B (404054-004) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB9B	404054-002	PETN	0.50 U	0.50 U	NA	None

U = Value non-detect at MRL.
NA = Not Applicable.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008), PETN was non-detect. All criteria were met. No qualifiers were applied.

Sample: 51SB1BMS (404068-004MS), PETN

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (28440406 * 20 * 1) / (162300 * 2 * 1 * 1000) = 1.8 mg/kg
Reported Value = 1.8 mg/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB9A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-001-029-1/1
Sample Volume :	2	Lab File ID :	LC11073U.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-002-030-1/1
Sample Volume :	2	Lab File ID :	LC11074U.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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SAMPLE NO
51SB9C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-003-031-1/1
Sample Volume :	2	Lab File ID :	LC11075U.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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SAMPLE NO
TMSB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-004-032-1/1
Sample Volume :	2	Lab File ID :	LC11079U.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-037-1/1
Sample Volume :	2	Lab File ID :	LC11080U.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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SAMPLE NO
51SB2B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-038-1/1
Sample Volume :	2	Lab File ID :	LC11081U.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-039-1/1
Sample Volume :	2	Lab File ID :	LC11084U.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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ANALYSIS DATA SHEET

SAMPLE NO
51SB2D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-008-040-1/1
Sample Volume :	2	Lab File ID :	LC11086U.D
% Moisture:		Date Received	04/07/0004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Semi-Volatiles
GPL Laboratories, Inc., SDG 404054

DATE: June 25, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004 and April 06, 2004. Samples were analyzed for semivolatile organic compounds (SVOCs) using USEPA SW846 Methods 3540C/8270C. A total of ten soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB9A	404054-001	51SB2B	404054-006DL
51SB9B	404054-002	51SB2B	404054-006DL2
51SB9C	404054-003	51SB2C	404054-007DL
TMSB9B	404054-004	51SB2C	404054-007DL2
51SB2A	404054-005	51SB2D	404054-008

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
X		Initial Calibration
	X	Continuing Calibration
X		Blank Analysis
	X	Surrogate Spikes
X		Internal Standards
	X	Laboratory Control Standard
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications except for the following. For samples 51SB2B (404054-006DL) and 51SB2C (404054-007DL), compound 2,4-dinitrotoluene exceeded the calibration range and were rejected "R". For samples 51SB2B (404054-006DL) and 51SB2C (404054-007DL), 2,6-dinitrotoluene exceeded the calibration range and were rejected "R". The diluted samples 51SB2B (404054-006DL2) and 51SB2C (404054-007DL2) should be used for these compounds.

Eric Malarek, Chemist

6/25/04
Date

RFAAP VALIDATION REPORT
SEMIVOLATILES REVIEW
SDG 404054

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For semivolatile organic compound (SVOC) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04 and 04/06/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04 and 04/06/04, extracted on 04/12/04, and analyzed for TCL SVOCs on 04/15/04, 04/20/04, and 04/21/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for compounds on the semivolatile target compound list (TCL). Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for pyridine was performed on 04/09/04 on instrument HP#D. All criteria were met. No qualifiers were applied. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), and 51SB2D (404054-008) apply to this initial calibration.

- Initial calibration for the TCL SVOCs was performed on 04/14/04 on instrument HP#D. Target compounds benzoic acid (30.4%; grossly exceeding), hexachlorocyclopentadiene (37.7%; grossly exceeding), 2,4-dinitrophenol (27.3%), 4-nitrophenol (22.3%), 4,6-dinitro-2-methylphenol (19.9%), and dibenz(a,h)anthracene (17.7%) were outside criteria. All RRFs were ≥ 0.05. Compounds 2,4-dinitrophenol, 4-nitrophenol, 4,6-dinitro-2-methylphenol, and dibenz(a,h)anthracene were qualified estimated "J" for detects and no qualifier for non-detects for the high %RSDs. For compounds benzoic acid and hexachlorocyclopentadiene, all non-detects were qualified estimated "UJ" based upon the grossly exceeding %RSD. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), and 51SB2D (404054-008) apply to this initial calibration.

- Initial calibration for the TCL SVOCs was performed on 04/17/04 on instrument HP#T. Target compounds benzoic acid (27.2%), 2,4-dinitrophenol (33.7%; grossly exceeding), 4-nitrophenol (15.6%), 4,6-dinitro-2-methylphenol (22.1%), di-n-butylphthalate (22.6%), and 3,3'-dichlorobenzidine (17.4%) were outside criteria. All RRFs were ≥ 0.05. Compounds benzoic acid, 4-nitrophenol, 4,6-dinitro-2-methylphenol, di-n-butylphthalate, and 3,3'-dichlorobenzidine were qualified estimated "J" for detects and no qualifier for non-detects for the high %RSDs. For compound 2,4-dinitrophenol, all non-detects were qualified estimated "UJ" based upon the grossly exceeding %RSD. Samples 51SB2B (404054-006DL), 51SB2B (404054-006DL2), 51SB2C (404054-007DL), and 51SB2C (404054-007DL2) apply to this initial calibration.

- Initial calibration for pyridine was performed on 04/17/04 on instrument HP#T. All criteria were met. No qualifiers were applied. Samples 51SB2B (404054-006DL), 51SB2B (404054-006DL2), 51SB2C (404054-007DL), and 51SB2C (404054-007DL2) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be ≥ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within ± 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the TCL SVOCs performed on 04/15/04 @12:53 on instrument HP#D, all criteria were met. No qualifiers were applied. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), and 51SB2D (404054-008) apply to this continuing calibration.

- For continuing calibration for pyridine performed on 04/15/04 @14:54 on instrument HP#D, target compound pyridine (21.5%) was outside criteria. All samples were non-detect for pyridine, therefore, no qualifiers were applied based upon this outlier. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), and 51SB2D (404054-008) apply to this continuing calibration.

- For continuing calibration for the TCL SVOCs performed on 04/20/04 @16:02 on instrument HP#T, all criteria were met. No qualifiers were applied. Samples 51SB2B (404054-006DL) and 51SB2C (404054-007DL) apply to this continuing calibration.

- For continuing calibration for pyridine performed on 04/20/04 @16:59 on instrument HP#T, all criteria were met. No qualifiers were applied. Samples 51SB2B (404054-006DL) and 51SB2C (404054-007DL) apply to this continuing calibration.

- For continuing calibration for the TCL SVOCs performed on 04/21/04 @10:04 on instrument HP#T, all criteria were met. No qualifiers were applied. Samples 51SB2B (404054-006DL2) and 51SB2C (404054-007DL2) apply to this continuing calibration.

- For continuing calibration for pyridine performed on 04/21/04 @10:48 on instrument HP#T, all criteria were met. No qualifiers were applied. Samples 51SB2B (404054-006DL2) and 51SB2C (404054-007DL2) apply to this continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 33). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/15/04	BLK65908	All compounds < MRL	NA	NA	None
04/20/04	BLK65908	All compounds < MRL	NA	NA	None
04/20/04	040704R	2,4-Dinitrotoluene	1320	6600	51SB9A, 51SB9B, 51SB9C, 51SB2BDL2, 51SB2CDL2, 51SB2D
04/20/04	040704R	2,6-Dinitrotoluene	460	2300	51SB9A, 51SB9B, 51SB9C, 51SB2BDL2, 51SB2CDL2
04/20/04	040704R	Benzoic Acid	290J	1450	None
04/20/04	040704R	bis(2-ethylhexyl) phthalate	160J	1600	51SB2BDL
04/20/04	040704R	Diethyl Phthalate	830	8300	None
04/20/04	040704R	di-n-Butyl Phthalate	460	4600	None
04/20/04	040704R	Phenol	99J	495	None

J = Estimated value <MRL and >MDL

VI-Surrogate Spikes

Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria:
2-Fluorophenol (20-106%) – S1 (USACE Shell Criteria: 35-140%)
Phenol – d5 (25-121%) – S2 (USACE Shell Criteria: 35-140%)
2,4,6-Tribromophenol (31-137%) – S3 (USACE Shell Criteria: 35-140%)
Nitrobenzene-d5 (29-117%) – S4 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (31-125%) – S5 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (26-160%) – S6 (USACE Shell Criteria: 45-135%)

- For samples 51SB2B (404054-006DL), 51SB2B (404054-006DL2), 51SB2C (404054-007DL), and 51SB2C (404054-007DL2), all surrogates were diluted out. No qualifiers were applied based upon these outliers. All criteria were met for all other samples. No qualifiers were applied.

VII-Internal Standards
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- For samples 51SB2B (404054-006DL2) and 51SB2C (404054-007DL2), internal standard perylene-d12 was below criteria. All associated compounds were qualified "J" for detects and "UJ for non-detects based upon these outliers for these samples. All other samples were within criteria.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for SVOCs are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65908 was used as the LCS for select SVOCs by USEPA SW-846 8270C. All criteria were met. No qualifiers were applied. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006DL), 51SB2B (404054-006DL2), 51SB2C (404054-007DL), 51SB2C (404054-007DL2), and 51SB2D (404054-008) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB3C (404043-003DL) was used for the MS/MSD analysis for select SVOCs. This sample was analyzed in SDG 404043. Compounds 2,4-dinitrotoluene (0,0%), 4-nitrophenol (0,0%), and phenol (114, 122%) were outside criteria. The sample concentration (2,4-dinitrotoluene) was significantly greater than the spike added, therefore no qualifiers were applied based upon this outlier based upon these outliers. Phenol was non-detect for the spiked sample, therefore no qualifiers were applied based upon this outlier.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB9B (404054-002) and TMSB9B (404054-004) was collected. The field duplicate evaluation is noted in **Table 3.** For where values exceeding calibration range, the diluted values were evaluated. If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB9B	404054-002	2,4-Dinitrotoluene	160 J	380 U	NA	None
51SB9B	404054-002	2,6-Dinitrotoluene	44 J	380 U	NA	None

J = Estimated value <MRL and >MDL.
U = Value non-detect at MRL.
NA = Not Applicable

XI-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J". For samples 51SB2B (404054-006DL) and 51SB2C (404054-007DL), compound 2,4-dinitrotoluene exceeded the calibration range and were rejected "R". For samples 51SB2B (404054-006DL) and 51SB2C (404054-007DL), 2,6-dinitrotoluene exceeded the calibration range and were rejected "R". The diluted samples 51SB2B (404054-006DL2) and 51SB2C (404054-007DL2) should be used for these compounds.

Sample: 51SB9A (404054-001), 2,4-dinitrotoluene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Is = Amount of internal standard injected (ng).
Vt = Volume of total extract (µL).
Ais = Area of characteristic ion for the internal standard.
RRF = Average relative response factor for compound being measured (from ICAL)
Vi = Volume of extract injected (µL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (215346 * 40 * 1000 * 1) / (677487 * 0.449 * 1 * 30 * 0.8426) = 1100 µg/kg
Reported Value = 1100 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB9A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-001-025-1/1
Sample Volume :	30	Lab File ID :	D33634.D
% Moisture:	15.74	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	400	U	
95-50-1	1,2-Dichlorobenzene	400	U	
541-73-1	1,3-Dichlorobenzene	400	U	
106-46-7	1,4-Dichlorobenzene	400	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	400	U	
95-95-4	2,4,5-Trichlorophenol	400	U	
88-06-2	2,4,6-Trichlorophenol	400	U	
120-83-2	2,4-Dichlorophenol	400	U	
105-67-9	2,4-Dimethylphenol	400	U	
51-28-5	2,4-Dinitrophenol	790	U	
121-14-2	2,4-Dinitrotoluene	1100		B
606-20-2	2,6-Dinitrotoluene	66	J	B
91-58-7	2-Chloronaphthalene	400	U	
95-57-8	2-Chlorophenol	400	U	
91-57-6	2-Methylnaphthalene	400	U	
88-74-4	2-Nitroaniline	400	U	
88-75-5	2-Nitrophenol	400	U	
95-48-7	2-methylphenol	400	U	
91-94-1	3,3-Dichlorobenzidine	790	U	
99-09-2	3-Nitroaniline	400	U	
534-52-1	4,6-dinitro-2-methyl phenol	790	U	
101-55-3	4-Bromophenyl-phenylether	400	U	
106-47-8	4-Chloroaniline	400	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	400	U	
100-01-6	4-Nitroaniline	400	U	
100-02-7	4-Nitrophenol	790	U	
59-50-7	4-chloro-3-methylphenol	400	U	
106-44-5	4-methylphenol	400	U	
83-32-9	Acenaphthene	400	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB9A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-001-025-1/1
Sample Volume :	30	Lab File ID :	D33634.D
% Moisture:	15.74	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	400	U	
120-12-7	Anthracene	400	U	
56-55-3	Benzo(a)anthracene	400	U	
50-32-8	Benzo(a)pyrene	400	U	
205-99-2	Benzo(b)fluoranthene	400	U	
191-24-2	Benzo(g,h,i)perylene	400	U	
207-08-9	Benzo(k)fluoranthene	400	U	
65-85-0	Benzoic Acid	790	U	UJ
100-51-6	Benzyl Alcohol	400	U	
85-68-7	Benzyl Butyl Phthalate	400	U	
86-74-8	Carbazole	400	U	
218-01-9	Chrysene	400	U	
53-70-3	Dibenz(a,h)Anthracene	400	U	
132-64-9	Dibenzofuran	400	U	
84-66-2	Diethyl Phthalate	400	U	
131-11-3	Dimethyl Phthalate	400	U	
206-44-0	Fluoranthene	400	U	
86-73-7	Fluorene	400	U	
118-74-1	Hexachlorobenzene	400	U	
87-68-3	Hexachlorobutadiene	400	U	
77-47-4	Hexachlorocyclopentadiene	400	U	UJ
67-72-1	Hexachloroethane	400	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	400	U	
78-59-1	Isophorone	400	U	
91-20-3	Naphthalene	400	U	
98-95-3	Nitrobenzene	400	U	
87-86-5	Pentachlorophenol	790	U	
85-01-8	Phenanthrene	400	U	
108-95-2	Phenol	400	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB9A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-001-025-1/1
Sample Volume :	30	Lab File ID :	D33634.D
% Moisture:	15.74	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	400	U
110-86-1	Pyridine	400	U
111-91-1	bis(2-chloroethoxy) methane	400	U
111-44-4	bis(2-chloroethyl) ether	400	U
117-81-7	bis(2-ethylhexyl) phthalate	400	U
84-74-2	di-n-Butyl Phthalate	400	U
117-84-0	di-n-Octyl Phthalate	400	U
621-64-7	n-Nitrosodi-n-Propylamine	400	U
86-30-6	n-Nitrosodiphenylamine	400	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-002-026-1/1
Sample Volume :	30	Lab File ID :	D33635.D
% Moisture:	12.17	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	380	U	
95-50-1	1,2-Dichlorobenzene	380	U	
541-73-1	1,3-Dichlorobenzene	380	U	
106-46-7	1,4-Dichlorobenzene	380	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	380	U	
95-95-4	2,4,5-Trichlorophenol	380	U	
88-06-2	2,4,6-Trichlorophenol	380	U	
120-83-2	2,4-Dichlorophenol	380	U	
105-67-9	2,4-Dimethylphenol	380	U	
51-28-5	2,4-Dinitrophenol	760	U	
121-14-2	2,4-Dinitrotoluene	160	J	B
606-20-2	2,6-Dinitrotoluene	44	J	B
91-58-7	2-Chloronaphthalene	380	U	
95-57-8	2-Chlorophenol	380	U	
91-57-6	2-Methylnaphthalene	380	U	
88-74-4	2-Nitroaniline	380	U	
88-75-5	2-Nitrophenol	380	U	
95-48-7	2-methylphenol	380	U	
91-94-1	3,3-Dichlorobenzidine	760	U	
99-09-2	3-Nitroaniline	380	U	
534-52-1	4,6-dinitro-2-methyl phenol	760	U	
101-55-3	4-Bromophenyl-phenylether	380	U	
106-47-8	4-Chloroaniline	380	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	380	U	
100-01-6	4-Nitroaniline	380	U	
100-02-7	4-Nitrophenol	760	U	
59-50-7	4-chloro-3-methylphenol	380	U	
106-44-5	4-methylphenol	380	U	
83-32-9	Acenaphthene	380	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-002-026-1/1
Sample Volume :	30	Lab File ID :	D33635.D
% Moisture:	12.17	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	380	U	
120-12-7	Anthracene	380	U	
56-55-3	Benzo(a)anthracene	380	U	
50-32-8	Benzo(a)pyrene	380	U	
205-99-2	Benzo(b)fluoranthene	380	U	
191-24-2	Benzo(g,h,i)perylene	380	U	
207-08-9	Benzo(k)fluoranthene	380	U	
65-85-0	Benzoic Acid	760	U	UJ
100-51-6	Benzyl Alcohol	380	U	
85-68-7	Benzyl Butyl Phthalate	380	U	
86-74-8	Carbazole	380	U	
218-01-9	Chrysene	380	U	
53-70-3	Dibenz(a,h)Anthracene	380	U	
132-64-9	Dibenzofuran	380	U	
84-66-2	Diethyl Phthalate	380	U	
131-11-3	Dimethyl Phthalate	380	U	
206-44-0	Fluoranthene	380	U	
86-73-7	Fluorene	380	U	
118-74-1	Hexachlorobenzene	380	U	
87-68-3	Hexachlorobutadiene	380	U	
77-47-4	Hexachlorocyclopentadiene	380	U	UJ
67-72-1	Hexachloroethane	380	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	380	U	
78-59-1	Isophorone	380	U	
91-20-3	Naphthalene	380	U	
98-95-3	Nitrobenzene	380	U	
87-86-5	Pentachlorophenol	760	U	
85-01-8	Phenanthrene	380	U	
108-95-2	Phenol	380	U	

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-002-026-1/1
Sample Volume :	30	Lab File ID :	D33635.D
% Moisture:	12.17	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	380	U
110-86-1	Pyridine	380	U
111-91-1	bis(2-chloroethoxy) methane	380	U
111-44-4	bis(2-chloroethyl) ether	380	U
117-81-7	bis(2-ethylhexyl) phthalate	380	U
84-74-2	di-n-Butyl Phthalate	380	U
117-84-0	di-n-Octyl Phthalate	380	U
621-64-7	n-Nitrosodi-n-Propylamine	380	U
86-30-6	n-Nitrosodiphenylamine	380	U

GPL Laboratories

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GPL
FORM 1
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SAMPLE NO
51SB9C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-003-027-1/1
Sample Volume :	30	Lab File ID :	D33636.D
% Moisture:	15.95	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	400	U	
95-50-1	1,2-Dichlorobenzene	400	U	
541-73-1	1,3-Dichlorobenzene	400	U	
106-46-7	1,4-Dichlorobenzene	400	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	400	U	
95-95-4	2,4,5-Trichlorophenol	400	U	
88-06-2	2,4,6-Trichlorophenol	400	U	
120-83-2	2,4-Dichlorophenol	400	U	
105-67-9	2,4-Dimethylphenol	400	U	
51-28-5	2,4-Dinitrophenol	790	U	
121-14-2	2,4-Dinitrotoluene	230	J	B
606-20-2	2,6-Dinitrotoluene	70	J	B
91-58-7	2-Chloronaphthalene	400	U	
95-57-8	2-Chlorophenol	400	U	
91-57-6	2-Methylnaphthalene	400	U	
88-74-4	2-Nitroaniline	400	U	
88-75-5	2-Nitrophenol	400	U	
95-48-7	2-methylphenol	400	U	
91-94-1	3,3-Dichlorobenzidine	790	U	
99-09-2	3-Nitroaniline	400	U	
534-52-1	4,6-dinitro-2-methyl phenol	790	U	
101-55-3	4-Bromophenyl-phenylether	400	U	
106-47-8	4-Chloroaniline	400	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	400	U	
100-01-6	4-Nitroaniline	400	U	
100-02-7	4-Nitrophenol	790	U	
59-50-7	4-chloro-3-methylphenol	400	U	
106-44-5	4-methylphenol	400	U	
83-32-9	Acenaphthene	400	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB9C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-003-027-1/1
Sample Volume :	30	Lab File ID :	D33636.D
% Moisture:	15.95	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	400	U	
120-12-7	Anthracene	400	U	
56-55-3	Benzo(a)anthracene	400	U	
50-32-8	Benzo(a)pyrene	400	U	
205-99-2	Benzo(b)fluoranthene	400	U	
191-24-2	Benzo(g,h,i)perylene	400	U	
207-08-9	Benzo(k)fluoranthene	400	U	
65-85-0	Benzoic Acid	790	U	UJ
100-51-6	Benzyl Alcohol	400	U	
85-68-7	Benzyl Butyl Phthalate	400	U	
86-74-8	Carbazole	400	U	
218-01-9	Chrysene	400	U	
53-70-3	Dibenz(a,h)Anthracene	400	U	
132-64-9	Dibenzofuran	400	U	
84-66-2	Diethyl Phthalate	400	U	
131-11-3	Dimethyl Phthalate	400	U	
206-44-0	Fluoranthene	400	U	
86-73-7	Fluorene	400	U	
118-74-1	Hexachlorobenzene	400	U	
87-68-3	Hexachlorobutadiene	400	U	
77-47-4	Hexachlorocyclopentadiene	400	U	UJ
67-72-1	Hexachloroethane	400	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	400	U	
78-59-1	Isophorone	400	U	
91-20-3	Naphthalene	400	U	
98-95-3	Nitrobenzene	400	U	
87-86-5	Pentachlorophenol	790	U	
85-01-8	Phenanthrene	400	U	
108-95-2	Phenol	400	U	

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FORM 1
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SAMPLE NO
51SB9C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-003-027-1/1
Sample Volume :	30	Lab File ID :	D33636.D
% Moisture:	15.95	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	400	U
110-86-1	Pyridine	400	U
111-91-1	bis(2-chloroethoxy) methane	400	U
111-44-4	bis(2-chloroethyl) ether	400	U
117-81-7	bis(2-ethylhexyl) phthalate	400	U
84-74-2	di-n-Butyl Phthalate	400	U
117-84-0	di-n-Octyl Phthalate	400	U
621-64-7	n-Nitrosodi-n-Propylamine	400	U
86-30-6	n-Nitrosodiphenylamine	400	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-004-028-1/1
Sample Volume :	30	Lab File ID :	D33637.D
% Moisture:	12.17	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	380	U
95-50-1	1,2-Dichlorobenzene	380	U
541-73-1	1,3-Dichlorobenzene	380	U
106-46-7	1,4-Dichlorobenzene	380	U
108-60-1	2,2-Oxybis(1-Chloropropane)	380	U
95-95-4	2,4,5-Trichlorophenol	380	U
88-06-2	2,4,6-Trichlorophenol	380	U
120-83-2	2,4-Dichlorophenol	380	U
105-67-9	2,4-Dimethylphenol	380	U
51-28-5	2,4-Dinitrophenol	760	U
121-14-2	2,4-Dinitrotoluene	380	U
606-20-2	2,6-Dinitrotoluene	380	U
91-58-7	2-Chloronaphthalene	380	U
95-57-8	2-Chlorophenol	380	U
91-57-6	2-Methylnaphthalene	380	U
88-74-4	2-Nitroaniline	380	U
88-75-5	2-Nitrophenol	380	U
95-48-7	2-methylphenol	380	U
91-94-1	3,3-Dichlorobenzidine	760	U
99-09-2	3-Nitroaniline	380	U
534-52-1	4,6-dinitro-2-methyl phenol	760	U
101-55-3	4-Bromophenyl-phenylether	380	U
106-47-8	4-Chloroaniline	380	U
7005-72-3	4-Chlorophenyl Phenyl Ether	380	U
100-01-6	4-Nitroaniline	380	U
100-02-7	4-Nitrophenol	760	U
59-50-7	4-chloro-3-methylphenol	380	U
106-44-5	4-methylphenol	380	U
83-32-9	Acenaphthene	380	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-004-028-1/1
Sample Volume :	30	Lab File ID :	D33637.D
% Moisture:	12.17	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	380	U	
120-12-7	Anthracene	380	U	
56-55-3	Benzo(a)anthracene	380	U	
50-32-8	Benzo(a)pyrene	380	U	
205-99-2	Benzo(b)fluoranthene	380	U	
191-24-2	Benzo(g,h,i)perylene	380	U	
207-08-9	Benzo(k)fluoranthene	380	U	
65-85-0	Benzoic Acid	760	U	UJ
100-51-6	Benzyl Alcohol	380	U	
85-68-7	Benzyl Butyl Phthalate	380	U	
86-74-8	Carbazole	380	U	
218-01-9	Chrysene	380	U	
53-70-3	Dibenz(a,h)Anthracene	380	U	
132-64-9	Dibenzofuran	380	U	
84-66-2	Diethyl Phthalate	380	U	
131-11-3	Dimethyl Phthalate	380	U	
206-44-0	Fluoranthene	380	U	
86-73-7	Fluorene	380	U	
118-74-1	Hexachlorobenzene	380	U	
87-68-3	Hexachlorobutadiene	380	U	
77-47-4	Hexachlorocyclopentadiene	380	U	UJ
67-72-1	Hexachloroethane	380	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	380	U	
78-59-1	Isophorone	380	U	
91-20-3	Naphthalene	380	U	
98-95-3	Nitrobenzene	380	U	
87-86-5	Pentachlorophenol	760	U	
85-01-8	Phenanthrene	380	U	
108-95-2	Phenol	380	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-004-028-1/1
Sample Volume :	30	Lab File ID :	D33637.D
% Moisture:	12.17	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	380	U
110-86-1	Pyridine	380	U
111-91-1	bis(2-chloroethoxy) methane	380	U
111-44-4	bis(2-chloroethyl) ether	380	U
117-81-7	bis(2-ethylhexyl) phthalate	380	U
84-74-2	di-n-Butyl Phthalate	380	U
117-84-0	di-n-Octyl Phthalate	380	U
621-64-7	n-Nitrosodi-n-Propylamine	380	U
86-30-6	n-Nitrosodiphenylamine	380	U

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SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-033-1/1
Sample Volume :	30	Lab File ID :	D33638.D
% Moisture:	15.93	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	400	U
95-50-1	1,2-Dichlorobenzene	400	U
541-73-1	1,3-Dichlorobenzene	400	U
106-46-7	1,4-Dichlorobenzene	400	U
108-60-1	2,2-Oxybis(1-Chloropropane)	400	U
95-95-4	2,4,5-Trichlorophenol	400	U
88-06-2	2,4,6-Trichlorophenol	400	U
120-83-2	2,4-Dichlorophenol	400	U
105-67-9	2,4-Dimethylphenol	400	U
51-28-5	2,4-Dinitrophenol	790	U
121-14-2	2,4-Dinitrotoluene	400	U
606-20-2	2,6-Dinitrotoluene	400	U
91-58-7	2-Chloronaphthalene	400	U
95-57-8	2-Chlorophenol	400	U
91-57-6	2-Methylnaphthalene	400	U
88-74-4	2-Nitroaniline	400	U
88-75-5	2-Nitrophenol	400	U
95-48-7	2-methylphenol	400	U
91-94-1	3,3-Dichlorobenzidine	790	U
99-09-2	3-Nitroaniline	400	U
534-52-1	4,6-dinitro-2-methyl phenol	790	U
101-55-3	4-Bromophenyl-phenylether	400	U
106-47-8	4-Chloroaniline	400	U
7005-72-3	4-Chlorophenyl Phenyl Ether	400	U
100-01-6	4-Nitroaniline	400	U
100-02-7	4-Nitrophenol	790	U
59-50-7	4-chloro-3-methylphenol	400	U
106-44-5	4-methylphenol	400	U
83-32-9	Acenaphthene	400	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-033-1/1
Sample Volume :	30	Lab File ID :	D33638.D
% Moisture:	15.93	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	400	U	
120-12-7	Anthracene	400	U	
56-55-3	Benzo(a)anthracene	400	U	
50-32-8	Benzo(a)pyrene	400	U	
205-99-2	Benzo(b)fluoranthene	400	U	
191-24-2	Benzo(g,h,i)perylene	400	U	
207-08-9	Benzo(k)fluoranthene	400	U	
65-85-0	Benzoic Acid	790	U	UJ
100-51-6	Benzyl Alcohol	400	U	
85-68-7	Benzyl Butyl Phthalate	400	U	
86-74-8	Carbazole	400	U	
218-01-9	Chrysene	400	U	
53-70-3	Dibenz(a,h)Anthracene	400	U	
132-64-9	Dibenzofuran	400	U	
84-66-2	Diethyl Phthalate	400	U	
131-11-3	Dimethyl Phthalate	400	U	
206-44-0	Fluoranthene	400	U	
86-73-7	Fluorene	400	U	
118-74-1	Hexachlorobenzene	400	U	
87-68-3	Hexachlorobutadiene	400	U	
77-47-4	Hexachlorocyclopentadiene	400	U	UJ
67-72-1	Hexachloroethane	400	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	400	U	
78-59-1	Isophorone	400	U	
91-20-3	Naphthalene	400	U	
98-95-3	Nitrobenzene	400	U	
87-86-5	Pentachlorophenol	790	U	
85-01-8	Phenanthrene	400	U	
108-95-2	Phenol	400	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-033-1/1
Sample Volume :	30	Lab File ID :	D33638.D
% Moisture:	15.93	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	400	U
110-86-1	Pyridine	400	U
111-91-1	bis(2-chloroethoxy) methane	400	U
111-44-4	bis(2-chloroethyl) ether	400	U
117-81-7	bis(2-ethylhexyl) phthalate	400	U
84-74-2	di-n-Butyl Phthalate	400	U
117-84-0	di-n-Octyl Phthalate	400	U
621-64-7	n-Nitrosodi-n-Propylamine	400	U
86-30-6	n-Nitrosodiphenylamine	400	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-034-1/1
Sample Volume :	30	Lab File ID :	T18909.D
% Moisture:	67.61	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/20/2004
Injection Volume :	1 µL	Dilution Factor :	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	100000	U	
95-50-1	1,2-Dichlorobenzene	100000	U	
541-73-1	1,3-Dichlorobenzene	100000	U	
106-46-7	1,4-Dichlorobenzene	100000	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	100000	U	
95-95-4	2,4,5-Trichlorophenol	100000	U	
88-06-2	2,4,6-Trichlorophenol	100000	U	
120-83-2	2,4-Dichlorophenol	100000	U	
105-67-9	2,4-Dimethylphenol	100000	U	
51-28-5	2,4-Dinitrophenol	210000	U	UJ
121-14-2	2,4-Dinitrotoluene	6500000	E	R
606-20-2	2,6-Dinitrotoluene	2100000	E	R
91-58-7	2-Chloronaphthalene	100000	U	
95-57-8	2-Chlorophenol	100000	U	
91-57-6	2-Methylnaphthalene	100000	U	
88-74-4	2-Nitroaniline	100000	U	
88-75-5	2-Nitrophenol	100000	U	
95-48-7	2-methylphenol	100000	U	
91-94-1	3,3-Dichlorobenzidine	210000	U	
99-09-2	3-Nitroaniline	100000	U	
534-52-1	4,6-dinitro-2-methyl phenol	210000	U	
101-55-3	4-Bromophenyl-phenylether	100000	U	
106-47-8	4-Chloroaniline	100000	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	100000	U	
100-01-6	4-Nitroaniline	100000	U	
100-02-7	4-Nitrophenol	210000	U	
59-50-7	4-chloro-3-methylphenol	100000	U	
106-44-5	4-methylphenol	100000	U	
83-32-9	Acenaphthene	100000	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-034-1/1
Sample Volume :	30	Lab File ID :	T18909.D
% Moisture:	67.61	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/20/2004
Injection Volume :	1 µL	Dilution Factor :	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
208-96-8	Acenaphthylene	100000	U
120-12-7	Anthracene	100000	U
56-55-3	Benzo(a)anthracene	100000	U
50-32-8	Benzo(a)pyrene	100000	U
205-99-2	Benzo(b)fluoranthene	100000	U
191-24-2	Benzo(g,h,i)perylene	100000	U
207-08-9	Benzo(k)fluoranthene	100000	U
65-85-0	Benzoic Acid	210000	U
100-51-6	Benzyl Alcohol	100000	U
85-68-7	Benzyl Butyl Phthalate	100000	U
86-74-8	Carbazole	100000	U
218-01-9	Chrysene	100000	U
53-70-3	Dibenz(a,h)Anthracene	100000	U
132-64-9	Dibenzofuran	100000	U
84-66-2	Diethyl Phthalate	100000	U
131-11-3	Dimethyl Phthalate	100000	U
206-44-0	Fluoranthene	100000	U
86-73-7	Fluorene	100000	U
118-74-1	Hexachlorobenzene	100000	U
87-68-3	Hexachlorobutadiene	100000	U
77-47-4	Hexachlorocyclopentadiene	100000	U
67-72-1	Hexachloroethane	100000	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	100000	U
78-59-1	Isophorone	100000	U
91-20-3	Naphthalene	100000	U
98-95-3	Nitrobenzene	100000	U
87-86-5	Pentachlorophenol	210000	U
85-01-8	Phenanthrene	100000	U
108-95-2	Phenol	100000	U

GPL Laboratories

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2BDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-034-1/1
Sample Volume :	30	Lab File ID :	T18909.D
% Moisture:	67.61	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/20/2004
Injection Volume :	1 µL	Dilution Factor :	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	100000	U	
110-86-1	Pyridine	100000	U	
111-91-1	bis(2-chloroethoxy) methane	100000	U	
111-44-4	bis(2-chloroethyl) ether	100000	U	
117-81-7	bis(2-ethylhexyl) phthalate	27000	J	B
84-74-2	di-n-Butyl Phthalate	100000	U	
117-84-0	di-n-Octyl Phthalate	100000	U	
621-64-7	n-Nitrosodi-n-Propylamine	100000	U	
86-30-6	n-Nitrosodiphenylamine	100000	U	

GPL Laboratories

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-034-1/1
Sample Volume :	30	Lab File ID :	T18922.D
% Moisture:	67.61	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor :	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	510000	U	
95-50-1	1,2-Dichlorobenzene	510000	U	
541-73-1	1,3-Dichlorobenzene	510000	U	
106-46-7	1,4-Dichlorobenzene	510000	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	510000	U	
95-95-4	2,4,5-Trichlorophenol	510000	U	
88-06-2	2,4,6-Trichlorophenol	510000	U	
120-83-2	2,4-Dichlorophenol	510000	U	
105-67-9	2,4-Dimethylphenol	510000	U	
51-28-5	2,4-Dinitrophenol	1000000	U	UJ
121-14-2	2,4-Dinitrotoluene	6800000		B
606-20-2	2,6-Dinitrotoluene	2000000		B
91-58-7	2-Chloronaphthalene	510000	U	
95-57-8	2-Chlorophenol	510000	U	
91-57-6	2-Methylnaphthalene	510000	U	
88-74-4	2-Nitroaniline	510000	U	
88-75-5	2-Nitrophenol	510000	U	
95-48-7	2-methylphenol	510000	U	
91-94-1	3,3-Dichlorobenzidine	1000000	U	
99-09-2	3-Nitroaniline	510000	U	
534-52-1	4,6-dinitro-2-methyl phenol	1000000	U	
101-55-3	4-Bromophenyl-phenylether	510000	U	
106-47-8	4-Chloroaniline	510000	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	510000	U	
100-01-6	4-Nitroaniline	510000	U	
100-02-7	4-Nitrophenol	1000000	U	
59-50-7	4-chloro-3-methylphenol	510000	U	
106-44-5	4-methylphenol	510000	U	
83-32-9	Acenaphthene	510000	U	

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-034-1/1
Sample Volume :	30	Lab File ID :	T18922.D
% Moisture:	67.61	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor :	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	510000	U	
120-12-7	Anthracene	510000	U	
56-55-3	Benzo(a)anthracene	510000	U	
50-32-8	Benzo(a)pyrene	510000	U	UJ
205-99-2	Benzo(b)fluoranthene	510000	U	UJ
191-24-2	Benzo(g,h,i)perylene	510000	U	UJ
207-08-9	Benzo(k)fluoranthene	510000	U	UJ
65-85-0	Benzoic Acid	1000000	U	
100-51-6	Benzyl Alcohol	510000	U	
85-68-7	Benzyl Butyl Phthalate	510000	U	
86-74-8	Carbazole	510000	U	
218-01-9	Chrysene	510000	U	
53-70-3	Dibenz(a,h)Anthracene	510000	U	UJ
132-64-9	Dibenzofuran	510000	U	
84-66-2	Diethyl Phthalate	510000	U	
131-11-3	Dimethyl Phthalate	510000	U	
206-44-0	Fluoranthene	510000	U	
86-73-7	Fluorene	510000	U	
118-74-1	Hexachlorobenzene	510000	U	
87-68-3	Hexachlorobutadiene	510000	U	
77-47-4	Hexachlorocyclopentadiene	510000	U	
67-72-1	Hexachloroethane	510000	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	510000	U	UJ
78-59-1	Isophorone	510000	U	
91-20-3	Naphthalene	510000	U	
98-95-3	Nitrobenzene	510000	U	
87-86-5	Pentachlorophenol	1000000	U	
85-01-8	Phenanthrene	510000	U	
108-95-2	Phenol	510000	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2BDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-034-1/1
Sample Volume :	30	Lab File ID :	T18922.D
% Moisture:	67.61	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor :	500
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
129-00-0	Pyrene	510000	U	
110-86-1	Pyridine	510000	U	
111-91-1	bis(2-chloroethoxy) methane	510000	U	
111-44-4	bis(2-chloroethyl) ether	510000	U	
117-81-7	bis(2-ethylhexyl) phthalate	510000	U	
84-74-2	di-n-Butyl Phthalate	510000	U	
117-84-0	di-n-Octyl Phthalate	510000	U	UJ
621-64-7	n-Nitrosodi-n-Propylamine	510000	U	
86-30-6	n-Nitrosodiphenylamine	510000	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-035-1/1
Sample Volume :	30	Lab File ID :	T18910.D
% Moisture:	11.42	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/20/2004
Injection Volume :	1 µL	Dilution Factor :	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	38000	U	
95-50-1	1,2-Dichlorobenzene	38000	U	
541-73-1	1,3-Dichlorobenzene	38000	U	
106-46-7	1,4-Dichlorobenzene	38000	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	38000	U	
95-95-4	2,4,5-Trichlorophenol	38000	U	
88-06-2	2,4,6-Trichlorophenol	38000	U	
120-83-2	2,4-Dichlorophenol	38000	U	
105-67-9	2,4-Dimethylphenol	38000	U	
51-28-5	2,4-Dinitrophenol	75000	U	UJ
121-14-2	2,4-Dinitrotoluene	5600000	E	R
606-20-2	2,6-Dinitrotoluene	1700000	E	R
91-58-7	2-Chloronaphthalene	38000	U	
95-57-8	2-Chlorophenol	38000	U	
91-57-6	2-Methylnaphthalene	38000	U	
88-74-4	2-Nitroaniline	38000	U	
88-75-5	2-Nitrophenol	38000	U	
95-48-7	2-methylphenol	38000	U	
91-94-1	3,3-Dichlorobenzidine	75000	U	
99-09-2	3-Nitroaniline	38000	U	
534-52-1	4,6-dinitro-2-methyl phenol	75000	U	
101-55-3	4-Bromophenyl-phenylether	38000	U	
106-47-8	4-Chloroaniline	38000	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	38000	U	
100-01-6	4-Nitroaniline	38000	U	
100-02-7	4-Nitrophenol	75000	U	
59-50-7	4-chloro-3-methylphenol	38000	U	
106-44-5	4-methylphenol	38000	U	
83-32-9	Acenaphthene	38000	U	

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GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-035-1/1
Sample Volume :	30	Lab File ID :	T18910.D
% Moisture:	11.42	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/20/2004
Injection Volume :	1 µL	Dilution Factor :	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
208-96-8	Acenaphthylene	38000	U
120-12-7	Anthracene	38000	U
56-55-3	Benzo(a)anthracene	38000	U
50-32-8	Benzo(a)pyrene	38000	U
205-99-2	Benzo(b)fluoranthene	38000	U
191-24-2	Benzo(g,h,i)perylene	38000	U
207-08-9	Benzo(k)fluoranthene	38000	U
65-85-0	Benzoic Acid	75000	U
100-51-6	Benzyl Alcohol	38000	U
85-68-7	Benzyl Butyl Phthalate	38000	U
86-74-8	Carbazole	38000	U
218-01-9	Chrysene	38000	U
53-70-3	Dibenz(a,h)Anthracene	38000	U
132-64-9	Dibenzofuran	38000	U
84-66-2	Diethyl Phthalate	38000	U
131-11-3	Dimethyl Phthalate	38000	U
206-44-0	Fluoranthene	38000	U
86-73-7	Fluorene	38000	U
118-74-1	Hexachlorobenzene	38000	U
87-68-3	Hexachlorobutadiene	38000	U
77-47-4	Hexachlorocyclopentadiene	38000	U
67-72-1	Hexachloroethane	38000	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	38000	U
78-59-1	Isophorone	38000	U
91-20-3	Naphthalene	38000	U
98-95-3	Nitrobenzene	38000	U
87-86-5	Pentachlorophenol	75000	U
85-01-8	Phenanthrene	38000	U
108-95-2	Phenol	38000	U

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2CDL

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-035-1/1
Sample Volume :	30	Lab File ID :	T18910.D
% Moisture:	11.42	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/20/2004
Injection Volume :	1 µL	Dilution Factor :	100
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	38000	U
110-86-1	Pyridine	38000	U
111-91-1	bis(2-chloroethoxy) methane	38000	U
111-44-4	bis(2-chloroethyl) ether	38000	U
117-81-7	bis(2-ethylhexyl) phthalate	38000	U
84-74-2	di-n-Butyl Phthalate	38000	U
117-84-0	di-n-Octyl Phthalate	38000	U
621-64-7	n-Nitrosodi-n-Propylamine	38000	U
86-30-6	n-Nitrosodiphenylamine	38000	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2CDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-035-1/1
Sample Volume :	30	Lab File ID :	T18923.D
% Moisture:	11.42	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor :	2000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	750000	U	
95-50-1	1,2-Dichlorobenzene	750000	U	
541-73-1	1,3-Dichlorobenzene	750000	U	
106-46-7	1,4-Dichlorobenzene	750000	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	750000	U	
95-95-4	2,4,5-Trichlorophenol	750000	U	
88-06-2	2,4,6-Trichlorophenol	750000	U	
120-83-2	2,4-Dichlorophenol	750000	U	
105-67-9	2,4-Dimethylphenol	750000	U	
51-28-5	2,4-Dinitrophenol	1500000	U	UJ
121-14-2	2,4-Dinitrotoluene	5900000		B
606-20-2	2,6-Dinitrotoluene	1400000		B
91-58-7	2-Chloronaphthalene	750000	U	
95-57-8	2-Chlorophenol	750000	U	
91-57-6	2-Methylnaphthalene	750000	U	
88-74-4	2-Nitroaniline	750000	U	
88-75-5	2-Nitrophenol	750000	U	
95-48-7	2-methylphenol	750000	U	
91-94-1	3,3-Dichlorobenzidine	1500000	U	
99-09-2	3-Nitroaniline	750000	U	
534-52-1	4,6-dinitro-2-methyl phenol	1500000	U	
101-55-3	4-Bromophenyl-phenylether	750000	U	
106-47-8	4-Chloroaniline	750000	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	750000	U	
100-01-6	4-Nitroaniline	750000	U	
100-02-7	4-Nitrophenol	1500000	U	
59-50-7	4-chloro-3-methylphenol	750000	U	
106-44-5	4-methylphenol	750000	U	
83-32-9	Acenaphthene	750000	U	

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2CDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-035-1/1
Sample Volume :	30	Lab File ID :	T18923.D
% Moisture:	11.42	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor :	2000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	750000	U	
120-12-7	Anthracene	750000	U	
56-55-3	Benzo(a)anthracene	750000	U	
50-32-8	Benzo(a)pyrene	750000	U	UJ
205-99-2	Benzo(b)fluoranthene	750000	U	UJ
191-24-2	Benzo(g,h,i)perylene	750000	U	UJ
207-08-9	Benzo(k)fluoranthene	750000	U	UJ
65-85-0	Benzoic Acid	1500000	U	
100-51-6	Benzyl Alcohol	750000	U	
85-68-7	Benzyl Butyl Phthalate	750000	U	
86-74-8	Carbazole	750000	U	
218-01-9	Chrysene	750000	U	
53-70-3	Dibenz(a,h)Anthracene	750000	U	UJ
132-64-9	Dibenzofuran	750000	U	
84-66-2	Diethyl Phthalate	750000	U	
131-11-3	Dimethyl Phthalate	750000	U	
206-44-0	Fluoranthene	750000	U	
86-73-7	Fluorene	750000	U	
118-74-1	Hexachlorobenzene	750000	U	
87-68-3	Hexachlorobutadiene	750000	U	
77-47-4	Hexachlorocyclopentadiene	750000	U	
67-72-1	Hexachloroethane	750000	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	750000	U	UJ
78-59-1	Isophorone	750000	U	
91-20-3	Naphthalene	750000	U	
98-95-3	Nitrobenzene	750000	U	
87-86-5	Pentachlorophenol	1500000	U	
85-01-8	Phenanthrene	750000	U	
108-95-2	Phenol	750000	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2CDL2

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-035-1/1
Sample Volume :	30	Lab File ID :	T18923.D
% Moisture:	11.42	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/21/2004
Injection Volume :	1 µL	Dilution Factor :	2000
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	750000	U
110-86-1	Pyridine	750000	U
111-91-1	bis(2-chloroethoxy) methane	750000	U
111-44-4	bis(2-chloroethyl) ether	750000	U
117-81-7	bis(2-ethylhexyl) phthalate	750000	U
84-74-2	di-n-Butyl Phthalate	750000	U
117-84-0	di-n-Octyl Phthalate	750000	U UJ
621-64-7	n-Nitrosodi-n-Propylamine	750000	U
86-30-6	n-Nitrosodiphenylamine	750000	U

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FORM 1
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SAMPLE NO
51SB2D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-008-036-1/1
Sample Volume :	30	Lab File ID :	D33639.D
% Moisture:	16.58	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
120-82-1	1,2,4-Trichlorobenzene	400	U	
95-50-1	1,2-Dichlorobenzene	400	U	
541-73-1	1,3-Dichlorobenzene	400	U	
106-46-7	1,4-Dichlorobenzene	400	U	
108-60-1	2,2-Oxybis(1-Chloropropane)	400	U	
95-95-4	2,4,5-Trichlorophenol	400	U	
88-06-2	2,4,6-Trichlorophenol	400	U	
120-83-2	2,4-Dichlorophenol	400	U	
105-67-9	2,4-Dimethylphenol	400	U	
51-28-5	2,4-Dinitrophenol	800	U	
121-14-2	2,4-Dinitrotoluene	1800		B
606-20-2	2,6-Dinitrotoluene	4900		
91-58-7	2-Chloronaphthalene	400	U	
95-57-8	2-Chlorophenol	400	U	
91-57-6	2-Methylnaphthalene	400	U	
88-74-4	2-Nitroaniline	400	U	
88-75-5	2-Nitrophenol	400	U	
95-48-7	2-methylphenol	400	U	
91-94-1	3,3-Dichlorobenzidine	800	U	
99-09-2	3-Nitroaniline	400	U	
534-52-1	4,6-dinitro-2-methyl phenol	150	J	J
101-55-3	4-Bromophenyl-phenylether	400	U	
106-47-8	4-Chloroaniline	400	U	
7005-72-3	4-Chlorophenyl Phenyl Ether	400	U	
100-01-6	4-Nitroaniline	400	U	
100-02-7	4-Nitrophenol	800	U	
59-50-7	4-chloro-3-methylphenol	400	U	
106-44-5	4-methylphenol	400	U	
83-32-9	Acenaphthene	400	U	

Form I Corr

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-008-036-1/1
Sample Volume :	30	Lab File ID :	D33639.D
% Moisture:	16.58	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	400	U	
120-12-7	Anthracene	400	U	
56-55-3	Benzo(a)anthracene	400	U	
50-32-8	Benzo(a)pyrene	400	U	
205-99-2	Benzo(b)fluoranthene	400	U	
191-24-2	Benzo(g,h,i)perylene	400	U	
207-08-9	Benzo(k)fluoranthene	400	U	
65-85-0	Benzoic Acid	800	U	UJ
100-51-6	Benzyl Alcohol	400	U	
85-68-7	Benzyl Butyl Phthalate	400	U	
86-74-8	Carbazole	400	U	
218-01-9	Chrysene	400	U	
53-70-3	Dibenz(a,h)Anthracene	400	U	
132-64-9	Dibenzofuran	400	U	
84-66-2	Diethyl Phthalate	400	U	
131-11-3	Dimethyl Phthalate	400	U	
206-44-0	Fluoranthene	400	U	
86-73-7	Fluorene	400	U	
118-74-1	Hexachlorobenzene	400	U	
87-68-3	Hexachlorobutadiene	400	U	
77-47-4	Hexachlorocyclopentadiene	400	U	UJ
67-72-1	Hexachloroethane	400	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	400	U	
78-59-1	Isophorone	400	U	
91-20-3	Naphthalene	400	U	
98-95-3	Nitrobenzene	400	U	
87-86-5	Pentachlorophenol	800	U	
85-01-8	Phenanthrene	400	U	
108-95-2	Phenol	400	U	

GPL Laboratories

Form I Copy

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-008-036-1/1
Sample Volume :	30	Lab File ID :	D33639.D
% Moisture:	16.58	Date Received	04/07/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	400	U
110-86-1	Pyridine	400	U
111-91-1	bis(2-chloroethoxy) methane	400	U
111-44-4	bis(2-chloroethyl) ether	400	U
117-81-7	bis(2-ethylhexyl) phthalate	400	U
84-74-2	di-n-Butyl Phthalate	400	U
117-84-0	di-n-Octyl Phthalate	400	U
621-64-7	n-Nitrosodi-n-Propylamine	400	U
86-30-6	n-Nitrosodiphenylamine	400	U

Shaw Environmental, Inc.

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Edgewood, MD 21040-1037
410.612.6350
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – TAL Inorganics
GPL Laboratories, Inc., SDG 404054

DATE: July 1, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004 and April 06, 2004. Samples were analyzed for target analyte list (TAL) Inorganics using USEPA SW-846 3050B/6010B for ICP metals, USEPA SW-846 7471A for mercury, and USEPA SW-846 9014 for cyanide. A total of eight soil samples were validated. All samples were analyzed for total TAL inorganics. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB9A	404054-001	51SB2A	404054-005
51SB9B	404054-002	51SB2B	404054-006
51SB9C	404054-003	51SB2C	404054-007
TMSB9B	404054-004	51SB2D	404054-008

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Inorganic Data Review* (April, 1993). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Initial and Continuing Calibration
X		Blank Analysis
	X	ICP Interference Check Sample (ICS)
	X	Laboratory Control Sample (LCS)
	X	Lab Sample Duplicate
X		Matrix Spike
	X	ICP Serial Dilution
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

7/1/04

Date

RFAAP VALIDATION REPORT
TAL INORGANICS REVIEW
SDG 404054

I-Holding Times

The primary objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample analysis. The soil samples are received and stored cool @4 °C ± 2 °C, with a maximum holding time of 180 days for ICP metals, 28 days for mercury, and 14 days for cyanide from collection (USEPA criteria).

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04 and 04/06/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: Samples were collected 04/05/04 and 04/06/04. They were digested on 04/10/04 and analyzed for ICP metals on 04/13/04 and 04/19/04. Samples were digested on 04/09/04 for mercury and were analyzed for mercury on 04/10/04. Samples were digested on 04/16/04 for cyanide and were analyzed for cyanide on 04/16/04. All holding time criteria were met. No qualifiers were applied.

II-Initial and Continuing Calibration

Requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of the analysis run, and continuing calibration verification documents that the initial calibration is still valid.

ICP: 1- blank (USACE <MDL)
3 – standards ($r \geq 0.995$)
ICV/CCV (90-110%) (USACE 90-110%)
MRL (70-130%) (USACE 80-120%)

Hg: 1 – blank (USACE <MDL)
5 – standards ($r \geq 0.995$)
ICV/CCV (80-120%) (USACE ICV 90-110% / CCV 80-120%)
MRL (80-120%)

CN: 1- blank (USACE <MDL)
5 – standards ($r \geq 0.995$)
ICV/CCV (85-115%)

- The samples were analyzed for ICP metals on 04/09/04 and 04/12/04. Mercury was analyzed on 04/10/04 with a correlation coefficient of 0.9999. Cyanide was analyzed on 04/16/04 with a correlation coefficient of 0.9998. All ICV/CCV standards were within criteria. No qualifiers were applied. **Table 2** summarizes the MRL standard analysis for metals. Samples with concentrations detected less than two times the MRL with out of criteria MRL recovery were qualified.

Table 2 MRL Analysis Summary

Analysis Date	Analysis	MRL (µg/L)	MRL (mg/kg)	MRL %Recovery	Qualified samples @ <2xMRL	Validation Qualifiers
04/12/04	ICP	Various	Various	All within criteria	None	None
04/19/04	ICP	Various	Various	All within criteria	None	None
04/10/04	Hg	0.2	0.033	All within criteria	None	None

III-Blanks

Blanks (preparation and calibration blanks) are assessed to determine the existence and magnitude of contamination problems. No contaminants should be detected (i.e. <MDL) in any of the associated blanks. USACE Shell limits are < ½MRL for the method blank. Samples are qualified "B" when they are less than 5X the absolute value of the maximum blank concentration. **Table 3** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factors = 10 for ICP; 6 for Hg; and 40 for CN). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 3 Blank Contamination Analysis Summary

Analysis Date	Analysis	QC Blank ID	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/12/04	ICP-Al	ICB/CCBs	7.79B	39.0	None
04/12/04	ICP-As	ICB/CCBs	0.37B	1.9	51SB9B, 51SB9C, TMSB9B, 51SB2C, 51SB2D
04/12/04	ICP-Be	ICB/CCBs	0.01B	0.05	None
04/12/04	ICP-Ca	ICB/CCBs	10.7B	53.5	51SB9B, TMSB9B
04/12/04	ICP-Co	ICB/CCBs	0.17B	0.85	None
04/12/04	ICP-Cu	ICB/CCBs	0.41B	2.1	51SB2D
04/12/04	ICP-Fe	ICB/CCBs	6.52B	32.6	None
04/12/04	ICP-Mg	ICB/CCBs	10.9B	54.5	None
04/12/04	ICP-Mn	ICB/CCBs	0.07B	0.35	None
04/12/04	ICP-Ni	ICB/CCBs	0.15B	0.75	None
04/12/04	ICP-V	ICB/CCBs	0.16B	0.80	None
04/19/04	ICP-Al	ICB/CCBs	2.91B	14.6	None
04/19/04	ICP-Ba	ICB/CCBs	0.09B	0.45	None
04/19/04	ICP-Cd	ICB/CCBs	0.05B	0.25	None
04/19/04	ICP-Fe	ICB/CCBs	5.41B	27.1	None
04/19/04	ICP-Mg	ICB/CCBs	5.91B	29.6	None
04/19/04	ICP-Mn	ICB/CCBs	0.14B	0.70	None
04/19/04	ICP-Se	ICB/CCBs	0.20B	1.0	51SB9A, 51SB2B, 51SB2C
04/10/04	Hg	ICB/CCBs	<MRL	NA	None
04/16/04	CN	ICB/CCBs	<MRL	NA	None
04/09/04	ICP-Al	PBS	2.0B	10.0	None
04/09/04	ICP-Sb	PBS	0.52B	2.6	51SB9A, 51SB9B, 51SB2A, 51SB2B, 51SB2C, 51SB2D
04/09/04	ICP-Ca	PBS	11.2B	56.0	51SB9B, TMSB9B
04/09/04	ICP-Cr	PBS	0.12B	0.60	None
04/09/04	ICP-Co	PBS	0.12B	0.60	None
04/09/04	ICP-Mn	PBS	0.15B	0.75	None
04/09/04	ICP-Ni	PBS	0.38B	1.9	None
04/09/04	ICP-Na	PBS	75.6B	378	51SB9A, 51SB9B, 51SB9C, TMSB9B, 51SB2A, 51SB2C
04/09/04	ICP-Tl	PBS	0.97B	4.9	51SB9C, TMSB9B, 51SB2A, 51SB2B, 51SB2D
04/10/04	Hg	PBS	<MRL	NA	None
04/16/04	CN	PBS	<MRL	NA	None
04/15/04	ICPMS-Ba	040704R	0.11B	0.55	None
04/15/04	ICPMS-Cd	040704R	0.021B	0.11	51SB9A, 51SB9B, 51SB2A, 51SB2C
04/15/04	ICPMS-Ca	040704R	53.1B	266	51SB9B, TMSB9B, 51SB2A, 51SB2C
04/15/04	ICPMS-Cr	040704R	0.38	1.9	None
04/15/04	ICPMS-Co	040704R	0.0012B	0.006	None
04/15/04	ICPMS-Cu	040704R	0.30E	1.5	51SB2D
04/15/04	ICPMS-Fe	040704R	1.86B	9.3	None
04/15/04	ICPMS-Pb	040704R	0.023B	0.12	None
04/15/04	ICPMS-Mg	040704R	9.81BE	49.1	None
04/15/04	ICPMS-Mn	040704R	0.22	1.1	None
04/15/04	ICPMS-Ni	040704R	0.041B	0.21	None
04/15/04	ICPMS-K	040704R	6.73BE	33.7	None
04/15/04	ICPMS-Na	040704R	21.0BE	105	51SB9A, 51SB9B, TMSB9B, 51SB2A
04/15/04	ICPMS-Zn	040704R	0.40BE	2.0	None
04/14/04	Hg	040704R	<MRL	NA	None
04/19/04	CN	040704R	<MRL	NA	None

B = Value is estimated <MRL and >MDL.
E = Serial Dilution percent difference not within limits.
N = Laboratory spike sample recovery not within control limits.

IV-ICP Interference Check Sample (ICS)
The ICP interference check sample (ICS) verifies interelement and background correction factors. ICP Interference Check is performed at the beginning and end of each sample analysis run. Control limits are 80-120% (USACE limits 80-120%).

- All criteria were met. No qualifiers were applied.

V-Laboratory Control Samples (LCS)
The laboratory control sample (LCS) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. All soil LCS results must fall within the control limits of 80-120% for ICPMS metals and mercury and 85-115% for cyanide. USACE Shell limits for metals are 80-120% (60-140% for sporadic marginal failures (SMF)).

- Sample BKS65833 was used as LCS for ICP metals analysis. All criteria were met. No qualifiers were applied.

- Sample BKS65820 was used as LCS for total mercury analysis. All criteria were met. No qualifiers were applied.

- Sample BKS1730 was used as LCS for total cyanide analysis. All criteria were met. No qualifiers were applied.

VI-Duplicate Sample Analysis
Duplicate sample determinations are used to demonstrate acceptable method precision by the laboratory at the time of analysis. Duplicate analysis are also performed to generate data in order to determine the long-term precision of the analytical method on various matrices. RPDs must be within established control limits. USACE Shell limits for metals are 25% RPD for ICP metals and 20% RPD for mercury and cyanide.

- Sample 51SB9A (404054-001) was used as sample duplicate for ICP metals analysis. Cadmium (200%) and selenium (200%) were outside criteria. Cadmium and selenium were outside due to low sample concentration, therefore no qualifiers were applied based upon this outliers.

- Sample 51SB1B (404068-004) was used as sample duplicate for mercury analysis. All criteria were met. No qualifiers were applied.

- Sample 51SB2D (404054-008) was used for the sample duplicate analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VII-Matrix Spike
MS are generated to determine long-term accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. Specific criteria include the analyses of matrix spike and matrix spike duplicate samples at a frequency of one MS per 20 samples of similar matrix. MS recoveries and relative percent differences between MS recoveries should be within the specified limits. USACE Shell limits for metals are 75-125% for ICP metals and 80-120% for mercury and cyanide. Post digestion spikes limits are 75-125% for ICP metals and 85-115% for mercury and cyanide.

- Sample 51SB9A (404054-001) was used for the MS analysis for ICP analysis. Aluminum (926%), antimony (55.8%), iron (18.7%), magnesium (127%), and potassium (141%) were outside of control limits. Post digestion spikes were within criteria for antimony, magnesium, and potassium. The sample concentration was >4 times the spike added for aluminum and iron, therefore no qualifiers were applied based upon these outliers. For antimony, the spiked sample was qualified bias low "L". For magnesium and potassium, the spiked sample was qualified bias high "K".

- Sample 51SB1B (404068-004) was used for the MS analysis for mercury analysis. This sample was analyzed in SDG 404068. All criteria were met. No qualifiers were applied.

- Sample 51SB2D (404054-008) was used for the MS analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VIII-ICP Serial Dilution

An ICP serial dilution is performed to determine whether significant physical or chemical interferences exist due to sample matrix at high concentrations. An analysis of a 5-fold dilution should agree within 10% difference of the original result when the concentration in sample is a factor of 50 above MDL.

- The serial dilution for the ICP was analyzed for sample 51SB9A (404054-001). Antimony (100%), arsenic (30.2%), cadmium (100%), nickel (16.3%), selenium (258%), and sodium (100%) were outside of criteria limits. Sample concentrations were <50 times MDL for antimony, arsenic, cadmium, nickel, selenium, and sodium, therefore no qualifiers were applied based upon these outliers.

IX-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the aqueous samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB9B (404054-002) and TMSB9B (404054-004) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB9B	404054-002	Aluminum	14900	14100	5.5	None
51SB9B	404054-002	Antimony	0.76 BN	0.49 UN	NA	None
51SB9B	404054-002	Arsenic	1.4 B	1.3 B	7.4	None
51SB9B	404054-002	Barium	35.0	32.6	7.1	None
51SB9B	404054-002	Beryllium	0.42	0.38	10.0	None
51SB9B	404054-002	Cadmium	0.062 B	0.043 U	NA	None
51SB9B	404054-002	Calcium	24.8 B	22.5 B	9.7	None
51SB9B	404054-002	Chromium	13.3 *	12.6 *	5.4	None
51SB9B	404054-002	Cobalt	10.4	9.2	12.2	None
51SB9B	404054-002	Copper	5.1	4.5	12.5	None
51SB9B	404054-002	Iron	16100	15100	6.4	None
51SB9B	404054-002	Lead	6.3	5.9	6.6	None
51SB9B	404054-002	Magnesium	715 N	644 N	10.5	None
51SB9B	404054-002	Manganese	312	280	10.8	None
51SB9B	404054-002	Nickel	5.8	5.7	1.7	None
51SB9B	404054-002	Potassium	736 N	703 N	4.6	None
51SB9B	404054-002	Sodium	113 B	115 B	1.8	None
51SB9B	404054-002	Thallium	0.55 U	0.71 B	NA	None
51SB9B	404054-002	Vanadium	29.4	27.2	7.8	None
51SB9B	404054-002	Zinc	20.8	20.1	3.4	None
51SB9B	404054-002	Mercury	0.015 U	0.016 U	NA	None
51SB9B	404054-002	Cyanide	0.16 U	0.16 U	NA	None

B = Estimated value <MRL and >MDL.
E = Serial Dilution percent difference not within limits.
N = Laboratory spike sample recovery not within control limits.
* = Laboratory duplicate not within control limits.
U = Value non-detect at MRL.
NA = Not Applicable

X-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." The following calculations were performed for verification.

ICP Sample: 51SB9A (404054-001), Total Barium

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(1257.936 μg/L)*(0.100 L)*(1)} / {(1.22 g)*(0.8426)} = 120 μg/g = 120 mg/kg

Reported concentration = 120 mg/kg
%D = 0.0%
Values were within 10% difference.

CVAA Sample: 51SB9A (404054-001), Total Mercury

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(0.153 μg/L)*(0.100 L)*(1)} / {(0.77 g)*(0.8426)} = 0.024 μg/g = 0.024 mg/kg

Reported concentration = 0.024 mg/kg
%D = 0.0%
Values were within 10% difference.

Cyanide Sample: 51SB2C (404054-007), Total Cyanide

Conc. (mg/kg) = {(conc. μg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(37.6 μg/L)*(0.050 L)*(1)} / {(1.92 g)*(0.8858)} = 1.1 μg/g = 1.1 mg/kg

Reported concentration = 1.1 mg/kg
%D = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

Form I copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-001-029-1/1 **Client ID:** 51SB9A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/10/04 **Prep Batch:** 65833

Weight: 1.22 **Volume:** 100 **Percent Moisture:** 15.74

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	1.7	19.5	14400		1	ICPST	4/13/04	4:27
Antimony	206.84	0.49	1.9	0.54	BN	B 1	ICPST	4/13/04	4:27
Arsenic	189.04	0.19	1.9	3.7		1	ICPST	4/13/04	4:27
Barium	493.41	0.031	0.49	120		1	ICPST	4/13/04	4:27
Beryllium	313.04	0.0055	0.19	0.80		1	ICPST	4/13/04	4:27
Cadmium	226.50	0.043	0.58	0.099	B	B 1	ICPST	4/13/04	4:27
Calcium	317.93	7.4	97.3	405		1	ICPST	4/13/04	4:27
Chromium	267.72	0.12	0.49	24.4	*	1	ICPST	4/13/04	4:27
Cobalt	228.62	0.078	0.49	6.0		1	ICPST	4/13/04	4:27
Copper	324.75	0.092	0.97	7.0		1	ICPST	4/13/04	4:27
Iron	271.44	3.8	14.6	17700		1	ICPST	4/13/04	4:27
Lead	220.35	0.20	0.97	20.4		1	ICPST	4/13/04	4:27
Magnesium	279.08	2.5	24.3	636	N	K 1	ICPST	4/13/04	4:27
Manganese	257.61	0.024	0.49	707		1	ICPST	4/13/04	4:27
Nickel	231.60	0.14	0.97	6.2		1	ICPST	4/13/04	4:27
Potassium	766.49	4.1	24.3	519	N	K 1	ICPST	4/13/04	4:27
Selenium	196.03	0.17	1.9	0.28	B	B 1	ICPST	4/13/04	4:27
Silver	328.07	0.13	0.29	0.13	U	1	ICPST	4/13/04	4:27
Sodium	330.23	32.8	243	66.2	B	B 1	ICPST	4/13/04	4:27
Thallium	190.86	0.56	2.9	0.56	U	1	ICPST	4/13/04	4:27
Vanadium	292.40	0.14	0.97	40.0		1	ICPST	4/13/04	4:27
Zinc	213.86	0.53	1.9	36.0		1	ICPST	4/13/04	4:27

Comments: Sample Date: 04/05/04 Sample Time: 05:45 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Org

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-001-029-1/1 **Client ID:** 51SB9A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65820

Weight: 0.77 **Volume:** 100 **Percent Moisture:** 15.74

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.031	0.024	B	J 1	CVAA	4/10/04	15:19

Comments: Sample Date: 04/05/04 Sample Time: 05:45 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Cont

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB9A	Lab Sample ID:	404054-001-029-1/1
Sample Date/Time:	04/05/2004 17:45	Percent Moisture:	15.74
Receipt Date/Time:	04/07/0004 00:00	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.17	1	mg/kg	04/16/04 16:00

Form I Copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-002-030-1/1 **Client ID:** 51SB9B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/10/04 **Prep Batch:** 65833

Weight: 1.21 **Volume:** 100 **Percent Moisture:** 12.17

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.6**	**18.8**	**14900**		1	**ICPST**	**4/13/04**	**5:26**
Antimony	**206.84**	**0.47**	**1.9**	**0.76**	**BN**	B 1	**ICPST**	**4/13/04**	**5:26**
Arsenic	**189.04**	**0.19**	**1.9**	**1.4**	**B**	B 1	**ICPST**	**4/13/04**	**5:26**
Barium	**493.41**	**0.030**	**0.47**	**35.0**		1	**ICPST**	**4/13/04**	**5:26**
Beryllium	**313.04**	**0.0054**	**0.19**	**0.42**		1	**ICPST**	**4/13/04**	**5:26**
Cadmium	**226.50**	**0.041**	**0.56**	**0.062**	**B**	B 1	**ICPST**	**4/13/04**	**5:26**
Calcium	**317.93**	**7.1**	**94.1**	**24.8**	**B**	B 1	**ICPST**	**4/13/04**	**5:26**
Chromium	**267.72**	**0.11**	**0.47**	**13.3**	*	1	**ICPST**	**4/13/04**	**5:26**
Cobalt	**228.62**	**0.075**	**0.47**	**10.4**		1	**ICPST**	**4/13/04**	**5:26**
Copper	**324.75**	**0.089**	**0.94**	**5.1**		1	**ICPST**	**4/13/04**	**5:26**
Iron	**271.44**	**3.7**	**14.1**	**16100**		1	**ICPST**	**4/13/04**	**5:26**
Lead	**220.35**	**0.20**	**0.94**	**6.3**		1	**ICPST**	**4/13/04**	**5:26**
Magnesium	**279.08**	**2.4**	**23.5**	**715**	**N**	1	**ICPST**	**4/13/04**	**5:26**
Manganese	**257.61**	**0.024**	**0.47**	**312**		1	**ICPST**	**4/13/04**	**5:26**
Nickel	**231.60**	**0.13**	**0.94**	**5.8**		1	**ICPST**	**4/13/04**	**5:26**
Potassium	**766.49**	**3.9**	**23.5**	**736**	**N**	1	**ICPST**	**4/13/04**	**5:26**
Selenium	196.03	0.16	1.9	0.16	U	1	ICPST	4/13/04	5:26
Silver	328.07	0.12	0.28	0.12	U	1	ICPST	4/13/04	5:26
Sodium	**330.23**	**31.7**	**235**	**113**	**B**	B 1	**ICPST**	**4/13/04**	**5:26**
Thallium	190.86	0.55	2.8	0.55	U	1	ICPST	4/13/04	5:26
Vanadium	**292.40**	**0.13**	**0.94**	**29.4**		1	**ICPST**	**4/13/04**	**5:26**
Zinc	**213.86**	**0.51**	**1.9**	**20.8**		1	**ICPST**	**4/13/04**	**5:26**

Comments: Sample Date: 04/05/04 Sample Time: 06:00 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Corr

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-002-030-1/1 **Client ID:** 51SB9B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65820

Weight: 0.74 **Volume:** 100 **Percent Moisture:** 12.17

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.031	0.015	U	1	CVAA	4/10/04	15:28

Comments: Sample Date: 04/05/04 Sample Time: 06:00 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

R Result is between IDL and RL

Form 1 Equivalent

Form I Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB9B	Lab Sample ID:	404054-002-030-1/1
Sample Date/Time:	04/05/2004 18:00	Percent Moisture:	12.17
Receipt Date/Time:	04/07/0004 00:00	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time	
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/16/04	16:00

Form I copy

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-003-031-1/1 **Client ID:** 51SB9C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/10/04 **Prep Batch:** 65833

Weight: 1.32 **Volume:** 100 **Percent Moisture:** 15.95

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.5**	**18.0**	**21900**		1	**ICPST**	**4/13/04**	**5:34**
Antimony	206.84	0.45	1.8	0.45	UN	1	ICPST	4/13/04	5:34
Arsenic	**189.04**	**0.18**	**1.8**	**2.2**		B 1	**ICPST**	**4/13/04**	**5:34**
Barium	**493.41**	**0.029**	**0.45**	**73.5**		1	**ICPST**	**4/13/04**	**5:34**
Beryllium	**313.04**	**0.0051**	**0.18**	**0.93**		1	**ICPST**	**4/13/04**	**5:34**
Cadmium	226.50	0.040	0.54	0.040	U	1	ICPST	4/13/04	5:34
Calcium	**317.93**	**6.8**	**90.1**	**718**		1	**ICPST**	**4/13/04**	**5:34**
Chromium	**267.72**	**0.11**	**0.45**	**37.5**	*	1	**ICPST**	**4/13/04**	**5:34**
Cobalt	**228.62**	**0.072**	**0.45**	**54.8**		1	**ICPST**	**4/13/04**	**5:34**
Copper	**324.75**	**0.086**	**0.90**	**8.3**		1	**ICPST**	**4/13/04**	**5:34**
Iron	**271.44**	**3.6**	**13.5**	**32000**		1	**ICPST**	**4/13/04**	**5:34**
Lead	**220.35**	**0.19**	**0.90**	**6.2**		1	**ICPST**	**4/13/04**	**5:34**
Magnesium	**279.08**	**2.3**	**22.5**	**8840**	**N**	1	**ICPST**	**4/13/04**	**5:34**
Manganese	**257.61**	**0.023**	**0.45**	**454**		1	**ICPST**	**4/13/04**	**5:34**
Nickel	**231.60**	**0.13**	**0.90**	**57.1**		1	**ICPST**	**4/13/04**	**5:34**
Potassium	**766.49**	**3.8**	**22.5**	**2140**	**N**	1	**ICPST**	**4/13/04**	**5:34**
Selenium	196.03	0.15	1.8	0.15	U	1	ICPST	4/13/04	5:34
Silver	328.07	0.12	0.27	0.12	U	1	ICPST	4/13/04	5:34
Sodium	**330.23**	**30.4**	**225**	**194**	**B**	B 1	**ICPST**	**4/13/04**	**5:34**
Thallium	**190.86**	**0.52**	**2.7**	**1.1**	**B**	B 1	**ICPST**	**4/13/04**	**5:34**
Vanadium	**292.40**	**0.13**	**0.90**	**30.6**		1	**ICPST**	**4/13/04**	**5:34**
Zinc	**213.86**	**0.49**	**1.8**	**24.0**		1	**ICPST**	**4/13/04**	**5:34**

Comments: Sample Date: 04/05/04 Sample Time: 06:55 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Copy

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Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-003-031-1/1 **Client ID:** 51SB9C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65820

Weight: 0.75 **Volume:** 100 **Percent Moisture:** 15.95

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.032	0.016	U	1	CVAA	4/10/04	15:30

Comments: Sample Date: 04/05/04 Sample Time: 06:55 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

R Result is between IDL and RL

Form 1 Equivalent

Form I Only

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB9C	Lab Sample ID:	404054-003-031-1/1
Sample Date/Time:	04/05/2004 18:55	Percent Moisture:	15.95
Receipt Date/Time:	04/07/0004 00:00	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.17	1	mg/kg	04/16/04 16:00

Form I Copy

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Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-004-032-1/1 **Client ID:** TMSB9B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/10/04 **Prep Batch:** 65833

Weight: 1.17 **Volume:** 100 **Percent Moisture:** 12.17

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.7**	**19.5**	**14100**		1	**ICPST**	**4/13/04**	**5:42**
Antimony	206.84	0.49	1.9	0.49	UN	1	ICPST	4/13/04	5:42
Arsenic	**189.04**	**0.19**	**1.9**	**1.3**	**B**	B 1	**ICPST**	**4/13/04**	**5:42**
Barium	**493.41**	**0.031**	**0.49**	**32.5**		1	**ICPST**	**4/13/04**	**5:42**
Beryllium	**313.04**	**0.0055**	**0.19**	**0.38**		1	**ICPST**	**4/13/04**	**5:42**
Cadmium	226.50	0.043	0.58	0.043	U	1	ICPST	4/13/04	5:42
Calcium	**317.93**	**7.4**	**97.3**	**22.5**	**B**	B 1	**ICPST**	**4/13/04**	**5:42**
Chromium	**267.72**	**0.12**	**0.49**	**12.6**	*	1	**ICPST**	**4/13/04**	**5:42**
Cobalt	**228.62**	**0.078**	**0.49**	**9.2**		1	**ICPST**	**4/13/04**	**5:42**
Copper	**324.75**	**0.092**	**0.97**	**4.4**		1	**ICPST**	**4/13/04**	**5:42**
Iron	**271.44**	**3.8**	**14.6**	**15100**		1	**ICPST**	**4/13/04**	**5:42**
Lead	**220.35**	**0.20**	**0.97**	**5.9**		1	**ICPST**	**4/13/04**	**5:42**
Magnesium	**279.08**	**2.5**	**24.3**	**644**	**N**	1	**ICPST**	**4/13/04**	**5:42**
Manganese	**257.61**	**0.024**	**0.49**	**280**		1	**ICPST**	**4/13/04**	**5:42**
Nickel	**231.60**	**0.14**	**0.97**	**5.7**		1	**ICPST**	**4/13/04**	**5:42**
Potassium	**766.49**	**4.1**	**24.3**	**703**	**N**	1	**ICPST**	**4/13/04**	**5:42**
Selenium	196.03	0.17	1.9	0.17	U	1	ICPST	4/13/04	5:42
Silver	328.07	0.13	0.29	0.13	U	1	ICPST	4/13/04	5:42
Sodium	**330.23**	**32.8**	**243**	**115**	**B**	B 1	**ICPST**	**4/13/04**	**5:42**
Thallium	**190.86**	**0.56**	**2.9**	**0.71**	**B**	B 1	**ICPST**	**4/13/04**	**5:42**
Vanadium	**292.40**	**0.14**	**0.97**	**27.2**		1	**ICPST**	**4/13/04**	**5:42**
Zinc	**213.86**	**0.53**	**1.9**	**20.1**		1	**ICPST**	**4/13/04**	**5:42**

Comments: Sample Date: 04/05/04 Sample Time: 06:00 PM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I Only

GPL - Maryland Laboratory

Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-004-032-1/1 **Client ID:** TMSB9B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65820

Weight: 0.73 **Volume:** 100 **Percent Moisture:** 12.17

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.031	0.016	U	1	CVAA	4/10/04	15:33

Comments: Sample Date: 04/05/04 Sample Time: 06:00 PM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	TMSB9B	Lab Sample ID:	404054-004-032-1/1
Sample Date/Time:	04/05/2004 18:00	Percent Moisture:	12.17
Receipt Date/Time:	04/07/0004 00:00	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/16/04 16:00

Form I Copy

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Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-005-037-1/1 **Client ID:** 51SB2A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/10/04 **Prep Batch:** 65833

Weight: 1.19 **Volume:** 100 **Percent Moisture:** 15.93

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.7**	**20.0**	**24600**		1	**ICPST**	**4/13/04**	**5:49**
Antimony	**206.84**	**0.50**	**2.0**	**0.68**	**BN**	B 1	**ICPST**	**4/13/04**	**5:49**
Arsenic	**189.04**	**0.20**	**2.0**	**4.6**		1	**ICPST**	**4/13/04**	**5:49**
Barium	**493.41**	**0.032**	**0.50**	**85.3**		1	**ICPST**	**4/13/04**	**5:49**
Beryllium	**313.04**	**0.0057**	**0.20**	**0.67**		1	**ICPST**	**4/13/04**	**5:49**
Cadmium	**226.50**	**0.044**	**0.60**	**0.070**	**B**	B 1	**ICPST**	**4/13/04**	**5:49**
Calcium	**317.93**	**7.6**	**100**	**295**		B 1	**ICPST**	**4/13/04**	**5:49**
Chromium	**267.72**	**0.12**	**0.50**	**29.0**	*	1	**ICPST**	**4/13/04**	**5:49**
Cobalt	**228.62**	**0.080**	**0.50**	**9.1**		1	**ICPST**	**4/13/04**	**5:49**
Copper	**324.75**	**0.095**	**1.0**	**12.4**		1	**ICPST**	**4/13/04**	**5:49**
Iron	**271.44**	**3.9**	**15.0**	**28500**		1	**ICPST**	**4/13/04**	**5:49**
Lead	**220.35**	**0.21**	**1.0**	**17.3**		1	**ICPST**	**4/13/04**	**5:49**
Magnesium	**279.08**	**2.5**	**25.0**	**1020**	**N**	1	**ICPST**	**4/13/04**	**5:49**
Manganese	**257.61**	**0.025**	**0.50**	**663**		1	**ICPST**	**4/13/04**	**5:49**
Nickel	**231.60**	**0.14**	**1.0**	**10.6**		1	**ICPST**	**4/13/04**	**5:49**
Potassium	**766.49**	**4.2**	**25.0**	**1060**	**N**	1	**ICPST**	**4/13/04**	**5:49**
Selenium	196.03	0.17	2.0	0.17	U	1	ICPST	4/13/04	5:49
Silver	328.07	0.13	0.30	0.13	U	1	ICPST	4/13/04	5:49
Sodium	**330.23**	**33.7**	**250**	**74.8**	**B**	B 1	**ICPST**	**4/13/04**	**5:49**
Thallium	**190.86**	**0.58**	**3.0**	**0.78**	**B**	B 1	**ICPST**	**4/13/04**	**5:49**
Vanadium	**292.40**	**0.14**	**1.0**	**59.2**		1	**ICPST**	**4/13/04**	**5:49**
Zinc	**213.86**	**0.54**	**2.0**	**34.4**		1	**ICPST**	**4/13/04**	**5:49**

Comments: Sample Date: 04/06/04 Sample Time: 07:30 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form I copy

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Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-005-037-1/1 **Client ID:** 51SB2A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65820

Weight: 0.77 **Volume:** 100 **Percent Moisture:** 15.93

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.031	0.097		1	CVAA	4/10/04	15:36

Comments: Sample Date: 04/06/04 Sample Time: 07:30 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

Form 1 copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB2A	Lab Sample ID:	404054-005-037-1/1
Sample Date/Time:	04/06/2004 07:30	Percent Moisture:	15.93
Receipt Date/Time:	04/07/0004 00:00	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.18	1	mg/kg	04/16/04 16:00

Form 1 copy

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Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-006-038-1/1 **Client ID:** 51SB2B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/10/04 **Prep Batch:** 65833

Weight: 1.26 **Volume:** 100 **Percent Moisture:** 67.61

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	8.3	98.0	29700		2	ICPST	4/19/04	16:12
Antimony	206.84	2.5	9.8	6.0	BN	B 2	ICPST	4/19/04	16:12
Arsenic	189.04	0.49	4.9	15.0		1	ICPST	4/13/04	5:57
Barium	493.41	0.16	2.5	167		2	ICPST	4/19/04	16:12
Beryllium	313.04	0.014	0.49	1.2		1	ICPST	4/13/04	5:57
Cadmium	226.50	0.22	2.9	6.4		2	ICPST	4/19/04	16:12
Calcium	317.93	18.6	245	27900		1	ICPST	4/13/04	5:57
Chromium	267.72	0.59	2.5	491	*	2	ICPST	4/19/04	16:12
Cobalt	228.62	0.20	1.2	5.9		1	ICPST	4/13/04	5:57
Copper	324.75	0.23	2.5	74.7		1	ICPST	4/13/04	5:57
Iron	271.44	19.3	73.5	191000		2	ICPST	4/19/04	16:12
Lead	220.35	1.0	4.9	3820		2	ICPST	4/19/04	16:12
Magnesium	279.08	12.4	123	3090	N	2	ICPST	4/19/04	16:12
Manganese	257.61	0.12	2.5	427		2	ICPST	4/19/04	16:12
Nickel	231.60	0.34	2.5	129		1	ICPST	4/13/04	5:57
Potassium	766.49	10.2	61.3	1130	N	1	ICPST	4/13/04	5:57
Selenium	196.03	0.83	9.8	1.9	B	B 2	ICPST	4/19/04	16:12
Silver	328.07	0.32	0.74	0.50	B	J 1	ICPST	4/13/04	5:57
Sodium	330.23	165	1230	2710		2	ICPST	4/19/04	16:12
Thallium	190.86	2.8	14.7	11.7	B	B 2	ICPST	4/19/04	16:12
Vanadium	292.40	0.69	4.9	59.7		2	ICPST	4/19/04	16:12
Zinc	213.86	2.6	9.8	548		2	ICPST	4/19/04	16:12

Comments: Sample Date: 04/06/04 Sample Time: 08:00 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

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Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-006-038-1/1 **Client ID:** 51SB2B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65820

Weight: 0.71 **Volume:** 100 **Percent Moisture:** 67.61

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.043	0.087	1.0		1	CVAA	4/10/04	15:39

Comments: Sample Date: 04/06/04 Sample Time: 08:00 AM

5.05.0

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

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Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB2B	Lab Sample ID:	404054-006-038-1/ 1
Sample Date/ Time:	04/ 06/ 2004 08:00	Percent Moisture:	67.61
Receipt Date/ Time:	04/ 07/ 0004 00:00	Preparation Method:	NA
Prepared Date/ Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/ Time
1)	**Cyanide, Total**	**10**		**0.46**	**1**	**mg/ kg**	**04/ 16/ 04 16:00**

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Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-007-039-1/1 **Client ID:** 51SB2C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/10/04 **Prep Batch:** 65833

Weight: 1.21 **Volume:** 100 **Percent Moisture:** 11.42

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	308.22	1.6	18.7	15700		1	ICPST	4/13/04	6:05
Antimony	206.84	0.47	1.9	0.47	BN	B 1	ICPST	4/13/04	6:05
Arsenic	189.04	0.19	1.9	1.2	B	B 1	ICPST	4/13/04	6:05
Barium	493.41	0.030	0.47	43.7		1	ICPST	4/13/04	6:05
Beryllium	313.04	0.0053	0.19	0.53		1	ICPST	4/13/04	6:05
Cadmium	226.50	0.041	0.56	0.13	B	B 1	ICPST	4/13/04	6:05
Calcium	317.93	7.1	93.3	108		B 1	ICPST	4/13/04	6:05
Chromium	267.72	0.11	0.47	20.9	*	1	ICPST	4/13/04	6:05
Cobalt	228.62	0.075	0.47	7.3		1	ICPST	4/13/04	6:05
Copper	324.75	0.089	0.93	5.9		1	ICPST	4/13/04	6:05
Iron	271.44	3.7	14.0	19900		1	ICPST	4/13/04	6:05
Lead	220.35	0.20	0.93	13.5		1	ICPST	4/13/04	6:05
Magnesium	279.08	2.4	23.3	943	N	1	ICPST	4/13/04	6:05
Manganese	257.61	0.023	0.47	328		1	ICPST	4/13/04	6:05
Nickel	231.60	0.13	0.93	6.8		1	ICPST	4/13/04	6:05
Potassium	766.49	3.9	23.3	799	N	1	ICPST	4/13/04	6:05
Selenium	196.03	0.16	1.9	0.17	B	B 1	ICPST	4/13/04	6:05
Silver	328.07	0.12	0.28	0.12	U	1	ICPST	4/13/04	6:05
Sodium	330.23	31.4	233	326		B 1	ICPST	4/13/04	6:05
Thallium	190.86	0.54	2.8	0.54	U	1	ICPST	4/13/04	6:05
Vanadium	292.40	0.13	0.93	38.8		1	ICPST	4/13/04	6:05
Zinc	213.86	0.50	1.9	24.7		1	ICPST	4/13/04	6:05

Comments: Sample Date: 04/06/04 Sample Time: 08:25 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

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Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-007-039-1/1 **Client ID:** 51SB2C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65820

Weight: 0.77 **Volume:** 100 **Percent Moisture:** 11.42

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.029	0.015	U	1	CVAA	4/10/04	15:42

Comments: Sample Date: 04/06/04 Sample Time: 08:25 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

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Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB2C	Lab Sample ID:	404054-007-039-1/1
Sample Date/Time:	04/06/2004 08:25	Percent Moisture:	11.42
Receipt Date/Time:	04/07/0004 00:00	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time	
1)	**Cyanide, Total**	**1.1**		**0.15**	**1**	**mg/kg**	**04/16/04**	**16:00**

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Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-008-040-1/1 **Client ID:** 51SB2D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/10/04 **Prep Batch:** 65833

Weight: 1.22 **Volume:** 100 **Percent Moisture:** 16.58

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.7**	**19.7**	**22800**		1	**ICPST**	**4/13/04**	**6:13**
Antimony	**206.84**	**0.49**	**2.0**	**0.82**	**BN**	B 1	**ICPST**	**4/13/04**	**6:13**
Arsenic	**189.04**	**0.20**	**2.0**	**1.4**	**B**	B 1	**ICPST**	**4/13/04**	**6:13**
Barium	**493.41**	**0.031**	**0.49**	**76.5**		1	**ICPST**	**4/13/04**	**6:13**
Beryllium	**313.04**	**0.0056**	**0.20**	**1.3**		1	**ICPST**	**4/13/04**	**6:13**
Cadmium	**226.50**	**0.043**	**0.59**	**0.19**	**B**	J 1	**ICPST**	**4/13/04**	**6:13**
Calcium	**317.93**	**7.4**	**98.3**	**575**		1	**ICPST**	**4/13/04**	**6:13**
Chromium	**267.72**	**0.12**	**0.49**	**35.4**	*	1	**ICPST**	**4/13/04**	**6:13**
Cobalt	**228.62**	**0.079**	**0.49**	**5.2**		1	**ICPST**	**4/13/04**	**6:13**
Copper	**324.75**	**0.093**	**0.98**	**1.2**		B 1	**ICPST**	**4/13/04**	**6:13**
Iron	**271.44**	**3.9**	**14.7**	**34500**		1	**ICPST**	**4/13/04**	**6:13**
Lead	**220.35**	**0.21**	**0.98**	**0.75**	**B**	J 1	**ICPST**	**4/13/04**	**6:13**
Magnesium	**279.08**	**2.5**	**24.6**	**17300**	**N**	1	**ICPST**	**4/13/04**	**6:13**
Manganese	**257.61**	**0.025**	**0.49**	**458**		1	**ICPST**	**4/13/04**	**6:13**
Nickel	**231.60**	**0.14**	**0.98**	**42.3**		1	**ICPST**	**4/13/04**	**6:13**
Potassium	**766.49**	**4.1**	**24.6**	**3000**	**N**	1	**ICPST**	**4/13/04**	**6:13**
Selenium	196.03	0.17	2.0	0.17	U	1	ICPST	4/13/04	6:13
Silver	328.07	0.13	0.29	0.13	U	1	ICPST	4/13/04	6:13
Sodium	**330.23**	**33.1**	**246**	**686**		1	**ICPST**	**4/13/04**	**6:13**
Thallium	**190.86**	**0.57**	**2.9**	**0.60**	**B**	B 1	**ICPST**	**4/13/04**	**6:13**
Vanadium	**292.40**	**0.14**	**0.98**	**18.8**		1	**ICPST**	**4/13/04**	**6:13**
Zinc	**213.86**	**0.53**	**2.0**	**17.6**		1	**ICPST**	**4/13/04**	**6:13**

Comments: Sample Date: 04/06/04 Sample Time: 08:50 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

E Serial dilution percent difference not within limits

U Result is less than the IDL

Form 1 Equivalent

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Metals Data Reporting Form

Sample Results **SDG:** 404054

Lab Sample ID: S 404054-008-040-1/1 **Client ID:** 51SB2D

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/09/04 **Prep Batch:** 65820

Weight: 0.72 **Volume:** 100 **Percent Moisture:** 16.58

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.017	0.033	0.017	U	1	CVAA	4/10/04	15:45

Comments: Sample Date: 04/06/04 Sample Time: 08:50 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form I Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB2D	Lab Sample ID:	404054-008-040-1/1
Sample Date/Time:	04/06/2004 08:50	Percent Moisture:	16.58
Receipt Date/Time:	04/07/0004 00:00	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time	
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/16/04	16:00

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation - Volatiles
GPL Laboratories, Inc., SDG 404054

DATE: June 24, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 05, 2004 and April 06, 2004. The samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs) using USEPA SW846 Method 5035/8260B. A total of eight soil samples including diluted samples were validated. The sample IDs are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB9A	404054-001	51SB2A	404054-005
51SB9B	404054-002	51SB2B	404054-006
51SB9C	404054-003	51SB2C	404054-007
TMSB9B	404054-004	51SB2D	404054-008

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated under data validation procedure Level M3 are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Results
X		Initial Calibration
X		Continuing Calibration
X		Blank Analysis
	X	Laboratory Control Sample
X		Matrix Spike/ Spike Duplicate Sample
X		System Monitoring Compounds
	X	Internal Standards
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with the noted qualifications, except for the following. Compound 2-butanone was rejected "R" for samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008) based upon low calibration response recoveries.

Eric Malarek, Chemist

6/24/04

Date

RFAAP VALIDATION REPORT
VOLATILES REVIEW
SDG 404054

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of analysis. Holding time criteria: For Encore soil samples cooled @ 4°C ± 2°C; the maximum holding time is 2 days for preparation, 14 days from sample collection to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/05/04 and 04/06/04, coolers were received by the laboratory at 3.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/05/04 and 04/06/04, prepped on 04/07/04, and analyzed for TCL VOCs on 04/17/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, bromofluorobenzene (BFB), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be ≥ 0.05 for all other compounds. Percent relative standard deviation (%RSD) must be ≤ 15% for each target compound and must be ≤ 30% for each calibration check compound. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For initial calibration for VOCs performed on 04/16/04 on instrument HP#F, target compounds bromomethane (32.0%; grossly exceeding), chloroethane (26.2%), acetone (26.7%), 2-butanone (18.2%, RRF=0.019), and 2-hexanone (46.7%; grossly exceeding) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compounds chloroethane, and acetone were qualified "J" for detects and no qualifier for non-detects based upon the high %RSD. Compound 2-hexanone and bromomethane were qualified "J" for detects and "UJ" for non-detects based upon the grossly exceeding %RSD. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Continuing calibration establishes the 12-hour relative response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be ≥ 0.05 for all other compounds. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within 20% for all target compounds. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for VOCs performed on 04/16/04 @15:58 on instrument HP#F, target compounds 2-butanone (RRF=0.017) and 2-hexanone (21.8%) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compound 2-hexanone was qualified "J" for detects and no qualifier for non-detects based upon this outlier. No samples apply to this continuing calibration.

- For continuing calibration for VOCs performed on 04/17/04 @10:52 on instrument HP#F, target compounds bromomethane (31.1%), chloroethane (22.0%), 2-butanone (RRF=0.017), and 2-hexanone (30.5%) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compounds 2-hexanone, bromomethane, and chloroethane were qualified "J" for detects and no qualifier for non-detects based upon this outlier. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008) apply to this continuing calibration.

V-Blank Analysis
The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of BFB. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants methylene chloride, acetone, and 2-butanone). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants methylene chloride, acetone, and 2-butanone, or 5 times (5X) the maximum amount for other volatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 1). Rinse blank 040704R and associated trip blank 040704T apply to these samples and were analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/17/04	BLK66018	acetone	6.1J	61	51SB9A, 51SB9B, 51SB9C, TMSB9B, 51SB2B, 51SB2C, 51SB2D
04/17/04	BLK66018	methylene chloride	3.0J	30	51SB9A, 51SB9B, 51SB9C, TMSB9B, 51SB2A, 51SB2B, 51SB2C, 51SB2D
04/14/04	040704R	2-butanone	2.1J	21	None
04/14/04	040704R	acetone	18	180	51SB9A, 51SB9B, 51SB9C, TMSB9B, 51SB2A, 51SB2B, 51SB2C, 51SB2D
04/14/04	040704R	benzene	0.95J	4.8	51SB2B
04/14/04	040704R	ethylbenzene	0.45J	2.3	None
04/14/04	040704R	m,p-xylenes	1.8	9.0	51SB2C
04/14/04	040704R	o-xylene	0.76J	3.8	51SB2C
04/14/04	040704R	toluene	3.7	18.5	None
04/14/04	040704T	2-butanone	1.9J	4.2	None
04/14/04	040704T	acetone	4.2J	42	51SB9A, 51SB9B, 51SB9C, TMSB9B, 51SB2B, 51SB2C, 51SB2D
04/14/04	040704T	methylene chloride	0.90J	9.0	51SB9A, 51SB9B, 51SB9C, TMSB9B, 51SB2A, 51SB2B, 51SB2C, 51SB2D

J = Estimated value <MRL and >MDL

VI-Laboratory Control Sample (LCS) and LCSD

Data for laboratory control samples (LCS) and LCSD are evaluated to determine long-term accuracy and precision of the analytical method on various matrices. Percent recoveries (%Rs) should be within the specified control limits. USACE Shell limits are 75-125%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- Sample BKS66018 was used as the LCS for the TCL VOC analysis. Compounds acetone (74%) and bromomethane (124%) were outside USACE or lab criteria and within the SMF criteria. There were a total of 35 spike recoveries with 2 sporadic marginal failures. Bromomethane was non-detect for all associated samples. No qualifiers were applied based upon these outliers. Samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), 51SB2B (404054-006), 51SB2C (404054-007), and 51SB2D (404054-008) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 70-130%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- Sample 51SB1B (404068-004) was used for the MS/MSD analysis for VOCs. This sample was analyzed in SDG 404068. Compounds 1,1,1-trichloroethane (RPD=21%), 2-hexanone (67%), acetone (52%, 52%), benzene (73%), bromodichloromethane (RPD=21%), chlorobenzene (71%), chloroethane (RPD=27%), chloromethane (67%), ethylbenzene (68%), styrene (67%), tetrachloroethylene (63%), toluene (71%), trichloroethene (70%), and m.p-xylenes (66%) were outside either lab or USACE criteria limits. Compounds 2-hexanone, acetone, benzene, chlorobenzene, chloromethane, ethylbenzene, styrene, tetrachloroethylene, toluene, trichloroethene, and m.p-xylenes were qualified bias low "L" for detects and "UL" for non-detects for the spiked sample based upon these outliers. Compounds 1,1,1-trichloroethane, bromodichloromethane, and chloroethane were non-detect for the spiked sample, therefore no qualifiers were applied based upon these outliers.

VIII-System Monitoring Compounds (Surrogates)
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Recoveries for system monitoring compounds in volatile samples and blanks must be within the specified control limits.

Criteria: 1,2-Dichlorobenzene-d4 (74-122%) – SMC1 (USACE Shell Criteria: 70-130%)
1,2-Dichloroethane-d4 (64-120%) – SMC2 (USACE Shell Criteria: 70-130%)
4-Bromofluorobenzene (76-116%) – SMC3 (USACE Shell Criteria: 70-130%)
Toluene-d8 (76-120%) – SMC4 (USACE Shell Criteria: 70-130%)

- For samples 51SB9A (404054-001), 51SB9B (404054-002), 51SB9C (404054-003), TMSB9B (404054-004), 51SB2A (404054-005), and 51SB2D (404054-008), all surrogates were within criteria. No qualifiers were applied.

- For sample 51SB2B (404054-006), surrogate 1,2-dichlorobenzene-d4 (127%) was above laboratory criteria limits. All detects were qualified estimated "J" and non-detects "UJ" based upon this outlier for this sample.

- For sample 51SB2C (404054-007), surrogate 1,2-dichlorobenzene-d4 (124%) was above laboratory criteria limits. All detects were qualified estimated "J" and non-detects "UJ" based upon this outlier for this sample.

IX-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: area counts (-50% to +100%) of the associated calibration standard, and retention time (± 30 seconds) from that of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB9B (404054-002) and TMSB9B (404054-004) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB9B	404054-002	Acetone	5.3 JB	5.0 JB	NA	None
51SB9B	404054-002	Methylene Chloride	4.3 JB	4.1 JB	NA	None

J = Estimated value <MRL and >MDL.
B = Compound detected in method blank.
NA = Not Applicable. Acetone and methylene chloride were detected in blanks.

XI-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB9A (404054-001), Acetone

Conc. (µg/kg) = {(Ax)*(Is)*(DF)*(Vp)} / {(Ais)*(RRF)*(Ws)*Fs)}

where: Ax is the compound area
Is is the corresponding internal standard concentration (ng/mL)
DF is the dilution factor
Vp is the volume purged (mL)
Ais is the corresponding internal standard area
RRF is the relative response factor
Ws is the weight of the sample (g)
Fs is the fraction solids for the sample = 1.0 for Wet Weight

Conc. µg/kg = (11378 * 50 ng/mL * 1 * 5 mL) / (607588 * 0.069 * 5.88g * 0.8426) = 14 µg/kg
Reported Conc. = 14 µg/kg
%D = 0.0
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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SAMPLE NO
51SB9A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-001-001-1/3
Sample Volume :	5.88	Lab File ID :	F39844.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	15.74	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.0	U	
79-00-5	1,1,2-Trichloroethane	5.0	U	
75-34-3	1,1-Dichloroethane	5.0	U	
75-35-4	1,1-Dichloroethene	5.0	U	
107-06-2	1,2-Dichloroethane	5.0	U	
78-87-5	1,2-Dichloropropane	5.0	U	
78-93-3	2-Butanone	10	U	R
591-78-6	2-Hexanone	10	U	UJ
108-10-1	4-Methyl-2-Pentanone	10	U	
67-64-1	Acetone	14	B	B
71-43-2	Benzene	5.0	U	
75-27-4	Bromodichloromethane	5.0	U	
75-25-2	Bromoform	5.0	U	
74-83-9	Bromomethane	10	U	UJ
75-15-0	Carbon Disulfide	5.0	U	
56-23-5	Carbon Tetrachloride	5.0	U	
108-90-7	Chlorobenzene	5.0	U	
75-00-3	Chloroethane	10	U	
67-66-3	Chloroform	5.0	U	
74-87-3	Chloromethane	10	U	
124-48-1	Dibromochloromethane	5.0	U	
100-41-4	Ethylbenzene	5.0	U	
75-09-2	Methylene Chloride	3.4	JB	B
100-42-5	Styrene	5.0	U	
127-18-4	Tetrachloroethylene	5.0	U	
108-88-3	Toluene	5.0	U	
79-01-6	Trichloroethene	5.0	U	
75-01-4	Vinyl Chloride	10	U	

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SAMPLE NO
51SB9A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-001-001-1/3
Sample Volume :	5.88	Lab File ID :	F39844.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	15.74	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.0	U
10061-01-5	cis-1,3-Dichloropropene	5.0	U
136777-61-2	m,p-Xylenes	5.0	U
95-47-6	o-Xylene	5.0	U
156-60-5	trans-1,2-dichloroethene	5.0	U
10061-02-6	trans-1,3-dichloropropene	5.0	U

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SAMPLE NO
51SB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-002-004-1/3
Sample Volume :	5.37	Lab File ID :	F39845.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	12.17	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.3	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.3	U	
79-00-5	1,1,2-Trichloroethane	5.3	U	
75-34-3	1,1-Dichloroethane	5.3	U	
75-35-4	1,1-Dichloroethene	5.3	U	
107-06-2	1,2-Dichloroethane	5.3	U	
78-87-5	1,2-Dichloropropane	5.3	U	
78-93-3	2-Butanone	11	U	R
591-78-6	2-Hexanone	11	U	UJ
108-10-1	4-Methyl-2-Pentanone	11	U	
67-64-1	Acetone	5.3	JB	B
71-43-2	Benzene	5.3	U	
75-27-4	Bromodichloromethane	5.3	U	
75-25-2	Bromoform	5.3	U	
74-83-9	Bromomethane	11	U	UJ
75-15-0	Carbon Disulfide	5.3	U	
56-23-5	Carbon Tetrachloride	5.3	U	
108-90-7	Chlorobenzene	5.3	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.3	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.3	U	
100-41-4	Ethylbenzene	5.3	U	
75-09-2	Methylene Chloride	4.3	JB	B
100-42-5	Styrene	5.3	U	
127-18-4	Tetrachloroethylene	5.3	U	
108-88-3	Toluene	5.3	U	
79-01-6	Trichloroethene	5.3	U	
75-01-4	Vinyl Chloride	11	U	

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SAMPLE NO
51SB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-002-004-1/3
Sample Volume :	5.37	Lab File ID :	F39845.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	12.17	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.3	U
10061-01-5	cis-1,3-Dichloropropene	5.3	U
136777-61-2	m,p-Xylenes	5.3	U
95-47-6	o-Xylene	5.3	U
156-60-5	trans-1,2-dichloroethene	5.3	U
10061-02-6	trans-1,3-dichloropropene	5.3	U

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SAMPLE NO
51SB9C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-003-007-1/3
Sample Volume :	5.31	Lab File ID :	F39846.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	15.95	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.6	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.6	U	
79-00-5	1,1,2-Trichloroethane	5.6	U	
75-34-3	1,1-Dichloroethane	5.6	U	
75-35-4	1,1-Dichloroethene	5.6	U	
107-06-2	1,2-Dichloroethane	5.6	U	
78-87-5	1,2-Dichloropropane	5.6	U	
78-93-3	2-Butanone	11	U	R
591-78-6	2-Hexanone	11	U	UJ
108-10-1	4-Methyl-2-Pentanone	11	U	
67-64-1	Acetone	6.5	JB	B
71-43-2	Benzene	5.6	U	
75-27-4	Bromodichloromethane	5.6	U	
75-25-2	Bromoform	5.6	U	
74-83-9	Bromomethane	11	U	UJ
75-15-0	Carbon Disulfide	5.6	U	
56-23-5	Carbon Tetrachloride	5.6	U	
108-90-7	Chlorobenzene	5.6	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.6	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.6	U	
100-41-4	Ethylbenzene	5.6	U	
75-09-2	Methylene Chloride	4.2	JB	B
100-42-5	Styrene	5.6	U	
127-18-4	Tetrachloroethylene	5.6	U	
108-88-3	Toluene	5.6	U	
79-01-6	Trichloroethene	5.6	U	
75-01-4	Vinyl Chloride	11	U	

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SAMPLE NO
51SB9C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-003-007-1/3
Sample Volume :	5.31	Lab File ID :	F39846.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	15.95	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.6	U
10061-01-5	cis-1,3-Dichloropropene	5.6	U
136777-61-2	m,p-Xylenes	5.6	U
95-47-6	o-Xylene	5.6	U
156-60-5	trans-1,2-dichloroethene	5.6	U
10061-02-6	trans-1,3-dichloropropene	5.6	U

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SAMPLE NO
TMSB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No: :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-004-010-1/3
Sample Volume :	5.86	Lab File ID :	F39847.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	12.17	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.9	U	
79-34-5	1,1,2,2-Tetrachloroethane	4.9	U	
79-00-5	1,1,2-Trichloroethane	4.9	U	
75-34-3	1,1-Dichloroethane	4.9	U	
75-35-4	1,1-Dichloroethene	4.9	U	
107-06-2	1,2-Dichloroethane	4.9	U	
78-87-5	1,2-Dichloropropane	4.9	U	
78-93-3	2-Butanone	9.7	U	R
591-78-6	2-Hexanone	9.7	U	UJ
108-10-1	4-Methyl-2-Pentanone	9.7	U	
67-64-1	Acetone	5.0	JB	B
71-43-2	Benzene	4.9	U	
75-27-4	Bromodichloromethane	4.9	U	
75-25-2	Bromoform	4.9	U	
74-83-9	Bromomethane	9.7	U	UJ
75-15-0	Carbon Disulfide	4.9	U	
56-23-5	Carbon Tetrachloride	4.9	U	
108-90-7	Chlorobenzene	4.9	U	
75-00-3	Chloroethane	9.7	U	
67-66-3	Chloroform	4.9	U	
74-87-3	Chloromethane	9.7	U	
124-48-1	Dibromochloromethane	4.9	U	
100-41-4	Ethylbenzene	4.9	U	
75-09-2	Methylene Chloride	4.1	JB	B
100-42-5	Styrene	4.9	U	
127-18-4	Tetrachloroethylene	4.9	U	
108-88-3	Toluene	4.9	U	
79-01-6	Trichloroethene	4.9	U	
75-01-4	Vinyl Chloride	9.7	U	

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SAMPLE NO
TMSB9B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-004-010-1/3
Sample Volume :	5.86	Lab File ID :	F39847.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	12.17	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID: 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	4.9	U
10061-01-5	cis-1,3-Dichloropropene	4.9	U
136777-61-2	m,p-Xylenes	4.9	U
95-47-6	o-Xylene	4.9	U
156-60-5	trans-1,2-dichloroethene	4.9	U
10061-02-6	trans-1,3-dichloropropene	4.9	U

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SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-013-1/3
Sample Volume :	6.06	Lab File ID :	F39848.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	15.93	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.9	U	
79-34-5	1,1,2,2-Tetrachloroethane	4.9	U	
79-00-5	1,1,2-Trichloroethane	4.9	U	
75-34-3	1,1-Dichloroethane	4.9	U	
75-35-4	1,1-Dichloroethene	4.9	U	
107-06-2	1,2-Dichloroethane	4.9	U	
78-87-5	1,2-Dichloropropane	4.9	U	
78-93-3	2-Butanone	9.8	U	R
591-78-6	2-Hexanone	9.8	U	UJ
108-10-1	4-Methyl-2-Pentanone	9.8	U	
67-64-1	Acetone	110	B	B
71-43-2	Benzene	4.9	U	
75-27-4	Bromodichloromethane	4.9	U	
75-25-2	Bromoform	4.9	U	
74-83-9	Bromomethane	9.8	U	UJ
75-15-0	Carbon Disulfide	4.9	U	
56-23-5	Carbon Tetrachloride	4.9	U	
108-90-7	Chlorobenzene	4.9	U	
75-00-3	Chloroethane	9.8	U	
67-66-3	Chloroform	4.9	U	
74-87-3	Chloromethane	9.8	U	
124-48-1	Dibromochloromethane	4.9	U	
100-41-4	Ethylbenzene	4.9	U	
75-09-2	Methylene Chloride	3.2	JB	B
100-42-5	Styrene	4.9	U	
127-18-4	Tetrachloroethylene	4.9	U	
108-88-3	Toluene	4.9	U	
79-01-6	Trichloroethene	4.9	U	
75-01-4	Vinyl Chloride	9.8	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB2A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-005-013-1/3
Sample Volume :	6.06	Lab File ID :	F39848.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	15.93	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	4.9	U
10061-01-5	cis-1,3-Dichloropropene	4.9	U
136777-61-2	m,p-Xylenes	4.9	U
95-47-6	o-Xylene	4.9	U
156-60-5	trans-1,2-dichloroethene	4.9	U
10061-02-6	trans-1,3-dichloropropene	4.9	U

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SAMPLE NO
51SB2B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-016-1/3
Sample Volume :	3.58	Lab File ID :	F39849.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	67.61	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	22	U	UJ
79-34-5	1,1,2,2-Tetrachloroethane	22	U	UJ
79-00-5	1,1,2-Trichloroethane	22	U	UJ
75-34-3	1,1-Dichloroethane	22	U	UJ
75-35-4	1,1-Dichloroethene	22	U	UJ
107-06-2	1,2-Dichloroethane	22	U	UJ
78-87-5	1,2-Dichloropropane	22	U	UJ
78-93-3	2-Butanone	43	U	R
591-78-6	2-Hexanone	43	U	UJ
108-10-1	4-Methyl-2-Pentanone	43	U	UJ
67-64-1	Acetone	62	B	B
71-43-2	Benzene	6.6	J	B
75-27-4	Bromodichloromethane	22	U	UJ
75-25-2	Bromoform	22	U	UJ
74-83-9	Bromomethane	43	U	UJ
75-15-0	Carbon Disulfide	22	U	UJ
56-23-5	Carbon Tetrachloride	22	U	UJ
108-90-7	Chlorobenzene	22	U	UJ
75-00-3	Chloroethane	43	U	UJ
67-66-3	Chloroform	22	U	UJ
74-87-3	Chloromethane	43	U	UJ
124-48-1	Dibromochloromethane	22	U	UJ
100-41-4	Ethylbenzene	22	U	UJ
75-09-2	Methylene Chloride	14	JB	B
100-42-5	Styrene	22	U	UJ
127-18-4	Tetrachloroethylene	22	U	UJ
108-88-3	Toluene	210		J
79-01-6	Trichloroethene	5.5	J	J
75-01-4	Vinyl Chloride	43	U	UJ

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SAMPLE NO
51SB2B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-006-016-1/3
Sample Volume :	3.58	Lab File ID :	F39849.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	67.61	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
156-59-2	cis-1,2-Dichloroethene	22	U	UJ
10061-01-5	cis-1,3-Dichloropropene	22	U	UJ
136777-61-2	m,p-Xylenes	22	U	UJ
95-47-6	o-Xylene	22	U	UJ
156-60-5	trans-1,2-dichloroethene	22	U	UJ
10061-02-6	trans-1,3-dichloropropene	22	U	UJ

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SAMPLE NO
51SB2C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-019-1/3
Sample Volume :	3.86	Lab File ID :	F39850.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	11.42	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	7.3	U	UJ
79-34-5	1,1,2,2-Tetrachloroethane	7.3	U	UJ
79-00-5	1,1,2-Trichloroethane	7.3	U	UJ
75-34-3	1,1-Dichloroethane	7.3	U	UJ
75-35-4	1,1-Dichloroethene	7.3	U	UJ
107-06-2	1,2-Dichloroethane	7.3	U	UJ
78-87-5	1,2-Dichloropropane	7.3	U	UJ
78-93-3	2-Butanone	15	U	R
591-78-6	2-Hexanone	6.2	J	J
108-10-1	4-Methyl-2-Pentanone	15		J
67-64-1	Acetone	23	B	B
71-43-2	Benzene	7.3	U	UJ
75-27-4	Bromodichloromethane	7.3	U	UJ
75-25-2	Bromoform	7.3	U	UJ
74-83-9	Bromomethane	15	U	UJ
75-15-0	Carbon Disulfide	7.3	U	UJ
56-23-5	Carbon Tetrachloride	7.3	U	UJ
108-90-7	Chlorobenzene	7.3	U	UJ
75-00-3	Chloroethane	15	U	UJ
67-66-3	Chloroform	7.3	U	UJ
74-87-3	Chloromethane	15	U	UJ
124-48-1	Dibromochloromethane	7.3	U	UJ
100-41-4	Ethylbenzene	7.3	U	UJ
75-09-2	Methylene Chloride	4.9	JB	B
100-42-5	Styrene	7.3	U	UJ
127-18-4	Tetrachloroethylene	7.3	U	UJ
108-88-3	Toluene	28		J
79-01-6	Trichloroethene	1.7	J	J
75-01-4	Vinyl Chloride	15	U	UJ

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FORM 1
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SAMPLE NO
51SB2C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-007-019-1/3
Sample Volume :	3.86	Lab File ID :	F39850.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	11.42	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
156-59-2	cis-1,2-Dichloroethene	7.3	U	UJ
10061-01-5	cis-1,3-Dichloropropene	7.3	U	UJ
136777-61-2	m,p-Xylenes	5.5	J	B
95-47-6	o-Xylene	2.7	J	B
156-60-5	trans-1,2-dichloroethene	7.3	U	UJ
10061-02-6	trans-1,3-dichloropropene	7.3	U	UJ

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB2D

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-008-022-1/3
Sample Volume :	5.53	Lab File ID :	F39851.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	16.58	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.4	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.4	U	
79-00-5	1,1,2-Trichloroethane	5.4	U	
75-34-3	1,1-Dichloroethane	5.4	U	
75-35-4	1,1-Dichloroethene	5.4	U	
107-06-2	1,2-Dichloroethane	5.4	U	
78-87-5	1,2-Dichloropropane	5.4	U	
78-93-3	2-Butanone	11	U	R
591-78-6	2-Hexanone	11	U	UJ
108-10-1	4-Methyl-2-Pentanone	11	U	
67-64-1	Acetone	15	B	B
71-43-2	Benzene	5.4	U	
75-27-4	Bromodichloromethane	5.4	U	
75-25-2	Bromoform	5.4	U	
74-83-9	Bromomethane	11	U	UJ
75-15-0	Carbon Disulfide	5.4	U	
56-23-5	Carbon Tetrachloride	5.4	U	
108-90-7	Chlorobenzene	5.4	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.4	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.4	U	
100-41-4	Ethylbenzene	5.4	U	
75-09-2	Methylene Chloride	4.1	JB	B
100-42-5	Styrene	5.4	U	
127-18-4	Tetrachloroethylene	5.4	U	
108-88-3	Toluene	5.4	U	
79-01-6	Trichloroethene	5.4	U	
75-01-4	Vinyl Chloride	11	U	

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Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404054
Case No. :		SDG NO :	404054
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404054-008-022-1/3
Sample Volume :	5.53	Lab File ID :	F39851.D
Level :	Low	Date Received	04/07/0004
% Moisture: not dec	16.58	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.4	U
10061-01-5	cis-1,3-Dichloropropene	5.4	U
136777-61-2	m,p-Xylenes	5.4	U
95-47-6	o-Xylene	5.4	U
156-60-5	trans-1,2-dichloroethene	5.4	U
10061-02-6	trans-1,3-dichloropropene	5.4	U

Shaw Environmental, Inc.

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Edgewood, MD 21040-1037
410.612.6350
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant Data Validation – Dioxin Furans
Pace Laboratories, Inc. SDG 04-1087238 (GPL SDG 404068)

DATE: July 29, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 07, 2004. The sample was analyzed for Dioxin Furan compounds using USEPA SW-846 Method 8290 High Resolution Gas Chromatography/High Resolution Mass Spectroscopy (HRGC/HRMS). A total of one soil sample was validated in this SDG. The sample Id is:

Field Sample ID	Lab Sample ID
TMSB1A	404068-003

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *USEPA Region III Dioxin/Furan Data Validation Guidance* (March, 1999). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
	X	Internal Standards
	X	Cleanup Standards
	X	Laboratory Control Standard/Ongoing Precision Result
	X	Matrix Spike and Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

7/29/04
Date

RADFORD ARMY AMMUNITION PLANT VALIDATION REPORT
DIOXIN FURAN REVIEW
SDG 04-1087238 (GPL SDG 404068)

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For dioxin furan compounds in cooled @4°C ± 2°C soil samples, the maximum holding time is 30 days from sample collection to preparative extraction and 45 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/07/04, coolers were received by GPL Laboratories, Inc. at 2.0°C and 2.0°C. The sample was then sent on to Pace Analytical for dioxin furan analysis and was received by the Pace Laboratories, Inc. at 1.0°C. Even though this was below criteria, the impact to the dioxin furan analysis is expected to be very minimal. No qualifiers were applied based upon this outlier.

- Holding Time Review: The soil samples were collected on 04/07/04, extracted on 04/13/04, and analyzed for dioxin furans on 04/17/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory (or field) blank analyses is to determine the existence and magnitude of contamination problems resulting from field and laboratory activities. No contamination should be found in any of the blanks > MDL. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 50). Rinse blank 040704R applies to these samples and was analyzed in GPL SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. ng/kg	Action Level ng/kg	B qualified samples
04/16/04	Blank-4669	All target compounds < MRL	NA	NA	None
04/18/04	040704R	All target compounds < MRL	NA	NA	None

III-Instrument Performance Check

Instrument must be tuned with perfluorokerosene (PFK) to achieve a static resolving power of at least 10,000 (10% valley). Documentation of the mass spectrometer resolving power is accomplished by recording the peak profile of the high-mass reference signal (typically m/z 330.9792) obtained during a peak examination by using the low-mass PFK ion at m/z 292.9825 or lower in mass as reference. At the beginning of the each 12-hour period, the chromatographic resolution is verified in the same fashion as in the initial calibration through the analysis of HRCC solution on the DB-5 (or equivalent) column or through the analysis of the column performance solution on the SP-2331 or SP-225 (or equivalent) column. A 25% valley must be achieved between the close eluters.

- All PFK forms were verified and found to be in compliance with method specification. No qualifiers were applied.

IV-Initial Calibration
Once the window defining mix has been analyzed and the descriptor switching times have been verified, the five point calibration solutions can be analyzed prior to sample analysis. Initial calibration criteria are as follows:

- The percent relative standard deviations for the mean response factors RRF(n) from the 17 unlabeled standards must not exceed ±20%, and those for the labeled reference compounds must not exceed ±30%
- Isotopic ratio must be within the specified control limits in Table 8 (SW846 Method 8290).

- For initial calibration performed on 04/06/04 for all target compounds on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Sample TMSB1A (404068-003) applies to this initial calibration.

V-Continuing Calibration
The continuing calibration consists of two parts: evaluation of the mass resolution and retention time check. The following stipulates the continuing calibration criteria.

- The signal signal-to-noise ratio (S/N) must be at least 10:1 for each selected ion current profile (SICP) and for each GC signal representing the elution of a target analyte or labeled standard for each analyte.
- The relative response factor of each analyte for the unlabeled standard must be within ±20% of the average RF obtained from the initial calibration, and the RRF of each labeled standard must be within ±30% of the average RRF established during initial calibration. This is expressed in term of percent difference %D.

- For continuing calibration performed on 04/16/04 @14:47 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/17/04 @03:16 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/17/04 @16:45 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. Sample TMSB1A (404068-003) applies to this continuing calibration.

- For continuing calibration performed on 04/18/04 @05:13 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/20/04 @14:30 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/21/04 @03:01 on instrument 10MSHR05, all criteria were met. No qualifiers were applied. No samples reported apply to this continuing calibration.

VI-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: Recoveries of the isotopically-labeled extraction standards to fall within the 40 to 135 percent range for the tetra- through octachlorinated congeners, or as stated in the data package

- All criteria were met. No qualifiers were applied.

VII-Cleanup Standards
Cleanup standards are added to every sample, blank, quality control sample, and calibration solution. This compound is added to the samples after extraction but prior to cleanup and is used to verify the percent recovery obtained using the isotope dilution technique. The control limits are 40-135%.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Standard (LCS) or Ongoing Precision Result (OPR)
LCSs/OPRs are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. Acceptable performance is determined by:

1. Recoveries of the isotopically-labeled extraction standards to fall within 40-135% control limits for the tetra- through octachlorinated congeners, or as stated in the data package;

2. Recoveries (accuracy) of the unlabeled compounds should be within $\pm$ 35% when spiked at the method quantitation limit and within $\pm$ 30% when spiked above 20 times the method quantitation limit, or as stated in the data package;

3. When duplicate OPR are required, the relative percent difference (RPD) of the unlabeled analytes concentrations should be within 30% when spiked at the method quantitation limit and within $\pm$ 25% when spiked above 20 times the method quantitation limit.

- Sample LCS-4670 was used as LCS analyzed on 04/16/04. All criteria were met. No qualifiers were applied. Sample TMSB1A (404068-003) applies to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits (40-135%; 50%RPD).

- Sample TMSB1A (404068-003) was performed as MS/MSD for dioxin furans. OCDD (0%, 0%) was outside criteria. The amount measured for OCDD in the spiked sample was significantly greater than the amount spiked. No qualifiers were applied based upon these outliers.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- No field duplicate was analyzed with this SDG.

XI-Quantitation Verification

The accuracy of analytical results was verified through the calculation of at least one the several parameters such as the %D, %RSD, % recovery, and/or compound concentration. Values were found to be within 10%. Any value reported by the laboratory as estimated "J" based on an analyte to internal standard ratio below the calibration curve was qualified as such. The signal signal-to-noise ratio (S/N) must be greater than 2.5 for each selected ion current profile (SICP) and for each GC signal representing the elution of a target analyte or labeled standard. For where the ion ratio failed the 25% criteria (I-lab flag), the estimated maximum possible concentration was reported and flagged estimated "J". For where any detected value had ether interference (E-lab flag), the estimated maximum possible concentration was reported and flagged estimated "J".

Sample: TMSB1A (404068-003), OCDD

A(x) = sum of the integrated ion abundances of the quantitation ions for the unlabeled ions;

A(is) = sum of the integrated ion abundances of the quantitation ions for the labeled ions;

Q(is) = quantity, in pg, of the internal standard added to the sample before extraction; Here need to multiply concentration (pg/uL) by final extract volume (uL).

W = weight, in g, of the sample (solid or organic liquid) as dry weight, or volume in mL of an aqueous sample; and

Avg. RRF(n) = calculated mean relative response factor for the unlabeled analyte.

$$\text{Conc. (ng/kg)} = \frac{(A(x))*Q(is)}{A(is)*W*Avg.RRF} = \frac{(1610000000+1840000000)*(4.00)(1000)}{(77600000+86600000)*(11.6*0.8650)*1.1323} =$$

= 7400 ng/kg

Reported Value = 7400 ng/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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Pace Analytical Services, Inc
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Pace Analytical™

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404068-003-045-1/1		
Lab Sample ID	105510895		
Filename	F40417B_11		
Injected By	BAL		
Total Amount Extracted	11.6 g	Matrix	Solid
% Moisture	13.5	Dilution	NA
Dry Weight Extracted	10.0 g	Collected	04/07/2004
ICAL Date	04/06/2004	Received	04/10/2004
CCal Filename(s)	F40417B_01 & F40417B_18	Extracted	04/13/2004
Method Blank ID	BLANK-4669	Analyzed	04/17/2004 23:26

Native Isomers	Conc ng/Kg	EMPC ng/Kg	LRL ng/Kg		Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.200		2,3,7,8-TCDF-13C	2.00	69
Total TCDF	0.59	-----	0.200	J J	2,3,7,8-TCDD-13C	2.00	69
					1,2,3,7,8-PeCDF-13C	2.00	74
2,3,7,8-TCDD	ND	-----	0.200		2,3,4,7,8-PeCDF-13C	2.00	84
Total TCDD	6.40	-----	0.200		1,2,3,7,8-PeCDD-13C	2.00	83
					1,2,3,4,7,8-HxCDF-13C	2.00	105
1,2,3,7,8-PeCDF	ND	-----	1.000		1,2,3,6,7,8-HxCDF-13C	2.00	83
2,3,4,7,8-PeCDF	ND	-----	1.000		2,3,4,6,7,8-HxCDF-13C	2.00	88
Total PeCDF	ND	-----	1.000		1,2,3,7,8,9-HxCDF-13C	2.00	97
					1,2,3,4,7,8-HxCDD-13C	2.00	81
1,2,3,7,8-PeCDD	ND	-----	1.000		1,2,3,6,7,8-HxCDD-13C	2.00	81
Total PeCDD	5.80	-----	1.000		1,2,3,4,6,7,8-HpCDF-13C	2.00	88
					1,2,3,4,7,8,9-HpCDF-13C	2.00	78
1,2,3,4,7,8-HxCDF	ND	-----	1.000		1,2,3,4,6,7,8-HpCDD-13C	2.00	83
1,2,3,6,7,8-HxCDF	ND	-----	1.000		OCDD-13C	4.00	93
2,3,4,6,7,8-HxCDF	ND	-----	1.000				
1,2,3,7,8,9-HxCDF	ND	-----	1.000		1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	1.30	-----	1.000	J J	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	1.000		2,3,7,8-TCDD-37Cl4	0.20	70
1,2,3,6,7,8-HxCDD	1.20	-----	1.000	J J			
1,2,3,7,8,9-HxCDD	2.20	-----	1.000	J J			
Total HxCDD	24.00	-----	1.000				
1,2,3,4,6,7,8-HpCDF	4.50	-----	1.000	J J	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	1.000		Equivalence: 8.5 ng/Kg		
Total HpCDF	4.50	-----	1.000	J J	(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	70.00	-----	1.000				
Total HpCDD	130.00	-----	1.000				
OCDF	5.40	-----	2.000	J J			
OCDD	7400.00	-----	2.000				

Results reported on a dry weight basis
Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087238

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414

Tel: 612-607-1700
Fax: 612- 607-6444

Pace Analytical™

Method 8290 Analysis Results

Client - GPL Laboratories LLLP

Client's Sample ID	404068-001-009-1/2 0407 CVK		
Lab Sample ID	105507230		
Filename	U40418A_11		
Injected By	BAL		
Total Amount Extracted	826 mL	Matrix	Water
% Moisture	NA	Dilution	NA
Dry Weight Extracted	NA	Collected	04/07/2004
ICAL Date	10/03/2003	Received	04/09/2004
CCal Filename(s)	U40418A_02 & U40418A_17	Extracted	04/13/2004
Method Blank ID	BLANK-4659	Analyzed	04/18/2004 15:58

Native Isomers	Conc ng/L	EMPC ng/L	LRL ng/L	Internal Standards	ng's Added	Percent Recovery
2,3,7,8-TCDF	ND	-----	0.00240	2,3,7,8-TCDF-13C	2.00	93
Total TCDF	ND	-----	0.00240	2,3,7,8-TCDD-13C	2.00	92
				1,2,3,7,8-PeCDF-13C	2.00	74
2,3,7,8-TCDD	ND	-----	0.00240	2,3,4,7,8-PeCDF-13C	2.00	90
Total TCDD	ND	-----	0.00240	1,2,3,7,8-PeCDD-13C	2.00	87
				1,2,3,4,7,8-HxCDF-13C	2.00	90
1,2,3,7,8-PeCDF	ND	-----	0.01200	1,2,3,6,7,8-HxCDF-13C	2.00	75
2,3,4,7,8-PeCDF	ND	-----	0.01200	2,3,4,6,7,8-HxCDF-13C	2.00	95
Total PeCDF	ND	-----	0.01200	1,2,3,7,8,9-HxCDF-13C	2.00	91
				1,2,3,4,7,8-HxCDD-13C	2.00	93
1,2,3,7,8-PeCDD	ND	-----	0.01200	1,2,3,6,7,8-HxCDD-13C	2.00	107
Total PeCDD	ND	-----	0.01200	1,2,3,4,6,7,8-HpCDF-13C	2.00	94
				1,2,3,4,7,8,9-HpCDF-13C	2.00	83
1,2,3,4,7,8-HxCDF	ND	-----	0.01200	1,2,3,4,6,7,8-HpCDD-13C	2.00	76
1,2,3,6,7,8-HxCDF	ND	-----	0.01200	OCDD-13C	4.00	73
2,3,4,6,7,8-HxCDF	ND	-----	0.01200			
1,2,3,7,8,9-HxCDF	ND	-----	0.01200	1,2,3,4-TCDD-13C	2.00	NA
Total HxCDF	ND	-----	0.01200	1,2,3,7,8,9-HxCDD-13C	2.00	NA
1,2,3,4,7,8-HxCDD	ND	-----	0.01200	2,3,7,8-TCDD-37Cl4	0.20	89
1,2,3,6,7,8-HxCDD	ND	-----	0.01200			
1,2,3,7,8,9-HxCDD	ND	-----	0.01200			
Total HxCDD	ND	-----	0.01200			
1,2,3,4,6,7,8-HpCDF	ND	-----	0.01200	Total 2,3,7,8-TCDD		
1,2,3,4,7,8,9-HpCDF	ND	-----	0.01200	Equivalence: 0.00 ng/L		
Total HpCDF	ND	-----	0.01200	(Using ITE Factors)		
1,2,3,4,6,7,8-HpCDD	ND	-----	0.01200			
Total HpCDD	ND	-----	0.01200			
OCDF	ND	-----	0.02400			
OCDD	ND	-----	0.02400			

Conc = Concentration (Totals include 2,3,7,8-substituted isomers)
EMPC = Estimated Maximum Possible Concentration
A = Detection Limit based on signal-to-noise measurement
J = Concentration detected is below the calibration range
B = Less than 10 times higher than method blank level
P = Recovery outside of target range
Nn = Value obtained from additional analysis

LRL = Lower Reporting Limit
I = Interference
E = PCDE Interference
S = Saturated signal
ND = Not Detected
NA = Not Applicable
NC = Not Calculated
* = See Discussion

Report No.....1087173

REPORT OF LABORATORY ANALYSIS

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Shaw Environmental, Inc.

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Edgewood, MD 21040-1037
410.612.6350
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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Explosives
GPL Laboratories, Inc., SDG 404068

DATE: July 27, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 07, 2004. Samples were analyzed for explosives using USEPA SW-846 8330. A total of four soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB1A	404068-002	51SB1B	404068-004
TMSB1A	404068-003	51SB1C	404068-005

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
X		Laboratory Control Sample
X		Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

7/27/04
Date

RFAAP VALIDATION REPORT
EXPLOSIVES REVIEW
SDG 404068

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For explosives soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/07/04, coolers were received by the laboratory at 2.0°C and 2.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/07/04, extracted on 04/12/04, and analyzed for explosives on 04/20/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for explosive target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/20/04	BLK65882	All target compounds < MRL	NA	NA	None
04/13/04	040704R	2,6-Dinitrotoluene	0.29	1.46	None

III-Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 02/27-28/04 on instrument LCD, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/12/04 @22:51 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/13/04 @09:44 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/19/04 @22:31 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB1A (404068-002), TMSB1A (404068-003), and 51SB1B (404068-004) applies to this continuing calibration.

- For continuing calibration performed on 04/20/04 @14:52 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB1C (404068-005) applies to this continuing calibration.

- For continuing calibration performed on 04/21/04 @02:57 on instrument LCD, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- All criteria were met. No qualifiers were applied.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for explosives are 60-120% (40-150% for sporadic marginal failures (SMF)).

- Sample BKS65882 was used as LCS for explosives analyzed on 04/20/04. Compounds 1,3,5-trinitrobenzene (45%), 2,4,6-trinitrotoluene (56%), HMX (83%), and tetryl (23%) were outside lab and/or USACE criteria. Compounds 1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, HMX, and tetryl were qualified bias low "L" for detects and "UL" for non-detects based upon these outliers. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for explosives are 50-140%; RPD ≤ 50% (40-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB1B (404068-004) was performed as MS/MSD for explosives. Compounds 1,3-dinitrobenzene (RPD=28%), 2,4-dinitrotoluene (13%; RPD=151%), and RDX (73%) were outside laboratory and/or USACE criteria. The sample concentration was greater than the spike added for 2,4-dinitrotoluene, therefore no qualifiers were applied based upon this outlier. RDX was qualified bias low "L" for the spiked sample based upon this outlier. Compound 1,3-dinitrobenzene was non-detect, therefore no qualifiers were applied based upon the high RPD.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB1A (404068-002) and TMSB1A (404068-003) was collected. The field duplicate evaluation is noted in **Table 3.** For where values exceeding calibration range, the diluted values were evaluated. If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB1A	404068-002	2,4,6-Trinitrotoluene	0.10 U	0.030 J	NA	None
51SB1A	404068-002	Nitrobenzene	0.11	0.14	24.0	None
51SB1A	404068-002	o-Nitrotoluene	0.20 U	0.18 J	NA	None

J = Estimated value.
NA = Not Applicable.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D. The explosives for SW-846 method 8330 were air-dried prior to analysis because RDX and HMX are water soluble and moisture in the soil could affect the results.

- For samples 51SB1A (404068-002), TMSB1A (404068-003), and 51SB1C (404068-005), all confirmation criteria were met. No qualifiers were applied.

- For sample 51SB1B (404068-004), compounds RDX and 2,4-dinitrotoluene exceeded criteria and were qualified as estimated "J".

Sample: 51SB1A (404068-002), nitrobenzene

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D * 1000)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (3278147 * 20 * 1) / (298800 * 2 * 1 * 1000) = 0.11 mg/kg
Reported Value = 0.11 mg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-029-1/1
Sample Volume :	2	Lab File ID :	LCD23536.D
% Moisture:		Date Received	04/08/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/20/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	UL
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.10	U	UL
121-14-2	2,4-Dinitrotoluene	0.10	U	
606-20-2	2,6-Dinitrotoluene	0.10	U	
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	UL
98-95-3	Nitrobenzene	0.11		
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	UL
99-08-1	m-Nitrotoluene	0.20	U	
88-72-2	o-Nitrotoluene	0.20	U	
99-99-0	p-Nitrotoluene	0.20	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-030-1/1
Sample Volume :	2	Lab File ID :	LCD23537.D
% Moisture:		Date Received	04/08/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/20/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.10	U	UL
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.030	J	L
121-14-2	2,4-Dinitrotoluene	0.10	U	
606-20-2	2,6-Dinitrotoluene	0.10	U	
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	UL
98-95-3	Nitrobenzene	0.14		
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	UL
99-08-1	m-Nitrotoluene	0.20	U	
88-72-2	o-Nitrotoluene	0.18	J	J
99-99-0	p-Nitrotoluene	0.20	U	

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GPL Laboratories

GPL
FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB1B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-004-033-1/2
Sample Volume :	2	Lab File ID :	LCD23538.D
% Moisture:		Date Received	04/08/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/20/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.070	J	L
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.10	U	UL
121-14-2	2,4-Dinitrotoluene	0.37		J
606-20-2	2,6-Dinitrotoluene	7.9		
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	UL
98-95-3	Nitrobenzene	0.090	J	J
121-82-4	RDX	1.2		J
479-45-8	Tetryl	0.20	U	UL
99-08-1	m-Nitrotoluene	0.20	U	
88-72-2	o-Nitrotoluene	0.20	U	
99-99-0	p-Nitrotoluene	0.20	U	

GPL Laboratories

Form I Copy

GPL
FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB1C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No: :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-005-036-1/1
Sample Volume :	2	Lab File ID :	LCD23548.D
% Moisture:		Date Received	04/08/2004
Extraction:	EXT_SW8330	Date Extracted:	04/12/2004
Extract Volume:	20 mL	Date Analyzed	04/20/2004
Injection Volume :	100 µ L	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q	
99-35-4	1,3,5-Trinitrobenzene	0.040	J	L
99-65-0	1,3-Dinitrobenzene	0.10	U	
118-96-7	2,4,6-Trinitrotoluene	0.30		L
121-14-2	2,4-Dinitrotoluene	0.030	J	J
606-20-2	2,6-Dinitrotoluene	0.10	U	
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.10	U	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.10	U	
2691-41-0	HMX	0.20	U	UL
98-95-3	Nitrobenzene	0.16		
121-82-4	RDX	0.20	U	
479-45-8	Tetryl	0.20	U	UL
99-08-1	m-Nitrotoluene	0.20	U	
88-72-2	o-Nitrotoluene	0.18	J	J
99-99-0	p-Nitrotoluene	0.20	U	

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Form I copy

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040704R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-001-007-1/2
Sample Volume :	770	Lab File ID :	LCD23355.D
% Moisture:		Date Received	04/08/2004
Extraction:	EXT_SW8330	Date Extracted:	04/09/2004
Extract Volume:	20 mL	Date Analyzed	04/13/2004
Injection Volume :	100 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
99-35-4	1,3,5-Trinitrobenzene	0.26	U
99-65-0	1,3-Dinitrobenzene	0.26	U
118-96-7	2,4,6-Trinitrotoluene	0.26	U
121-14-2	2,4-Dinitrotoluene	0.26	U
606-20-2	2,6-Dinitrotoluene	0.73	
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.26	U
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.26	U
2691-41-0	HMX	0.52	U
98-95-3	Nitrobenzene	0.26	U
121-82-4	RDX	0.52	U
479-45-8	Tetryl	0.52	U
99-08-1	m-Nitrotoluene	0.52	U
88-72-2	o-Nitrotoluene	0.52	U
99-99-0	p-Nitrotoluene	0.52	U

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MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Herbicides
GPL Laboratories, Inc., SDG 404068

DATE: July 27, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 07, 2004. Samples were analyzed for chlorinated herbicides using USEPA SW846 Method 8151A. A total of two soil samples were validated. The sample ID is:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB1A	404068-002	TMSB1A	404068-003

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	**No**	
	X	Holding Times
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	System Monitoring Compounds
	X	Laboratory Control Sample
X		Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

7/27/04
Date

RFAAP VALIDATION REPORT
CHLORINATED HERBICIDES REVIEW
SDG 404068

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For chlorinated herbicides in cooled @4°C±2°C soil samples, the maximum holding time is 14 days from sample collection to extraction and 40 days from extraction to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/07/04, coolers were received by the laboratory at 2.0°C and 2.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/07/04, extracted on 04/26/04, and analyzed for herbicides on 04/27/04. All criteria were met. No qualifiers were applied.

II-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. Percent relative standard deviation (%RSD) for a 5-point standard calibration should be ≤20% for each target compound.

- For initial calibration performed on 04/26/04 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Samples 51SB1A (404068-002) and TMSB1A (404068-003) apply to this initial calibration.

III-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration establishes the response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. Percent difference (%D) between the initial calibration CF and the continuing calibration CF must be ≤15%.

- For continuing calibration performed on 04/27/04 @09:46 on instrument GC-I, 2,4-DB (15.7%) was outside criteria were met for primary and within criteria for the secondary column. All other target compounds were within criteria. All samples were non-detect for target compounds. No qualifiers were applied. Samples 51SB1A (404068-002) and TMSB1A (404068-003) apply to this continuing calibration.

- For continuing calibration performed on 04/27/04 @10:11 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. Samples 51SB1A (404068-002) and TMSB1A (404068-003) apply to this continuing calibration.

- For continuing calibration performed on 04/27/04 @15:30 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/27/04 @15:55 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/27/04 @18:26 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/27/04 @18:51 on instrument GC-I, all criteria were met for primary and secondary columns for the target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

IV-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field or laboratory activities. No contaminants should be detected in any of the associated blanks. Positive sample results are qualified "B" if the concentration of the analyte is ≤ five times (5X) the absolute maximum blank concentration. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 100). Rinse blank 040204R applies to these samples and was analyzed in SDG 0404027.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/27/04	BLK66174	All target compounds < MRL	NA	NA	None
04/09/04	040204R	All target compounds < MRL	NA	NA	None

V-System Monitoring Compounds (Surrogates)

Laboratory performance on individual samples is established by means of spiking activities. All samples are spiked with surrogate compounds prior to sample preparation. Spike recoveries must be within the specified control limits.

Control Limit: 2,4-DCAA (29-143%) (USACE Shell Criteria: 70-130%)

- All criteria were met. No qualifiers were applied.

VI-Laboratory Control Samples

Data for laboratory control samples (LCS) are generated to determine long-term precision and accuracy of the analytical method. Percent recoveries must be within the specified control limits.

- Sample BKS66174 was used as the LCS. All criteria were met. No qualifiers were applied. Samples 51SB1A (404068-002) and TMSB1A (404068-003) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits.

- Sample 51SB1A (404068-002) was used for the MS/MSD analysis. Dinoseb (0%, 3%) was outside criteria limits. The spiked sample was qualified bias low non-detect "UL" based upon these outliers.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB1A (404068-002) and TMSB1A (404068-003) was collected. The field duplicate evaluation is noted in **Table 3**. For where values exceeding calibration range, the diluted values were evaluated. If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB1A	404068-002	All compounds < MRL	NA	NA	NA	None

NA = Not Applicable

IX-Quantitation Verification
The accuracy of analytical results is verified through the calculation of several parameters. Percent difference (%D) between the calculated value and the reported value must be within 10%. All positive values must have less than or equal to 40% %D between the primary and secondary columns. Any sample value > MDL and < MRL is qualified as estimated, "J." All criteria were met. No qualifiers were applied.

Sample: BKS66174, 2,4-D

Conc. µg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (430867 * 10 * 1) / (1376 * 10 * 1) = 310 µg/kg
Reported Value = 310 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

GPL Laboratories

FORM 1 Form I Copy
ANALYSIS DATA SHEET

SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-027-1/1
Sample Volume :	10	Lab File ID :	I27442.D
% Moisture:	13.56	Date Received	04/08/2004
Extraction:	EXT_SW8151	Date Extracted:	04/26/2004
Extract Volume:	10 mL	Date Analyzed	04/27/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
93-76-5	2,4,5-T	120	U
93-72-1	2,4,5-TP (Silvex)	120	U
94-75-7	2,4-D	120	U
94-82-6	2,4-DB	120	U
75-99-0	Dalapon	120	U
1918-00-9	Dicamba	120	U
120-36-5	Dichloroprop	120	U
88-85-7	Dinoseb	120	U
94-74-6	MCPA	12000	U
93-65-2	MCPP	12000	U

GPL Laboratories

GPL Form I Copy
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-028-1/1
Sample Volume :	10	Lab File ID :	I27443.D
% Moisture:	13.8	Date Received	04/08/2004
Extraction:	EXT_SW8151	Date Extracted:	04/26/2004
Extract Volume:	10 mL	Date Analyzed	04/27/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
93-76-5	2,4,5-T	120	U
93-72-1	2,4,5-TP (Silvex)	120	U
94-75-7	2,4-D	120	U
94-82-6	2,4-DB	120	U
75-99-0	Dalapon	120	U
1918-00-9	Dicamba	120	U
120-36-5	Dichloroprop	120	U
88-85-7	Dinoseb	120	U
94-74-6	MCPA	12000	U
93-65-2	MCPP	12000	U

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MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I
RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Nitroglycerine
GPL Laboratories, Inc., SDG 404068

DATE: July 27, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 07, 2004. Samples were analyzed for nitroglycerine using USEPA SW-846 8332. A total of four soil samples were validated including diluted samples. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB1A	404068-002	51SB1B	404068-004
TMSB1A	404068-003	51SB1C	404068-005

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable.

E. Malarek

Eric Malarek, Chemist

7/27/04

Date

RFAAP VALIDATION REPORT
NITROGLYCERINE REVIEW
SDG 404068

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For nitroglycerine soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/07/04, coolers were received by the laboratory at 2.0°C and 2.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/07/04, extracted on 04/12/04, and analyzed for nitroglycerine on 04/16/04 and 04/17/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.20). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/16/04	BLK65911	All target compounds < MRL	NA	NA	None
04/15/04	040704R	All target compounds < MRL	NA	NA	None

III-Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 04/15/04 on instrument HPLC-E, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/15/04 @19:56 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/15/04 @22:37 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB1A (404068-002) applies to this continuing calibration.

- For continuing calibration performed on 04/16/04 @01:19 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Samples TMSB1A (404068-003) and 51SB1B (404068-004) applies to this continuing calibration.

- For continuing calibration performed on 04/16/04 @04:00 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/17/04 @21:04 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. Sample 51SB1C (404068-005) applies to this continuing calibration.

- For continuing calibration performed on 04/17/04 @23:24 on instrument HPLC-E, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- All criteria were met. No qualifiers were applied.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for nitroglycerine are 60-120%.

- Sample BKS65911 was used as LCS for nitroglycerine analyzed on 04/15/04. All criteria were met. No qualifiers were applied. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for nitroglycerine are 50-140%; RPD ≤ 50%.

- Sample 51SB1B (404068-004) was performed as MS/MSD for nitroglycerine. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB1A (404068-002) and TMSB1A (404068-003) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB1A	404068-002	nitroglycerine	5.8 U	5.8 U	NA	None

U = Value non-detect at MRL.
NA = Not Applicable.

IX-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005), nitroglycerine was non-detect. All criteria were met. No qualifiers were applied.

Sample: BKS659511, nitroglycerine

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (25018944 * 20 * 1) / (2542000 * 4 * 1.0) = 50 mg/kg
Reported Value = 49 mg/kg
% Difference = 2.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-029-1/1
Sample Volume :	4	Lab File ID :	LCE0736.D
% Moisture:	13.56	Date Received	04/08/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/16/2004
Injection Volume :	25 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.8	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-030-1/1
Sample Volume :	4	Lab File ID :	LCE0740.D
% Moisture:	13.8	Date Received	04/08/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/16/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.8	U

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB1B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-004-033-1/2
Sample Volume :	4	Lab File ID :	LCE0741.D
% Moisture:	12.06	Date Received	04/08/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/16/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.7	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-005-036-1/1
Sample Volume :	4	Lab File ID :	LCE0823.D
% Moisture:	13.22	Date Received	04/08/2004
Extraction:	EXT_8332	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/17/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	5.8	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040704R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-001-007-1/2
Sample Volume :	1	Lab File ID :	LCE0725.D
% Moisture:		Date Received	04/08/2004
Extraction:	SW8332	Date Extracte	
Extract Volume	1 mL	Date Analyzed	04/15/2004
Injection Volume :	25 µL	Dilution Factor	1
GPC Clean up (Y/N):	pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/L

CAS NO	COMPOUND		Q
55-63-0	Nitroglycerine	1.0	U

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – PAHs
GPL Laboratories, Inc., SDG 404068

DATE: July 27, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 07, 2004. Samples were analyzed for polynuclear aromatic hydrocarbons (PAHs) using USEPA SW846 Methods 3540C/8270C Low Level. A total of four soil samples were validated. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB1A	404068-002	51SB1B	404068-004
TMSB1A	404068-003	51SB1C	404068-005

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
X		Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	Surrogate Spikes
	X	Internal Standards
	X	Laboratory Control Standard
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

7/27/04

Date

RFAAP VALIDATION REPORT
POLYNUCLEAR AROMATIC HYDROCARBONS REVIEW
SDG 404068

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For polynuclear aromatic hydrocarbons (PAHs) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/07/04, coolers were received by the laboratory at 2.0°C and 2.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/07/04, extracted on 04/12/04, and analyzed for PAHs on 04/14/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for PAH compounds by GC/MS low level. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for the PAHs by USEPA SW-846 8270C low level was performed on 04/14/04 on instrument HP#T. All RRFs were ≥ 0.05. Compounds naphthalene (17.6%), acenaphthylene (16.9%), and phenanthrene (16.6%) were outside criteria. For noted compounds, all detects were qualified estimated "J" and non-detects no qualifier based upon these outliers. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be ≥ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within ± 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the PAHs by USEPA SW-846 8270C low level performed on 04/14/04 @16:04 on instrument HP#H, all target compounds were within criteria. No qualifiers were applied. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to his continuing calibration.

- For continuing calibration for the PAHs by USEPA SW-846 8270C low level performed on 04/15/04 @15:35 on instrument HP#T, all target compounds were within criteria. No qualifiers were applied. No samples reported apply to his continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 30). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/14/04	BLK65895	All compounds < MRL	NA	NA	None
04/15/04	040704R	Naphthalene	17.4	87.0	None

VI-Surrogate Spikes
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria: Nitrobenzene-d5 (36-164%) – S1 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (54-124%) – S2 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (56-150%) – S3 (USACE Shell Criteria: 45-135%)

- All criteria were met. No qualifiers were applied.

VII-Internal Standards
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for PAHs by 8270C low level are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65895 was used as the LCS for PAHs by USEPA SW-846 8270C low level. dibenz(a,h)anthracene (138%) was above USACE criteria and within SMF criteria. There were a total of 17 spike recoveries with 1 sporadic marginal failure. No qualifiers were applied based upon this outlier. In addition, all samples were non-detect for dibenz(a,h)anthracene. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB1B (404068-004) was used for the MS/MSD analysis for PAHs. Compounds benzo(g,h,i)perylene (126%, 126%), dibenz(a,h)anthracene (155%, 155%), and indeno(1,2,3-cd)pyrene (126%, 126%) were outside lab criteria. Three compounds were outside USACE criteria and within SMF criteria. All detects were qualified bias high "K" for the spiked sample and non-detects no qualifier based upon these outliers.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB1A (404068-002) and TMSB1A (404068-003) was collected. The field duplicate evaluation is noted in **Table 3.** For where values exceeding calibration range, the diluted values were evaluated. If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB1A	404068-002	phenanthrene	8.9	11	21.1	None

XI-Quantitation Verification
The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB1A (404068-002), phenanthrene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Is = Amount of internal standard injected (ng).
Vt = Volume of total extract (µL).
Ais = Area of characteristic ion for the internal standard.
RRF = Average relative response factor for compound being measured (from ICAL)
Vi = Volume of extract injected (µL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (63998 * 4 * 1000 * 1) / (1269100 * 0.893 * 1 * 30 * 0.8644) = 8.8 µg/kg
Reported Value = 8.9 µg/kg
% Difference = 1.1%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-025-1/1
Sample Volume :	30	Lab File ID :	T18806.D
% Moisture:	13.56	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/14/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.7	U
83-32-9	Acenaphthene	7.7	U
208-96-8	Acenaphthylene	7.7	U
120-12-7	Anthracene	7.7	U
56-55-3	Benzo(a)anthracene	7.7	U
50-32-8	Benzo(a)pyrene	7.7	U
205-99-2	Benzo(b)fluoranthene	7.7	U
191-24-2	Benzo(g,h,i)perylene	7.7	U
207-08-9	Benzo(k)fluoranthene	7.7	U
218-01-9	Chrysene	7.7	U
53-70-3	Dibenz(a,h)Anthracene	7.7	U
206-44-0	Fluoranthene	7.7	U
86-73-7	Fluorene	7.7	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.7	U
91-20-3	Naphthalene	7.7	U
85-01-8	Phenanthrene	8.9	J
129-00-0	Pyrene	7.7	U

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GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-026-1/1
Sample Volume :	30	Lab File ID :	T18807.D
% Moisture:	13.8	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/14/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
91-57-6	2-Methylnaphthalene	7.7	U	
83-32-9	Acenaphthene	7.7	U	
208-96-8	Acenaphthylene	7.7	U	
120-12-7	Anthracene	7.7	U	
56-55-3	Benzo(a)anthracene	7.7	U	
50-32-8	Benzo(a)pyrene	7.7	U	
205-99-2	Benzo(b)fluoranthene	7.7	U	
191-24-2	Benzo(g,h,i)perylene	7.7	U	
207-08-9	Benzo(k)fluoranthene	7.7	U	
218-01-9	Chrysene	7.7	U	
53-70-3	Dibenz(a,h)Anthracene	7.7	U	
206-44-0	Fluoranthene	7.7	U	
86-73-7	Fluorene	7.7	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.7	U	
91-20-3	Naphthalene	7.7	U	
85-01-8	Phenanthrene	11		J
129-00-0	Pyrene	7.7	U	

GPL Laboratories

Form I Org

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-004-031-1/2
Sample Volume :	30	Lab File ID :	T18808.D
% Moisture:	12.06	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/14/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.6	U
83-32-9	Acenaphthene	7.6	U
208-96-8	Acenaphthylene	7.6	U
120-12-7	Anthracene	7.6	U
56-55-3	Benzo(a)anthracene	7.6	U
50-32-8	Benzo(a)pyrene	7.6	U
205-99-2	Benzo(b)fluoranthene	7.6	U
191-24-2	Benzo(g,h,i)perylene	7.6	U
207-08-9	Benzo(k)fluoranthene	7.6	U
218-01-9	Chrysene	7.6	U
53-70-3	Dibenz(a,h)Anthracene	7.6	U
206-44-0	Fluoranthene	7.6	U
86-73-7	Fluorene	7.6	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.6	U
91-20-3	Naphthalene	7.6	U
85-01-8	Phenanthrene	7.6	U
129-00-0	Pyrene	7.6	U

Form 1 Copy

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-005-035-1/1
Sample Volume :	30	Lab File ID :	T18811.D
% Moisture:	13.22	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracted:	04/12/2004
Extract Volume:	1 mL	Date Analyzed	04/14/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	7.7	U
83-32-9	Acenaphthene	7.7	U
208-96-8	Acenaphthylene	7.7	U
120-12-7	Anthracene	7.7	U
56-55-3	Benzo(a)anthracene	7.7	U
50-32-8	Benzo(a)pyrene	7.7	U
205-99-2	Benzo(b)fluoranthene	7.7	U
191-24-2	Benzo(g,h,i)perylene	7.7	U
207-08-9	Benzo(k)fluoranthene	7.7	U
218-01-9	Chrysene	7.7	U
53-70-3	Dibenz(a,h)Anthracene	7.7	U
206-44-0	Fluoranthene	7.7	U
86-73-7	Fluorene	7.7	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	7.7	U
91-20-3	Naphthalene	7.7	U
85-01-8	Phenanthrene	7.7	U
129-00-0	Pyrene	7.7	U

GPL Laboratories

Form I Copy

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040704R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-001-003-1/2
Sample Volume :	770	Lab File ID :	T18830.D
% Moisture:		Date Received	04/08/2004
Extraction:	SW3520C-LL	Date Extracted:	04/13/2004
Extract Volume:	1 mL	Date Analyzed	04/15/2004
Injection Volume :	μL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
91-57-6	2-Methylnaphthalene	0.26	U
83-32-9	Acenaphthene	0.26	U
208-96-8	Acenaphthylene	0.26	U
120-12-7	Anthracene	0.26	U
56-55-3	Benzo(a)anthracene	0.26	U
50-32-8	Benzo(a)pyrene	0.26	U
205-99-2	Benzo(b)fluoranthene	0.26	U
191-24-2	Benzo(g,h,i)perylene	0.26	U
207-08-9	Benzo(k)fluoranthene	0.26	U
218-01-9	Chrysene	0.26	U
53-70-3	Dibenz(a,h)Anthracene	0.26	U
206-44-0	Fluoranthene	0.26	U
86-73-7	Fluorene	0.26	U
193-39-5	Indeno(1,2,3-c,d)Pyrene	0.26	U
91-20-3	Naphthalene	0.58	
85-01-8	Phenanthrene	0.26	U
129-00-0	Pyrene	0.26	U

Shaw Environmental, Inc.

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Pesticides and PCBs
GPL Laboratories, Inc., SDG 404068

DATE: July 27, 2004

The purpose of this memorandum is to present the data validation report for the sample collected for the SWMU 51 RFI at the RFAAP on April 07, 2004. Sample was analyzed for pesticides and PCBs using USEPA Method 3540C/8081A and 3540C/8082, respectively. A total of two soil samples were validated for pesticides and PCBs. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB1A	404068-002	TMSB1A	404068-003

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (USEPA, September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
	X	Initial Calibration
	X	Continuing Calibration
	X	Blank Analysis
	X	System Monitoring Compounds
X		Laboratory Control Samples
X		Matrix Spike/Spike Duplicate
	X	Field Sample Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

7/27/04
Date

RFAAP VALIDATION REPORT
PESTICIDE/PCB REVIEW
SDG 404068

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For pesticide and PCB soil samples, cooled @4°C ±2°C, the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis (USEPA criteria).

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/07/04, coolers were received by the laboratory at 2.0°C and 2.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The samples were collected 04/07/04 for pesticides and PCB compounds. They were extracted on 04/10/04 and analyzed for pesticides on 04/12/04 and PCBs on 04/13/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check (Degradation Standard)
Performance checks on the gas chromatograph with electron capture detector (GC/ECD) system are performed to ensure adequate resolution and instrument sensitivity. The performance evaluation mixture (PEM) must be analyzed at the beginning of the analytical sequence. The breakdown of Endrin and 4,4'-DDT must be ≤ 15% on both columns (USEPA and USACE criteria) and ≤ 30% combined Endrin and 4,4'-DDT on both columns (USEPA criteria).

- For analysis performed on 03/31/04, endrin and 4,4'-DDT breakdowns were 5.7% and 2.1% on column #1 and 8.5% and 2.6% on column #2, respectively. All criteria were met. No qualifiers were applied.

- For analysis performed on 04/12/04, endrin and 4,4'-DDT breakdowns were 10.4% and 5.6% on column #1 and 12.0% and 6.6% on column #2, respectively. All criteria were met. No qualifiers were applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The percent relative standard deviation (%RSD) for all single peak target analytes, and aroclors 1016 and 1260 must be < 20% or the mean %RSD for all analytes in the standard must be ≤ 20%. If linear regression is used, the correlation coefficient must be ≥0.990 (USEPA and USACE criteria).

- For the pesticide initial calibration performed on 03/31/04 on instrument GC-K, all criteria were met. All compounds were determined using calibration factors with RSDs ≤20% for single peak pesticides. No qualifiers were applied. Samples 51SB1A (404068-002) and TMSB1A (404068-003) apply to this initial calibration.

- For the PCB initial calibration performed on 03/31/04 on instrument GC-L, all criteria were met. All compounds were determined using calibration factors with RSDs ≤20% for PCB 1016 and PCB 1260. No qualifiers were applied. Samples 51SB1A (404068-002) and TMSB1A (404068-003) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for pesticide/PCB target compounds. Continuing calibration standards containing both target compounds and surrogates are analyzed at the beginning of each 12-hour analytical shift and after every 20 samples. The percent difference (%D) or the mean %RSD for all analytes in the standard from the initial calibration should be no greater than ± 15%.

- For pesticide continuing calibration performed on 04/12/04 @15:00 on instrument GC-K, all criteria were met on column #1 for all target compounds. For column #2, endrin (24.7%) was outside criteria. All samples were non-detect for this compound, therefore no qualifiers were applied based upon these outliers. Samples 51SB1A (404068-002) and TMSB1A (404068-003) apply to this continuing calibration.

- For pesticide continuing calibration performed on 04/12/04 @21:18 on instrument GC-K, all criteria were met on column #1 for all target compounds. For column #2, endrin (32.4%) and endrin ketone (16.0%) were outside criteria. All samples were non-detect for this compound, therefore no qualifiers were applied based upon these outliers. No samples apply to this continuing calibration.

- For PCB continuing calibration performed on 04/12/04 @14:54 on instrument GC-L, all criteria were met on column #1 and column #2 for all target compounds. No qualifiers were applied. No reported samples apply to his continuing calibration.

- For PCB continuing calibration performed on 04/13/04 @01:59 on instrument GC-L, the following %Ds were determined. For column #1, arochlor 1016 #2 (15.1%) and arochlor 1016 #3 (21.3%) were outside criteria. The average of the peaks for arochlor 1016 was within criteria and all samples were non-detect. For column #2, arochlor 1016 was within criteria. For column #1, arochlor 1260 #1 (19.6%), arochlor 1260 #2 (16.9%), arochlor 1260 #3 (18.8%), arochlor 1260 #4 (16.4%), and arochlor 1260 #5 (24.7%) were outside criteria. For column #2, arochlor 1260 #2 (17.1%), arochlor 1260 #4 (15.2%), and arochlor 1260 #5 (21.6%) were outside criteria. All samples were non-detect for this compound. Therefore, no qualifiers were applied based upon these outliers. Samples 51SB1A (404068-002) and TMSB1A (404068-003) apply to this continuing calibration.

- For PCB continuing calibration performed on 04/13/04 @05:51 on instrument GC-L, the following %Ds were determined. For column #1, arochlor 1260 #2 (18.5%), arochlor 1260 #4 (15.1%), and arochlor 1260 #5 (23.1) were outside criteria. The average of the peaks for arochlor 1260 (16.6%) was outside criteria and all samples were non-detect. For column #1, arochlor 1016 was within criteria. For column #2, arochlor 1260 was within criteria. For column #2, arochlor 1016 #1 (20.6%) was outside criteria. The average of the peaks for arochlor 1016 was within criteria and all samples were non-detect. Therefore, no qualifiers were applied based upon these outliers. No reported samples apply to his continuing calibration.

- For PCB continuing calibration performed on 04/18/04 @05:51 on instrument GC-L, the following %Ds were determined. For column #1, arochlor 1260 #1 (20.2%), arochlor 1260 #2 (19.4%), arochlor 1260 #3 (16.7%), arochlor 1260 #4 (15.1%), and arochlor 1260 #5 (20.9%) were outside criteria. The average of the peaks for arochlor 1260 (18.5%) was outside criteria and all samples were non-detect. Therefore, no qualifiers would be applied based upon these outliers. For column #1, arochlor 1016 was within criteria. For column #2, arochlor 1016 and arochlor 1260 were within criteria. No reported samples apply to his continuing calibration.

- For PCB continuing calibration performed on 04/18/04 @08:14 on instrument GC-L, the following %Ds were determined. For column #1, arochlor 1260 #1 (18.1%) and arochlor 1260 #2 (15.2%) were outside criteria. The average of the peaks for arochlor 1260 (14.8%) was within criteria. Therefore, no qualifiers would be applied based upon these outliers. For column #1, arochlor 1016 was within criteria. For column #2, arochlor 1016 and arochlor 1260 were within criteria. No reported samples apply to this continuing calibration.

- For PCB continuing calibration performed on 04/18/04 @20:38 on instrument GC-L, the following %Ds were determined. For column #1, arochlor 1260 #1 (20.1%), arochlor 1260 #2 (16.6%), arochlor 1260 #3 (16.8%), and arochlor 1260 #5 (19.9%) were outside criteria. The average of the peaks for arochlor 1260 (17.6%) outside criteria and all samples were non-detect. Therefore, no qualifiers would be applied based upon these outliers. For column #1, arochlor 1016 was within criteria. For column #2, arochlor 1016 was within criteria. For column #2, arochlor 1260 #5 (17.8%) was outside criteria. The average of the peaks for arochlor 1260 was within criteria and all samples were non-detect. Therefore, no qualifiers were applied based upon these outliers. No reported samples apply to this continuing calibration.

V-Blank Analysis

The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks > MDL or MRL (USEPA criteria) or all target compounds < one-half the MRL (USACE criteria). Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 30). For pesticides, rinse blank 040204R applies to these samples and was analyzed in SDG 0404027. For PCBs, rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Parameter	Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
Pesticides	04/12/04	BKS65858	All < MRL	NA	NA	None
Pesticides	04/15/04	040204R	All < MRL	NA	NA	None
PCBs	04/12/04	BKS65862	All < MRL	NA	NA	None
PCBs	04/18/04	040704R	All < MRL	NA	NA	None

VI-System Monitoring Compound (Surrogates)

Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the specified laboratory control limits.

Criteria: Decachlorobiphenyl: Pesticides: 55-151% (USACE criteria 50-130%)
Tetrachloro-m-xylene: Pesticides: 34-100% (USACE criteria 50-130%)
Decachlorobiphenyl: PCBs: 47-161% (USACE criteria 50-130%)
Tetrachloro-m-xylene: PCBs: 54-168% (USACE criteria 50-130%)

- For pesticide analysis for sample 51SB1A (404068-002), surrogate tetrachloro-m-xylene (115% => matrix) was outside lab criteria and within USACE criteria. Since surrogate decachlorobiphenyl was within criteria and all surrogate recoveries >10%, no qualifiers were applied based upon this outlier.

- For pesticide analysis for sample TMSB1A (404068-003), all criteria were met. No qualifiers were applied.

- For PCB analysis for sample 51SB1A (404068-002), surrogate tetrachloro-m-xylene (44%, 38% => matrix) were outside criteria. Since surrogate decachlorobiphenyl was within criteria and all surrogate recoveries >10%, no qualifiers were applied based upon these outliers.

- For PCB analysis for sample TMSB1A (404068-003), all criteria were met. No qualifiers were applied.

VII-Laboratory Control Samples
Laboratory control samples (LCS) are used to monitor long-term precision and accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within the specified control limits. USACE Shell limits for pesticides/PCBs are 50-130% (30-150% for sporadic marginal failures (SMF)).

- Sample BKS65858 was used for the LCS for TCL pesticide compounds. Delta-BHC (19%) was outside USACE and SMF criteria. Samples 51SB1A (404068-002) and TMSB1A (404068-003) were non-detect for all target compounds. Delta-BHC was qualified bias low "UL" non-detect based upon the low recovery.

- Sample BKS65862 was used for the LCS for PCB aroclors. All criteria were met. No qualifiers were applied. Samples 51SB1A (404068-002) and TMSB1A (404068-003) apply to this LCS.

VIII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits for pesticides/PCBs are 40-140%; RPD<50% (30-150%; RPD<60% for sporadic marginal failures (SMF) for pesticides).

- Sample 51SB5A (404021-005) was used for the MS/MSD analysis for pesticide compounds. This sample was analyzed in SDG 404021. Compounds 4,4-DDD (60%, 59%), 4,4-DDE (53%, 54%), 4,4-DDT (55%, 55%), aldrin (57%, 61%), alpha-BHC (53%, 53%), alpha-chlordane (49%, 49%), beta-BHC (119%, 118%), delta-BHC (18%, 17%), endosulfan I (52%, 50%), endosulfan II (65%, 65%), endosulfan sulfate (58%, 56%), gamma-BHC (57%, 56%), and gamma-chlordane (58%, 57%) were outside lab criteria. All RPDs were within criteria. Sample 51SB5A (404021-005) was non-detect for all target compounds. All non-detects for the spiked sample were qualified "UL" for these compounds (except beta-BHC) based upon the low recoveries. Beta-BHC was non-detect for the spiked sample and recovered high. Therefore, no qualifiers were applied based upon this outlier.

- Sample 51SB5A (404021-005) was used for the MS/MSD analysis for PCB compounds. This sample was analyzed in SDG 404021. All criteria were met. No qualifiers were applied.

IX-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. The project precision control criterion was established at 50% RPD for the solid samples.

- Field soil sample duplicate pair 51SB1A (404068-002) and TMSB1A (404068-003) was collected. The field duplicate evaluation is noted in **Table 3.** For where values exceeding calibration range, the diluted values were evaluated. If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB1A	404068-002	All compounds < MRL	NA	NA	NA	None

NA = Not Applicable

X-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. The difference between the calculated value and the reported value must be within 10% difference. All samples were non-detect for PCBs, therefore the quantification verification not included here. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." The difference between the primary column and the confirmatory column must be ≤ 40% difference (USEPA and USACE criteria).

- For this SDG, all pesticides/PCBs were non-detect for all samples. No qualifiers were applied.

Sample: 51SB5AMS (404021-005MS), endrin

Conc. µg/kg = (Ax * Vt * DF) / (CF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area/response for compound being measured.
Vt = Volume of total extract, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean V(t) = 10000 µL.
CF = Ave calibration response factor for compound being measured from ICAL (Area/pg)
Vi = Volume of extract injected (mL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100 = 1.0 for Wet Weight
DF = Dilution factor

Conc. µg/kg = (1551791 Area*10000µL*1) / (42620Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 15 µg/kg

Reported Value = 15 µg/kg
% Difference = 0.0%
Values were within 10% difference

Sample: 51SB5AMS (404021-005MS), Aroclor 1260

Conc. µg/kg = (Ax * Vt * DF) / (CF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area/response for compound being measured.
Vt = Volume of total extract, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean V(t) = 10000 µL.
CF = Ave calibration response factor for compound being measured from ICAL (Area/pg)
Vi = Volume of extract injected (mL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100 = 1.0 for Wet Weight
DF = Dilution factor

Signal #1
Conc1 µg/kg = (140694Area*10000µL*1) / (382.3Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 149.44 µg/kg
Conc2 µg/kg = (213944Area*10000µL*1) / (545.1Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 159.37 µg/kg
Conc3 µg/kg = (249460Area*10000µL*1) / (622.1Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 162.83 µg/kg
Conc4 µg/kg = (94744Area*10000µL*1) / (269.3Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 142.86 µg/kg
Conc5 µg/kg = (231104Area*10000µL*1) / (702.4Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 133.60 µg/kg
Average concentration = 150 µg/kg

Signal #2
Conc1 µg/kg = (786176Area*10000µL*1) / (1917Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 166.53 µg/kg
Conc2 µg/kg = (756020Area*10000µL*1) / (1987Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 154.50 µg/kg
Conc3 µg/kg = (397020Area*10000µL*1) / (973Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 165.69 µg/kg
Conc4 µg/kg = (580532Area*10000µL*1) / (1507Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 156.42 µg/kg
Conc5 µg/kg = (976496Area*10000µL*1) / (2810Area/pg*(1000 pg/ng)*1 µL*30g*0.8209) = 141.11 µg/kg
Average concentration = 160 µg/kg

Reported Value = 160 µg/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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GPL Form I Org
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-027-1/1
Sample Volume :	30	Lab File ID :	K125419.D
% Moisture:	13.56	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
72-54-8	4,4-DDD	1.9	U
72-55-9	4,4-DDE	1.9	U
50-29-3	4,4-DDT	1.9	U
309-00-2	Aldrin	1.9	U
319-84-6	Alpha-BHC	1.9	U
5103-71-9	Alpha-Chlordane	1.9	U
319-85-7	Beta-BHC	1.9	U
319-86-8	Delta-BHC	1.9	U
959-98-8	Endosulfan I	1.9	U
33213-65-9	Endosulfan II	1.9	U
1031-07-8	Endosulfan Sulfate	1.9	U
72-20-8	Endrin	1.9	U
7421-93-4	Endrin Aldehyde	1.9	U
53494-70-5	Endrin Ketone	1.9	U
58-89-9	Gamma-BHC (Lindane)	1.9	U
5566-34-7	Gamma-Chlordane	1.9	U
76-44-8	Heptachlor	1.9	U
1024-57-3	Heptachlor Epoxide	1.9	U
72-43-5	Methoxychlor	1.9	U
8001-35-2	Toxaphene	39	U

UL

GPL Laboratories

GPL Form I 0A7
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-027-1/1
Sample Volume :	30	Lab File ID :	L33067.D
% Moisture:	13.56	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
12674-11-2	PCB-1016	39	U
11104-28-2	PCB-1221	39	U
11141-16-5	PCB-1232	39	U
53469-21-9	PCB-1242	39	U
12672-29-6	PCB-1248	39	U
11097-69-1	PCB-1254	39	U
11096-82-5	PCB-1260	39	U

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SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-028-1/1
Sample Volume :	30	Lab File ID :	K125420.D
% Moisture:	13.8	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/12/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg ~~dry weight~~) : ug/kg

CAS NO	COMPOUND		Q
72-54-8	4,4-DDD	1.9	U
72-55-9	4,4-DDE	1.9	U
50-29-3	4,4-DDT	1.9	U
309-00-2	Aldrin	1.9	U
319-84-6	Alpha-BHC	1.9	U
5103-71-9	Alpha-Chlordane	1.9	U
319-85-7	Beta-BHC	1.9	U
319-86-8	Delta-BHC	1.9	U
959-98-8	Endosulfan I	1.9	U
33213-65-9	Endosulfan II	1.9	U
1031-07-8	Endosulfan Sulfate	1.9	U
72-20-8	Endrin	1.9	U
7421-93-4	Endrin Aldehyde	1.9	U
53494-70-5	Endrin Ketone	1.9	U
58-89-9	Gamma-BHC (Lindane)	1.9	U
5566-34-7	Gamma-Chlordane	1.9	U
76-44-8	Heptachlor	1.9	U
1024-57-3	Heptachlor Epoxide	1.9	U
72-43-5	Methoxychlor	1.9	U
8001-35-2	Toxaphene	39	U

UL

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SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-028-1/1
Sample Volume :	30	Lab File ID :	L33068.D
% Moisture:	13.8	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracted:	04/10/2004
Extract Volume:	10 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
12674-11-2	PCB-1016	39	U
11104-28-2	PCB-1221	39	U
11141-16-5	PCB-1232	39	U
53469-21-9	PCB-1242	39	U
12672-29-6	PCB-1248	39	U
11097-69-1	PCB-1254	39	U
11096-82-5	PCB-1260	39	U

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ANALYSIS DATA SHEET

SAMPLE NO
040704R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-001-005-1/2
Sample Volume :	780	Lab File ID :	L33169.D
% Moisture:		Date Received	04/08/2004
Extraction:	SW3520C	Date Extracted:	04/13/2004
Extract Volume:	10 mL	Date Analyzed	04/18/2004
Injection Volume :	1 µL	Dilution Factor :	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
12674-11-2	PCB-1016	1.3	U
11104-28-2	PCB-1221	1.3	U
11141-16-5	PCB-1232	1.3	U
53469-21-9	PCB-1242	1.3	U
12672-29-6	PCB-1248	1.3	U
11097-69-1	PCB-1254	1.3	U
11096-82-5	PCB-1260	1.3	U

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Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Pentaerythritol Tetranitrate GPL Laboratories, Inc., SDG 404068

DATE: July 28, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 07, 2004. Samples were analyzed for pentaerythritol tetranitrate (PETN) using USEPA SW-846 8330. A total of eight soil samples were validated. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB1A	404068-002	51SB1B	404068-004
TMSB1A	404068-003	51SB1C	404068-005

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Blank Analysis
	X	Initial Calibration
	X	Continuing Calibration
	X	System Monitoring Compounds
	X	Laboratory Control Sample
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
	X	Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable.

E. Malarek

Eric Malarek, Chemist

7/28/04

Date

RFAAP VALIDATION REPORT
PETN REVIEW
SDG 404068

I-Holding Times

The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For PETN soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/07/04, coolers were received by the laboratory at 2.0°C and 2.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/07/04, extracted on 04/12/04, and analyzed for PETN on 04/14/04. All criteria were met. No qualifiers were applied.

II-Blank Analysis

The purpose of laboratory or field blank analyses is to determine the existence and magnitude of contamination problems resulting from laboratory or field activities. One method blank per analytical batch must be run on each instrument used to analyze samples. No contaminants should be present in the blanks. Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤5 times (5X) the maximum amount for target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor to mg/kg = 0.40). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/14/04	BLK65883	All target compounds < MRL	NA	NA	None
04/12/04	040704R	All target compounds < MRL	NA	NA	None

III-Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. The initial 5-point calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. The correlation coefficient (r^2) must be ≥ 0.990 and/or the percent relative standard deviation (%RSD) must be ≤ 15%. All detects were qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For the initial calibration performed on 03/03/04 on instrument LCC-UV, all criteria were met for target compounds. All compounds were determined using calibration factors with RSDs ≤15%. No qualifiers were applied. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this initial calibration.

IV-Continuing Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the target compounds. Continuing calibration standards are analyzed after every 10 injections, and at the end of the analysis sequence. The percent difference (%D) from initial calibration should be no greater than ± 15%. All detects were qualified as estimated "J" for where there were exceeding %Ds, and all non-detects were qualified as estimated "UJ" for where there were grossly exceeding recoveries. Grossly exceeding is defined as twice the established criteria limits.

- For continuing calibration performed on 04/12/04 @18:55 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/12/04 @21:49 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

- For continuing calibration performed on 04/13/04 @22:32 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB1A (404068-002) and TMSB1A (404068-003) reported apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @04:01 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. Samples 51SB1B (404068-004) and 51SB1C (404068-005) apply to this continuing calibration.

- For continuing calibration performed on 04/14/04 @07:14 on instrument LCC-UV, all criteria were met for target compounds. No qualifiers were applied. No samples reported apply to this continuing calibration.

V-System Monitoring Compound (Surrogates)
Laboratory performance on individual samples is established by means of spiking activities. The percent recovery (%R) for all samples and blanks must be within the laboratory control limits.

Criteria: 4-nitroaniline (31-129%) (USACE Shell Criteria: 50-150%)

- For sample 51SB1B (404068-004), 4-nitroaniline (134%) was outside criteria. Since this sample was non-detect for PETN, no qualifiers were applied based upon the high recovery outlier. Surrogate 4-nitroaniline was within criteria for all other samples.

VI-Laboratory Control Sample
Laboratory control samples (LCS) are used to monitor long-term accuracy of the analytical method. The analysis is performed at a frequency of 1 per analytical batch. The percent recoveries (%Rs) must be within specified control limits. USACE Shell limits for PETN are 60-120%.

- Sample BKS65883 was used as LCS for PETN analyzed on 04/14/04. All criteria were met. No qualifiers were applied. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate
Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within specified limits. USACE Shell limits for PETN are 50-140%; RPD ≤ 50%.

- Sample 51SB1B (404068-004) was performed as MS/MSD for PETN. All criteria were met. No qualifiers were applied.

VIII-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB1A (404068-002) and TMSB1A (404068-003) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2*MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB1A	404068-002	PETN	0.50 U	0.50 U	NA	None

U = Value non-detect at MRL.
NA = Not Applicable.

IX-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. The calculation was based calibration factors. The absolute percent difference (%D) between the calculated and the reported value must be within 10% difference. All values >MDL and <MRL or <3*MDL (whichever was greater) were qualified as estimated "J". All detected compounds with confirmations on dissimilar column must have >40% D.

- For samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005), PETN was non-detect. All criteria were met. No qualifiers were applied.

Sample: 51SB1BMS (404068-004MS), PETN

Conc. mg/kg = (Ax * Vt * DF) / (CF * Ws * D)

where: Conc. = Sample concentration in mg/kg
Ax = Area of characteristic ion for compound being measured.
Vt = Volume of total extract (mL).
CF = Average relative calibration factor for compound being measured (from ICAL)
W(s) = Weight of sample in kilograms.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. mg/kg = (28440406 * 20 * 1) / (162300 * 2 * 1 * 1000) = 1.8 mg/kg
Reported Value = 1.8 mg/kg
% Difference = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-029-1/1
Sample Volume :	2	Lab File ID :	LC11064U.D
% Moisture:		Date Received	04/08/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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ANALYSIS DATA SHEET

SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-030-1/1
Sample Volume :	2	Lab File ID :	LC11065U.D
% Moisture:		Date Received	04/08/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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SAMPLE NO
51SB1B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-004-033-1/2
Sample Volume :	2	Lab File ID :	LC11069U.D
% Moisture:		Date Received	04/08/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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SAMPLE NO
51SB1C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-005-036-1/1
Sample Volume :	2	Lab File ID :	LC11072U.D
% Moisture:		Date Received	04/08/2004
Extraction:	EXT_SW8330	Date Extracte	04/12/2004
Extract Volume	20 mL	Date Analyzed	04/14/2004
Injection Volume :	100 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : mg/kg

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	0.50	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040704R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-001-007-1/2
Sample Volume :	770	Lab File ID :	LC11016U.D
% Moisture:		Date Received	04/08/2004
Extraction:	EXT_SW8330	Date Extracte	04/09/2004
Extract Volume	20 mL	Date Analyzed	04/12/2004
Injection Volume :	100 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
78-11-5	Pentaerythritol Tetranitrate	1.3	U

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MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – Semi-Volatiles
GPL Laboratories, Inc., SDG 404068

DATE: August 4, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 07, 2004. Samples were analyzed for semivolatile organic compounds (SVOCs) using USEPA SW846 Methods 3540C/8270C. A total of four soil samples were validated. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB1A	404068-002	51SB1B	404068-004
TMSB1A	404068-003	51SB1C	404068-005

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Check
X		Initial Calibration
	X	Continuing Calibration
X		Blank Analysis
	X	Surrogate Spikes
	X	Internal Standards
	X	Laboratory Control Standard
	X	Matrix Spike/Spike Duplicate
	X	Field Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

Eric Malarek, Chemist

8/4/04
Date

RFAAP VALIDATION REPORT
SEMIVOLATILES REVIEW
SDG 404068

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample extraction and analysis. Holding time criteria: For semivolatile organic compound (SVOC) soil samples cooled @ 4°C ± 2°C; the maximum holding time is the maximum holding time is 14 days from sample collection to preparative extraction and 40 days from preparative extraction to determinative analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/07/04, coolers were received by the laboratory at 2.0°C and 2.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/07/04, extracted on 04/10/04, and analyzed for TCL SVOCs on 04/13/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
GC/MS instrument performance checks are performed to ensure mass resolution, identification and, to some degree, sensitivity. The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, decafluorotriphenylphosphine (DFTPP), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for compounds on the semivolatile target compound list (TCL). Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. The minimum relative response factor (RRF) criteria must be ≥ 0.05. Initial calibration percent relative standard deviation (%RSD) must be ≤ 15% on the average for all compounds (< 30% for CCCs). All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- Initial calibration for pyridine was performed on 04/09/04 on instrument HP#D. All criteria were met. No qualifiers were applied. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this initial calibration.

- Initial calibration for the TCL SVOCs was performed on 04/12/04 on instrument HP#D. Target compounds benzoic acid (38.2%; grossly exceeding), hexachlorocyclopentadiene (44.0%; grossly exceeding), 2,4-dinitrophenol (23.6%), 4-nitrophenol (21.5%), fluorene (17.4%), 4-chlorophenyl-phenylether (17.3%), 4-nitroaniline (16.1%), 3,3'-dichlorobenzidine (16.6%), benzo(b)fluoranthracene (17.7%), and benzo(k)fluoranthene (17.9%) were outside criteria. All RRFs were ≥ 0.05. Compounds 2,4-dinitrophenol, 4-nitrophenol, fluorene, 4-chlorophenyl-phenylether, 4-nitroaniline, 3,3'-dichlorobenzidine, benzo(b)fluoranthracene, and benzo(k)fluoranthene were qualified estimated "J" for detects and no qualifier for non-detects for the high %RSDs. For compounds benzoic acid and hexachlorocyclopentadiene, all non-detects were qualified estimated "UJ" based upon the grossly exceeding %RSD. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used was capable of producing acceptable qualitative and quantitative data for semivolatile target compounds. Continuing calibration standards containing both target and surrogates compounds are analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of blanks and samples. The minimum relative response factors (RRF) for semivolatile target compounds and surrogates must be ≥ 0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within ± 20% for all target compounds. Grossly exceeding is defined where %D>40%. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for the TCL SVOCs performed on 04/12/04 @23:21 on instrument HP#D, hexachlorocyclopentadiene (30.1%), pyrene (23.8%), 3,3'-dichlorobenzidine (22.5%), and bis(2-ethylhexyl)phthalate (28.2%) were outside criteria. Since all associated samples were non-detect for these compounds, no qualifiers were applied based upon these outliers. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this continuing calibration.

- For continuing calibration for pyridine performed on 04/12/04 @10:21 on instrument HP#D, all criteria were met for pyridine. No qualifiers were applied. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of DFTPP. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants phthalate esters). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is ≤ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants phthalate esters, or 5 times (5X) the maximum amount for other semivolatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 33). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/13/04	BLK65838	All compounds < MRL	NA	NA	None
04/20/04	040704R	2,4-Dinitrotoluene	1320	6600	51SB1C
04/20/04	040704R	2,6-Dinitrotoluene	460	2300	None
04/20/04	040704R	Benzoic Acid	290J	1450	None
04/20/04	040704R	Bis(2-ethylhexyl) phthalate	160J	1600	None
04/20/04	040704R	Diethyl Phthalate	830	8300	None
04/20/04	040704R	di-n-Butyl Phthalate	460	4600	None
04/20/04	040704R	Phenol	99J	495	None

J = Estimated value <MRL and >MDL

VI-Surrogate Spikes

Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Surrogate spikes are added to all samples and blanks to measure their recovery in sample and blank matrices. The percent recoveries (%Rs) must be within the specified control limits.

Criteria:
2-Fluorophenol (20-106%) – S1 (USACE Shell Criteria: 35-140%)
Phenol – d5 (25-121%) – S2 (USACE Shell Criteria: 35-140%)
2,4,6-Tribromophenol (31-137%) – S3 (USACE Shell Criteria: 35-140%)
Nitrobenzene-d5 (29-117%) – S4 (USACE Shell Criteria: 45-135%)
2-Fluorobiphenyl (31-125%) – S5 (USACE Shell Criteria: 45-135%)
Terphenyl – d14 (26-160%) – S6 (USACE Shell Criteria: 45-135%)

- All criteria were met. No qualifiers were applied.

VII-Internal Standards

Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated calibration standard. The retention time of the internal standards in samples and blanks must not vary by more than ± 30 seconds from the retention time of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

VIII-Laboratory Control Samples

Laboratory control samples (LCS) are used to monitor laboratory accuracy by calculating the percent recoveries of the spiked compounds. All LCS percent recoveries must be within the specified control limits. USACE Shell limits for SVOCs are 45-135% (25-150% for sporadic marginal failures (SMF)).

- Sample BKS65838 was used as the LCS for select SVOCs by USEPA SW-846 8270C. All criteria were met. No qualifiers were applied. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this LCS.

IX-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 45-135%; RPD ≤ 60% (15-150%; RPD ≤ 60% for sporadic marginal failures (SMF)).

- Sample 51SB1B (404068-004) was used for the MS/MSD analysis for select SVOCs. All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB1A (404068-002) and TMSB1A (404068-003) was collected. The field duplicate evaluation is noted in **Table 3.** For where values exceeding calibration range, the diluted values were evaluated. If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)	Duplicate Result (µg/kg)	%RPD	Qualifier
51SB1A	404068-002	All compounds < MRL	NA	NA	NA	None

NA = Not Applicable

XI-Quantitation Verification

The accuracy of analytical results was verified through the calculation of several parameters. Percent difference (%D) between the calculated and reported values must be ≤10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB1C (404068-005), 2,4-dinitrotoluene

Conc. µg/kg = (Ax * Is * Vt * DF) / (Ais * RRF * Vi * Ws * D)

where: Conc. = Sample concentration in µg/kg
Ax = Area of characteristic ion for compound being measured.
Is = Amount of internal standard injected (ng).
Vt = Volume of total extract (µL).
Ais = Area of characteristic ion for the internal standard.
RRF = Average relative response factor for compound being measured (from ICAL)
Vi = Volume of extract injected (µL).
W(s) = Weight of sample extracted or diluted in grams.
D = Percent dry weight (100 - % moisture in sample)/100
DF = Dilution factor

Conc. µg/kg = (30053 * 40 * 1000 * 1) / (392883 * 0.520 * 1 * 30 * 0.8678) = 230 µg/kg
Reported Value = 230 µg/kg
% Difference = 0.0%
Values were within 10% difference

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-025-1/1
Sample Volume :	30	Lab File ID :	D33575.D
% Moisture:	13.56	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	390	U
95-50-1	1,2-Dichlorobenzene	390	U
541-73-1	1,3-Dichlorobenzene	390	U
106-46-7	1,4-Dichlorobenzene	390	U
108-60-1	2,2-Oxybis(1-Chloropropane)	390	U
95-95-4	2,4,5-Trichlorophenol	390	U
88-06-2	2,4,6-Trichlorophenol	390	U
120-83-2	2,4-Dichlorophenol	390	U
105-67-9	2,4-Dimethylphenol	390	U
51-28-5	2,4-Dinitrophenol	770	U
121-14-2	2,4-Dinitrotoluene	390	U
606-20-2	2,6-Dinitrotoluene	390	U
91-58-7	2-Chloronaphthalene	390	U
95-57-8	2-Chlorophenol	390	U
91-57-6	2-Methylnaphthalene	390	U
88-74-4	2-Nitroaniline	390	U
88-75-5	2-Nitrophenol	390	U
95-48-7	2-methylphenol	390	U
91-94-1	3,3-Dichlorobenzidine	770	U
99-09-2	3-Nitroaniline	390	U
534-52-1	4,6-dinitro-2-methyl phenol	770	U
101-55-3	4-Bromophenyl-phenylether	390	U
106-47-8	4-Chloroaniline	390	U
7005-72-3	4-Chlorophenyl Phenyl Ether	390	U
100-01-6	4-Nitroaniline	390	U
100-02-7	4-Nitrophenol	770	U
59-50-7	4-chloro-3-methylphenol	390	U
106-44-5	4-methylphenol	390	U
83-32-9	Acenaphthene	390	U

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SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-025-1/1
Sample Volume :	30	Lab File ID :	D33575.D
% Moisture:	13.56	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	390	U	
120-12-7	Anthracene	390	U	
56-55-3	Benzo(a)anthracene	390	U	
50-32-8	Benzo(a)pyrene	390	U	
205-99-2	Benzo(b)fluoranthene	390	U	
191-24-2	Benzo(g,h,i)perylene	390	U	
207-08-9	Benzo(k)fluoranthene	390	U	
65-85-0	Benzoic Acid	770	U	UJ
100-51-6	Benzyl Alcohol	390	U	
85-68-7	Benzyl Butyl Phthalate	390	U	
86-74-8	Carbazole	390	U	
218-01-9	Chrysene	390	U	
53-70-3	Dibenz(a,h)Anthracene	390	U	
132-64-9	Dibenzofuran	390	U	
84-66-2	Diethyl Phthalate	390	U	
131-11-3	Dimethyl Phthalate	390	U	
206-44-0	Fluoranthene	390	U	
86-73-7	Fluorene	390	U	
118-74-1	Hexachlorobenzene	390	U	
87-68-3	Hexachlorobutadiene	390	U	
77-47-4	Hexachlorocyclopentadiene	390	U	UJ
67-72-1	Hexachloroethane	390	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	390	U	
78-59-1	Isophorone	390	U	
91-20-3	Naphthalene	390	U	
98-95-3	Nitrobenzene	390	U	
87-86-5	Pentachlorophenol	770	U	
85-01-8	Phenanthrene	390	U	
108-95-2	Phenol	390	U	

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SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-025-1/1
Sample Volume :	30	Lab File ID :	D33575.D
% Moisture:	13.56	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	390	U
110-86-1	Pyridine	390	U
111-91-1	bis(2-chloroethoxy) methane	390	U
111-44-4	bis(2-chloroethyl) ether	390	U
117-81-7	bis(2-ethylhexyl) phthalate	390	U
84-74-2	di-n-Butyl Phthalate	390	U
117-84-0	di-n-Octyl Phthalate	390	U
621-64-7	n-Nitrosodi-n-Propylamine	390	U
86-30-6	n-Nitrosodiphenylamine	390	U

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SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-026-1/1
Sample Volume :	30	Lab File ID :	D33576.D
% Moisture:	13.8	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	390	U
95-50-1	1,2-Dichlorobenzene	390	U
541-73-1	1,3-Dichlorobenzene	390	U
106-46-7	1,4-Dichlorobenzene	390	U
108-60-1	2,2-Oxybis(1-Chloropropane)	390	U
95-95-4	2,4,5-Trichlorophenol	390	U
88-06-2	2,4,6-Trichlorophenol	390	U
120-83-2	2,4-Dichlorophenol	390	U
105-67-9	2,4-Dimethylphenol	390	U
51-28-5	2,4-Dinitrophenol	770	U
121-14-2	2,4-Dinitrotoluene	390	U
606-20-2	2,6-Dinitrotoluene	390	U
91-58-7	2-Chloronaphthalene	390	U
95-57-8	2-Chlorophenol	390	U
91-57-6	2-Methylnaphthalene	390	U
88-74-4	2-Nitroaniline	390	U
88-75-5	2-Nitrophenol	390	U
95-48-7	2-methylphenol	390	U
91-94-1	3,3-Dichlorobenzidine	770	U
99-09-2	3-Nitroaniline	390	U
534-52-1	4,6-dinitro-2-methyl phenol	770	U
101-55-3	4-Bromophenyl-phenylether	390	U
106-47-8	4-Chloroaniline	390	U
7005-72-3	4-Chlorophenyl Phenyl Ether	390	U
100-01-6	4-Nitroaniline	390	U
100-02-7	4-Nitrophenol	770	U
59-50-7	4-chloro-3-methylphenol	390	U
106-44-5	4-methylphenol	390	U
83-32-9	Acenaphthene	390	U

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SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-026-1/1
Sample Volume :	30	Lab File ID :	D33576.D
% Moisture:	13.8	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	390	U	
120-12-7	Anthracene	390	U	
56-55-3	Benzo(a)anthracene	390	U	
50-32-8	Benzo(a)pyrene	390	U	
205-99-2	Benzo(b)fluoranthene	390	U	
191-24-2	Benzo(g,h,i)perylene	390	U	
207-08-9	Benzo(k)fluoranthene	390	U	
65-85-0	Benzoic Acid	770	U	UJ
100-51-6	Benzyl Alcohol	390	U	
85-68-7	Benzyl Butyl Phthalate	390	U	
86-74-8	Carbazole	390	U	
218-01-9	Chrysene	390	U	
53-70-3	Dibenz(a,h)Anthracene	390	U	
132-64-9	Dibenzofuran	390	U	
84-66-2	Diethyl Phthalate	390	U	
131-11-3	Dimethyl Phthalate	390	U	
206-44-0	Fluoranthene	390	U	
86-73-7	Fluorene	390	U	
118-74-1	Hexachlorobenzene	390	U	
87-68-3	Hexachlorobutadiene	390	U	
77-47-4	Hexachlorocyclopentadiene	390	U	UJ
67-72-1	Hexachloroethane	390	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	390	U	
78-59-1	Isophorone	390	U	
91-20-3	Naphthalene	390	U	
98-95-3	Nitrobenzene	390	U	
87-86-5	Pentachlorophenol	770	U	
85-01-8	Phenanthrene	390	U	
108-95-2	Phenol	390	U	

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SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-026-1/1
Sample Volume :	30	Lab File ID :	D33576.D
% Moisture:	13.8	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	390	U
110-86-1	Pyridine	390	U
111-91-1	bis(2-chloroethoxy) methane	390	U
111-44-4	bis(2-chloroethyl) ether	390	U
117-81-7	bis(2-ethylhexyl) phthalate	390	U
84-74-2	di-n-Butyl Phthalate	390	U
117-84-0	di-n-Octyl Phthalate	390	U
621-64-7	n-Nitrosodi-n-Propylamine	390	U
86-30-6	n-Nitrosodiphenylamine	390	U

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SAMPLE NO
51SB1B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-004-031-1/2
Sample Volume :	30	Lab File ID :	D33572.D
% Moisture:	12.06	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	380	U
95-50-1	1,2-Dichlorobenzene	380	U
541-73-1	1,3-Dichlorobenzene	380	U
106-46-7	1,4-Dichlorobenzene	380	U
108-60-1	2,2-Oxybis(1-Chloropropane)	380	U
95-95-4	2,4,5-Trichlorophenol	380	U
88-06-2	2,4,6-Trichlorophenol	380	U
120-83-2	2,4-Dichlorophenol	380	U
105-67-9	2,4-Dimethylphenol	380	U
51-28-5	2,4-Dinitrophenol	760	U
121-14-2	2,4-Dinitrotoluene	380	U
606-20-2	2,6-Dinitrotoluene	380	U
91-58-7	2-Chloronaphthalene	380	U
95-57-8	2-Chlorophenol	380	U
91-57-6	2-Methylnaphthalene	380	U
88-74-4	2-Nitroaniline	380	U
88-75-5	2-Nitrophenol	380	U
95-48-7	2-methylphenol	380	U
91-94-1	3,3-Dichlorobenzidine	760	U
99-09-2	3-Nitroaniline	380	U
534-52-1	4,6-dinitro-2-methyl phenol	760	U
101-55-3	4-Bromophenyl-phenylether	380	U
106-47-8	4-Chloroaniline	380	U
7005-72-3	4-Chlorophenyl Phenyl Ether	380	U
100-01-6	4-Nitroaniline	380	U
100-02-7	4-Nitrophenol	760	U
59-50-7	4-chloro-3-methylphenol	380	U
106-44-5	4-methylphenol	380	U
83-32-9	Acenaphthene	380	U

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-004-031-1/2
Sample Volume :	30	Lab File ID :	D33572.D
% Moisture:	12.06	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	380	U	
120-12-7	Anthracene	380	U	
56-55-3	Benzo(a)anthracene	380	U	
50-32-8	Benzo(a)pyrene	380	U	
205-99-2	Benzo(b)fluoranthene	380	U	
191-24-2	Benzo(g,h,i)perylene	380	U	
207-08-9	Benzo(k)fluoranthene	380	U	
65-85-0	Benzoic Acid	760	U	UJ
100-51-6	Benzyl Alcohol	380	U	
85-68-7	Benzyl Butyl Phthalate	380	U	
86-74-8	Carbazole	380	U	
218-01-9	Chrysene	380	U	
53-70-3	Dibenz(a,h)Anthracene	380	U	
132-64-9	Dibenzofuran	380	U	
84-66-2	Diethyl Phthalate	380	U	
131-11-3	Dimethyl Phthalate	380	U	
206-44-0	Fluoranthene	380	U	
86-73-7	Fluorene	380	U	
118-74-1	Hexachlorobenzene	380	U	
87-68-3	Hexachlorobutadiene	380	U	
77-47-4	Hexachlorocyclopentadiene	380	U	UJ
67-72-1	Hexachloroethane	380	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	380	U	
78-59-1	Isophorone	380	U	
91-20-3	Naphthalene	380	U	
98-95-3	Nitrobenzene	380	U	
87-86-5	Pentachlorophenol	760	U	
85-01-8	Phenanthrene	380	U	
108-95-2	Phenol	380	U	

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FORM 1
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SAMPLE NO
51SB1B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-004-031-1/2
Sample Volume :	30	Lab File ID :	D33572.D
% Moisture:	12.06	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	380	U
110-86-1	Pyridine	380	U
111-91-1	bis(2-chloroethoxy) methane	380	U
111-44-4	bis(2-chloroethyl) ether	380	U
117-81-7	bis(2-ethylhexyl) phthalate	380	U
84-74-2	di-n-Butyl Phthalate	380	U
117-84-0	di-n-Octyl Phthalate	380	U
621-64-7	n-Nitrosodi-n-Propylamine	380	U
86-30-6	n-Nitrosodiphenylamine	380	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-005-035-1/1
Sample Volume :	30	Lab File ID :	D33577.D
% Moisture:	13.22	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	380	U
95-50-1	1,2-Dichlorobenzene	380	U
541-73-1	1,3-Dichlorobenzene	380	U
106-46-7	1,4-Dichlorobenzene	380	U
108-60-1	2,2-Oxybis(1-Chloropropane)	380	U
95-95-4	2,4,5-Trichlorophenol	380	U
88-06-2	2,4,6-Trichlorophenol	380	U
120-83-2	2,4-Dichlorophenol	380	U
105-67-9	2,4-Dimethylphenol	380	U
51-28-5	2,4-Dinitrophenol	770	U
121-14-2	2,4-Dinitrotoluene	230	J B
606-20-2	2,6-Dinitrotoluene	4600	
91-58-7	2-Chloronaphthalene	380	U
95-57-8	2-Chlorophenol	380	U
91-57-6	2-Methylnaphthalene	380	U
88-74-4	2-Nitroaniline	380	U
88-75-5	2-Nitrophenol	380	U
95-48-7	2-methylphenol	380	U
91-94-1	3,3-Dichlorobenzidine	770	U
99-09-2	3-Nitroaniline	380	U
534-52-1	4,6-dinitro-2-methyl phenol	770	U
101-55-3	4-Bromophenyl-phenylether	380	U
106-47-8	4-Chloroaniline	380	U
7005-72-3	4-Chlorophenyl Phenyl Ether	380	U
100-01-6	4-Nitroaniline	380	U
100-02-7	4-Nitrophenol	770	U
59-50-7	4-chloro-3-methylphenol	380	U
106-44-5	4-methylphenol	380	U
83-32-9	Acenaphthene	380	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-005-035-1/1
Sample Volume :	30	Lab File ID :	D33577.D
% Moisture:	13.22	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	380	U	
120-12-7	Anthracene	380	U	
56-55-3	Benzo(a)anthracene	380	U	
50-32-8	Benzo(a)pyrene	380	U	
205-99-2	Benzo(b)fluoranthene	380	U	
191-24-2	Benzo(g,h,i)perylene	380	U	
207-08-9	Benzo(k)fluoranthene	380	U	
65-85-0	Benzoic Acid	770	U	UJ
100-51-6	Benzyl Alcohol	380	U	
85-68-7	Benzyl Butyl Phthalate	380	U	
86-74-8	Carbazole	380	U	
218-01-9	Chrysene	380	U	
53-70-3	Dibenz(a,h)Anthracene	380	U	
132-64-9	Dibenzofuran	380	U	
84-66-2	Diethyl Phthalate	380	U	
131-11-3	Dimethyl Phthalate	380	U	
206-44-0	Fluoranthene	380	U	
86-73-7	Fluorene	380	U	
118-74-1	Hexachlorobenzene	380	U	
87-68-3	Hexachlorobutadiene	380	U	
77-47-4	Hexachlorocyclopentadiene	380	U	UJ
67-72-1	Hexachloroethane	380	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	380	U	
78-59-1	Isophorone	380	U	
91-20-3	Naphthalene	380	U	
98-95-3	Nitrobenzene	380	U	
87-86-5	Pentachlorophenol	770	U	
85-01-8	Phenanthrene	380	U	
108-95-2	Phenol	380	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-005-035-1/1
Sample Volume :	30	Lab File ID :	D33577.D
% Moisture:	13.22	Date Received	04/08/2004
Extraction:	SW3540C	Date Extracte	04/10/2004
Extract Volume	1 mL	Date Analyzed	04/13/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
129-00-0	Pyrene	380	U
110-86-1	Pyridine	380	U
111-91-1	bis(2-chloroethoxy) methane	380	U
111-44-4	bis(2-chloroethyl) ether	380	U
117-81-7	bis(2-ethylhexyl) phthalate	380	U
84-74-2	di-n-Butyl Phthalate	380	U
117-84-0	di-n-Octyl Phthalate	380	U
621-64-7	n-Nitrosodi-n-Propylamine	380	U
86-30-6	n-Nitrosodiphenylamine	380	U

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040704R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-001-001-1/2
Sample Volume :	810	Lab File ID :	T18905.D
% Moisture:		Date Received	04/08/2004
Extraction:	SW3520C	Date Extracte	04/13/2004
Extract Volume	1 mL	Date Analyzed	04/20/2004
Injection Volume :	1 µL	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
120-82-1	1,2,4-Trichlorobenzene	12	U
95-50-1	1,2-Dichlorobenzene	12	U
541-73-1	1,3-Dichlorobenzene	12	U
106-46-7	1,4-Dichlorobenzene	12	U
108-60-1	2,2-Oxybis(1-Chloropropane)	12	U
95-95-4	2,4,5-Trichlorophenol	12	U
88-06-2	2,4,6-Trichlorophenol	12	U
120-83-2	2,4-Dichlorophenol	12	U
105-67-9	2,4-Dimethylphenol	12	U
51-28-5	2,4-Dinitrophenol	25	U
121-14-2	2,4-Dinitrotoluene	40	
606-20-2	2,6-Dinitrotoluene	14	
91-58-7	2-Chloronaphthalene	12	U
95-57-8	2-Chlorophenol	12	U
91-57-6	2-Methylnaphthalene	12	U
88-74-4	2-Nitroaniline	12	U
88-75-5	2-Nitrophenol	12	U
95-48-7	2-methylphenol	12	U
91-94-1	3,3-Dichlorobenzidine	25	U
99-09-2	3-Nitroaniline	12	U
534-52-1	4,6-dinitro-2-methyl phenol	25	U
101-55-3	4-Bromophenyl-phenylether	12	U
106-47-8	4-Chloroaniline	12	U
7005-72-3	4-Chlorophenyl Phenyl Ether	12	U
100-01-6	4-Nitroaniline	12	U
100-02-7	4-Nitrophenol	25	U
59-50-7	4-chloro-3-methylphenol	12	U
106-44-5	4-methylphenol	12	U
83-32-9	Acenaphthene	12	U

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040704R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-001-001-1/2
Sample Volume :	810	Lab File ID :	T18905.D
% Moisture:		Date Received	04/08/2004
Extraction:	SW3520C	Date Extracte	04/13/2004
Extract Volume	1 mL	Date Analyzed	04/20/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q	
208-96-8	Acenaphthylene	12	U	
120-12-7	Anthracene	12	U	
56-55-3	Benzo(a)anthracene	12	U	
50-32-8	Benzo(a)pyrene	12	U	
205-99-2	Benzo(b)fluoranthene	12	U	
191-24-2	Benzo(g,h,i)perylene	12	U	
207-08-9	Benzo(k)fluoranthene	12	U	
65-85-0	Benzoic Acid	8.8	J	J
100-51-6	Benzyl Alcohol	12	U	
85-68-7	Benzyl Butyl Phthalate	12	U	
86-74-8	Carbazole	12	U	
218-01-9	Chrysene	12	U	
53-70-3	Dibenz(a,h)Anthracene	12	U	
132-64-9	Dibenzofuran	12	U	
84-66-2	Diethyl Phthalate	25		
131-11-3	Dimethyl Phthalate	12	U	
206-44-0	Fluoranthene	12	U	
86-73-7	Fluorene	12	U	
118-74-1	Hexachlorobenzene	12	U	
87-68-3	Hexachlorobutadiene	12	U	
77-47-4	Hexachlorocyclopentadiene	12	U	
67-72-1	Hexachloroethane	12	U	
193-39-5	Indeno(1,2,3-c,d)Pyrene	12	U	
78-59-1	Isophorone	12	U	
91-20-3	Naphthalene	12	U	
98-95-3	Nitrobenzene	12	U	
87-86-5	Pentachlorophenol	25	U	
85-01-8	Phenanthrene	12	U	
108-95-2	Phenol	3.0	J	J

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Form 1 Copy

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040704R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastruct
Lab Code	GPL	SAS NO. :	
Case No.		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-001-001-1/2
Sample Volume :	810	Lab File ID :	T18905.D
% Moisture:		Date Received	04/08/2004
Extraction:	SW3520C	Date Extracte	04/13/2004
Extract Volume	1 mL	Date Analyzed	04/20/2004
Injection Volume :	1 µ L	Dilution Factor	1
GPC Clean up (Y/N):	N pH:		

Concentration Units (ug/L or ug/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
129-00-0	Pyrene	12	U
110-86-1	Pyridine	12	U
111-91-1	bis(2-chloroethoxy) methane	12	U
111-44-4	bis(2-chloroethyl) ether	12	U
117-81-7	bis(2-ethylhexyl) phthalate	4.9	J
84-74-2	di-n-Butyl Phthalate	14	
117-84-0	di-n-Octyl Phthalate	12	U
621-64-7	n-Nitrosodi-n-Propylamine	12	U
86-30-6	n-Nitrosodiphenylamine	12	U

J

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation – TAL Inorganics
GPL Laboratories, Inc., SDG 404068

DATE: July 28, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 07, 2004. Samples were analyzed for target analyte list (TAL) Inorganics using USEPA SW-846 3050B/6010B for ICP metals, USEPA SW-846 7471A for mercury, and USEPA SW-846 9014 for cyanide. A total of four soil samples were validated. All samples were analyzed for total TAL inorganics. The sample Ids are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB1A	404068-002	51SB1B	404068-004
TMSB1A	404068-003	51SB1C	404068-005

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements* (USACE, February 2001), method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Inorganic Data Review* (April, 1993). Parameters evaluated are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Initial and Continuing Calibration
X		Blank Analysis
	X	ICP Interference Check Sample (ICS)
	X	Laboratory Control Sample (LCS)
	X	Lab Sample Duplicate
X		Matrix Spike
	X	ICP Serial Dilution
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with noted qualifications.

E. Malarek

Eric Malarek, Chemist

7/28/04

Date

RFAAP VALIDATION REPORT
TAL INORGANICS REVIEW
SDG 404068

I-Holding Times

The primary objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of sample analysis. The soil samples are received and stored cool @4 °C ± 2 °C, with a maximum holding time of 180 days for ICP metals, 28 days for mercury, and 14 days for cyanide from collection (USEPA criteria).

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/07/04, coolers were received by the laboratory at 2.0°C and 2.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: Samples were collected 04/07/04. They were digested on 04/13/04 and analyzed for ICP metals on 04/14/04. Samples were digested on 04/09/04 for mercury and were analyzed for mercury on 04/10/04. Samples were digested on 04/19/04 for cyanide and were analyzed for cyanide on 04/19/04. All holding time criteria were met. No qualifiers were applied.

II-Initial and Continuing Calibration

Requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of the analysis run, and continuing calibration verification documents that the initial calibration is still valid.

ICP: 1- blank (USACE <MDL)
3 – standards (r≥0.995)
ICV/CCV (90-110%) (USACE 90-110%)
MRL (70-130%) (USACE 80-120%)

Hg: 1 – blank (USACE <MDL)
5 – standards (r≥0.995)
ICV/CCV (80-120%) (USACE ICV 90-110% / CCV 80-120%)
MRL (80-120%)

CN: 1- blank (USACE <MDL)
5 – standards (r≥0.995)
ICV/CCV (85-115%)

- The samples were analyzed for ICP metals on 04/14/04. Mercury was analyzed on 04/10/04 with a correlation coefficient of 0.9999. Cyanide was analyzed on 04/19/04 with a correlation coefficient of 0.9997. All ICV/CCV standards were within criteria. No qualifiers were applied. **Table 2** summarizes the MRL standard analysis for metals. Samples with concentrations detected less than two times the MRL with out of criteria MRL recovery were qualified.

Table 2 MRL Analysis Summary

Analysis Date	Analysis	MRL (µg/L)	MRL (mg/kg)	MRL %Recovery	Qualified samples @ <2xMRL	Validation Qualifiers
04/14/04	ICP	Various	Various	All within criteria	None	None
04/10/04	Hg	0.2	0.033	All within criteria	None	None

III-Blanks

Blanks (preparation and calibration blanks) are assessed to determine the existence and magnitude of contamination problems. No contaminants should be detected (i.e. <MDL) in any of the associated blanks. USACE Shell limits are < ½MRL for the method blank. Samples are qualified "B" when they are less than 5X the absolute value of the maximum blank concentration. **Table 3** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factors = 10 for ICP; 6 for Hg; and 40 for CN). Rinse blank 040704R applies to these samples and was analyzed in SDG 0404068.

Table 3 Blank Contamination Analysis Summary

Analysis Date	Analysis	QC Blank ID	Max Conc. mg/kg	Action Level mg/kg	B qualified samples
04/14/04	ICP-Al	ICB/CCBs	2.0B	10.0	None
04/14/04	ICP-Ba	ICB/CCBs	0.02B	0.10	None
04/14/04	ICP-Be	ICB/CCBs	0.02B	0.10	None
04/14/04	ICP-Cu	ICB/CCBs	0.11B	0.55	None
04/14/04	ICP-Mg	ICB/CCBs	3.65B	18.3	None
04/14/04	ICP-Ni	ICB/CCBs	0.09B	0.45	None
04/10/04	Hg	ICB/CCBs	<MRL	NA	None
04/16/04	CN	ICB/CCBs	<MRL	NA	None
04/14/04	ICP-Ba	PBS	0.026B	0.13	None
04/14/04	ICP-Ca	PBS	9.0B	45.0	51SB1B
04/14/04	ICP-Cr	PBS	0.11B	0.55	None
04/14/04	ICP-Cu	PBS	0.14B	0.70	None
04/14/04	ICP-Mg	PBS	1.8B	9.0	None
04/14/04	ICP-Mn	PBS	0.12B	0.60	None
04/14/04	ICP-Ni	PBS	0.34B	1.7	None
04/14/04	ICP-K	PBS	3.0B	15.0	None
04/14/04	ICP-Na	PBS	63.7B	319	51SB1A, TMSB1A, 51SB1B, 51SB1C
04/14/04	ICP-Tl	PBS	0.40B	2.0	None
04/10/04	Hg	PBS	<MRL	NA	None
04/16/04	CN	PBS	<MRL	NA	None
04/15/04	ICPMS-Ba	040704R	0.11B	0.55	None
04/15/04	ICPMS-Cd	040704R	0.021B	0.11	51SB1A, TMSB1A, 51SB1B
04/15/04	ICPMS-Ca	040704R	53.1B	266	51SB1A, TMSB1A, 51SB1B
04/15/04	ICPMS-Cr	040704R	0.38	1.9	None
04/15/04	ICPMS-Co	040704R	0.0012B	0.006	None
04/15/04	ICPMS-Cu	040704R	0.30E	1.5	51SB1C
04/15/04	ICPMS-Fe	040704R	1.86B	9.3	None
04/15/04	ICPMS-Pb	040704R	0.023B	0.12	None
04/15/04	ICPMS-Mg	040704R	9.81BE	49.1	None
04/15/04	ICPMS-Mn	040704R	0.22	1.1	None
04/15/04	ICPMS-Ni	040704R	0.041B	0.21	None
04/15/04	ICPMS-K	040704R	6.73BE	33.7	None
04/15/04	ICPMS-Na	040704R	21.0BE	105	None
04/15/04	ICPMS-Zn	040704R	0.40BE	2.0	None
04/14/04	Hg	040704R	<MRL	NA	None
04/19/04	CN	040704R	<MRL	NA	None

B = Value is estimated <MRL and >MDL.
E = Serial Dilution percent difference not within limits.

IV-ICP Interference Check Sample (ICS)
The ICP interference check sample (ICS) verifies interelement and background correction factors. ICP Interference Check is performed at the beginning and end of each sample analysis run. Control limits are 80-120% (USACE limits 80-120%).

- All criteria were met. No qualifiers were applied.

V-Laboratory Control Samples (LCS)
The laboratory control sample (LCS) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. All soil LCS results must fall within the control limits of 80-120% for ICPMS metals and mercury and 85-115% for cyanide. USACE Shell limits for metals are 80-120% (60-140% for sporadic marginal failures (SMF)).

- Sample BKS65876 was used as LCS for ICP metals analysis. All criteria were met. No qualifiers were applied.

- Sample BKS65820 was used as LCS for total mercury analysis. All criteria were met. No qualifiers were applied.

- Sample BKS1731 was used as LCS for total cyanide analysis. All criteria were met. No qualifiers were applied.

VI-Duplicate Sample Analysis
Duplicate sample determinations are used to demonstrate acceptable method precision by the laboratory at the time of analysis. Duplicate analysis are also performed to generate data in order to determine the long-term precision of the analytical method on various matrices. RPDs must be within established control limits. USACE Shell limits for metals are 25% RPD for ICP metals and 20% RPD for mercury and cyanide.

- Sample 51SB1B (404068-004) was used as sample duplicate for ICP metals analysis. Calcium (42.4%) was outside criteria. Calcium was outside due to low sample concentration, therefore no qualifiers were applied based upon this outlier.

- Sample 51SB1B (404068-004) was used as sample duplicate for mercury analysis. All criteria were met. No qualifiers were applied.

- Sample 51SB1B (404068-004) was used for the sample duplicate analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VII-Matrix Spike
MS are generated to determine long-term accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. Specific criteria include the analyses of matrix spike and matrix spike duplicate samples at a frequency of one MS per 20 samples of similar matrix. MS recoveries and relative percent differences between MS recoveries should be within the specified limits. USACE Shell limits for metals are 75-125% for ICP metals and 80-120% for mercury and cyanide. Post digestion spikes limits are 75-125% for ICP metals and 85-115% for mercury and cyanide.

- Sample 51SB1B (404068-004) was used for the MS analysis for ICP analysis. Aluminum (1002%), antimony (54.1%), and iron (213%) were outside of control limits. Post digestion spikes were within criteria for antimony. The sample concentration was >4 times the spike added for aluminum and iron, therefore no qualifiers were applied based upon these outliers. For antimony, the spiked sample was qualified bias low non-detect "UL".

- Sample 51SB1B (404068-004) was used for the MS analysis for mercury analysis. This sample was analyzed in SDG 404068. All criteria were met. No qualifiers were applied.

- Sample 51SB1B (404068-004) was used for the MS analysis for cyanide analysis. All criteria were met. No qualifiers were applied.

VIII-ICP Serial Dilution

An ICP serial dilution is performed to determine whether significant physical or chemical interferences exist due to sample matrix at high concentrations. An analysis of a 5-fold dilution should agree within 10% difference of the original result when the concentration in sample is a factor of 50 above MDL.

- The serial dilution for the ICP was analyzed for sample 51SB1B (404068-004). Arsenic (70.6%), beryllium (13.4%), cadmium (100%), calcium (41.6%), and sodium (100%) were outside of criteria limits. Sample concentrations were <50 times MDL for arsenic, beryllium, cadmium, calcium, and sodium, therefore no qualifiers were applied based upon these outliers.

IX-Field Duplicate Sample Analysis

Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the aqueous samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB1A (404068-002) and TMSB1A (404068-003) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (mg/kg)	Duplicate Result (mg/kg)	%RPD	Qualifier
51SB1A	404068-002	Aluminum	22500	22900	1.8	None
51SB1A	404068-002	Arsenic	3.3	2.8	16.4	None
51SB1A	404068-002	Barium	58.6	54.2	7.8	None
51SB1A	404068-002	Beryllium	0.60	0.63	4.9	None
51SB1A	404068-002	Cadmium	0.13 B	0.13 B	0.0	None
51SB1A	404068-002	Calcium	157	140	11.4	None
51SB1A	404068-002	Chromium	26.0	19.2	30.1	None
51SB1A	404068-002	Cobalt	7.7	9.4	19.9	None
51SB1A	404068-002	Copper	9.3	9.7	4.2	None
51SB1A	404068-002	Iron	25800	26800	3.8	None
51SB1A	404068-002	Lead	11.7	10.3	12.7	None
51SB1A	404068-002	Magnesium	949	1090	13.8	None
51SB1A	404068-002	Manganese	260	278	6.7	None
51SB1A	404068-002	Nickel	8.6	9.2	6.7	None
51SB1A	404068-002	Potassium	960	1090	12.7	None
51SB1A	404068-002	Selenium	0.59 B	0.62 B	5.0	None
51SB1A	404068-002	Sodium	75.4 B	70.1 B	7.3	None
51SB1A	404068-002	Vanadium	53.7	53.7	0.0	None
51SB1A	404068-002	Zinc	30.9	32.9	6.3	None
51SB1A	404068-002	Mercury	0.050	0.053	5.8	None
51SB1A	404068-002	Cyanide	0.16 U	0.15 U	NA	None

B = Estimated value <MRL and >MDL.
U = Value non-detect at MRL.
NA = Not Applicable

X-Quantitation Verification

The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." The following calculations were performed for verification.

ICP Sample: 51SB1A (404068-002), Total Barium

Conc. (mg/kg) = {(conc. µg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(638.3331 µg/L)*(0.100 L)*(1)} / {(1.26 g)*(0.8644)} = 58.6 µg/g = 58.6 mg/kg

Reported concentration = 58.6 mg/kg
%D = 0.0%
Values were within 10% difference.

CVAA Sample: 51SB1A (404068-002), Total Mercury

Conc. (mg/kg) = {(conc. µg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(0.321 µg/L)*(0.100 L)*(1)} / {(0.75 g)*(0. 8644)} = 0.050 µg/g = 0.050 mg/kg

Reported concentration = 0.050 mg/kg
%D = 0.0%
Values were within 10% difference.

Cyanide Sample: 51SB1BMS (404068-004MS), Total Cyanide

Conc. (mg/kg) = {(conc. µg/L)*(Final Volume L)*(DF)} / {(Weight Sample g)*(Fraction Solids)}

Conc. (mg/kg) = {(41.2 µg/L)*(0.050 L)*(1)} / {(1.92 g)*(0.8794)} = 1.22 µg/g = 1.22 mg/kg

Reported concentration = 1.22 mg/kg
%D = 0.0%
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

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Metals Data Reporting Form

Sample Results **SDG:** 404068S

Lab Sample ID: S 404068-002-029-1/1 **Client ID:** 51SB1A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/13/04 **Prep Batch:** 65876

Weight: 1.26 **Volume:** 100 **Percent Moisture:** 13.56

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.2**	**18.4**	**22500**		1	**ICPST**	**4/14/04**	**15:45**
Antimony	206.84	0.30	1.8	0.30	UN	1	ICPST	4/14/04	15:45
Arsenic	**189.04**	**0.35**	**1.8**	**3.3**		1	**ICPST**	**4/14/04**	**15:45**
Barium	**493.41**	**0.015**	**0.46**	**58.6**		1	**ICPST**	**4/14/04**	**15:45**
Beryllium	**313.04**	**0.012**	**0.18**	**0.60**		1	**ICPST**	**4/14/04**	**15:45**
Cadmium	**226.50**	**0.032**	**0.55**	**0.13**	**B**	B 1	**ICPST**	**4/14/04**	**15:45**
Calcium	**317.93**	**7.1**	**91.8**	**157**		B 1	**ICPST**	**4/14/04**	**15:45**
Chromium	**267.72**	**0.042**	**0.46**	**26.0**		1	**ICPST**	**4/14/04**	**15:45**
Cobalt	**228.62**	**0.080**	**0.46**	**7.7**		1	**ICPST**	**4/14/04**	**15:45**
Copper	**324.75**	**0.081**	**0.92**	**9.3**		1	**ICPST**	**4/14/04**	**15:45**
Iron	**271.44**	**3.0**	**13.8**	**25800**		1	**ICPST**	**4/14/04**	**15:45**
Lead	**220.35**	**0.12**	**0.92**	**11.7**		1	**ICPST**	**4/14/04**	**15:45**
Magnesium	**279.08**	**0.85**	**23.0**	**948**		1	**ICPST**	**4/14/04**	**15:45**
Manganese	**257.61**	**0.015**	**0.46**	**260**		1	**ICPST**	**4/14/04**	**15:45**
Nickel	**231.60**	**0.056**	**0.92**	**8.6**		1	**ICPST**	**4/14/04**	**15:45**
Potassium	**766.49**	**2.7**	**23.0**	**960**		1	**ICPST**	**4/14/04**	**15:45**
Selenium	**196.03**	**0.59**	**1.8**	**0.59**	**B**	J 1	**ICPST**	**4/14/04**	**15:45**
Silver	328.07	0.12	0.28	0.12	U	1	ICPST	4/14/04	15:45
Sodium	**330.23**	**29.8**	**230**	**75.4**	**B**	B 1	**ICPST**	**4/14/04**	**15:45**
Thallium	190.86	0.36	2.8	0.36	U	1	ICPST	4/14/04	15:45
Vanadium	**292.40**	**0.075**	**0.92**	**53.7**		1	**ICPST**	**4/14/04**	**15:45**
Zinc	**206.2**	**0.52**	**1.8**	**30.9**		1	**ICPST**	**4/14/04**	**15:45**

Comments: Sample Date: 04/07/04 Sample Time: 07:55 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

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Metals Data Reporting Form

Sample Results **SDG:** 404068S

Lab Sample ID: S 404068-002-029-1/1 **Client ID:** 51SB1A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65820

Weight: 0.75 **Volume:** 100 **Percent Moisture:** 13.56

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.031	0.050		1	CVAA	4/10/04	15:48

Comments: Sample Date: 04/07/04 Sample Time: 07:55 AM

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

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Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB1A	Lab Sample ID:	404068-002-029-1/1
Sample Date/Time:	04/07/2004 07:55	Percent Moisture:	13.56
Receipt Date/Time:	04/08/2004 12:49	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time	
1)	Cyanide, Total	BQL	U	0.16	1	mg/kg	04/19/04	17:00

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Metals Data Reporting Form

Sample Results **SDG:** 404068S

Lab Sample ID: S 404068-003-030-1/1 **Client ID:** TMSB1A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/13/04 **Prep Batch:** 65876

Weight: 1.29 **Volume:** 100 **Percent Moisture:** 13.80

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.2**	**18.0**	**22900**		**1**	**ICPST**	**4/14/04**	**15:53**
Antimony	**206.84**	**0.30**	**1.8**	**0.35**	**BN**	**J 1**	**ICPST**	**4/14/04**	**15:53**
Arsenic	**189.04**	**0.34**	**1.8**	**2.8**		**1**	**ICPST**	**4/14/04**	**15:53**
Barium	**493.41**	**0.014**	**0.45**	**54.2**		**1**	**ICPST**	**4/14/04**	**15:53**
Beryllium	**313.04**	**0.012**	**0.18**	**0.62**		**1**	**ICPST**	**4/14/04**	**15:53**
Cadmium	**226.50**	**0.031**	**0.54**	**0.13**	**B**	**B 1**	**ICPST**	**4/14/04**	**15:53**
Calcium	**317.93**	**6.9**	**89.9**	**140**		**B 1**	**ICPST**	**4/14/04**	**15:53**
Chromium	**267.72**	**0.041**	**0.45**	**19.2**		**1**	**ICPST**	**4/14/04**	**15:53**
Cobalt	**228.62**	**0.078**	**0.45**	**9.4**		**1**	**ICPST**	**4/14/04**	**15:53**
Copper	**324.75**	**0.079**	**0.90**	**9.7**		**1**	**ICPST**	**4/14/04**	**15:53**
Iron	**271.44**	**2.9**	**13.5**	**26800**		**1**	**ICPST**	**4/14/04**	**15:53**
Lead	**220.35**	**0.12**	**0.90**	**10.3**		**1**	**ICPST**	**4/14/04**	**15:53**
Magnesium	**279.08**	**0.84**	**22.5**	**1090**		**1**	**ICPST**	**4/14/04**	**15:53**
Manganese	**257.61**	**0.014**	**0.45**	**278**		**1**	**ICPST**	**4/14/04**	**15:53**
Nickel	**231.60**	**0.055**	**0.90**	**9.2**		**1**	**ICPST**	**4/14/04**	**15:53**
Potassium	**766.49**	**2.7**	**22.5**	**1090**		**1**	**ICPST**	**4/14/04**	**15:53**
Selenium	**196.03**	**0.58**	**1.8**	**0.62**	**B**	**J 1**	**ICPST**	**4/14/04**	**15:53**
Silver	328.07	0.12	0.27	0.12	U	1	ICPST	4/14/04	15:53
Sodium	**330.23**	**29.2**	**225**	**70.1**	**B**	**B 1**	**ICPST**	**4/14/04**	**15:53**
Thallium	190.86	0.35	2.7	0.35	U	1	ICPST	4/14/04	15:53
Vanadium	**292.40**	**0.074**	**0.90**	**53.7**		**1**	**ICPST**	**4/14/04**	**15:53**
Zinc	**206.2**	**0.51**	**1.8**	**32.9**		**1**	**ICPST**	**4/14/04**	**15:53**

Comments: Sample Date: 04/07/04 Sample Time: 07:55 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

U Result is less than the IDL

B Result is between IDL and RL

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Metals Data Reporting Form

Sample Results **SDG:** 404068S

Lab Sample ID: S 404068-003-030-1/1 **Client ID:** TMSB1A

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65820

Weight: 0.75 **Volume:** 100 **Percent Moisture:** 13.80

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.031	0.053		1	CVAA	4/10/04	15:51

Comments: Sample Date: 04/07/04 Sample Time: 07:55 AM

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

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Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	TMSB1A	Lab Sample ID:	404068-003-030-1/1
Sample Date/Time:	04/07/2004 07:55	Percent Moisture:	13.8
Receipt Date/Time:	04/08/2004 12:49	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time	
1)	Cyanide, Total	BQL	U	0.15	1	mg/kg	04/19/04	17:00

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Metals Data Reporting Form

Sample Results **SDG:** 404068S

Lab Sample ID: S 404068-004-033-1/2 **Client ID:** 51SB1B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/13/04 **Prep Batch:** 65876

Weight: 1.25 **Volume:** 100 **Percent Moisture:** 12.06

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.2**	**18.2**	**16700**		1	ICPST	4/14/04	16:01
Antimony	206.84	0.30	1.8	0.30	UN	UL 1	ICPST	4/14/04	16:01
Arsenic	**189.04**	**0.35**	**1.8**	**1.5**	**B**	J 1	ICPST	4/14/04	16:01
Barium	**493.41**	**0.015**	**0.45**	**40.5**		1	ICPST	4/14/04	16:01
Beryllium	**313.04**	**0.012**	**0.18**	**0.52**		1	ICPST	4/14/04	16:01
Cadmium	**226.50**	**0.032**	**0.55**	**0.088**	**B**	B 1	ICPST	4/14/04	16:01
Calcium	**317.93**	**7.0**	**91.0**	**34.6**	**B**	B 1	ICPST	4/14/04	16:01
Chromium	**267.72**	**0.042**	**0.45**	**15.2**		1	ICPST	4/14/04	16:01
Cobalt	**228.62**	**0.079**	**0.45**	**7.1**		1	ICPST	4/14/04	16:01
Copper	**324.75**	**0.080**	**0.91**	**5.5**		1	ICPST	4/14/04	16:01
Iron	**271.44**	**2.9**	**13.6**	**18300**		1	ICPST	4/14/04	16:01
Lead	**220.35**	**0.12**	**0.91**	**7.4**		1	ICPST	4/14/04	16:01
Magnesium	**279.08**	**0.85**	**22.7**	**650**		1	ICPST	4/14/04	16:01
Manganese	**257.61**	**0.015**	**0.45**	**316**		1	ICPST	4/14/04	16:01
Nickel	**231.60**	**0.055**	**0.91**	**6.1**		1	ICPST	4/14/04	16:01
Potassium	**766.49**	**2.7**	**22.7**	**710**		1	ICPST	4/14/04	16:01
Selenium	196.03	0.58	1.8	0.58	U	1	ICPST	4/14/04	16:01
Silver	328.07	0.12	0.27	0.12	U	1	ICPST	4/14/04	16:01
Sodium	**330.23**	**29.6**	**227**	**78.0**	**B**	B 1	ICPST	4/14/04	16:01
Thallium	190.86	0.35	2.7	0.35	U	1	ICPST	4/14/04	16:01
Vanadium	**292.40**	**0.075**	**0.91**	**38.3**		1	ICPST	4/14/04	16:01
Zinc	**206.2**	**0.52**	**1.8**	**23.2**		1	ICPST	4/14/04	16:01

Comments: Sample Date: 04/07/04 Sample Time: 08:35 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

U Result is less than the IDL

B Result is between IDL and RL

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Metals Data Reporting Form

Sample Results **SDG:** 404068S

Lab Sample ID: S 404068-004-033-1/2 **Client ID:** 51SB1B

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65820

Weight: 0.73 **Volume:** 100 **Percent Moisture:** 12.06

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.016	0.031	0.023	B	J 1	CVAA	4/10/04	15:54

Comments: Sample Date: 04/07/04 Sample Time: 08:35 AM

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form I Only

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB1B	Lab Sample ID:	404068-004-033-1/2
Sample Date/Time:	04/07/2004 08:35	Percent Moisture:	12.06
Receipt Date/Time:	04/08/2004 12:49	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time	
1)	Cyanide, Total	BQL	U	0.15	1	mg/kg	04/19/04	17:00

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Metals Data Reporting Form

Sample Results **SDG:** 404068S

Lab Sample ID: S 404068-005-036-1/1 **Client ID:** 51SB1C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/13/04 **Prep Batch:** 65876

Weight: 1.25 **Volume:** 100 **Percent Moisture:** 13.22

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	**308.22**	**1.2**	**18.4**	**27700**		1	**ICPST**	**4/14/04**	**16:41**
Antimony	206.84	0.30	1.8	0.30	UN	1	ICPST	4/14/04	16:41
Arsenic	**189.04**	**0.35**	**1.8**	**2.2**		1	**ICPST**	**4/14/04**	**16:41**
Barium	**493.41**	**0.015**	**0.46**	**80.4**		1	**ICPST**	**4/14/04**	**16:41**
Beryllium	**313.04**	**0.012**	**0.18**	**1.5**		1	**ICPST**	**4/14/04**	**16:41**
Cadmium	**226.50**	**0.032**	**0.55**	**0.43**	**B**	J 1	**ICPST**	**4/14/04**	**16:41**
Calcium	**317.93**	**7.1**	**92.2**	**1220**		1	**ICPST**	**4/14/04**	**16:41**
Chromium	**267.72**	**0.042**	**0.46**	**47.7**		1	**ICPST**	**4/14/04**	**16:41**
Cobalt	**228.62**	**0.080**	**0.46**	**6.5**		1	**ICPST**	**4/14/04**	**16:41**
Copper	**324.75**	**0.081**	**0.92**	**1.3**		B 1	**ICPST**	**4/14/04**	**16:41**
Iron	**271.44**	**3.0**	**13.8**	**37800**		1	**ICPST**	**4/14/04**	**16:41**
Lead	**220.35**	**0.12**	**0.92**	**0.80**	**B**	J 1	**ICPST**	**4/14/04**	**16:41**
Magnesium	**279.08**	**0.86**	**23.0**	**22200**		1	**ICPST**	**4/14/04**	**16:41**
Manganese	**257.61**	**0.015**	**0.46**	**354**		1	**ICPST**	**4/14/04**	**16:41**
Nickel	**231.60**	**0.056**	**0.92**	**53.6**		1	**ICPST**	**4/14/04**	**16:41**
Potassium	**766.49**	**2.7**	**23.0**	**3040**		1	**ICPST**	**4/14/04**	**16:41**
Selenium	196.03	0.59	1.8	0.59	U	1	ICPST	4/14/04	16:41
Silver	328.07	0.12	0.28	0.12	U	1	ICPST	4/14/04	16:41
Sodium	**330.23**	**30.0**	**230**	**84.7**	**B**	B 1	**ICPST**	**4/14/04**	**16:41**
Thallium	190.86	0.36	2.8	0.36	U	1	ICPST	4/14/04	16:41
Vanadium	**292.40**	**0.076**	**0.92**	**22.5**		1	**ICPST**	**4/14/04**	**16:41**
Zinc	**206.2**	**0.53**	**1.8**	**19.0**		1	**ICPST**	**4/14/04**	**16:41**

Comments: Sample Date: 04/07/04 Sample Time: 09:35 AM Color(Before): BROWN Color(After): YELLOW Clarity(After): CLEAR Texture: MEDIUM

U Result is less than the IDL

B Result is between IDL and RL

Form I Copy

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Metals Data Reporting Form

Sample Results **SDG:** 404068S

Lab Sample ID: S 404068-005-036-1/1 **Client ID:** 51SB1C

Matrix: Soil **Units:** mg/kg **Prep Date:** 4/9/04 **Prep Batch:** 65820

Weight: 0.76 **Volume:** 100 **Percent Moisture:** 13.22

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.015	0.030	0.015	U	1	CVAA	4/10/04	16:09

Comments: Sample Date: 04/07/04 Sample Time: 09:35 AM

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

Form I Comp

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	SOIL
Client Sample ID:	51SB1C	Lab Sample ID:	404068-005-036-1/1
Sample Date/Time:	04/07/2004 09:35	Percent Moisture:	13.22
Receipt Date/Time:	04/08/2004 12:49	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.15	1	mg/kg	04/19/04 17:00

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Metals Data Reporting Form

Sample Results **SDG:** 404068W

Lab Sample ID: S 404068-001-011-1/1 **Client ID:** 040704R

Matrix: Water **Units:** ug/L **Prep Date:** 4/15/04 **Prep Batch:** 65877

Weight: 100.00 **Volume:** 100 **Percent Moisture:** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Aluminum	27	0.30	100	0.30	U	1	ICPMS	4/15/04	22:22
Antimony	121	0.081	4.0	0.081	U	1	ICPMS	4/15/04	22:22
Arsenic	75	0.12	5.0	0.12	U	1	ICPMS	4/15/04	22:22
Barium	**137**	**0.018**	**5.0**	**1.1**	**B**	**J 1**	**ICPMS**	**4/15/04**	**22:22**
Beryllium	9	0.0025	0.20	0.0025	U	1	ICPMS	4/15/04	22:22
Cadmium	**110**	**0.032**	**0.50**	**0.21**	**B**	**J 1**	**ICPMS**	**4/15/04**	**22:22**
Calcium	**44**	**1.5**	**1000**	**531**	**B**	**J 1**	**ICPMS**	**4/15/04**	**22:22**
Chromium	**52**	**0.068**	**2.0**	**3.8**		**1**	**ICPMS**	**4/15/04**	**22:22**
Cobalt	**59**	**0.0077**	**1.0**	**0.012**	**B**	**J 1**	**ICPMS**	**4/15/04**	**22:22**
Copper	**65**	**0.017**	**2.0**	**3.0**	**E**	**1**	**ICPMS**	**4/15/04**	**22:22**
Iron	**56**	**0.75**	**50.0**	**18.6**	**B**	**J 1**	**ICPMS**	**4/15/04**	**22:22**
Lead	**208**	**0.015**	**2.0**	**0.23**	**B**	**J 1**	**ICPMS**	**4/15/04**	**22:22**
Magnesium	**25**	**0.79**	**100**	**98.1**	**BE**	**J 1**	**ICPMS**	**4/15/04**	**22:22**
Manganese	**55**	**0.098**	**2.0**	**2.2**		**1**	**ICPMS**	**4/15/04**	**22:22**
Nickel	**60**	**0.013**	**1.0**	**0.41**	**B**	**J 1**	**ICPMS**	**4/15/04**	**22:22**
Potassium	**39**	**0.67**	**1000**	**67.3**	**BE**	**J 1**	**ICPMS**	**4/15/04**	**22:22**
Selenium	82	0.13	10.0	0.13	U	2	ICPMS	4/16/04	21:01
Silver	107	0.0023	0.30	0.0023	U	1	ICPMS	4/15/04	22:22
Sodium	**23**	**0.65**	**1000**	**210**	**BE**	**J 1**	**ICPMS**	**4/15/04**	**22:22**
Thallium	203	0.064	2.0	0.064	U	1	ICPMS	4/15/04	22:22
Vanadium	51	0.35	5.0	0.35	U	1	ICPMS	4/15/04	22:22
Zinc	**66**	**0.022**	**10.0**	**4.0**	**BE**	**J 1**	**ICPMS**	**4/15/04**	**22:22**

Comments: Sample Date: 04/07/04 Sample Time: 10:15 AM

U Result is less than the IDL

B Result is between IDL and RL

E Serial dilution percent difference not within limits

Form 1 Equivalent

Form I Copy

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Metals Data Reporting Form

Sample Results **SDG:** 404068W

Lab Sample ID: S 404068-001-011-1/1 **Client ID:** 040704R

Matrix: Water **Units:** ug/L **Prep Date:** 4/13/04 **Prep Batch:** 65888

Weight: 100.00 **Volume:** 100 **Percent Moisture:** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Mercury	253.7	0.10	0.20	0.10	U	1	CVAA	4/14/04	12:27

Comments: Sample Date: 04/07/04 Sample Time: 10:15 AM

E Serial dilution percent difference not within limits

U Result is less than the IDL

R Result is between IDL and RL

Form 1 Equivalent

Form I Copy

Analytical Summary Report

Client Name:	Shaw Environmental & Infrastructure	Sample Matrix:	WATER
Client Sample ID:	040704R	Lab Sample ID:	404068-001-012-1/1
Sample Date/Time:	04/07/2004 10:15	Percent Moisture:	NA
Receipt Date/Time:	04/08/2004 12:49	Preparation Method:	NA
Prepared Date/Time:		Analytical Method:	SW9014T

#	Parameter	Reported Result	Q	Reporting Limit	Dil Fact	Units	Analysis Date/Time
1)	Cyanide, Total	BQL	U	0.010	1	mg/L	04/19/04 17:00

Shaw Environmental, Inc.

2113 Emmorton Park Road
Edgewood, MD 21040-1037
410.612.6350
Fax 410.612.6351

Shaw™ Shaw Environmental, Inc.

MEMORANDUM

TO: Jeff Parks, Shaw E&I RFAAP Project Manager

FROM: Eric Malarek, Shaw E&I RFAAP Project Chemist

SUBJECT: Radford Army Ammunition Plant (RFAAP) Data Validation - Volatiles
GPL Laboratories, Inc., SDG 404068

DATE: July 26, 2004

The purpose of this memorandum is to present the data validation report for the samples collected for the SWMU 51 RFI at the RFAAP on April 07, 2004. The samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs) using USEPA SW846 Method 5035/8260B. A total of four soil samples were validated. The sample IDs are:

Field Sample ID	Lab Sample ID	Field Sample ID	Lab Sample ID
51SB1A	404068-002	51SB1B	404068-004
TMSB1A	404068-003	51SB1C	404068-005

Data were reviewed by Eric Malarek and validated using a combination of project QAPP, *USACE Shell for Analytical Chemistry Requirements*, method-specific criteria, and laboratory SOP criteria. The data qualifier scheme was consistent with the *Region III Modifications to the National Functional Guidelines for Organic Data Review* (September 1994). Parameters evaluated under data validation procedure Level M3 are presented in **Table 1**. Data associated with parameters in compliance with quality control specifications have not been qualified. Data associated with parameters that did not comply with quality control specifications and directly impacted project data have been qualified in accordance with USEPA Region III specifications.

Table 1 Laboratory Performance Criteria

Qualified		Parameter
Yes	No	
	X	Holding Times
	X	Instrument Performance Results
X		Initial Calibration
X		Continuing Calibration
X		Blank Analysis
	X	Laboratory Control Sample
X		Matrix Spike/ Spike Duplicate Sample
	X	System Monitoring Compounds
	X	Internal Standards
	X	Field Sample Duplicate
X		Quantitation Verification

The quality of data collected in support of this sampling activity is considered acceptable with the noted qualifications, except for the following. Compound 2-butanone was rejected "R" for samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) based upon low calibration response recoveries.

E. Malarek

Eric Malarek, Chemist

7/26/04

Date

RFAAP VALIDATION REPORT
VOLATILES REVIEW
SDG 404068

I-Holding Times
The objective is to ascertain the validity of results based on the holding time of the sample from time of collection to time of analysis. Holding time criteria: For Encore soil samples cooled @ 4°C ± 2°C; the maximum holding time is 2 days for preparation, 14 days from sample collection to analysis.

- Temperature Review: The temperature blank was sent with each cooler and recorded by the lab upon receipt. For samples collected on 04/07/04, coolers were received by the laboratory at 2.0°C and 2.0°C. All criteria were met. No qualifiers were applied.

- Holding Time Review: The soil samples were collected on 04/07/04, prepped on 04/08/04, and analyzed for TCL VOCs on 04/17/04. All criteria were met. No qualifiers were applied.

II-Instrument Performance Check
The analysis of the instrument performance check solution must be performed at the beginning of each 12-hour period during which samples are analyzed.

- The instrument performance check, bromofluorobenzene (BFB), met the ion abundance criteria. No qualification was applied.

III-Initial Calibration
Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be ≥ 0.05 for all other compounds. Percent relative standard deviation (%RSD) must be ≤ 15% for each target compound and must be ≤ 30% for each calibration check compound. For compounds analyzed using linear regression or second order, correlation coefficients must be >0.99. All detects are qualified as estimated "J" for where there were exceeding %RSDs, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For initial calibration for VOCs performed on 04/16/04 on instrument HP#F, target compounds bromomethane (32.0%; grossly exceeding), chloroethane (26.2%), acetone (26.7%), 2-butanone (18.2%, RRF=0.019), and 2-hexanone (46.7%; grossly exceeding) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compounds chloroethane and acetone were qualified "J" for detects and no qualifier for non-detects based upon the high %RSD. Compounds 2-hexanone and bromomethane were qualified "J" for detects and "UJ" for non-detects based upon the grossly exceeding %RSD. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this initial calibration.

IV-Continuing Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument used is capable of producing acceptable qualitative and quantitative data for volatile target compounds. Continuing calibration establishes the 12-hour relative response factors on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. The RRF must be greater than 0.1 for chloromethane, 1,1-dichloroethane, and bromoform and greater than 0.3 for 1,1,2,2-tetrachloroethane and chlorobenzene. The minimum relative response factor (RRF) must be $\geq$ 0.05 for all other compounds. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF must be within 20% for all target compounds. All detects are qualified as estimated "J" for where there were exceeding %Ds, and all non-detects are qualified as estimated "UJ" for where there were grossly exceeding recoveries, unless determined to be unusable "R". Grossly exceeding is defined as twice the established criteria limits. For where there were low RRFs, all detects are qualified as estimated "J" and non-detects are rejected "R".

- For continuing calibration for VOCs performed on 04/16/04 @15:58 on instrument HP#F, target compounds 2-butanone (RRF=0.017) and 2-hexanone (21.8%) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compound 2-hexanone was qualified "J" for detects and no qualifier for non-detects based upon this outlier. No samples apply to this continuing calibration.

- For continuing calibration for VOCs performed on 04/17/04 @10:52 on instrument HP#F, target compounds bromomethane (31.1%), chloroethane (22.0%), 2-butanone (RRF=0.017), and 2-hexanone (30.5%) were outside control limits. Compound 2-butanone was qualified "J" for detects and rejected "R" for non-detects based upon low calibration response. Compounds 2-hexanone, bromomethane, and chloroethane were qualified "J" for detects and no qualifier for non-detects based upon this outlier. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this continuing calibration.

V-Blank Analysis

The purpose of blank analyses is to determine the presence and magnitude of contamination problems resulting from field and laboratory activities. A method blank analysis must be performed after the calibration standards and once every 12-hour time period beginning with the injection of BFB. No contaminants should be detected in any of the associated blanks > the MDL. USACE Shell criteria specifies all concentrations should be less than one-half MRL (<MRL for common laboratory contaminants methylene chloride, acetone, and 2-butanone). Positive sample results are reported and qualified "B", if the concentration of the compound in the sample is $\leq$ 10 times (10x) the maximum amount in any blank for the common laboratory contaminants methylene chloride, acetone, and 2-butanone, or 5 times (5X) the maximum amount for other volatile target compounds. **Table 2** summarizes the blank contamination analysis. Action levels are based upon dilution factor of one, 100% solids, and were converted to soil values (soil conversion factor = 1). Rinse blank 040704R and associated trip blank 040704T apply to these samples and were analyzed in SDG 0404068.

Table 2 Blank Contamination Analysis Summary

Analysis Date	QC Blank ID	Compound	Max Conc. µg/kg	Action Level µg/kg	B qualified samples
04/17/04	BLK66018	acetone	6.1J	61	51SB1A, TMSB1A, 51SB1B, 51SB1C
04/17/04	BLK66018	methylene chloride	3.0J	30	51SB1A, TMSB1A, 51SB1B
04/14/04	040704R	2-butanone	2.1J	21	None
04/14/04	040704R	acetone	18	180	51SB1A, TMSB1A, 51SB1B, 51SB1C
04/14/04	040704R	benzene	0.95J	4.8	None
04/14/04	040704R	ethylbenzene	0.45J	2.3	None
04/14/04	040704R	m,p-xylenes	1.8	9.0	None
04/14/04	040704R	o-xylene	0.76J	3.8	None
04/14/04	040704R	toluene	3.7	18.5	None
04/14/04	040704T	2-butanone	1.9J	4.2	None
04/14/04	040704T	acetone	4.2J	42	51SB1A, TMSB1A, 51SB1B, 51SB1C
04/14/04	040704T	methylene chloride	0.90J	9.0	51SB1A, TMSB1A, 51SB1B

J = Estimated value <MRL and >MDL

VI-Laboratory Control Sample (LCS) and LCSD

Data for laboratory control samples (LCS) and LCSD are evaluated to determine long-term accuracy and precision of the analytical method on various matrices. Percent recoveries (%Rs) should be within the specified control limits. USACE Shell limits are 75-125%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- Sample BKS66018 was used as the LCS for the TCL VOC analysis. Compounds acetone (74%) and bromomethane (124%) were outside USACE or lab criteria and within the SMF criteria. There were a total of 35 spike recoveries with 2 sporadic marginal failures. Bromomethane was non-detect for all associated samples. No qualifiers were applied based upon these outliers. Samples 51SB1A (404068-002), TMSB1A (404068-003), 51SB1B (404068-004), and 51SB1C (404068-005) apply to this LCS.

VII-Matrix Spike/Matrix Spike Duplicate

Data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. The percent recoveries (%Rs) and the relative percent difference (RPD) must be within the specified control limits. USACE Shell limits are 70-130%; RPD ≤ 30% (60-140%; RPD ≤ 40% for sporadic marginal failures (SMF)).

- Sample 51SB1B (404068-004) was used for the MS/MSD analysis for VOCs. Compounds 1,1,1-trichloroethane (RPD=21%), 2-hexanone (67%), acetone (52%, 52%), benzene (73%), bromodichloromethane (RPD=21%), chlorobenzene (71%), chloroethane (RPD=27%), chloromethane (67%), ethylbenzene (68%), styrene (67%), tetrachloroethylene (63%), toluene (71%), trichloroethene (70%), and m.p-xylenes (66%) were outside either lab or USACE criteria limits. Compounds 2-hexanone, acetone, benzene, chlorobenzene, chloromethane, ethylbenzene, styrene, tetrachloroethylene, toluene, trichloroethene, and m,p-xylenes were qualified bias low "L" for detects and "UL" for non-detects for the spiked sample based upon these outliers. Compounds 1,1,1-trichloroethane, bromodichloromethane, and chloroethane were non-detect for the spiked sample, therefore no qualifiers were applied based upon these outliers.

VIII-System Monitoring Compounds (Surrogates)
Laboratory performance on individual samples is evaluated through the review of surrogate spike samples. Recoveries for system monitoring compounds in volatile samples and blanks must be within the specified control limits.

Criteria: 1,2-Dichlorobenzene-d4 (74-122%) – SMC1 (USACE Shell Criteria: 70-130%)
1,2-Dichloroethane-d4 (64-120%) – SMC2 (USACE Shell Criteria: 70-130%)
4-Bromofluorobenzene (76-116%) – SMC3 (USACE Shell Criteria: 70-130%)
Toluene-d8 (76-120%) – SMC4 (USACE Shell Criteria: 70-130%)

- All criteria were met. No qualifiers were applied.

IX-Internal Standards (IS)
Internal standards performance criteria ensure that GC/MS sensitivity and response are stable during every analytical run. Specific criteria include: area counts (-50% to +100%) of the associated calibration standard, and retention time (± 30 seconds) from that of the associated calibration standard.

- All criteria were met. No qualifiers were applied.

X-Field Duplicate Sample Analysis
Field duplicates were collected to identify the cumulative precision of the sampling and analytical process and sent to the laboratory blind. The RPD was calculated only for those analytes which were detected at levels exceeding the method reporting limits in both samples of the duplicate pair. Analytes that were qualified because of blank contamination (B-qualified) or were rejected (R-qualified) in either sample of the duplicate pair were excluded from the duplicate assessment. Precision control criterion was established at 50% RPD for the soil samples. Analytical results were qualified as estimated (J) for any RPDs exceeding criteria.

- Field soil sample duplicate pair 51SB1A (404068-002) and TMSB1A (404068-003) was collected. The field duplicate evaluation is noted in **Table 3.** If one of the duplicate pair was non-detect and other <2MRL, then was not evaluated. All criteria were met. No qualifiers were applied.

Table 3 Field Duplicate Analysis Summary

Sample ID	Lab ID	Compound	Original Result (µg/kg)		Duplicate Result (µg/kg)		%RPD	Qualifier
51SB1A	404068-002	Acetone	17	JB	18	JB	NA	None
51SB1A	404068-002	Methylene Chloride	1.1	JB	1.2	JB	NA	None

J = Estimated value <MRL and >MDL.
B = Compound detected in method blank.
NA = Not Applicable. Acetone and methylene chloride were detected in blanks.

XI-Quantitation Verification
The accuracy of analytical results is verified through the calculation of several parameters. The percent difference (%D) between the calculated and the reported values should be within 10%. Any sample value > MDL and < MRL or < 3*MDL (whichever is greater) was qualified as estimated, "J." Any tentatively identified compounds found were qualified as estimated "J".

Sample: 51SB1A (404068-002), Acetone

Conc. (µg/kg) = {(Ax)*(Is)*(DF)*(Vp)} / {(Ais)*(RRF)*(Ws)*Fs)}
where: Ax is the compound area
Is is the corresponding internal standard concentration (ng/mL)
DF is the dilution factor
Vp is the volume purged (mL)
Ais is the corresponding internal standard area
RRF is the relative response factor
Ws is the weight of the sample (g)
Fs is the fraction solids for the sample = 1.0 for Wet Weight

Conc. µg/kg = (16628 * 50 ng/mL * 1 * 5 mL) / (636272 * 0.069 * 6.41g * 0.8644) = 17 µg/kg
Reported Conc. = 17 µg/kg
%D = 0.0
Values were within 10% difference.

USEPA Region III Validation Qualifiers

(No Code) = Confirmed identification.

B = The analyte has been detected in the sample and the associated laboratory or field blank.

J = Indicates an estimated value for (1) estimated value due to QC non-conformance. Reported value may not be accurate or precise, (2) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, or (3) estimating a concentration ≥ MDL and <MRL or <3*MDL, whichever is greater.

K = Analyte present. Reported value may be biased high (estimated) due to QC non-conformance.

L = Analyte present. Reported value may be biased low (estimated) due to QC non-conformance.

R = Unreliable result. Analyte may or may not be present in the sample due to QC non-conformance.

UL = Value is estimated bias low and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise. Quantitation limit is probably higher.

UJ = Value is estimated and not detected due to QC non-conformance. Reporting limit may be inaccurate or imprecise.

Laboratory Qualifiers

(No Code) = Confirmed identification.

A (Dioxins) = MDL is based upon the signal-to-noise measurement.

B (Metals) = The reported value was obtained from a reading <MRL and ≥MDL and is considered estimated.

B (Organics and Dioxins) = The analyte or compound has been detected in the sample and laboratory method blank. It indicates probable blank contamination.

D (Organics) = Indicates sample was analyzed at a dilution.

E (Metals) = Reported value is estimated because of the presence of interferences.

E (Organics) = Identifies compounds whose concentrations exceed the upper level of the calibration range.

E (Dioxins) = Reported value is estimated because of the presence of ether interferences.

EMPC (Dioxins) = The ion-abundance ratio between the two characteristic PCDD/F ions is outside accepted ranges. The detected PCDD/F is reported as an estimated maximum possible concentration (EMPC).

I (Dioxins) = Reported value is estimated because of the incorrect isotope rations were obtained.

J (All) = Indicates an estimated value for (1) estimating a concentration as a tentatively identified compound as indicated by the mass spectral and retention time data, (2) estimating a concentration <MRL and ≥ MDL, or estimating a concentration below the calibration range.

N (Organics) = Indicates presumptive evidence of a compound for tentatively identified compounds using a library search.

N (Metals) = Laboratory spike sample recovery not within control limits.

P (Organics) = Target analyte confirmation >40% difference for detected compound between the primary and secondary columns. The lower of the two values was reported.

U (All) = ND = BQL = Not detected. The associated number indicates the compound reporting limit for the sample.

* (Metals) = Duplicate analysis not within control limits.

* (Organics) = Surrogate outside of QC limits on both original and re-analysis.

GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-013-1/3
Sample Volume :	6.41	Lab File ID :	F39841.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec	13.56	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.5	U	
79-34-5	1,1,2,2-Tetrachloroethane	4.5	U	
79-00-5	1,1,2-Trichloroethane	4.5	U	
75-34-3	1,1-Dichloroethane	4.5	U	
75-35-4	1,1-Dichloroethene	4.5	U	
107-06-2	1,2-Dichloroethane	4.5	U	
78-87-5	1,2-Dichloropropane	4.5	U	
78-93-3	2-Butanone	9.0	U	R
591-78-6	2-Hexanone	9.0	U	UJ
108-10-1	4-Methyl-2-Pentanone	9.0	U	
67-64-1	Acetone	17	B	B
71-43-2	Benzene	4.5	U	
75-27-4	Bromodichloromethane	4.5	U	
75-25-2	Bromoform	4.5	U	
74-83-9	Bromomethane	9.0	U	UJ
75-15-0	Carbon Disulfide	4.5	U	
56-23-5	Carbon Tetrachloride	4.5	U	
108-90-7	Chlorobenzene	4.5	U	
75-00-3	Chloroethane	9.0	U	
67-66-3	Chloroform	4.5	U	
74-87-3	Chloromethane	9.0	U	
124-48-1	Dibromochloromethane	4.5	U	
100-41-4	Ethylbenzene	4.5	U	
75-09-2	Methylene Chloride	1.1	JB	B
100-42-5	Styrene	4.5	U	
127-18-4	Tetrachloroethylene	4.5	U	
108-88-3	Toluene	4.5	U	
79-01-6	Trichloroethene	4.5	U	
75-01-4	Vinyl Chloride	9.0	U	

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FORM 1
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SAMPLE NO
51SB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No: :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-002-013-1/3
Sample Volume :	6.41	Lab File ID :	F39841.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec	13.56	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	4.5	U
10061-01-5	cis-1,3-Dichloropropene	4.5	U
136777-61-2	m,p-Xylenes	4.5	U
95-47-6	o-Xylene	4.5	U
156-60-5	trans-1,2-dichloroethene	4.5	U
10061-02-6	trans-1,3-dichloropropene	4.5	U

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GPL Laboratories

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-016-1/3
Sample Volume :	6.17	Lab File ID :	F39842.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec	13.8	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	4.7	U	
79-34-5	1,1,2,2-Tetrachloroethane	4.7	U	
79-00-5	1,1,2-Trichloroethane	4.7	U	
75-34-3	1,1-Dichloroethane	4.7	U	
75-35-4	1,1-Dichloroethene	4.7	U	
107-06-2	1,2-Dichloroethane	4.7	U	
78-87-5	1,2-Dichloropropane	4.7	U	
78-93-3	2-Butanone	9.4	U	R
591-78-6	2-Hexanone	9.4	U	UJ
108-10-1	4-Methyl-2-Pentanone	9.4	U	
67-64-1	Acetone	18	B	B
71-43-2	Benzene	4.7	U	
75-27-4	Bromodichloromethane	4.7	U	
75-25-2	Bromoform	4.7	U	
74-83-9	Bromomethane	9.4	U	UJ
75-15-0	Carbon Disulfide	4.7	U	
56-23-5	Carbon Tetrachloride	4.7	U	
108-90-7	Chlorobenzene	4.7	U	
75-00-3	Chloroethane	9.4	U	
67-66-3	Chloroform	4.7	U	
74-87-3	Chloromethane	9.4	U	
124-48-1	Dibromochloromethane	4.7	U	
100-41-4	Ethylbenzene	4.7	U	
75-09-2	Methylene Chloride	1.2	JB	B
100-42-5	Styrene	4.7	U	
127-18-4	Tetrachloroethylene	4.7	U	
108-88-3	Toluene	4.7	U	
79-01-6	Trichloroethene	4.7	U	
75-01-4	Vinyl Chloride	9.4	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
TMSB1A

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No: :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-003-016-1/3
Sample Volume :	6.17	Lab File ID :	F39842.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec	13.8	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	4.7	U
10061-01-5	cis-1,3-Dichloropropene	4.7	U
136777-61-2	m,p-Xylenes	4.7	U
95-47-6	o-Xylene	4.7	U
156-60-5	trans-1,2-dichloroethene	4.7	U
10061-02-6	trans-1,3-dichloropropene	4.7	U

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SAMPLE NO
51SB1B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No: :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-004-019-1/3
Sample Volume :	4.63	Lab File ID :	F39840.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec	12.06	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	6.1	U	
79-34-5	1,1,2,2-Tetrachloroethane	6.1	U	
79-00-5	1,1,2-Trichloroethane	6.1	U	
75-34-3	1,1-Dichloroethane	6.1	U	
75-35-4	1,1-Dichloroethene	6.1	U	
107-06-2	1,2-Dichloroethane	6.1	U	
78-87-5	1,2-Dichloropropane	6.1	U	
78-93-3	2-Butanone	12	U	R
591-78-6	2-Hexanone	12	U	UJ
108-10-1	4-Methyl-2-Pentanone	12	U	
67-64-1	Acetone	14	B	B
71-43-2	Benzene	6.1	U	UL
75-27-4	Bromodichloromethane	6.1	U	
75-25-2	Bromoform	6.1	U	
74-83-9	Bromomethane	12	U	UJ
75-15-0	Carbon Disulfide	6.1	U	
56-23-5	Carbon Tetrachloride	6.1	U	
108-90-7	Chlorobenzene	6.1	U	UL
75-00-3	Chloroethane	12	U	
67-66-3	Chloroform	6.1	U	
74-87-3	Chloromethane	12	U	UL
124-48-1	Dibromochloromethane	6.1	U	
100-41-4	Ethylbenzene	6.1	U	UL
75-09-2	Methylene Chloride	1.6	JB	B
100-42-5	Styrene	6.1	U	UL
127-18-4	Tetrachloroethylene	6.1	U	UL
108-88-3	Toluene	6.1	U	UL
79-01-6	Trichloroethene	6.1	U	UL
75-01-4	Vinyl Chloride	12	U	

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FORM I
ANALYSIS DATA SHEET

SAMPLE NO
51SB1B

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-004-019-1/3
Sample Volume :	4.63	Lab File ID :	F39840.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec	12.06	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
156-59-2	cis-1,2-Dichloroethene	6.1	U	
10061-01-5	cis-1,3-Dichloropropene	6.1	U	
136777-61-2	m,p-Xylenes	6.1	U	VL
95-47-6	o-Xylene	6.1	U	
156-60-5	trans-1,2-dichloroethene	6.1	U	
10061-02-6	trans-1,3-dichloropropene	6.1	U	

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ANALYSIS DATA SHEET

SAMPLE NO
51SB1C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-005-022-1/3
Sample Volume :	5.3	Lab File ID :	F39843.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec	13.22	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	5.4	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.4	U	
79-00-5	1,1,2-Trichloroethane	5.4	U	
75-34-3	1,1-Dichloroethane	5.4	U	
75-35-4	1,1-Dichloroethene	5.4	U	
107-06-2	1,2-Dichloroethane	5.4	U	
78-87-5	1,2-Dichloropropane	5.4	U	
78-93-3	2-Butanone	11	U	R
591-78-6	2-Hexanone	11	U	UJ
108-10-1	4-Methyl-2-Pentanone	11	U	
67-64-1	Acetone	6.3	JB	B
71-43-2	Benzene	5.4	U	
75-27-4	Bromodichloromethane	5.4	U	
75-25-2	Bromoform	5.4	U	
74-83-9	Bromomethane	11	U	UJ
75-15-0	Carbon Disulfide	5.4	U	
56-23-5	Carbon Tetrachloride	5.4	U	
108-90-7	Chlorobenzene	5.4	U	
75-00-3	Chloroethane	11	U	
67-66-3	Chloroform	5.4	U	
74-87-3	Chloromethane	11	U	
124-48-1	Dibromochloromethane	5.4	U	
100-41-4	Ethylbenzene	5.4	U	
75-09-2	Methylene Chloride	11	U	
100-42-5	Styrene	5.4	U	
127-18-4	Tetrachloroethylene	5.4	U	
108-88-3	Toluene	5.4	U	
79-01-6	Trichloroethene	5.4	U	
75-01-4	Vinyl Chloride	11	U	

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FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
51SB1C

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	SOIL	Lab Sample ID :	404068-005-022-1/3
Sample Volume :	5.3	Lab File ID :	F39843.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec	13.22	Date Analyzed	04/17/2004
GC Column :	RTX_VOA ID. 0.53	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/kg

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	5.4	U
10061-01-5	cis-1,3-Dichloropropene	5.4	U
136777-61-2	m,p-Xylenes	5.4	U
95-47-6	o-Xylene	5.4	U
156-60-5	trans-1,2-dichloroethene	5.4	U
10061-02-6	trans-1,3-dichloropropene	5.4	U

Form I (Lab)

GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040704R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-006-037-1/3
Sample Volume :	25	Lab File ID :	B07298.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec		Date Analyzed	04/14/2004
GC Column :	RTX_502.2 ID. 0.18	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/L

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	1.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U	
79-00-5	1,1,2-Trichloroethane	1.0	U	
75-34-3	1,1-Dichloroethane	1.0	U	
75-35-4	1,1-Dichloroethene	1.0	U	
107-06-2	1,2-Dichloroethane	1.0	U	
78-87-5	1,2-Dichloropropane	1.0	U	
78-93-3	2-Butanone	5.0	U	R
591-78-6	2-Hexanone	5.0	U	
108-10-1	4-Methyl-2-Pentanone	5.0	U	
67-64-1	Acetone	18		
71-43-2	Benzene	0.95	J	J
75-27-4	Bromodichloromethane	1.0	U	
75-25-2	Bromoform	1.0	U	
74-83-9	Bromomethane	1.0	U	
75-15-0	Carbon Disulfide	1.0	U	
56-23-5	Carbon Tetrachloride	1.0	U	
108-90-7	Chlorobenzene	1.0	U	
75-00-3	Chloroethane	2.0	U	
67-66-3	Chloroform	1.0	U	
74-87-3	Chloromethane	2.0	U	
124-48-1	Dibromochloromethane	1.0	U	
100-41-4	Ethylbenzene	0.45	J	J
75-09-2	Methylene Chloride	1.0	U	
100-42-5	Styrene	1.0	U	
127-18-4	Tetrachloroethylene	1.0	U	
108-88-3	Toluene	3.7		
79-01-6	Trichloroethene	1.0	U	
75-01-4	Vinyl Chloride	1.0	U	

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040704R

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-006-037-1/3
Sample Volume :	25	Lab File ID :	B07298.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec		Date Analyzed	04/14/2004
GC Column :	RTX_502.2 ID. 0.18	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
136777-61-2	m,p-Xylenes	1.8	
95-47-6	o-Xylene	0.76	J
156-60-5	trans-1,2-dichloroethene	1.0	U
10061-02-6	trans-1,3-dichloropropene	1.0	U

J

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GPL Laboratories

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040704T

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-007-040-1/2
Sample Volume :	25	Lab File ID :	B07299.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec		Date Analyzed	04/14/2004
GC Column :	RTX_502.2 ID. 0.18	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/L

CAS NO	COMPOUND		Q	
71-55-6	1,1,1-Trichloroethane	1.0	U	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U	
79-00-5	1,1,2-Trichloroethane	1.0	U	
75-34-3	1,1-Dichloroethane	1.0	U	
75-35-4	1,1-Dichloroethene	1.0	U	
107-06-2	1,2-Dichloroethane	1.0	U	
78-87-5	1,2-Dichloropropane	1.0	U	
78-93-3	2-Butanone	1.9	J	J
591-78-6	2-Hexanone	5.0	U	
108-10-1	4-Methyl-2-Pentanone	5.0	U	
67-64-1	Acetone	4.2	J	J
71-43-2	Benzene	1.0	U	
75-27-4	Bromodichloromethane	1.0	U	
75-25-2	Bromoform	1.0	U	
74-83-9	Bromomethane	1.0	U	
75-15-0	Carbon Disulfide	1.0	U	
56-23-5	Carbon Tetrachloride	1.0	U	
108-90-7	Chlorobenzene	1.0	U	
75-00-3	Chloroethane	2.0	U	
67-66-3	Chloroform	1.0	U	
74-87-3	Chloromethane	2.0	U	
124-48-1	Dibromochloromethane	1.0	U	
100-41-4	Ethylbenzene	1.0	U	
75-09-2	Methylene Chloride	0.90	J	J
100-42-5	Styrene	1.0	U	
127-18-4	Tetrachloroethylene	1.0	U	
108-88-3	Toluene	1.0	U	
79-01-6	Trichloroethene	1.0	U	
75-01-4	Vinyl Chloride	1.0	U	

GPL Laboratories

Form I Cover

GPL
FORM 1
ANALYSIS DATA SHEET

SAMPLE NO
040704T

Lab Name :	GPL Laboratories	Client. :	Shaw Environmental & Infrastructure
Lab Code :	GPL	SAS NO. :	404068
Case No. :		SDG NO :	404068
Matrix : (Soil / Water)	WATER	Lab Sample ID :	404068-007-040-1/2
Sample Volume :	25	Lab File ID :	B07299.D
Level :	Low	Date Received	04/08/2004
% Moisture: not dec		Date Analyzed	04/14/2004
GC Column :	RTX_502.2 ID. 0.18	Dilution Factor :	1
Soil Extract Volume :	(µ L)	Soil Aliquot Volume :	(µ L)

Concentration Units (mg/L or mg/kg dry weight) : ug/L

CAS NO	COMPOUND		Q
156-59-2	cis-1,2-Dichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
136777-61-2	m,p-Xylenes	1.0	U
95-47-6	o-Xylene	1.0	U
156-60-5	trans-1,2-dichloroethene	1.0	U
10061-02-6	trans-1,3-dichloropropene	1.0	U

Appendix B

Lithologic Boring Logs, Geophysical Report, and Monitoring Well Purge Forms

Appendix B-1

Lithologic Boring Logs

Drilling Log

Soil Boring **51SB1**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1824.6 ft. — Total Hole Depth 37.2 ft. — North 3601086.89 ft — East 10892807.89 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 4/7/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Chemical boring

51SB1

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) — Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0		51SB1A			ML	Silt, brown, medium dense, damp, with roots extending to depth of 3-inches, with some soft clay with slight plasticity, with some coarse grained sand.	1824.55
2					SC	Silt, brown, soft, damp, with some clay and some fine grained sand.	1824
						Sandy clay, strong brown, poorly graded, fine grained, slightly damp, clay is medium stiff.	1822
4					SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, slightly damp.	
						Same as above with some silt.	1820
6					SC	Sand, strong brown, poorly graded, fine-medium grained, medium dense, damp, with some clay.	
						Sandy clay, strong brown, poorly graded, fine grained, micaceous, damp, clay is soft with low plasticity.	1818
8					SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, micaceous, damp.	
					CL	Clay, strong brown, stiff, slightly damp, mottled red and tan.	1816
10					SP	Sand, strong brown, poorly graded, fine grained, medium dense, slightly damp.	
						Sand, strong brown, poorly graded, fine-medium grained, loose, micaceous, dry, with some black staining.	1814
12							1812
14					SW	Sand, well graded, fine-coarse grained, loose, micaceous, dry.	1810
		51SB1B					
16					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, dry, with trace of fine grained gravel.	1808
						Same as above with some silt.	
18					GM	Silty gravel, brown, well graded, fine-coarse grained, red shale <1.0-inch diameter, and quartz < 1.5-inch diameter, with some medium-coarse grained sand.	1806
					SC	Sandy clay, strong brown, poorly graded, fine grained, clay is soft with low plasticity.	
20					GC	Clayey gravel, strong brown, well graded, fine-coarse grained, loose, damp, with some medium-coarse grained sand, clay is soft.	1804
22					ML	Silt, pale olive, friable, dry, with interbedded layers of laminated red shale, grading into reddish yellow silt, with olive and tan mottling.	1802
24						Silt, pale olive, friable, dry, with interbeds of red shale and	

Continued Next Page

Drilling Log

Soil Boring **51SB1**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					CL	yellow/gray clay.	1800
						Clay, olive yellow, soft, low plasticity, damp.	
26					ML	Silt, brownish yellow, soft, damp.	1798
						Silt, brownish yellow, soft, wet, with fine-medium grained sand sized red shale, and a trace of fine grained gravel.	
28						Same as above without trace of gravel.	
					SP	Sand, strong brown, poorly graded, medium-coarse grained, loose, slightly wet, with some soft clay.	1796
30					ML	Silt, brownish yellow, slightly damp, with layers of red shale.	1794
						Silt, brownish yellow, slightly wet, with interbedded layers of laminated red shale and olive clay and saprolite < 0.5-inch diameter.	
32						Silt, pale olive, friable, dry, with interbedded layers of red shale and olive saprolite.	1792
						Same as above except color is brownish yellow.	
34					GP	Gravel, strong brown, poorly graded, coarse grained < 1.8-inch diameter, loose, with some medium grained sand.	1790
		51SB1C			ML	Silt, brownish yellow, friable, dry, with interbedded layers of red shale and olive saprolite.	
36						Same as above except color is pale olive.	1788
						Same as above with saprolite < 1.2-inch diameter. Refusal at 37.2 feet.	
38							1786
40							1784
42							1782
44							1780
46							1778
48							1776
50							1774
52							1772
54							1770
56							

DRILLING LOG Rev: 11/8/04 SWMU 51.GPJ SHAW IT.GDT 4/19/05

Drilling Log

Soil Boring **51SB2**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Surface Elev. *1824.3 ft.* Total Hole Depth *35.8 ft.* North *3601055.78 ft* East *10892820.11 ft.*

Top of Casing *NA* Water Level Initial *NA* Static *NA* Diameter *2 in.*

Screen: Dia *NA* Length *NA* Type/Size *NA*

Casing: Dia *NA* Length *NA* Type *NA*

Fill Material *bentonite* Rig/Core *Bobcat-mounted/NA*

Drill Co. *Marshall Miller* Method *Direct Push*

Driller *K. Carr* Log By *J. Choynowski* Date *4/6/04* Permit # *NA*

Checked By *M. Thomas* License No.

COMMENTS
Chemical boring

51SB2

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) — Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0		51SB2A			ML	Silt, brown, loose, damp, with some medium grained sand.	1824.26
					CL	Clay, strong brown, stiff, slightly damp.	1824
2						Clay, yellowish red, stiff, slightly damp, with red mottling.	
					ML	Silt, strong brown, slightly damp.	1822
4						Silt, yellowish brown, slightly damp, with little fine grained micaceous sand.	
					CL	Clay, strong brown, soft low plasticity, damp, with some fine grained sand.	1820
6						No Recovery.	1818
					SC	Sandy clay, strong brown, poorly graded, fine grained, medium dense, micaceous, damp, clay is soft with low plasticity.	
8					CL	Clay, strong brown, soft, damp, low plasticity.	1816
						Clay, black, pastelike (trench sludge).	
10		51SB2B			SC	Sandy clay, dark yellowish brown, sand is fine grained. Clay is soft, low plasticity, mottled black, pastelike (trench sludge).	1814
					SP	Sand, very dark red, poorly graded, medium grained, with black pastelike clay (trench sludge).	
12					CL	Clay, very dark gray, soft, pastelike (trench sludge).	1812
14							1810
		51SB2C			SP	Sand, strong brown, poorly graded, medium to fine grained, loose, slightly damp.	
16							1808
					GM	Silty gravel, brownish yellow, fine grained with some medium to coarse grained sand, damp, loose.	
18					SP	Sand, brownish yellow, poorly graded, medium to coarse grained, loose damp.	1806
						Same as above, except brown and slightly damp.	
20					GM	Silty gravel, brownish yellow, fine to coarse grained, < 1.7-inch diameter quartz and red terrace deposits, with some silt and medium to coarse grained sand, damp, loose.	1804
					GC	Gravel, with clay and silt, brownish yellow, gravel is fine grained, loose, with some medium to coarse grained sand.	
22					ML	Silt, red, dry, friable, with brownish yellow and gray mottling, trace of clay.	1802
					ML		
24							

Continued Next Page

Drilling Log

Soil Boring **51SB2**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					GM	Silt, yellowish brown, dry, friable, with red and gray mottling.	1800
					SP	Silty gravel, dark yellowish brown, fine grained loose.	
					ML	Sand, dark yellowish brown, poorly graded, medium to coarse grained, with some silt.	
26					SP		1798
						Silt, reddish yellow, dry, friable, with interbedded layers of red shale and olive clay.	
28						Sand, yellowish brown, poorly graded, medium grained, loose, slightly damp.	1796
						Silt, yellowish brown, dry, friable, mottled yellow and gray, with layers of red shale.	
30						Silt, yellowish brown, dry, friable, with interbedded layers of olive clay and saprolite, and red shale.	1794
					ML	Silt, pale olive, wet, with interbedded layers of gray clay and red shale, and a trace of saprolite.	
32							1792
		51SB2D				Silt, brownish yellow, soft, very wet, with coarse grained shale and saprolite.	
34						Silt, pale olive, dry, friable, with interbedded layers of laminated red shale and saprolite.	1790
						Silt and saprolite, pale olive, dry, friable. Saprolite is <1.3-inch diameter. Refusal at 35.8 feet.	
36							1788
38							1786
40							1784
42							1782
44							1780
46							1778
48							1776
50							1774
52							1772
54							1770
56							

Drilling Log

Soil Boring **51SB3**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1825.6 ft. — Total Hole Depth 38.8 ft. — North 3601032.5 ft. — East 10892828.72 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 4/5/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Chemical boring

51SB3

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) — Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0		51SB3A			ML	Silt and clay, brown, damp, low plasticity, with roots to depth of 6-inches.	1825.56
2					ML	Silt and sand, strong brown, sand is fine grained, with some clay, slight plasticity, damp.	1824
					ML	Silt and clay, strong brown, dry, medium stiff, slight plasticity.	
4					CL	Clay, strong brown, dry, medium stiff, with some silt.	1822
6					ML	Silt, strong brown, medium stiff, slightly damp, with some clay.	1820
8					CL	Clay, strong brown, low plasticity, slightly damp, with trace of fine grained sand.	1818
10					SC	Sandy clay, strong brown, poorly graded, fine-medium grained sand, damp. Clay has slight plasticity.	1816
					SC	Same as above with some black staining.	1814
12		51SB3B			CL	Clay, brownish yellow, low plasticity, with some silt and fine grained sand.	
14					CL	Clay, black, very soft, pastelike (trench sludge) with some silt and fine grained sand.	1812
		51SB3C			SP	Sand, yellowish red, poorly graded, fine-medium grained, medium dense, damp, with some black staining.	1810
16					GW	Gravel, strong brown, well graded, fine-coarse grained, quartz <1.8-inch diameter, with some red terrace deposits, loose, slightly damp.	
18					GP	Gravel, strong brown, poorly graded, fine grained, with some medium-coarse grained sand, loose, damp.	1808
20					GW	Gravel, brown, well graded, fine-coarse grained, quartz <2.0-inch diameter, with some red terrace deposits, and with some medium-coarse grained sand, loose, slightly damp.	1806
22					GP	Gravel, strong brown, poorly graded, fine grained, with some medium-coarse grained sand, loose, damp.	1804
					ML	Silt, brownish yellow, dry, friable, with trace of clay and fine	
24						Continued Next Page	1802

Drilling Log

Soil Boring **51SB3**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						grained sand.	
						Same as above except with fine grained shale fragments and no clay and sand.	1800
26						Same as above with red and tan mottling.	
						Silt, brownish yellow, friable, dry, with interbedded layers of red shale and olive clay.	1798
28					ML		
							1796
30						Silt, brownish yellow, very soft, saturated, with some clay and trace of fine grained sand.	
						Silt, pale olive, friable, dry, with yellow mottling and interbeds of red shale and yellow clay.	1794
32					GC	Clayey gravel, brown, fine-coarse grained, with fine-medium grained sand, and clay and silt, wet, loose.	
						Silt, brownish yellow, damp to wet, with some fine-medium grained sand.	1792
34						Silt, pale olive, friable and dry, with yellow mottling, with interbedded layers of red shale and saprolite.	
		51SB3D			ML		1790
36							
							1788
38						Same as above with saprolite fragments <0.8-inch diameter. Refusal at 38.8 feet.	
							1786
40							
							1784
42							
							1782
44							
							1780
46							
							1778
48							
							1776
50							
							1774
52							
							1772
54							
							1770
56							

Drilling Log

Soil Boring **51SB4**

Project: SWMU 51 RFI | Owner: Radford Army Ammunition Plant
Location: SWMU 51 | Proj. No.: 839197-050
Surface Elev.: 1826.6 ft. | Total Hole Depth: 38.0 ft. | North: 3601009.55 ft | East: 10892838.08 ft.
Top of Casing: NA | Water Level Initial: NA | Static: NA | Diameter: 2 in.
Screen: Dia: NA | Length: NA | Type/Size: NA
Casing: Dia: NA | Length: NA | Type: NA
Fill Material: bentonite | Rig/Core: Bobcat-mounted/NA
Drill Co.: Marshall Miller | Method: Direct Push
Driller: K. Carr | Log By: J. Choynowski | Date: 4/1/04 | Permit #: NA
Checked By: M. Thomas | License No.:

COMMENTS
Chemical boring

51SB4

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) — Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0		51SB4A			CL	Clay, strong brown, soft, low plasticity, with some fine grained sand, and roots extended to depth of 8-inches.	1826.55
							1826
2					SC	Sandy clay, strong brown, fine-medium grained, medium dense, damp.	
4							1824
							1822
6					SP	Sand, strong brown, poorly graded, fine-medium grained, micaceous, loose, damp, with some clay.	
					ML	Silt and clay, strong brown, slightly damp, clay is stiff.	1820
8					SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, micaceous, with some black staining.	
							1818
10						No Recovery.	
							1816
12					ML	Silt, brownish yellow, soft, damp, with some soft clay and fine grained sand.	
		51SB4B					1814
14					CL	Clay, black, very soft, pastelike (trench sludge), with some fine grained sand.	
							1812
16					GW	Gravel, strong brown, well graded, fine-coarse grained, with medium-coarse grained sand, very loose.	
		51SB4C					1810
18					GP	Gravel, strong brown, poorly graded, fine grained, with some medium-coarse grained sand, loose, wet.	
						No Recovery.	1808
20					GW	Gravel, strong brown, well graded, fine-coarse grained, with some fine-coarse grained sand.	
						No Recovery.	1806
22						Gravel, brownish yellow, poorly graded, fine grained, with some medium-coarse grained sand, very loose.	
					ML	Silt, brownish yellow, friable and dry, with interbedded layers of red shale and clay.	1804
24							

Continued Next Page

Drilling Log

Soil Boring **51SB4**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24							1802
26					ML	Silt, light olive gray, friable and dry, with interbedded layers of laminated red shale, mottled tan and yellow.	1800
28						Silt, brownish yellow, friable and dry, with interbedded layers of olive clay and red shale. Silt, light olive gray, friable and dry, with interbedded layers of laminated red shale and yellow clay.	1798
30					GW	Gravel, strong brown, well graded, fine-coarse grained, loose.	1796
					SP	Sand, brown, poorly graded, medium-coarse grained.	
					ML	Silt, brownish yellow, saturated, very soft, with some fine grained sand.	
32					GM	Gravel and silt, brownish yellow, fine grained, weathered shale and saprolite in matrix of saturated silt.	1794
34						Silt, light olive gray, friable and dry, with interbedded layers of red shale and olive saprolite.	1792
36		51SB4D			ML	Silt, yellow, friable and dry, with interbedded layers of red shale and olive saprolite. Silt, pale brown, dry, friable, with light gray weathered saprolite < 0.5-inch diameter. Refusal at 38 feet.	1790
38							1788
40							1786
42							1784
44							1782
46							1780
48							1778
50							1776
52							1774
54							1772
56							

Drilling Log

Soil Boring **51SB5**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Surface Elev. *1827.2 ft.* Total Hole Depth *33.4 ft.* North *3600986.38 ft* East *10892846.61 ft.*

Top of Casing *NA* Water Level Initial *NA* Static *NA* Diameter *2 in.*

Screen: Dia *NA* Length *NA* Type/Size *NA*

Casing: Dia *NA* Length *NA* Type *NA*

Fill Material *bentonite* Rig/Core *Bobcat-mounted/NA*

Drill Co. *Marshall Miller* Method *Direct Push*

Driller *K. Carr* Log By *J. Choynowski* Date *4/1/04* Permit # *NA*

Checked By *M. Thomas* License No.

COMMENTS
Chemical boring

51SB5

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0		51SB5A			CL	Clay, red, soft, low plasticity, with organic roots extending to a depth of 4-inches.	1827.18
						Sand, strong brown, poorly graded, fine-medium grained, medium dense, micaceous, damp, with trace of clay.	1826
2					SP	Same as above except no clay.	1824
4						Same as above with black staining.	
						Same as above with trace of fine grained gravel.	1822
6						No Recovery	
8							1820
					SW	Sand, strong brown, well graded, fine-coarse grained, with some soft damp clay, and a trace of fine grained gravel.	1818
10					SC	Sandy clay, strong brown, poorly graded, fine-medium grained, micaceous, light yellowish brown and red staining, damp, with some soft clay.	1816
12		51SB5B			CL	Clay, black, very soft, pastelike (trench sludge), with some fine grained sand.	1814
14							
					GP	Gravel, strong brown, poorly graded, coarse grained, with some medium-coarse grained sand.	1812
16		51SB5C			GW	Gravel, brownish yellow, well graded, fine-coarse grained, loose, with some fine-coarse grained sand.	1810
18						Gravel, yellowish brown, poorly graded, fine grained, with coarse-medium grained sand, loose, slightly damp.	
20					GP		1808
					GM	Gravel and silt, strong brown, fine grained, with some fine-medium grained sand, and trace of clay.	1806
22					ML	Silt, yellowish red, dry and friable, with interbedded layers of olive clay.	
24							1804

Continued Next Page

Drilling Log

Soil Boring **51SB5**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
24						*Continued* Silt, light olive gray, dry and friable, with interbedded layers of red laminated shale and olive clay, and tan and red mottling.	1802
26						Same as above except color is reddish yellow and mottling is tan and yellow.	1800
28					ML	Silt, brownish yellow, very soft, saturated, with some fine grained sand.	1798
30		51SB5D				Silt, brownish yellow, dry and friable, with red shale mottled red and olive.	1796
32						Silt, pale brown, with weathered saprolite interbedded with red shale. Refusal at 33.4 feet.	1794
34							1792
36							1790
38							1788
40							1786
42							1784
44							1782
46							1780
48							1778
50							1776
52							1774
54							1772
56							

DRILLING LOG Rev: 4/4/03 SWMU 51.GPJ SHAW IT.GDT 10/27/04

Drilling Log

Soil Boring **51SB6**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1827.0 ft. — Total Hole Depth 35.0 ft. — North 3600964.45 ft — East 10892862.82 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 3/30/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Chemical boring

51SB6

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) — Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0		51SB6A			ML	Silt, dark brown, soft, with roots to a depth of 6-inches, some fine grained sand, loose, damp.	1827.00
2					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, damp.	1826
4						No Recovery.	1824
					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, damp.	1822
6		51SB6B			ML	Silt, dusky red, pastelike, very soft (trench sludge).	
					CL	Clay, dusky red, very soft, very wet (trench sludge).	1820
8						Sand, dusky red, poorly graded, fine-medium grained, damp, with very soft, pastelike clay (trench sludge).	
		51SB6C					1818
10					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, damp, trace of gravel.	1816
12						Same as above without trace of gravel.	1814
14					SC	Sandy clay, strong brown, poorly graded, fine grained, clay is soft, low plasticity, damp.	
					GP	Gravel, strong brown, poorly graded, fine grained, loose, with black and red staining.	1812
16					SC	Sandy clay, yellowish brown, fine grained, clay is damp with low plasticity, some silt.	
18					GP	Gravel, strong brown, poorly graded, fine grained, damp, with some very fine grained sand.	1810
						Same as above except color is yellowish brown and sand is fine grained.	1808
20					SC	Sandy clay, strong brown, poorly graded, fine grained, clay is soft, low plasticity, damp.	1806
22					GW	Gravel, brownish yellow, well graded, fine-coarse grained, < 1-inch diameter, loose, damp.	
24						Same as above with some red sand, grain size <0.25-inch	1804

Continued Next Page

Drilling Log

Soil Boring **51SB6**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					SC	diameter. Sandy clay, strong brown, poorly graded, fine grained, clay is soft, low plasticity, damp.	1802
26					GW	Gravel, strong brown, well graded, fine-coarse grained, loose, with some fine grained sand, and silt and clay.	
					ML	Silt, reddish yellow, saturated, with little fine grained sand.	1800
28					SP	Sand, reddish yellow, poorly graded, fine-medium grained, loose, saturated, with trace of fine grained gravel.	
					ML	Silt, olive, friable and dry, dense, with tan, yellow and red mottling.	
30					GM	Silty gravel, strong brown, fine grained, damp, with fine-medium grained sand, and some clay.	1798
					ML	Same as above except color is brownish yellow.	
32					GP	Silt, brownish yellow, very soft, saturated.	1796
					GM	Gravel, brownish yellow, poorly graded, fine grained, damp, with some medium grained sand.	
34		51SB6D			ML	Silty gravel, brownish yellow, fine grained, with some dense clay and silt, silt is friable and dry, with fine-medium grained sand. Silt, light olive brown, friable and dry, yelow and tan mottling, and trace of saprolite. Refusal at 35 feet.	1794
							1792
36							1790
38							1788
40							1786
42							1784
44							1782
46							1780
48							1778
50							1776
52							1774
54							1772
56							

Drilling Log

Soil Boring **51SB7**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1827.1 ft. — Total Hole Depth 34.5 ft. — North 3600941.05 ft — East 10892869.7 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 3/30/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Chemical boring

51SB7

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0		51SB7A			ML	Silt, dark brown, medium dense, damp, with some fine grained sand.	1827.06
2					ML	Silt, strong brown, dense, damp, with some fine grained sand.	1826
4					SC	Sandy clay, strong brown, fine grained, clay has low plasticity.	1824
					ML	Silt and clay, dense and dry, clay is mottled yellow.	
6					SP	Sand, reddish yelow, poorly graded, very fine-medium grained, damp, with black staining.	1822
8		51SB7B			SC	Sandy clay, strong brown, poorly graded, fine-medium grained, damp, clay is brownish yellow with low plasticity, some silt. Same as above except moist and clay is mottled black.	1820
10							1818
12					SP	Same as above except no black motling.	1816
14						Sand, strong brown, poorly graded, fine-medium grained, loose, micaceous, slightly moist, with some red staining.	1814
16					GP	Gravel, strong brown, poorly graded, fine grained, moist.	1812
					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, damp.	
18					GW	Gravel, brown, well graded, fine-coarse grained, loose, moist, with some medium-coarse grained sand.	1810
20					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, damp, with little clay.	1808
					SC	Sandy clay, brown, poorly graded, fine-medium grained sand, damp.	1806
22					GM		
					SC		
					GW	Silty gravel, well graded, fine-coarse grained with medium grained sand.	1804
24						Sandy clay, brown, poorly graded, fine grained sand, damp.	

Continued Next Page

Drilling Log

Soil Boring **51SB7**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					GM	Gravel, brown, well graded, fine-coarse grained, < 1.5-inch diameter, loose, damp.	
						Same as above with medium-coarse grained sand.	1802
26						Silty gravel, brownish yellow, fine grained, loose, saturated, with fine-medium grained sand.	
					ML	Silt and clay, brownish yellow, dry and friable, dense, with olive and red mottling.	1800
28						Clay, strong brown, wet, low plasticity, with trace of fine grained sand.	
					CL		1798
30							
						Silt, light olive brown, dry and friable.	1796
32		51SB7C			ML	Silt, yellowish red, hard, mottled tan and yellow, with some dense olive clay and laminated shale. Refusal at 34.5 feet.	
							1794
34							
							1792
36							
							1790
38							
							1788
40							
							1786
42							
							1784
44							
							1782
46							
							1780
48							
							1778
50							
							1776
52							
							1774
54							
							1772
56							

Drilling Log

Soil Boring **51SB8**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1828.5 ft. — Total Hole Depth 38.4 ft. — North 3600991.5 ft. — East 10892861.73 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

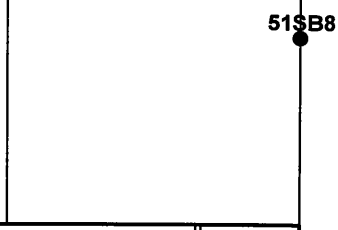
Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 4/1/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Chemical boring



Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) — Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0		51SB8A			CL	Clay, strong brown, damp, with trace of fine grained sand, and soft silt.	1828.53
						Clay, strong brown, medium stiff, damp.	1828
2							1826
4							1824
6					ML	Silt, strong brown, dry and friable.	1822
8					GP	Gravel, yellowish brown, poorly graded, fine-medium grained, loose, with medium-coarse grained sand.	
					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, damp, micaceous.	1820
10						Same as above with black staining.	1818
12						Same as above without black staining.	1816
14					ML	Silt, strong brown, dry, hard.	
					SP	Sand, strong brown, poorly graded, medium grained, loose.	1814
16						Sand, yellow, poorly graded, medium-coarse grained, very loose, dry.	1812
18		51SB8B			GP	Gravel, brown, poorly graded, fine grained, loose, with medium-coarse grained sand.	
					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, dry.	1810
20					GP	Gravel, brown, poorly graded, fine grained, loose, dry, with medium-coarse grained sand.	
					SP	Sand, strong brown, poorly graded, medium-coarse, loose, dry, with little fine grained gravel.	1808
22					GW	Gravel, strong brown, well graded, fine-coarse grained, loose, dry.	1806
					GC	Clayey gravel, strong brown, fine grained, clay is soft.	
24					ML	Silt, yellowish brown, dry and friable, with red and black mottling.	

Continued Next Page

Drilling Log

Soil Boring **51SB8**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						Silt, brownish yellow, very wet, loose.	1804
26						Same as above except saturated with red shale in silt matrix.	1802
28					GC	Clayey gravel, strong brown, fine grained, loose, wet, clay is soft.	
						Silt, yellowish brown, very wet, soft, with interbedded shale layers.	1800
30					ML	Same as above except saturated.	
						Same as above except wet with olive saprolite.	1798
32					GC	Clayey gravel, brown, poorly graded, fine grained, very wet.	
						Silt, brownish yellow, soft, very wet, with some fine grained sand.	1796
34						Silt, brownish yellow, friable and dry, with interbedded layers of laminated red shale and olive saprolite.	
					ML	Same as above except color is pale olive.	1794
36		51SB8C				Same as above except color is yellow.	1792
38						Same as above except color is pale brown, and contains saprolite fragments < 0.8-inches diameter. Refusal at 38.4 feet.	1790
40							1788
42							1786
44							1784
46							1782
48							1780
50							1778
52							1776
54							1774
56							

Drilling Log

Soil Boring **51SB9**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant
Location SWMU 51 — Proj. No. 839197-050
Surface Elev. 1825.8 ft. — Total Hole Depth 35.1 ft. — North 3601036.91 ft — East 10892843.24 ft.
Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.
Screen: Dia NA — Length NA — Type/Size NA
Casing: Dia NA — Length NA — Type NA
Fill Material bentonite — Rig/Core Bobcat-mounted/NA
Drill Co. Marshall Miller — Method Direct Push
Driller K. Carr — Log By J. Choynowski — Date 4/5/04 — Permit # NA
Checked By M. Thomas — License No.

COMMENTS
Chemical boring

51SB9

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) — Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0		51SB9A			ML	Silt and clay, dark yellowish brown, soft, damp, slight plasticity.	1825.76
2					CL	Clay and silt, strong brown, soft, damp, low plasticity.	1824
4					ML	Silt, red, soft, slightly damp, with some clay.	1822
6					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, dry.	1820
8						Same as above except medium dense, and with little fine grained gravel.	1818
10						Same as above without the gravel.	1816
12						Same as above except loose with some black staining. Same as above with some clay.	1814
14		51SB9B				Same as above except medium dense, with little silt and clay.	1812
16						Sand, strong brown, poorly graded, medium grained with little coarse grained sand and fine grained gravel, loose, damp.	1810
18					GP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, dry, with some fine grained gravel. Gravel, strong brown, poorly graded, fine grained, loose, damp, with some medium grained sand.	1808
20					GW	Gravel, brown, well graded, fine-coarse grained, loose, slightly damp, with medium-coarse grained sand.	1806
22					CL	Clay, brown, soft, low plasticity, damp, with some fine grained sand.	1804
24					GC	Clayey gravel, brownish yellow, fine grained, loose, slightly damp, with some silt and coarse grained sand.	1802
					SP	Sand, strong brown, poorly graded, medium grained, medium dense, dry, with some clay.	
					GC	Clayey gravel, brownish yellow, fine grained, loose, slightly damp, with some silt and coarse grained sand.	

Continued Next Page

Drilling Log

Soil Boring **51SB9**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						Silt, yellow, very moist, with interbedded layers of red shale and olive clay.	
26							1800
					ML	Silt, pale yellow, dry and friable, with interbedded layers of red shale.	
28							1798
						Silt, pale olive, friable and dry, with interbedded layers of laminated red shale and gray saprolite.	
30							1796
					SC	Sandy clay, brownish yellow, soft, damp to very wet, poorly graded, fine grained sand, clay is soft with low plasticity.	
32						Silt, yellowish brown, saturated, soft, with fine grained red shale and saprolite in silt matrix.	1794
		51SB9C			ML		
34						Silt, pale olive, dry and friable, with interbedded layers of red shale and gray, fine grained saprolite.	1792
						Same as above except saprolite fragments <1-inch diameter. Refusal at 35.1 feet.	
36							1790
38							1788
40							1786
42							1784
44							1782
46							1780
48							1778
50							1776
52							1774
54							1772
56							1770

Drilling Log

Soil Boring **51SB10**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Surface Elev. *1826.4 ft.* Total Hole Depth *32.0 ft.* North *3600982.86 ft* East *10892828.13 ft.*

Top of Casing *NA* Water Level Initial *NA* Static *NA* Diameter *2 in.*

Screen: Dia *NA* Length *NA* Type/Size *NA*

Casing: Dia *NA* Length *NA* Type *NA*

Fill Material *bentonite* Rig/Core *Bobcat-mounted/NA*

Drill Co. *Marshall Miller* Method *Direct Push*

Driller *K. Carr* Log By *J. Choynowski* Date *4/1/04* Permit # *NA*

Checked By *M. Thomas* License No.

COMMENTS
Chemical boring

51SB10

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0		51SB10A			ML	Clay and silt, brown, soft, low plasticity, with some fine grained sand.	1826.35 1826
2					CL	Clay, strong brown, stiff.	1824
4						Same as above with light gray mottling.	1822
6					SP	Same as above except mottled red. Same as above except with black mottling. Sand, strong brown, poorly graded, fine-medium grained, medium dense, with some clay.	1820
8						Same as above except damp with black staining. Same as above except no black staining. Same as above except micaceous with some clay.	1818
10						Same as above except loose.	1816
12							1814
14						Same as above except no clay.	1812
16						Same as above with black staining.	1810
18		51SB10B			SC	Sandy clay, strong brown, poorly graded, fine grained, medium dense, damp.	1808
20					SP	Sand, strong brown, poorly graded, fine-medium grained, loose.	1806
22					GW	Gravel, strong brown, well graded, fine-coarse grained, loose, slightly damp.	1804
24					GP	Gravel, brownish yellow, poorly graded, fine grained, loose, with medium-coarse grained sand.	
					SW	Sand, strong brown, well graded, fine-coarse grained, medium dense, micaceous, damp.	
					GC	Clayey gravel, strong brown, well graded, fine-coarse grained, loose, with some fine-medium grained sand.	
					ML	Silt, brownish yellow, dry, with interbedded layers of laminated red shale and olive clay, with olive and tan mottling.	
					SC	Sandy clay, strong brown, poorly graded, fine grained, clay is soft,	

Continued Next Page

Drilling Log

Soil Boring **51SB10**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					ML	damp.	1802
					SP	Silt, brownish yellow, dry, dense, with interbedded layers of laminated red shale and olive clay, with olive and tan mottling.	
26					CL	Sand, strong brown, poorly graded, fine grained, medium dense, with some clay.	1800
					ML	Clay, strong brown, dry and stiff.	
28						Silt, brownish yellow, friable and dry, with interbedded layers of laminated red shale and olive clay.	1798
					CL	Clay, strong brown, very stiff, dry, with trace of fine grained sand.	
30		51SB10C				Same as above with red and olive mottling.	1796
					ML	Silt, light olive, dry, with interbedded layers of red shale and olive saprolite, mottled tan and gray. Refusal at 32 feet.	
32							1794
34							1792
36							1790
38							1788
40							1786
42							1784
44							1782
46							1780
48							1778
50							1776
52							1774
54							1772
56							

DRILLING LOG Rev: 4/4/03 SWMU 51.GPJ SHAW IT.GDT 10/27/04

Drilling Log

Soil Boring **51SB11**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1824.4 ft. — Total Hole Depth 38.0 ft. — North 3601027.95 ft — East 10892810.92 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 4/5/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Chemical boring

51SB11

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0		51SB11A			CL	Clay, strong brown, soft, damp, with little fine grained sand and silt.	1824.40
						Clay, strong brown, stiff, dry, with little silt.	1824
2							1822
4						Same as above except color is red with brown mottling.	1820
					SC	Sandy clay, red, dry, stiff, sand is poorly graded, fine grained.	
6					SP	Sand, yellowish red, poorly graded, fine-medium grained, medium dense, dry, with black staining.	1818
8							1816
					SC	Sandy clay, brown, poorly graded, fine-medium grained, damp, clay is soft with low plasticity.	
10					SP	Sand, yellowish red, poorly graded, fine-medium grained, medium dense, dry, micaceous, with black staining.	1814
12						Sand, strong brown, poorly graded, fine-medium grained, medium dense, damp, with some soft clay.	1812
						Same as above except dry and loose with little clay.	
14		51SB11B					1810
16					SC	Sandy clay, strong brown, poorly graded, fine grained, damp, clay is soft with low plasticity.	1808
					GP	Gravel, strong brown, poorly graded, fine grained, with some coarse grained gravel, and some medium-coarse grained sand, loose.	
18					SW	Sand, strong brown, well graded, fine-coarse grained, loose, dry.	1806
					SP	Sand, strong brown, poorly graded, medium-coarse grained, loose, slightly damp, with some clay.	
20					GP	Gravel, light yellowish brown, poorly graded, fine grained, loose, with black staining, with some fine grained sand and white clay.	1804
					SP		
22					ML	Sand, brownish yellow, poorly graded, medium-coarse grained, loose, with some brownish yellow fine grained gravel.	1802
					CL	Sand, strong brown, poorly graded, fine-medium grained, medium dense, with some clay.	
24					SC		

Continued Next Page

Drilling Log

Soil Boring **51SB11**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					ML	Silt, brownish yellow, dry and friable with some layers of red shale. Clay, brownish yellow, soft, damp, low plasticity. Sandy clay, strong brown, fine grained, micaceous, clay is soft with low plasticity.	1800
26					SP	Silt, brownish yellow, dry and friable, with interbedded layers of red shale and olive clay.	1798
28					GP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, damp, micaceous, with some soft clay.	1796
					GC	Gravel, strong brown, poorly graded, fine grained, loose, dry, with medium-coarse grained sand. Clayey gravel, strong brown, fine grained, loose, slightly damp.	
30					ML	Silt, brownish yellow, friable and dry, with interbedded layers of laminated red shale and olive clay.	1794
32							1792
34						Silt, yellowish brown, very soft, saturated, with fine grained fragments of red shale and fine grained sand.	1790
					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, damp.	
36		51SB11C			ML	Silt, brownish yellow, dry and friable, with some shale. Silt, pale olive, friable and dry, with interbedded layers of laminated red shale and olive/gray saprolite. Saprolite fragments <1.2-inches in diameter. Refusal at 37.8 feet.	1788
38							1786
40							1784
42							1782
44							1780
46							1778
48							1776
50							1774
52							1772
54							1770
56							

Drilling Log

Soil Boring **51SBC1**

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Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1824.7 ft. — Total Hole Depth 20.3 ft. — North 3601077.48 ft — East 10892790.06 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted Geoprobe/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 4/7/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Stratigraphic characterization boring

51SBC1

Depth (ft.)	PID (ppm)	Sample ID / % Recovery / Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0				ML	Silt, strong brown, soft, damp, with some fine grained sand.	1824.69
						1824
2				CL	Clay, strong brown, soft, with a trace of fine grained sand.	1822
				ML	Silt, red, damp, soft, with some clay.	
4					Same as above with some very fine grained sand.	1820
6				SP	Sand, yellowish red, poorly graded, fine to medium grained, medium dense, damp, micaceous.	1818
8					Sand, yellowish red, poorly graded, fine to medium grained, loose, damp, micaceous.	1816
				SP SM	Same as above with some silt.	
10				SP	Same as above without some silt.	1814
					Same as above with black staining.	
12				SW	Sand, strong brown, well graded, fine to coarse grained, loose, damp.	1812
14				SP	Sand, strong brown, poorly graded, fine to medium grained, medium dense, slightly damp, micaceous, with some black staining.	1810
16				GW	Gravel, strong brown, well graded, fine to coarse grained, loose, damp, with medium to coarse grained sand.	1808
18				GC	Gravel and clay, strong browm, medium to coarse grained with quartz < 0.9-inches diameter.	1806
20				GP	Gravel, brown, poorly graded, coarse grained, < 2.1-inches diameter, loose, damp, with some coarse grained sand. Refusal at 20.3-feet.	1804
22						1802
24						

DRILLING LOG Rev: 11/8/04 SWMU 51.GPJ SHAW IT.GDT 11/8/04

Drilling Log

Soil Boring **51SBC2**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1825.5 ft. — Total Hole Depth 38.4 ft. — North 3601079.76 ft — East 10892792.4 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted Geoprobe/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 4/7/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Stratigraphic characterization boring

51SBC2

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					ML	Silt, olive brown, soft, damp, with some silt and fine grained sand.	1825.50
						Silt, strong brown, soft, damp with some fine grained sand.	
2					SP	Sand, strong brown, poorly graded, medium grained, medium dense, slightly damp, micaceous.	1824
					ML		
					CL	Silt, strong brown, hard, slightly damp.	
4					SC	Clay, strong brown, very stiff, with red and tan mottling.	1822
					ML	Sandy clay, red. Sand is poorly graded, fine grained, micaceous, damp. Clay is very stiff, damp.	
6					SP	Silt, red, damp, soft, with some clay and fine grained micaceous sand.	1820
						Sand, yellowish red, poorly graded, fine to medium grained, medium dense, damp, micaceous.	
8						Sand, strong brown, poorly graded, fine to medium grained, loose, damp, micaceous.	1818
						Same as above with some silt.	
10							1816
					SW	Sand, strong brown, well graded, fine to coarse grained, loose, damp.	
12					SP	Sand, strong brown, poorly graded, fine to medium grained, loose, slightly damp, micaceous, with some black staining.	1814
						Sand, strong brown, poorly graded, fine to medium grained, medium dense, slightly damp, micaceous, with some black staining.	
14							1812
					SW	Sand, strong brown, well graded, fine to coarse grained, very loose, damp.	1810
16					GM	Gravel strong brown, fine grained, loose, damp, with medium to coarse grained sand and some silt.	
					SW	Sand, strong brown, well graded, fine to coarse grained, loose, dry.	1808
18							
					GC	Gravel, brown, fine to coarse grained (<1.3-inch diameter), damp, loose, with some fine to medium grained sand, and some clay.	1806
20					SP	Sand, strong brown, poorly graded, fine to medium grained, medium dense, slightly damp, with some clay and some silt.	
					ML	Silt, brownish yellow, dry, with red shale inerlayered with olive clay.	1804
22						Same as above except yellowish brown.	
						Same as above except light yellowish brown.	1802
24					CL	Silt and clay, light yellowish brown, very stiff, slightly damp, with	

Continued Next Page

Drilling Log

Soil Boring **51SBC2**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						interbeds of red shale, mottled red, brown, and yellow.	
					ML	Silt, brownish yellow, damp, with interbedded layers of red shale and olive clay.	1800
26							
					SP	Sand, strong brown, poorly graded, medium to coarse grained, loose, slightly wet, with some clay.	1798
28						Silt, pale olive, dry, friable, with layers of laminated red shale.	
30							1796
						Silt, brownish yellow, very soft, saturated, with fine grained red shale in silt matrix.	1794
32					ML		
34							1792
						Silt, yellow, damp, with interbedded layers of red shale.	1790
36						Silt, dry, with saprolite interbedded with red shale. Saprolite < 1.3-inches diameter.	
					ML	Same as above. Refusal at 38.4-feet.	1788
38							
40							1786
42							1784
44							1782
46							1780
48							1778
50							1776
52							1774
54							1772
56							1770

Drilling Log

Soil Boring **51SBC3**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1824.9 ft. — Total Hole Depth 38.8 ft. — North 3601089.27 ft — East 10892814.79 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted Geoprobe/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 4/7/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Stratigraphic characterization boring

51SBC3

Depth (ft.)	PID (ppm)	Sample ID / % Recovery / Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0				ML	Silt, brown, loose with some clay and sand. Sand is poorly graded, medium grained, and clay has slight plasticity. Root mass to 3-inch depth.	1824.93
				CL	Clay, strong brown, stiff, dry, with red mottling.	1824
2				SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, with some clay.	1822
4				ML	Silt, strong brown, hard, with some micaceous fine grained sand.	
				CL	Clay, strong brown, stiff, dry.	1820
6				ML	Silt, reddish brown, hard, dry, with some clay.	
					Same as above with trace of fine grained sand.	1818
8				CL	Clay, yellowish red, stiff, dry, with tan and yellow mottling.	1816
10				SP	Sand, yellowish red, poorly graded, fine-medium grained, medium dense, micaceous, with some clay.	1814
12					Sand, strong brown, poorly graded, fine-medium grained, medium dense, slightly damp.	1812
14					Same as above except loose and dry..	1810
16				SW	Sand, strong brown, well graded, fine-coarse grained, loose, slightly damp, with trace of fine grained gravel.	1808
				GP	Gravel, brown, poorly graded, fine grained, loose, damp, with some fine-coarse grained sand.	
18				GW	Gravel, brown, well graded, fine-coarse grained < 1.9-inch diameter, loose, damp, with medium-coarse grained sand.	1806
20				GC	Clayey gravel, strong brown, poorly graded, fine grained, loose, damp, with red shale <0.5-inch diameter, clay is soft. Clayey gravel, brown, well graded, fine-coarse grained, with quartz <1.5-inch diameter, slightly damp, with some medium-coarse grained sand and some silt.	1804
22				ML	Silt, yellowish brown, loose, damp, with some clay and trace of fine grained gravel.	1802
24					Silt, brownish yellow, friable, dry, with interbedded layers of	

Continued Next Page

Drilling Log

Soil Boring **51SBC3**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						laminated red shale and olive clay.	
						Silt, yellowish brown, with fine grained shale and saprolite < 0.4-inch diameter.	1800
26						Silt, brownish yellow, friable, dry, with interbedded layers of laminated red shale and olive clay and saprolite.	1798
28					ML	Same as above except slightly damp.	
						Silt, brownish yellow, friable, dry, with layers of laminated red shale and olive saprolite, with a little clay.	1796
30						Same as above except color is pale olive.	1794
32					GM	Silty gravel, strong brown, poorly graded, fine grained, loose,	
					SP	damp, with some medium-coarse grained sand.	
					ML	Sand, strong brown, poorly graded, fine-medium grained, medium dense, damp.	1792
34					CL	Silt, pale olive, friable, dry, with interbedded layers of laminated red shale and saprolite <0.6-inch diameter.	
					GM	Clay, olive green, soft, low plasticity.	1790
36						Silty gravel, strong brown, poorly graded, fine gained, loose, damp, with some medium-coarse grained sand.	
					ML	Silt, brownish yellow, soft, very wet, grading into silt with weathered layers of red shale and saprolite, slightly damp.	1788
38						Silt, pale olive, dry, with interbedded layers of red shale and olive saprolite.	
						Same as above with coarse grained gravel sized saprolite < 1.5-inch diameter. Refusal at 38.8 feet.	1786
40							1784
42							1782
44							1780
46							1778
48							1776
50							1774
52							1772
54							1770
56							

Drilling Log

Soil Boring **51SBC4**

Project SWMU 51 RFI | Owner Radford Army Ammunition Plant

Location SWMU 51 | Proj. No. 839197-050

Surface Elev. 1825.7 ft. | Total Hole Depth 39.1 ft. | North 3601093.84 ft | East 10892824.6 ft.

Top of Casing NA | Water Level Initial NA | Static NA | Diameter 2 in.

Screen: Dia NA | Length NA | Type/Size NA

Casing: Dia NA | Length NA | Type NA

Fill Material bentonite | Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller | Method Direct Push

Driller K. Carr | Log By J. Choynowski | Date 4/7/04 | Permit # NA

Checked By M. Thomas | License No.

COMMENTS
Stratigraphic characterization boring

51SBC4

Depth (ft.)	PID (ppm)	Sample ID / % Recovery / Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0				ML	Silt and clay, brown, soft, damp, with roots in top 3-inches.	1825.67
2				ML	Silt, reddish brown, hard, dry, with trace of fine-grained micaceous sand.	1824
4				ML	Silt, yellowish red, hard, damp, with some clay.	1822
				SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, slightly damp, with some silt and soft clay.	
6				ML	Silt, yellowish red, soft, with some fine grained micaceous sand, slightly damp.	1820
				SP	Sand, strong brown, poorly graded, fine-medium grained, loose, slightly damp.	
8				SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, damp, with some black staining.	1818
10				SP		1816
12				SP	Sand, strong brown, poorly graded, fine-medium grained, loose, dry.	1814
				SC	Sandy clay, yellowish red, fine-medium grained, slightly damp. Clay is soft with low plasticity.	
				SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, slightly damp, with some clay.	
14				SW	Sand, strong brown, well graded, fine-coarse grained, loose, slightly damp, with some fine grained gravel.	1812
16				SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, slightly damp, with trace of fine grained gravel and some silt and clay.	1810
				SW	Sand, brown, well graded, fine-coarse grained, loose, slightly damp, with trace of fine grained gravel.	
18				GC	Gravel, brown, fine-coarse grained, loose, with some fine-medium grained sand and some clay. Quartz <1.4-inch diameter.	1808
				SW	Sand, brown, well graded, fine-coarse grained, loose, slightly damp, with some very fine grained gravel.	
20				GW	Gravel, brown, well graded, fine-coarse grained, damp, loose, with some coarse grained sand and weathered quartz and red shale < 1.9-inch diameter.	1806
22				GP		1804
				SP		
				GP		
24				ML	Gravel, strong brown, poorly graded, fine grained, black stained gravel and red shale, loose, slightly moist, with some	1802

Continued Next Page

Drilling Log

Soil Boring **51SBC4**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						medium-coarse grained sand.	
						Sand, strong brown, poorly graded, fine-medium grained, medium dense, slightly damp, with some clay and trace of fine grained gravel.	1800
26						Gravel, brown, poorly graded, loose, dry. Gravel is <0.4-inch diameter.	
						Silt, yellowish brown, dry, friable, with interbedded layers of red shale, olive clay and saprolite.	1798
28						Silt, brownish yellow, dry, friable, with weathered red shale <0.4-inch diameter and some fine grained saprolite.	
						Same as above except color is pale olive.	1796
30					ML	Silt, brownish yellow, slightly damp, with saprolite <0.3-inch diameter, and red shale fragments.	
						Silt, yellow, saturated, with red shale and olive saprolite in soft silt matrix.	1794
32						Silt, pale olive, loose, slightly damp, with saprolite and red shale < 0.8-inch diameter.	
						Silt, yellow, saturated, soft.	1792
34						Same as above with 0.6-inch diameter saprolite and red shale.	
							1790
36						Saprolite from silt size to < 1.3-inch diameter, pale olive, with weathered red shale, slightly damp. Refusal at 39.1 feet.	
							1788
38							
							1786
40							
							1784
42							
							1782
44							
							1780
46							
							1778
48							
							1776
50							
							1774
52							
							1772
54							
							1770
56							

Drilling Log

Soil Boring **51SBC5**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1825.7 ft. — Total Hole Depth 38.1 ft. — North 3601049.94 ft — East 10892802.29 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 4/6/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Stratigraphic characterization boring

51SBC5

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					ML	Silt, brown, damp, soft, with some clay and fine grained sand, roots to 8-inch depth.	1825.74
					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, damp, with some silt.	
2					CL	Clay, red, very stiff, dry, with mottled light brown.	1824
4					ML	Silt, strong brown, hard, dry, with some clay and some fine grained micaceous sand.	1822
6					SP	Sand, yellowish red, poorly graded, fine grained, medium dense, slightly damp, with some silt.	1820
8						Sand, strong brown, poorly graded, fine grained, medium dense.	1818
10						Sand, strong brown, poorly graded, fine grained, medium dense, slightly damp, with some black staining.	1816
12						Sand strong brown, poorly graded, fine grained, medium dense, slightly damp, with some clay.	1814
14						Sand, yellowish red, poorly graded, fine-medium grained, medium dense, slightly damp, micaceous.	1812
16						Sand, strong brown, poorly graded, medium-coarse grained, loose, micaceous, slightly damp, with trace of fine grained gravel.	1810
18					GW	Gravel, brown, well graded, fine-coarse grained, < 1.8-inch diameter, with medium-coarse grained sand, loose.	1808
					GM	Same as above with some silt.	
20					SW	Sand, strong brown, well graded, fine-coarse grained, very loose, dry.	1806
22					SP	Sand, strong brown, poorly graded, fine-medium grained, dry, loose, with some clay.	1804
					ML	Silt, brownish yellow, dry, friable, with interbedded layers of red shale and olive clay.	
24							1802

Continued Next Page

Drilling Log

Soil Boring **51SBC5**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
24						*Continued* Silt, reddish yellow, dry, friable, with olive clay layers.	
26							1800
						Silt, brownish yellow, dry, friable, with interbedded layers of red shale and olive clay.	
28							1798
30					ML		1796
						Silt, strong brown, with interbedded layers of red shale and olive clay, and some very fine grained sand.	
32							1794
						Silt, brownish yellow, saturated, with red shale in silt matrix and some very fine grained sand.	
34							1792
						Silt, brownish yellow, friable, damp, with red shale and fine grained saprolite.	
36							1790
						Silt and saprolite, pale olive, dry, with laminated layers of red shale and saprolite < 1.0-inch diameter.	
						Red shale and saprolite <1.4-inch diameter in silt matrix. Refusal at 38.1 feet.	
38							1788
40							1786
42							1784
44							1782
46							1780
48							1778
50							1776
52							1774
54							1772
56							1770

Drilling Log

Soil Boring **51SBC6**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1823.4 ft. — Total Hole Depth 37.7 ft. — North 3601051.3 ft. — East 10892806.98 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 4/6/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Stratigraphic characterization boring

51SBC6

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					ML	Silt, brown, loose, damp, roots extend to 6-inch depth, with some fine grained gravel.	1823.43
					CL	Clay, yellowish red, stiff, slightly damp, mottled tan and red.	1822
2					ML	Silt, strong brown, loose, slightly damp, with some fine grained micaceuos sand.	
					SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, damp, with some clay.	1820
4						Sand, strong brown, poorly graded, fine-medium grained, medium dense, damp, with little silt.	
							1818
6						Sand, strong brown, poorly graded, fine-medium grained, damp, loose, with some black staining.	
8							1816
						Sand, strong brown, poorly graded, medium-coarse grained, slightly damp, loose, with little clay.	1814
10						Same as above with trace of fine grained gravel.	
					SW	Sand, strong brown, well graded, fine-coarse grained, medium dense, slightly damp, with some clay.	1812
12					SC	Sandy clay, strong brown, poorly graded, fine-medium grained, clay is soft with low plasticity, trace of fine grained gravel.	
					SW	Sand, strong brown, well graded, fine-coarse grained, damp, loose, with trace of fine grained gravel.	1810
14					GP	Gravel, strong brown, poorly graded, fine grained, loose, with some medium-coarse grained sand.	
					SP	Sand, strong brown, poorly graded, medium-coarse grained, loose, slightly damp.	1808
16							
					GC	Gravelly clay, brown, poorly graded, loose, slightly damp, with some medium-coarse grained sand.	1806
18					SP	Sand, brown, poorly graded, medium-coarse grained, loose, slightly damp.	
					GM	Gravel and silt, strong brown, poorly graded, fine-coarse grained <1.4-inch diameter, loose, with white and yellow medium grained sand.	1804
20							
					SP	Sand, strong brown, poorly graded, medium-coarse grained, medium dense, damp.	1802
22						Same as above with some clay, soft, low plasticity.	
						Sand, strong brown, poorly graded, fine-medium grained, medium dense, with some silt.	1800
24							

Continued Next Page

Drilling Log

Soil Boring **51SBC6**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						Silt, strong brown, soft, damp, with some clay and fine grained sand.	
							1798
26						Silt, brownish yellow, soft, slightly damp, with interbedded layers of red shale and olive clay.	
						Silt, brownish yellow, friable, dry, with interbedded layers of red shale and olive clay.	1796
28							
							1794
30					ML	Silt, pale olive, dry, friable, with red shale and olive/yellow saprolite.	
						Silt, brownish yellow, soft, damp, with interbedded layers of red shale and olive clay.	1792
32						Silt, brownish yellow, saturated, soft, with red shale and some very fine grained sand.	
							1790
34							
						Silt, pale olive, friable, dry, with layers of red shale and yellowish gray saprolite and clay.	1788
36						Same as above except coarse grained saprolite fragments < 1.8-inch diameter. Refusal at 37.7 feet.	
							1786
38							
							1784
40							
							1782
42							
							1780
44							
							1778
46							
							1776
48							
							1774
50							
							1772
52							
							1770
54							
							1768
56							

DRILLING LOG Rev: 11/8/04 SWMU 51.GPJ SHAW IT.GDT 11/8/04

Drilling Log

Soil Boring **51SBC7**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1824.8 ft. — Total Hole Depth 32.5 ft. — North 3601057.94 ft — East 10892828.08 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 4/6/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Stratigraphic characterization boring

51SBC7

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) — Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					ML	Silt, brown, soft, damp, with some clay, roots extend to 5-inch depth.	1824.8
						Silt, strong brown, slightly damp, with some clay and fine grained micaceous sand.	1824
2							
						Silt, strong brown, dry, with some clay and fine grained micaceous sand.	1822
4					SW	Sand, strong brown, well graded, fine-coarse grained, dry, with some clay and trace of fine grained gravel.	1820
6					SP	Sand, brown, poorly graded, fine grained, with some clay.	
						Sand, strong brown, poorly graded, fine-medium grained, medium dense, damp, with some silt.	1818
8						Sand, dark yellowish brown, poorly graded, fine-medium grained, loose, slightly damp, micaceous, with little silt.	1816
10							
						Same as above except no silt and color is strong brown.	1814
12						Sand, strong brown, poorly graded, fine-medium grained, medium dense, micaceous, with some clay.	1812
						Sand, strong brown, poorly graded, fine-medium grained, loose, dry, micaceous.	
14							1810
						Same as above with dark brown staining.	
16					ML	Silt, brown, soft, damp.	
					CL	Clay, strong brown, damp, low plasticity.	1808
18					GC	Gravel and clay, strong brown, poorly graded, fine grained, loose, with some coarse gravel < 1.5-inch diameter.	
					SP	Sand, strong brown, poorly graded, medium-coarse grained, loose, damp.	1806
20					GW	Gravel, strong brown, well graded, fine-coarse grained, with quartz gravel <2.0-inch diameter, and black stained gravel and trace of clay.	
					SP	Sand, dark yellowish brown, poorly graded, fine-medium grained, damp, micaceous, with some silt.	1804
22					GM	Gravel and silt, dark yellowish brown, poorly graded, fine grained, loose, damp, with some medium-coarse grained sand.	
					ML	Silt, brownish yellow, friable, dry, with interbedded layers of red	1802
24					SC		

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Drilling Log

Soil Boring **51SBC7**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					ML	shale and olive clay.	
					CL	Sandy clay, strong brown, poorly graded, fine grained, damp, micaceous, clay is soft with low plasticity.	1800
26					GC	Silt, brownish yellow, dry, friable, with interbedded layers of red shale and olive clay.	
						Clay, dark yellowish brown, soft, low plasticity, with trace of fine grained gravel.	1798
28					ML	Gravel and clay, dark yellowish brown, gravel is fine grained and red, with fine-medium grained sand, loose, wet.	
						Silt, pale olive, dry, friable.	1796
30						Silt, brownish yellow, dry, friable, with olive and red mottling, and layers of red shale.	
						Silt, yellowish brown, soft, saturated, with fine grained red shale in silt matrix.	1794
32						Silt, yellowish brown, friable, dry, with interbedded layers of red shale and olive saprolite.	
						Saprolite and weathered shale, pale olive to light gray, dry, friable, saprolite grains < 1.3-inch diameter.	1792
34							
							1790
36							
							1788
38							
							1786
40							
							1784
42							
							1782
44							
							1780
46							
							1778
48							
							1776
50							
							1774
52							
							1772
54							
							1770
56							

Drilling Log

Soil Boring **51SBC8**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Surface Elev. *1826.0 ft.* Total Hole Depth *32.0 ft.* North *3601060.52 ft* East *10892837.64 ft.*

Top of Casing *NA* Water Level Initial *NA* Static *NA* Diameter *2 in.*

Screen: Dia *NA* Length *NA* Type/Size *NA*

Casing: Dia *NA* Length *NA* Type *NA*

Fill Material *bentonite* Rig/Core *Bobcat-mounted/NA*

Drill Co. *Marshall Miller* Method *Direct Push*

Driller *K. Carr* Log By *J. Choynowski* Date *4/6/04* Permit # *NA*

Checked By *M. Thomas* License No.

COMMENTS
Stratigraphic characterization boring

51SBC8

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					ML	Silt and clay, brown, soft, slight plasticity, slightly damp, with some fine grained sand and roots to 4-inch depth.	1825.95
					CL	Clay, strong brown, stiff, dry	
2						Clay, dark yellowish brown, stiff, dry.	1824
					ML	Silt, strong brown, loose, slightly damp, with trace of fine grained gravel.	
4						Same as above except no gravel.	1822
					SC	Sandy clay, strong brown, poorly graded, fine grained, micaceous, clay is soft with low plasticity.	
6							1820
						Same as above with trace of fine grained gravel.	
8					SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, micaceous, slightly damp.	1818
10						Same as above with some clay.	1816
						Same as above without clay.	
12					SC	Sandy clay, brown, poorly graded, fine-medium grained, dense, slightly damp, with some soft clay with low plasticity.	1814
14					SW	Sand, strong brown, well graded, fine-coarse grained, loose, micaceous, dry.	1812
16					ML	Silt, brown, soft, damp.	1810
					CL	Clay, strong brown, soft, low plasticity, damp.	
18					GC	Clayey gravel, strong brown, poorly graded, fine grained, loose, damp, with quartz gravel <1.3-inch diameter.	1808
					GW	Gravel, strong brown, well graded, fine-coarse grained, with black stained quartz gravel <1.9-inch diameter, and trace of clay.	
20					SP	Sand, dark yellowish brown, poorly graded, fine-medium grained, micaceous, damp, with some silt.	1806
22					ML	Silt, olive yellow, friable, dry, with layers of red shale mottled olive.	1804
24							1802
						Continued Next Page	

Drilling Log

Soil Boring **51SBC8**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
24						*Continued*
					GM	Gravel and silt, dark yellowish brown, poorly graded, fine grained, loose, slightly damp.
					SP	Sand, dark yellowish brown, poorly graded, fine-medium grained, loose, damp, with trace of clay.
26						Silt, light yellowish brown, friable, dry, with interbedded layers of red shale and olive clay.
						Silt and clay, brown, soft, damp, slight plasticity.
28						Silt, light yellowish brown, damp, soft.
					ML	Silt, yellowish brown, soft, saturated, with some fine grained red shale.
30						Silt, yellowish brown, friable, dry, with interbedded layers of red shale and oilve saprolite.
						Silt and saprolite, pale olive, weathered red shale and saprolite is coarse grained < 1.4-inch diameter. Refusal at 32 feet.
32						
34						
36						
38						
40						
42						
44						
46						
48						
50						
52						
54						
56						

Drilling Log

Soil Boring **51SBC9**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Surface Elev. *1824.3 ft.* Total Hole Depth *38.0 ft.* North *3601029.12 ft* East *10892815.84 ft.*

Top of Casing *NA* Water Level Initial *NA* Static *NA* Diameter *2 in.*

Screen: Dia *NA* Length *NA* Type/Size *NA*

Casing: Dia *NA* Length *NA* Type *NA*

Fill Material *bentonite* Rig/Core *Bobcat-mounted/NA*

Drill Co. *Marshall Miller* Method *Direct Push*

Driller *K. Carr* Log By *J. Choynowski* Date *4/5/04* Permit # *NA*

Checked By *M. Thomas* License No.

COMMENTS
Stratigraphic characterization boring

51SBC9

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					CL ML	Clay and silt, brown, soft, damp, clay has low plasticity, trace of gravel.	1824.25 1824
2					ML	Silt, strong brown, soft, damp, with some fine grained sand and clay.	1822
4					SC	Sandy clay, strong brown, poorly graded, fine grained, micaceous, clay is soft, low plasticity, damp.	1820
6					SP	Sand, strong brown, poorly graded, fine-medium grained, slightly damp, with some clay.	1818
8					CL	Clay, strong brown, soft, low plasticity, with some fine grained sand.	1816
10					SP	Sand, strong brown, poorly graded, fine-medium grained, micaceous, slightly damp, with trace of clay.	
					SC	Sandy clay, strong brown, poorly graded, fine-medium grained, micaceous, damp, clay is soft, low plasticity.	1814
12					GP	Gravel, white, poorly graded, coarse grained, quartz <2.0-inch diameter.	
					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, micaceous, damp.	1812
14						Sand, strong brown, poorly graded, fine-medium grained, slightly damp.	1810
						Same as above with trace of fine grained gravel.	
16					SC	Sandy clay, strong brown, poorly graded, fine grained, damp, clay is soft with low plasticity.	1808
					GC	Gravel and clay, brownish yellow, poorly graded, fine grained, with some quartz gravel <1.4-inch diameter, and some medium-coarse grained sand, and some silt.	
18					SW	Sand, yellowish brown, well graded, fine-coarse grained, loose, damp.	1806
20					SC	Sandy clay, strong brown, poorly graded, fine-medium grained, micaceous, damp, clay is soft, low plasticity.	1804
					GC	Gravel and clay, strong brown, poorly graded, fine grained, with some quartz gravel <1.4-inch diameter, and some medium-coarse grained sand.	
22					SC ML	Sandy clay, strong brown, poorly graded, fine grained, damp, clay is soft, low plasticity.	1802
24							

Continued Next Page

Drilling Log

Soil Boring **51SBC9**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						Silt, yellowish brown, hard, slightly damp, with little clay, mottled olive and red.	1800
26					ML	Silt, brownish yellow, with interbedded layers of red shale and clay, mottled tan, red, and oilve, slightly damp. Same as above except dry.	1798
28						Silt, brownish yellow, soft, very wet, with layers of red laminated shale and fragments of saprolite, with some clay.	1796
30					CL	Clay, brown, very soft, low plasticity, with trace of very fine grained sand.	1794
32					ML	Silt, yellowish brown, soft, very wet, with interbedded layers of laminated red shale and olive clay. Same as above except slightly damp.	1792
34						Silt, brownish yellow, very soft, saturated, with some fine grained saprolite.	1790
36						Silt, pale olive, friable, dry, with interbedded layers of red shale and yellow gray saprolite. Same as above with saprolite <1.2-inch diameter. Refusal at 38 feet.	1788
38							1786
40							1784
42							1782
44							1780
46							1778
48							1776
50							1774
52							1772
54							1770
56							

Drilling Log

Soil Boring **51SBC10**

Project SWMU 51 RFI | Owner Radford Army Ammunition Plant

Location SWMU 51 | Proj. No. 839197-050

Surface Elev. 1825.9 ft. | Total Hole Depth 38.2 ft. | North 3601035.31 ft | East 10892838.36 ft.

Top of Casing NA | Water Level Initial NA | Static NA | Diameter 2 in.

Screen: Dia NA | Length NA | Type/Size NA

Casing: Dia NA | Length NA | Type NA

Fill Material bentonite | Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller | Method Direct Push

Driller K. Carr | Log By J. Choynowski | Date 4/5/04 | Permit # NA

Checked By M. Thomas | License No.

COMMENTS
Stratigraphic characterization boring

51SBC10

Depth (ft.)	PID (ppm)	Sample ID / % Recovery / Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0				ML	Silt, brown, damp, with some clay and sand, sand is medium grained, clay is soft with low plasticity.	1825.94
					Silt, yellowish red, slightly damp, with some clay.	
2				CL	Clay, yellowish red, stiff, dry, with trace of fine grained gravel.	1824
				ML	Silt, strong brown, dry, with some fine grained sand.	
4				SW	Sand, strong brown, well graded, fine-coarse grained, loose, dry.	1822
					Same as above with some fine grained gravel.	
6						1820
8				SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, slightly damp.	1818
10						1816
12				SC	Sandy clay, strong brown, poorly graded, fine grained, damp, clay is soft with low plasticity.	1814
				SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, with some clay.	
14				GM	Gravel and silt, strong brown, poorly graded, fine grained, loose, damp.	1812
16				GP	Gravel, white, coarse grained quartz <1.8-inch diameter, loose, dry.	1810
				GC	Clayey gravel, strong brown, poorly graded, fine grained, loose, damp, clay is soft.	
18				GM	Gravel and silt, strong brown, poorly graded, fine grained, loose, slightly damp.	1808
20				GC	Clayey gravel, strong brown, fine grained quartz <0.6-inch diameter, loose, slightly damp.	1806
				GP		
				ML	Gravel, strong brown, poorly graded, fine grained, loose, with black staining.	
22				SP	Silt, strong brown, soft, damp, with some soft clay with low plasticity.	1804
				ML	Sand, dark yellowish brown, poorly graded, fine-medium grained,	
24						1802

Continued Next Page

Drilling Log

Soil Boring **51SBC10**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						medium dense, with some clay.	
						Silt, brownish yellow, friable, dry, with some clay.	
						Silt, brownish yellow, damp, with some clay and fine grained sand.	
26						Silt, pale olive, friable, dry, with red shale interbedded with yellow clay.	1800
						Silt, brownish yellow, friable, dry, with interbedded layers of red shale and olive clay.	
28					ML	Same as above with some fine grained gravel.	1798
						Same as above without the gravel.	
30							1796
						Silt, strong brown, very soft, saturated, with some fine grained sand and trace of gravel.	
32							1794
					GP	Gravel, brown, poorly graded, fine grained, with some fine grained sand and clay and silt.	
34						Silt, brownish yellow, friable, dry, with interbedded layers of olive/gray saprolite and clay, and red shale.	1792
						Silt, pale olive, friable, dry, with fine grained saprolite and red shale.	
36					ML		1790
						Silt, pale olive, friable, dry, with interbedded layers of red shale and saprolite <0.9-inch diameter. Refusal at 38.2 feet.	
38							1788
40							1786
42							1784
44							1782
46							1780
48							1778
50							1776
52							1774
54							1772
56							1770

DRILLING LOG Rev: 4/4/03 SWMU 51.GPJ SHAW IT.GDT 10/27/04

Drilling Log

Soil Boring **51SBC11**

Project SWMU 51 RFI | Owner Radford Army Ammunition Plant

Location SWMU 51 | Proj. No. 839197-050

Surface Elev. 1825.2 ft. | Total Hole Depth 38.2 ft. | North 3601005.66 ft | East 10892820.24 ft.

Top of Casing NA | Water Level Initial NA | Static NA | Diameter 2 in.

Screen: Dia NA | Length NA | Type/Size NA

Casing: Dia NA | Length NA | Type NA

Fill Material bentonite | Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller | Method Direct Push

Driller K. Carr | Log By J. Choynowski | Date 4/2/04 | Permit # NA

Checked By M. Thomas | License No.

COMMENTS
Stratigraphic characterization boring

51SBC11

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					CL	Clay, dark brown, soft, low plasticity, with roots extending to 6-inch depth.	1825.16
						Sandy clay, reddish brown, poorly graded, fine grained, micaceous, damp, clay is soft with low plasticity.	1824
2					SC		
4							1822
						Sand, yellowish red, poorly graded, fine-medium grained, medium dense, micaceous, slightly damp.	1820
6						Same as above with black staining.	
							1818
8						Sand, strong brown, poorly graded, fine-medium grained, medium dense, slightly damp.	
							1816
10					SP	Same as above with black staining.	
						Sand, strong brown, poorly graded, medium grained, medium dense, slightly damp, with some fine grained gravel.	1814
12						Sand, yellowish red, poorly graded, fine-medium grained, medium dense, slightly damp, with little clay.	
						Sand, strong brown, poorly graded, fine-medium grained, medium dense, dry.	1812
14						Same as above with little clay.	
						Same as above except no clay and stained black.	1810
16					SC	Sandy clay, yellowish red, poorly graded, fine grained, damp, clay is soft with low plasticity.	
					SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, micaceous with some black staining.	1808
18					CL	Clay, strong brown, soft, low plasticity, with trace of fine grained sand.	
					GC	Clayey gravel, strong brown, poorly graded, fine grained, loose, with some medium-coarse grained sand.	1806
20					SP	Sand, brown, poorly graded, fine-medium grained, medium dense, damp.	
					GC	Clayey gravel, strong brown, well graded, fine-coarse grained, <1.3-inch diameter, damp, with some medium-coarse grained sand and silt and clay.	1804
22					CL	Clay, brown, soft, low plasticity, with some fine grained sand.	
					ML		1802
24							

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Drilling Log

Soil Boring **51SBC11**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery / Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
					Continued	
24				SC	Silt, yellowish brown, friable, dry, with interbedded layers of red shale and olive clay.	
				SP		
				ML	Sandy clay, strong brown, poorly graded, fine grained, clay is soft with low plasticity.	1800
26				SC	Sand, strong brown, poorly graded, fine-medium grained, medium dense, damp, with some clay.	
				ML	Silt, brownish yellow, friable, dry, with interbedded layers of red shale and olive clay.	1798
28				CL		
				SC	Sandy clay, brown, poorly graded, fine grained, micaceous, clay is soft with low plasticity.	1796
				ML	Silt, brownish yellow, friable, dry, with interbedded layers of red shale and olive clay.	
30					Clay, strong brown, soft, low plasticity.	1794
					Sandy clay, strong brown, poorly graded, fine grained, micaceous, clay is soft with low plasticity.	
32				CL	Silt, yellow, friable, slightly damp, with interbedded layers of red shale and olive/light gray saprolite.	
				SC	Clay, brown, soft, low plasticity, with olive and red mottling.	1792
34				ML	Sandy clay, brown, poorly graded, medium grained, micaceous, clay is soft with low plasticity.	
				SC	Silt, pale olive, friable, dry, with interbedded layers of fine grained red shale and olive/light gray saprolite.	1790
36					Sandy clay, strong brown, poorly graded, fine-medium grained, damp, clay is soft with low plasticity.	
				ML	Silt, yellowish brown, very soft, saturated, with some very fine grained sand.	1788
38					Silt, pale olive, friable, dry, with coarse grained saprolite <1.3-inch diameter. Refusal at 38.2 feet.	
						1786
40						
						1784
42						
						1782
44						
						1780
46						
						1778
48						
						1776
50						
						1774
52						
						1772
54						
						1770
56						

Drilling Log

Soil Boring **51SBC12**

Project SWMU 51 RFI | Owner Radford Army Ammunition Plant

Location SWMU 51 | Proj. No. 839197-050

Surface Elev. 1825.6 ft. | Total Hole Depth 38.7 ft. | North 3601006.78 ft | East 10892825.97 ft.

Top of Casing NA | Water Level Initial NA | Static NA | Diameter 2 in.

Screen: Dia NA | Length NA | Type/Size NA

Casing: Dia NA | Length NA | Type NA

Fill Material bentonite | Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller | Method Direct Push

Driller K. Carr | Log By J. Choynowski | Date 4/2/04 | Permit # NA

Checked By M. Thomas | License No.

COMMENTS
Stratigraphic characterization boring

51SBC12

Depth (ft.)	PID (ppm)	Sample ID / % Recovery / Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0				CL	Clay, brown, soft, with roots to depth of 7-inches, grades into silt	1825.60
				ML	and clay, soft.	
2				CL	Clay, strong brown, stiff, slightly damp.	1824
4					Same as above with some fine grained sand.	1822
6				ML	Silt, strong brown, dry, with some fine grained sand and clay.	1820
					Silt, strong brown, slightly damp, with some fine grained sand.	
8				SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, slightly damp.	1818
10					Same as above except micaceous.	1816
					Same as above with some fine grained gravel.	
12					Same as above without gravel.	1814
14					Same as above with some clay.	1812
16				SC	Sandy clay, strong brown, poorly graded, fine grained, micaceous, damp, clay is soft with low plasticity.	1810
18				SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, damp, with brown staining.	1808
				SW	Sand, brown, well graded, fine-coarse grained, loose, damp.	
20				GC	Clayey gravel, strong brown, poorly graded, fine grained, loose, damp, with some coarse grained gravel <1.4-inch diameter, clay is soft, with some fine grained sand.	1806
					Clayey gravel, brown, poorly graded, fine grained, loose, damp, clay is soft, with some fine grained sand.	
22				GP	Gravel, white, loose, dry, quartz gravel <2.1-inch diameter.	1804
				SP	Sand, brownish yellow, poorly graded, medium-coarse grained, loose.	
24				ML	Silt, brownish yellow, saturated, with laminated layers of red shale	1802

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DRILLING LOG Rev: 4/4/03 SWMU 51.GPJ SHAW IT.GDT 10/27/04

Drilling Log

Soil Boring **51SBC12**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery / Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
					Continued	
24				SC	interbedded with clay.	
				ML	Sandy clay, strong brown, poorly graded, medium grained, wet, clay is soft with low plasticity.	1800
26				CL	Silt, brownish yellow, friable, dry, with interbedded layers of tan, red, and olive clay and saprolite.	
				ML	Clay, strong brown, soft, mottled red and olive with trace of coarse grained sand.	1798
28				SC	Silt, pale yellow, friable, dry, with interbeds of shale and clay mottled red and olive.	
				ML	Sandy clay, strong brown, poorly graded, fine grained, micaceous, damp, clay is soft with low plasticity.	1796
30				SP	Silt, pale yellow, friable, dry, with interbedded layers of red shale and light gray saprolite.	
					Sand, dark yellowish brown, poorly graded, fine-medium grained, medium dense, damp, with some soft clay.	1794
32				ML	Silt, pale yellow, friable, dry, mottled tan and red with weathered shale and saprolite.	
						1792
34				SC	Sandy clay, brownish yellow, poorly graded, fine grained, damp, clay is soft with low plasticity.	
					Silt, olive yellow, very soft, saturated, with fine-medium grained saprolite.	1790
36				ML		
					Silt, pale olive, friable, dry, with saprolite <0.9-inch diameter and laminated layers of weathered red shale. Refusal at 38.7 feet.	1788
38						
						1786
40						
						1784
42						
						1782
44						
						1780
46						
						1778
48						
						1776
50						
						1774
52						
						1772
54						
						1770
56						

Drilling Log

Soil Boring **51SBC13**

Project SWMU 51 RFI | Owner Radford Army Ammunition Plant
Location SWMU 51 | Proj. No. 839197-050
Surface Elev. 1827.3 ft. | Total Hole Depth 38.9 ft. | North 3601012.47 ft | East 10892847.69 ft.
Top of Casing NA | Water Level Initial NA | Static NA | Diameter 2 in.
Screen: Dia NA | Length NA | Type/Size NA
Casing: Dia NA | Length NA | Type NA
Fill Material bentonite | Rig/Core Bobcat-mounted/NA
Drill Co. Marshall Miller | Method Direct Push
Driller K. Carr | Log By J. Choynowski | Date 4/2/04 | Permit # NA
Checked By M. Thomas | License No.

COMMENTS
Stratigraphic characterization boring

51SBC13

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					CL	Clay, brown, soft, low plasticity, with some fine grained gravel and roots to 5-inch depth.	1827.32
2					SC	Sandy clay, strong brown, medium stiff, damp.	1826
4						Same as above with some fine grained sand.	1824
6					SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, micaceous, damp.	1822
8							1820
10					ML	Silt, strong brown, medium stiff, damp, with some clay and some fine grained sand.	1818
12					SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, damp, with some black staining.	1816
14						Same as above with trace of fine grained gravel.	1814
16					GP	Gravel, strong brown, poorly graded, coarse grained, loose, damp, quartz, with little coarse grained sand.	1812
18						Gravel, brown, poorly graded, fine grained, loose, with coarse grained sand, little to no fines.	1810
20					GC	Gravel and clay, strong brown, well graded, fine-coarse grained, with quartz <1.9-inch diameter, and some medium-coarse grained sand.	1808
22					GW	Gravel, strong brown, well graded, fine-coarse grained, loose, with quartz <1.9-inch diameter, gravel stained red and black, with some medium-coarse grained sand.	1806
24					GC	Clayey gravel, brown, poorly graded, coarse grained <2.1-inch diameter, damp, with some coarse grained sand.	1804
					SC / ML	Sandy clay, strong brown, poorly graded, fine-medium grained, damp, clay is soft with low plasticity.	

Continued Next Page

Drilling Log

Soil Boring **51SBC13**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						Silt, brownish yellow, friable, dry with interbedded layers of red shale and olive clay.	
26					ML	Silt, pale yellow, friable, dry with interbedded layers of red shale and olive clay.	1802
							1800
28					SC	Sandy clay, brown, poorly graded, medium grained, micaceous, damp, clay is soft with low plasticity.	
					CL	Clay, strong brown, soft with low plasticity, olive mottling, with trace of fine grained gravel.	1798
30					SW	Sand, brown, well graded, fine-coarse grained, medium dense with some fine grained gravel.	
					ML	Silt, brownish yellow, damp, intebedded with layers of red shale.	1796
32					CL	Silt, yellowish brown, damp, with interbedded layers of red shale and olive saprolite and clay.	
					SW	Clay, reddish yellow, soft, damp, low plasticity, grades into same with trace of fine grained gravel.	1794
34					ML	Sand, strong brown, well graded, fine-coarse grained, medium dense, damp, with some fine grained gravel.	
					CL	Silt, brownish yellow, friable and dry, with interbedded layers of red shale and olive saprolite and clay.	1792
36					GC	Clay, strong brown, soft with low plasticity, damp, with some fine grained gravel and coarse grained sand.	
					ML	Clayey gravel, well graded, fine-coarse grained, loose, damp, with some fine grained sand.	1790
38						Silt, brownish yellow, soft, saturated, grading into silt with saprolite.	
						Silt, pale olive, dry friable, with saprolite <1.7-inch diameter. Refusal at 38.9 feet.	1788
40							
							1786
42							
							1784
44							
							1782
46							
							1780
48							
							1778
50							
							1776
52							
							1774
54							
							1772
56							

Drilling Log

Soil Boring **51SBC14**

Project SWMU 51 RFI | Owner Radford Army Ammunition Plant

Location SWMU 51 | Proj. No. 839197-050

Surface Elev. 1827.4 ft. | Total Hole Depth 40.0 ft. | North 3601014.08 ft | East 10892852.44 ft.

Top of Casing NA | Water Level Initial NA | Static NA | Diameter 2 in.

Screen: Dia NA | Length NA | Type/Size NA

Casing: Dia NA | Length NA | Type NA

Fill Material bentonite | Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller | Method Direct Push

Driller K. Carr | Log By J. Choynowski | Date 4/2/04 | Permit # NA

Checked By M. Thomas | License No.

COMMENTS
Stratigraphic characterization boring

51SBC14

Depth (ft.)	PID (ppm)	Sample ID / % Recovery / Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0				CL	Clay, brown, soft, low plasticity, with roots to a depth of 6-inches.	1827.40
					Clay, yellowish red, soft, low plasticity, slightly damp.	1826
2					Same as above with some yellow mottling.	
				ML	Silt, yellowish red, friable, dry.	1824
4						
				SP	Sand, yellowish red, poorly graded, fine-medium grained, loose, slightly damp.	1822
6					Sand, strong brown, poorly graded, fine-medium grained, loose, slightly dry.	
					Sand, strong brown, poorly graded, fine-medium grained, loose, micaceous, dry, with black staining.	1820
8					Sand, strong brown, poorly graded, fine-medium grained, medium dense, micaceous, damp.	
						1818
10					Same as above with black staining.	
					Sand, strong brown, poorly graded, fine-medium grained, medium dense, micaceous, damp, with trace of clay.	1816
12				SC	Sandy clay, strong brown, poorly graded, fine-medium grained, damp, with soft clay with low plasticity.	
				SP	Sand, strong brown, poorly graded, fine-medium grained, medium dense, micaceous, damp, with some soft clay with low plasticity.	1814
14					Sand, strong brown, poorly graded, fine-medium grained, loose, micaceous, dry.	
				GC	Gravel and clay, red, well graded, fine-coarse grained, <1.0-inch diameter, with fine to medium grained sand and brown clay.	1812
16				SC		
				GP	Sandy clay, strong brown, poorly graded, fine-medium grained, damp, with soft clay with low plasticity.	1810
18					Gravel, brown, poorly graded, fine grained <0.75-inch diameter, loose, with red and clear colored quartz <0.5-inch diameter, with medium-coarse grained sand.	
				CL	Clay, brown, soft, low plasticity, damp, with trace of fine grained gravel.	1808
20					Same as above except color is strong brown.	
				GC	Gravel, brown, poorly graded, fine grained, <0.5-inch diameter,with medium-coarse grained sand and some clay.	1806
22				CL	Clay, red, soft, with low plasticity.	
				SC	Sandy clay, brown, poorly graded, fine grained, clay is soft with low plasticity.	1804
				GC		
24					Continued Next Page	

Drilling Log

Soil Boring **51SBC14**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						Clayey gravel, brown, poorly graded, fine grained, <0.6-inch diameter quartz, loose, damp, with medium-coarse grained sand.	
						Silt, yellowish brown, damp-wet, with interbedded layers of red shale and saprolite.	1802
26						Silt, brownish yellow, damp, with interbedded layers of red shale and saprolite.	
					ML	Same as above with traces of fine grained saprolite.	1800
28							
							1798
30						Silt, brownish yellow, friable, dry, with interbedded layers of weathered red shale and saprolite.	
						Sandy clay, brownish yellow, poorly graded, coarse grained, damp, clay is soft with low plasticity.	1796
32					SC	Sandy clay, brown, poorly graded, medium-coarse grained, loose, damp, clay is soft with low plasticity.	
							1794
34						Silt, brownish yellow, very soft, saturated, with fine grained saprolite in silt matrix.	
							1792
36						Silt, pale olive, friable, dry, with fine grained gravel sized grains of saprolite.	
					ML		1790
38							
							1788
40							
							1786
42							
							1784
44							
							1782
46							
							1780
48							
							1778
50							
							1776
52							
							1774
54							
							1772
56							

Drilling Log

Soil Boring **51SBC15**

Project SWMU 51 RFI | Owner Radford Army Ammunition Plant

Location SWMU 51 | Proj. No. 839197-050

Surface Elev. 1826.9 ft. | Total Hole Depth 24.9 ft. | North 3600984.87 ft | East 10892833.35 ft.

Top of Casing NA | Water Level Initial NA | Static NA | Diameter 2 in.

Screen: Dia NA | Length NA | Type/Size NA

Casing: Dia NA | Length NA | Type NA

Fill Material bentonite | Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller | Method Direct Push

Driller K. Carr | Log By J. Choynowski | Date 3/31/04 | Permit # NA

Checked By M. Thomas | License No.

COMMENTS
Stratigraphic characterization boring

51SBC15

Depth (ft.)	PID (ppm)	Sample ID / % Recovery / Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0				CL	Clay, brown, soft, low plasticity, with roots to a depth of 6-inches,	1826.90
				ML	grades into silt and clay, damp, with some fine grained sand.	1826
2				SP	Sand, strong brown, poorly graded, fine-medium grained, loose, slightly damp.	
4						1824
6						1822
8						1820
10						1818
12						1816
					Sand, strong brown, poorly graded, fine-medium grained, loose, micaceous, damp.	1814
14					Same as above with black staining.	
16				ML		1812
					Silt, brownish yellow, soft, damp, with some clay with low plasticity, and some fine grained sand.	1810
18				GP	Gravel, strong brown, well graded, fine-coarse grained, loose, with some medium-coarse grained sand.	
					Same as above with coarse grained quartz <1.5-inch diameter.	1808
20				GM	Gravel and silt, strong brown, poorly graded, fine grained, loose, damp, with some medium-coarse grained sand.	1806
				GC	Clayey gravel, reddish yellow, poorly graded, fine grained, loose, damp, with some medium-coarse grained sand and some silt.	
22				ML	Silt, light yellowish brown, dry, with interbedded layers of red shale and olive saprolite.	1804
24					Silt, light yellowish brown, hard, friable, dry, with black and olive	

Continued Next Page

Drilling Log

Soil Boring **51SBC15**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					ML	staining. Silt, hard, dry, interbedded with light gray saprolite and red shale. Refusal at 24.9 feet.	1802
26							1800
28							1798
30							1796
32							1794
34							1792
36							1790
38							1788
40							1786
42							1784
44							1782
46							1780
48							1778
50							1776
52							1774
54							1772
56							

Drilling Log

Soil Boring **51SBC16**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1827.7 ft. — Total Hole Depth 31.7 ft. — North 3600989.46 ft — East 10892857.17 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 3/31/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Stratigraphic characterization boring

51SBC16

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					CL / ML	Clay, yellowish red, soft, low plasticity, with roots extending to depth of 7-inches, grades into yellowish red silt, soft, damp.	1827.67
2					ML	Silt, yellowish red, friable, dry, with some very fine-fine grained sand, loose.	1826
4					ML	Silt, brown, friable, dry.	1824
6					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, damp.	1822
8					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, micaceous, slightly damp.	1820
10					SP		1818
12					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, micaceous, slightly damp, with some black staining.	1816
14					SP		1814
16					GP / SP	Gravel, strong brown, poorly graded, fine grained, with quartz <0.5-inch diameter, and some medium-coarse grained sand, loose.	1812
18					GW / GM	Sand, strong brown, poorly graded, fine-medium grained, loose, damp. Gravel, reddish yellow, well graded, fine-coarse grained, with quartz <2.0-inch diameter, and some medium-coarse grained sand, loose.	1810
20					GP / GW	Gravel and silt, reddish yellow, poorly graded, fine grained, loose, with some medium-coarse grained sand. Gravel, strong brown, poorly graded, fine grained, damp, loose, with some medium-coarse grained sand, loose.	1808
22					SP / SM / GP	Gravel, strong brown, well graded, fine-coarse grained, with quartz <2.0-inch diameter, and with some medium-coarse grained sand, loose.	1806
24					ML	Sand and silt, strong brown, poorly graded, fine grained.	1804

Continued Next Page

Drilling Log

Soil Boring **51SBC16**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					GW	Gravel, white, poorly graded, quartz <2.0-inch diameter.	
						Silt, light yellowish brown, friable, dry.	
					ML	Gravel, brown, well graded, fine-coarse grained, loose, Quartz <1.4-inch diameter, with some coarse grained sand.	1802
26					GM	Silt, brownish yellow, friable, dry, with interbeds of olive clay.	
					ML	Silty gravel, strong brown, poorly graded, fine grained, with some fine-medium grained sand and some clay.	1800
28					SP	Silt, brownish yellow, friable, dry, with interbedded layers of red and gray laminated shale.	
					ML	Sand, brown, poorly graded, medium-coarse grained, loose, micaceous, with little fine grained gravel, and trace of clay.	1798
30						Silt, brownish yellow, friable, dry, with interbedded layers of laminated shale.	
						Silt, light yellowish brown, hard, dry, with black and olive staining.	
32						Silt, light gray, dry, hard, with interbedded layers of red shale and saprolite. Refusal at 31.7 feet.	1796
34							1794
36							1792
38							1790
40							1788
42							1786
44							1784
46							1782
48							1780
50							1778
52							1776
54							1774
56							1772

Drilling Log

Soil Boring **51SBC17**

Project SWMU 51 RFI | Owner Radford Army Ammunition Plant

Location SWMU 51 | Proj. No. 839197-050

Surface Elev. 1827.4 ft. | Total Hole Depth 34.8 ft. | North 3600961.22 ft | East 10892839.74 ft.

Top of Casing NA | Water Level Initial NA | Static NA | Diameter 2 in.

Screen: Dia NA | Length NA | Type/Size NA

Casing: Dia NA | Length NA | Type NA

Fill Material bentonite | Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller | Method Direct Push

Driller K. Carr | Log By J. Choynowski | Date 3/30/04 | Permit # NA

Checked By M. Thomas | License No.

COMMENTS
Stratigraphic characterization boring
51SBC17

Depth (ft.)	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0	ML	Silt, dark brown, medium dense, with roots to depth of 6-inches, with some fine grained sand and some clay.	1827.43
		Silt, yellowish red, slightly damp, with some fine grained sand.	1826
2	SP	Sand, strong brown, poorly graded, fine-medium grained, loose, dry.	
	CL	Clay, dark yellowish brown, low plasticity, damp with little silt and sand.	1824
4	SC	Sandy clay, yellowish red, poorly graded, fine-medium grained, micaceous, damp, with some black staining.	
6			1822
8			1820
	ML	Silt, yellowish red, loose, dry.	1818
10	SP	Sand, strong brown, poorly graded, fine-medium grained, damp.	
		Sand, strong brown, poorly graded, medium-coarse grained, damp, with some fine grained gravel.	1816
12	SC	Sandy clay, strong brown, poorly graded, fine-medium grained, damp, clay is soft with low plasticity.	
	SP	Sand, yellowish red, poorly graded, fine-medium grained, loose, wet, with some black staining and trace of silt.	1814
14			
			1812
16	SC	Sandy clay, yellowish red, poorly graded, fine-medium grained, damp, clay has low plasticity.	
	GM	Silty gravel, brown, poorly graded, fine grained, with medium-coarse grained sand.	1810
18	GP	Gravel, strong brown, poorly graded, fine grained, loose, damp, with some medium-coarse grained sand.	
			1808
20	SP	Sand, strong brown, poorly graded, fine-medium grained, loose, wet.	
		Same as above with little clay and damp.	1806
22	SC	Sandy clay, strong brown, poorly graded, fine grained, damp, clay has low plasticity.	
	GM	Silty gravel, yellowish gray, poorly graded, fine grained, damp, with quartz <1.5-inch diameter, with some fine grained sand.	1804
24	CL		

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Drilling Log

Soil Boring **51SBC17**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery / Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
					Continued	
24				SP	Clay light yellowish brown, dense, with tan and olive mottling, little silt.	
					Sand, strong brown, poorly graded, fine-medium grained, micaceous, damp, with some clay.	1802
26				CL	Clay, soft, wet, low plasticity, with some silt.	
				ML	Silt, brownish yellow, friable, dry, interbedded with black and olive mottled clay.	1800
28				SP	Sand, dark yellowish brown, poorly graded, fine-medium grained, damp, with some clay.	
				CL	Clay, yellowish brown, soft with low plasticity.	1798
30				SC	Sandy clay, brownish yellow, poorly graded, fine grained, clay is soft with low plasticity.	
					Silt, strong brown, damp, with some clay.	1796
32				ML	Same as above except silt is friable and dry.	
					Silt, olive, dense, interbedded with red shale and olive saprolite, dry. Refusal at 34.8 feet.	1794
34						
						1792
36						
						1790
38						
						1788
40						
						1786
42						
						1784
44						
						1782
46						
						1780
48						
						1778
50						
						1776
52						
						1774
54						
						1772
56						

Drilling Log

Soil Boring **51SBC18**

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Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Surface Elev. *1828.2 ft.* Total Hole Depth *35.1 ft.* North *3600962.94 ft* East *10892842.86 ft.*

Top of Casing *NA* Water Level Initial *NA* Static *NA* Diameter *2 in.*

Screen: Dia *NA* Length *NA* Type/Size *NA*

Casing: Dia *NA* Length *NA* Type *NA*

Fill Material *bentonite* Rig/Core *Bobcat-mounted/NA*

Drill Co. *Marshall Miller* Method *Direct Push*

Driller *K. Carr* Log By *J. Choynowski* Date *3/31/04* Permit # *NA*

Checked By *M. Thomas* License No.

COMMENTS
Stratigraphic characterization boring
51SBC18

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					ML	Clayey silt, dark brown, with roots to a depth of 6-inches, grades into clayey silt, yellowish red, firm, damp.	1828.17 1828
2					SP	Sand, strong brown, poorly graded, fine-medium grained, damp.	1826
4							1824
6						Same as above with some fine grained gravel.	1822
8						No Recovery.	1820
10					SC	Sandy clay, strong brown, poorly graded, fine grained sand, clay is soft with low plasticity.	1818
12					SW	Sand, strong brown, well graded, fine-coarse grained, damp, with black staining.	1816
14					SP	Sand, strong brown, poorly graded, fine-coarse grained with black staining, damp.	1814
16					GP	Gravel, strong brown, poorly graded, fine grained, sand is medium-coarse grained, damp, no fines.	1812
18					SP	Sand, strong brown, poorly graded, fine-medium grained, damp, with some clay, soft. Sand, strong brown, poorly graded, fine-medium grained, slightly moist.	1810
20					GW	Gravel, strong brown, well graded, fine-coarse grained <1.5-inch diameter, damp, with some sand, medium-coarse grained.	1808
22					SC	Sandy clay, strong brown, poorly graded, fine-medium grained, damp, clay is soft with low plasticity.	1806
24					SP	Sand, strong brown, poorly graded, fine-medium grained, damp.	
					GP	Gravel, strong brown, poorly graded, fine grained <0.75-inch diameter, sand is medium-coarse grained, damp, no fines. Same as above with black staining.	
					SP	Sand, strong brown, poorly graded, fine grained, damp, with some clay, soft.	
					GM	Silty gravel, yellowish brown, poorly graded, fine grained, with quartz <0.75-inch diameter, damp, with some medium grained sand.	
					ML	Silt, dark red, dry, with yellow mottling and some soft clay. Silt, light yellowish brown, friable, dry, with some stiff clay mottled	

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Drilling Log

Soil Boring **51SBC18**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					ML	yellow and red.	1804
					CL	Clay, reddish yellow, very soft, damp to slightly wet, with some silt, and trace of fine grained sand.	
26					ML	Silt, reddish yellow, friable, damp, with some soft clay.	1802
					CL ML	Silt and clay, strong brown, wet, with trace of fine grained sand.	
28						Silt and clay, brown, soft, slightly damp, with some fine grained sand.	1800
					ML	Silt, brownish yellow, friable, dry, with olive mottling.	
30						Silt, strong brown, dry, with interbedded layers of olive clay.	1798
						Silt, friable, dry, interbedded with laminated red shale and olive clay.	
32					GC	Clayey gravel, brownish yellow, poorly graded, fine grained, damp, with some fine-medium grained sand.	1796
						Same as above except color is strong brown.	
34					ML	Silt, pale brown, dry, with interbedded olive saprolite, mottled yellow. Refusal at 35.1 feet.	1794
36							1792
38							1790
40							1788
42							1786
44							1784
46							1782
48							1780
50							1778
52							1776
54							1774
56							

Drilling Log

Soil Boring **51SBC19**

Project SWMU 51 RFI | Owner Radford Army Ammunition Plant
Location SWMU 51 | Proj. No. 839197-050
Surface Elev. 1828.6 ft. | Total Hole Depth 35.0 ft. | North 3600964.55 ft | East 10892858.62 ft.
Top of Casing NA | Water Level Initial NA | Static NA | Diameter 2 in.
Screen: Dia NA | Length NA | Type/Size NA
Casing: Dia NA | Length NA | Type NA
Fill Material bentonite | Rig/Core Bobcat-mounted/NA
Drill Co. Marshall Miller | Method Direct Push
Driller K. Carr | Log By J. Choynowski | Date 3/29/04 | Permit # NA
Checked By M. Thomas | License No.

COMMENTS
Stratigraphic characterization boring

51SBC19

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					ML	Silt, dark brown, with roots to a depth of 6-inches, firm, grades to clayey silt, yellowish red.	1828.62
						Sand, strong brown, poorly graded, fine-medium grained, with some fine grained gravel.	1828
2					SP		1826
4							1824
					SW	Sand, black, well graded, fine-coarse grained, mottled yellow, subangular-subrounded grains.	
6						No Recovery.	1822
8					SW	Sand, black, well graded, fine-coarse grained, subangular-subrounded, with some fine grained gravel.	1820
					CL	Clayey paste (trench sludge), dark reddish gray.	
10							1818
					SW	Sand, strong brown, well graded, fine-coarse grained, with some fine grained gravel and black staining.	
12						Sand, strong brown, poorly graded, fine-medium grained, with some black paste (trench sludge), possible slough from borehole.	1816
					SP	Sand, strong brown, poorly graded, fine-medium grained, damp, with some clay.	
14							1814
					GP	Gravel, strong brown, poorly graded, fine grained, loose, damp, with some medium-coarse grained sand, and trace of clay.	
16						Same as above without the clay.	1812
						Same as above with some coarse grained white quartz.	
18						Same as above except no quartz and with some fine grained gravel sized red shale.	1810
						Same as above except no red shale.	
20						Gravel, yellowish brown, poorly graded, fine grained, loose, damp, with some fine-medium grained sand.	1808
22						Same as above with some fine grained quartz gravel.	1806
					ML	Silt, strong brown, friable, dry, mottled black, olive, and red.	
24							

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Drilling Log

Soil Boring **51SBC19**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24						No Recovery.	1804
26							1802
28						Sandy clay, strong brown, poorly graded, medium grained sand, damp, clay is soft with low plasticity.	1800
30					SC	Same as above except color is yellowish brown, and some fine grained gravel.	1798
32						Silt, brownish yellow, friable, dry, with interbeds of red shale and olive clay.	1796
34					ML	Silt, light olive brown, friable, dry, with interbeds of red shale and olive saprolite. Refusal at 35 feet.	1794
36							1792
38							1790
40							1788
42							1786
44							1784
46							1782
48							1780
50							1778
52							1776
54							1774
56							

DRILLING LOG Rev: 11/8/04 SWMU 51.GPJ SHAW IT.GDT 11/8/04

Drilling Log

Soil Boring **51SBC20**

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Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1827.5 ft. — Total Hole Depth 35.9 ft. — North 3600973.93 ft — East 10892862.57 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 3/30/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Stratigraphic characterization boring

51SBC20

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					SC	Sandy clay, dark brown, with roots to a depth of 6-inches.	1827.48
						Sandy clay, strong brown, damp, with fine grained sand.	1826
2					SP	Sand, strong brown, poorly graded, fine-medium grained, damp, with a trace of clay.	
							1824
4					SW	Sand, strong brown, well graded, fine-coarse grained, damp, with some silt.	
					SP	Sand, strong brown, poorly graded, fine-medium grained, damp, with some silt.	1822
6					SC	Sandy clay, strong brown, poorly graded, fine grained, damp.	
						Same as above with black staining.	1820
8						Same as above without black staining.	
					SW	Sand, strong brown, well graded, fine-coarse grained, damp, with little black mottling.	1818
10					SC	Sandy clay, strong brown, poorly graded, fine grained, damp, clay is soft with low plasticity.	
						Same as above except color is yellowish red.	1816
12					CL	Clay, yellowish red, soft, damp, low plasticity.	
							1814
14					SP	Sand, yellowish brown, poorly graded, fine-medium grained, loose, damp.	
						Same as above except color is strong brown with some clay.	1812
16					SC	Sandy clay, yellowish brown, poorly graded, fine grained, damp, clay is soft with low plasticity.	
					GM	Silty gravel, yellowish brown, poorly graded, fine grained, with some fine grained sand and some clay.	1810
18						Silty gravel, yellowish brown, well graded, fine-coarse grained, quartz gravel <2.0-inch diameter, with some fine-medium grained sand.	
							1808
20					SC	Sandy clay, strong brown, poorly graded, fine grained, damp, clay is soft with low plasticity.	
					GM	Silty gravel, yellowish brown, well graded, damp, fine-coarse grained, quartz gravel <2.0-inch diameter, with some fine-medium grained sand.	1806
22					ML		
							1804
24						Continued Next Page	

DRILLING LOG Rev: 11/8/04 SWMU 51.GPJ SHAWIT.GDT 11/8/04

Drilling Log

Soil Boring **51SBC20**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					GP	Silty gravel, yellowish brown, poorly graded, fine grained, with some fine grained sand and some clay.	1806
						Silt, brownish yellow, friable, dry, with olive and red mottling.	
26					ML	Gravel, strong brown, poorly graded, fine grained, damp, with some fine-medium grained sand.	1804
						Silt, yellowish brown, friable, very wet, with some soft clay with low plasticity.	
28						Same as above except dry.	
					CL	Clay, strong brown, firm, dry, with little silt.	1802
						Sandy clay, strong brown, poorly graded, very fine grained, damp, clay is soft with low plasticity.	
30					ML	Silt, brownish yellow, friable, dry, with red and olive mottling.	1800
32					CL ML	Silt and clay, brownish yellow, silt is dense, damp, clay has low plasticity.	1798
						Silt, brownish yellow, very soft, saturated, with trace of very fine grained sand.	
34					ML	Silt, brownish yellow, friable, dry, with interbedded layers of red shale and olive saprolite. Refusal at 35.9 feet.	1796
36							1794
38							1792
40							1790
42							1788
44							1786
46							1784
48							1782
50							1780
52							1778
54							1776
56							

Drilling Log

Soil Boring **51SBC21**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Surface Elev. *1828.1 ft.* Total Hole Depth *31.1 ft.* North *3600974.57 ft* East *10892866.55 ft.*

Top of Casing *NA* Water Level Initial *NA* Static *NA* Diameter *2 in.*

Screen: Dia *NA* Length *NA* Type/Size *NA*

Casing: Dia *NA* Length *NA* Type *NA*

Fill Material *bentonite* Rig/Core *Bobcat-mounted/NA*

Drill Co. *Marshall Miller* Method *Direct Push*

Driller *K. Carr* Log By *J. Choynowski* Date *3/30/04* Permit # *NA*

Checked By *M. Thomas* License No.

COMMENTS
Stratigraphic characterization boring

51SBC21

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					CL	Clay, dark yellowish brown, damp, low plasticity, with roots to a depth of 6-inches.	1828.12
						Silt, strong brown, hard, damp.	
2					SC	Sandy clay, yellowish brown, poorly graded, fine grained, damp, clay is soft with low plasticity.	1826
					ML	Silt, brown, friable, dry.	
4						Sand, strong brown, poorly graded, fine-medium grained, damp.	1824
6					SP ML		1822
8						Same as above except sand is medium grained.	1820
						Sand, strong brown, poorly graded, fine-medium grained, damp, with some silt and some fine grained gravel.	
10					SC	Sandy clay, strong brown, poorly graded, fine-medium grained, damp, clay is dense.	1818
						Silt, strong brown, hard, friable, damp, with some very fine-fine grained sand.	
12					CL	Clay, yellowish brown, firm, damp, low plasticity.	1816
					ML	Silt, strong brown, firm, with some clay mottled yellow and olive.	
14					CL	Clay, strong brown, firm, damp, low plasticity.	1814
						Sand, strong brown, poorly graded, fine-medium grained, damp, with some black mottling.	
16					SP	Sand, yellowish red, poorly graded, fine-medium grained, damp, with some black mottling.	1812
						Same as above without black mottling.	
18						Silty gravel, strong brown, poorly graded, fine grained, loose, damp, with some fine-medium grained sand and gravel <2.0-inch diameter.	1810
					GM	Same as above with quartz < 2-inch diameter.	
20							1808
					SC	Sandy clay, yellowish brown, poorly graded, fine-medium grained, damp, clay is soft with low plasticity.	
22					GP	Gravel, yellowish brown, poorly graded, fine grained, with some silt, clay, and fine grained sand.	1806
					CL	Clay, yellowish brown, damp, low plasticity, with trace of very fine	
24							

Continued Next Page

Drilling Log

Soil Boring **51SBC21**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					SC	grained sand.	1804
					GP	Sandy clay, yellowish brown, poorly graded, fine-medium grained, damp, clay is soft with low plasticity.	
26					CL ML	Gravel, strong brown, poorly graded, fine grained, damp, with some silt, and fine grained sand. Clay and silt, pale yellow, clay is stiff with olive and tan mottling.	1802
28					ML	Silt, strong brown, friable, dry, with trace of fine grained gravel.	1800
					CL ML	Silt and clay, strong brown, clay is dense with interbeds of red shale and tan clay.	
30					ML	Silt, yellowish brown, dense, with some clay, and interbeds of red shale, and olive saprolite. Refusal at 31.1 feet.	1798
32							1796
34							1794
36							1792
38							1790
40							1788
42							1786
44							1784
46							1782
48							1780
50							1778
52							1776
54							1774
56							

Drilling Log

Soil Boring **51SBC22**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Surface Elev. *1825.6 ft.* Total Hole Depth *46.3 ft.* North *3600935.98 ft* East *10892863.1 ft.*

Top of Casing *NA* Water Level Initial *NA* Static *NA* Diameter *2 in.*

Screen: Dia *NA* Length *NA* Type/Size *NA*

Casing: Dia *NA* Length *NA* Type *NA*

Fill Material *bentonite* Rig/Core *Bobcat-mounted Geoprobe/NA*

Drill Co. *Marshall Miller* Method *Direct Push*

Driller *K. Carr* Log By *J. Choynowski* Date *3/29/04* Permit # *NA*

Checked By *M. Thomas* License No.

COMMENTS
Stratigraphic characterization boring

51SBC22

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					ML	Silt and sand, dark brown, fine grained, damp, medium dense, grades into sand and silt with some clay	1825.63
						Sandy silt, yellowish red, slightly damp with some coarse sand.	1824
2					CL	Clay, dark yellowish brown, low plasticity with little silt.	
					ML	Sand and silt, strong brown, with some fine grained gravel, subangular.	1822
4					SC	Sandy clay, strong brown, damp, micaceous, with little fine grained gravel and fine grained sand.	
6						Sand, strong brown, damp, poorly graded, with some silt.	1820
						Sand, strong brown, poorly graded, damp, micaceous, fine to medium grained, with some silt, and trace of fine grained gravel.	1818
8					SP	Sand, strong brown, damp, fine to medium grained, poorly graded,with some silt and trace of gravel.	
10							1816
						Sand, strong brown, poorly graded, damp, micaceous, with gravel 1.25" and 1.75" diameter.	1814
12						Same as above with black mottling.	
					GM	Silty gravel, yellowish red, damp. Sand is fine to medium grained, gravel is fine grained.	1812
14						Same as above, with red mottling grading into sandy, clayey, gravel with dark brown mottling	
					GP	Gravel, dark brown, poorly graded, little fines, medium to coarse grained, loose, damp.	1810
16					SC	Sand, dark brown, poorly graded, fine to medium grained, damp, with some silt grading into silty sand with some subangular gravel.	
						Sandy clay, yellowish red, damp, with trace of fine grained gravel.	1808
18					GP	Gravel, strong brown, poorly graded, up to 1" diameter, liitle or no fines, medium to coarse grained sand, damp.	
							1806
20					SC	Sandy clay, strong brown, low plasticity. Sand is damp, fine to medium grained.	
						Gravel,reddish yellow, poorly graded, fine to medium grained, with some clay grading into black, subangular gravel, mottled red.	1804
22					GP	Cobbles, white, 2" length, 1.5" diameter, quartz gravel, powdery.	
					ML	Silt, yellowish brown, friable, slightly damp with olive, red, and yellow mottling.	1802
24							

Continued Next Page

Drilling Log

Soil Boring **51SBC22**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery / Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
					Continued	
24				ML	Sand and silt, strong brown, micaceous, fine to medium grained, damp. Grades into silt and clay, damp, little sand.	
				GP	Gravel, olive yellow, coarse grained, no fines, 0.75" diameter.	1800
26					Grades into strong brown silt and clay, damp with little sand	
				ML	Silt, strong brown, with some sand, mottled tan and yellow.	
					Silt, light olive gray, friable with black, red, and yellow mottling.	
28					Grades into gravelly strong brown medium grained sand, no fines.	1798
				SC	Sandy clay, strong brown, with yellow mottling, damp, sand is fine grained with a trace of coarse grained sand.	
					Silt, pale yellow, dry, friable, with yellow tan mottling.	1796
30				ML		
					Sandy silt with some coarse grained sand.	1794
32					Clay, strong brown, with some silt, low plasticity.	
				CL	Same as above, except micaceous.	
34						1792
				ML	Silt, strong brown, micaceous, damp, with some clay with yellow mottling.	
				CL	Clay, yellowish brown, low plasticity, trace of silt.	1790
36					Clayey gravel, strong brown, with some sand and fine grained	
				GC	gravel, damp.	
						1788
38					Silt, light yellowish brown, dry, friable, olive mottling.	
					Silt, yellowish brown, dry, friable, red and olive mottling.	
40				ML		1786
					Silt, interbedded with thinly laminated olive gray shale.	
					Silt, yellowish brown, interbedded with shale, gray and red mottling.	
42						1784
				CL	Clay, yellowish brown, interbedded with olive silt and gray shale.	
				ML	Silt and clay interbedded with gray shale	
44						1782
				SP	Sand, olive yellow, poorly graded, fine to medium grained, saturated, with silt and clay.	
				ML	Silt, dry, with weathered olive green shale with fine grained gravel.	1780
46						
					Macro core refusal on saprolite, consisting of gravel and weathered shale	
48						1778
50						1776
52						1774
54						1772
56						1770

Drilling Log

Soil Boring **51SBC23**

Project SWMU 51 RFI | Owner Radford Army Ammunition Plant

Location SWMU 51 | Proj. No. 839197-050

Surface Elev. 1824.7 ft. | Total Hole Depth 41.1 ft. | North 3600937.53 ft | East 10892867.31 ft.

Top of Casing NA | Water Level Initial NA | Static NA | Diameter 2 in.

Screen: Dia NA | Length NA | Type/Size NA

Casing: Dia NA | Length NA | Type NA

Fill Material bentonite | Rig/Core Bobcat-Mounted/NA

Drill Co. Marshall Miller | Method Direct Push

Driller K. Carr | Log By J. Choynowski | Date 3/31/04 | Permit # NA

Checked By M. Thomas | License No.

COMMENTS
Stratigraphic characterization boring

51SBC23

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) — Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					CL	Clay, reddish brown, soft, with root mass.	1824.70
					ML	Silt, strong brown, soft, damp, with some soft clay and very fine grained sand.	1824
2							
						Silt, strong brown, and clay, micaceous, with red mottling.	1822
4					CL	Clay, strong brown, medium stiff, damp, with little silt	1820
					SC	Sandy clay, strong brown, poorly graded, fine to medium grained, damp. Clay has low plasticity.	
6					SP	Sand, strong brown, poorly graded, fine to medium grained with some black lignitic grains.	1818
8							
						Sand, strong brown, poorly graded, fine to medium grained, damp, with trace of clay.	1816
10							
					GC	Gravel, poorly graded, fine grained, damp, and sand. Sand is poorly graded, fine to medium grained, damp, with some clay and silt.	1814
12					SP	Sand, strong brown, poorly graded, fine to medium grained, damp, micaceous.	1812
14						Sand, strong brown, poorly graded, medium to coarse grained, loose, damp, micaceous.	1810
						Sand, strong brown, poorly graded, fine to medium grained, loose, damp, with trace of soft white clay.	
16					SC	Sandy clay, strong brown. Sand is poorly graded, fine grained, damp. Clay is soft with low plasticity.	1808
18					SP	Sand, brownish yellow, poorly graded, fine grained, damp, micaceous, with some clay.	1806
						Sand, strong brown, poorly graded, medium to coarse grained, loose, micaceous.	
20					GP	Gravel, strong brown, poorly graded, fine grained, with red terrace deposits <1-inch diameter, and with medium to coarse grained sand, loose, damp.	1804
					GC		
22					GP GM	Same as above with some soft wet clay.	
					ML	Gravel, strong brown, well graded, fine to coarse grained, wet, with quartz > 1-inch diameter, with some fine to medium grained sand and some silt and clay.	1802
24							

Continued Next Page

Drilling Log

Soil Boring **51SBC23**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					ML	Silt and clay, reddish yellow, very wet grading to dry. Dry silt is friable and clay is medium stiff. Wet silt and clay is soft.	1800
					GC	Clayey gravel and sand, reddish yellow, loose, damp. Gravel is fine grained, and sand is medium to coarse grained.	
26					SP	Sand, strong brown, poorly graded, fine to medium grained with some soft clay.	1798
					ML	Silt, reddish yellow, dry friable, with little clay, mottled olive and red.	
28						No Recovery.	1796
30					ML	Silt interbedded with red and olive shale, saprolite, and clay. Silt is friable and dry.	1794
32					CL	Clay, strong brown, soft, damp, low plasticity.	1792
					ML	Silt, strong brown, dry, friable, interbedded with red and olive laminated shale and saprolite.	
34					SC	Sandy clay, strong brown. Sand is poorly graded, fine grained, damp. Clay is soft, low plasticity.	1790
					ML	Silt, light yellowish brown, dry, friable, interbedded with olive colored weathered bedrock, and some clay with yellow and tan mottling.	
36					SP	Sand, strong brown, poorly graded, fine grained, with some soft clay.	1788
38					ML	Shale, pale olive, laminated, with interbeds of weathered red shale and saprolite.	1786
					ML	Sandy silt, yellowish red, loose, saturated. Sand is fine grained.	
40					ML	Shale and saprolite, pale olive, laminated. Refusal at 41.1 feet.	1784
42							1782
44							1780
46							1778
48							1776
50							1774
52							1772
54							1770
56							

Drilling Log

Soil Boring **51SBC24**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Surface Elev. *1824.2 ft.* Total Hole Depth *34.5 ft.* North *3600952 ft.* East *10892896.78 ft.*

Top of Casing *NA* Water Level Initial *NA* Static *NA* Diameter *2 in.*

Screen: Dia *NA* Length *NA* Type/Size *NA*

Casing: Dia *NA* Length *NA* Type *NA*

Fill Material *bentonite* Rig/Core *Bobcat-mounted/NA*

Drill Co. *Marshall Miller* Method *Direct Push*

Driller *K. Carr* Log By *J. Choynowski* Date *3/31/04* Permit # *NA*

Checked By *M. Thomas* License No.

COMMENTS
Stratigraphic characterization boring

51SBC24

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					CL	Clay, reddish brown, soft, with roots to a depth of 8-inches, with some silt.	1824.18 1824
					ML	Silt, strong brown, soft, damp, with some clay.	
2						Same as above with some fine grained sand.	1822
4					CL	Clay, strong brown, soft, low plasticity.	1820
6						Clay, brown, dense, dry.	1818
8					SP	Sand, strong brown, poorly graded, fine grained, micaceous, with some soft clay.	1816
						Sand, strong brown, poorly graded, fine-medium grained, with some black mottling.	
10							1814
12						Sand, yellowish red, poorly graded, medium-coarse grained, micaceous, loose.	1812
						Sand, strong brown, poorly graded, fine-medium grained, loose, damp, micaceous.	
14							1810
						Same as above with some soft clay.	
16					SC	Sandy clay, strong brown, poorly graded, fine grained, damp, clay is soft.	1808
					GW	Gravel, strong brown, well graded, fine-coarse grained, quartz < 1.5-inch diameter, with some medium-coarse grained sand.	
18						Same as above except no quartz gravel.	1806
					GP	Gravel, strong brown, poorly graded, fine grained, loose, damp, red shale < 0.5-inch diameter, with some medium-coarse grained sand.	
20					CL		1804
					SP	Clay, strong brown, dense, with some clay.	
					GW	Sand, strong brown, poorly graded, fine grained, with some soft clay.	
22					GM	Gravel, strong brown, well graded, fine-coarse grained, quartz <1.8-inch diameter, with some medium-coarse grained sand.	1802
					GC	Silty gravel, brownish yellow, poorly graded, fine grained, loose,	
24							

Continued Next Page

Drilling Log

Soil Boring **51SBC24**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					ML	damp, with some fine-medium grained sand.	1800
					SP	Clayey gravel, brownish yellow, poorly graded, fine grained, loose, damp, with some medium grained sand.	
26					ML	Silt, yellowish red, friable, dry.	1798
						Sand, strong brown, poorly graded, fine-medium grained, loose, damp, with some soft clay, low plasticity.	
28					SP	Same as above except sand is fine grained and trace of fine grained gravel.	1796
						Silt, yellowish brown, soft, saturated, with some fine grained loose sand.	
					SP SM	Silt, brownish yellow, friable, dry, with laminated red shale.	
30						Silt, light yellowish brown, mottled dark red and tan.	1794
						Sand, strong brown, poorly graded, fine grained, damp, with some soft clay, and trace of fine grained gravel.	
32					ML	Sand and silt, strong brown, poorly graded, fine grained, saturated.	1792
						Silt, brownish yellow, friable, dry, interbedded with laminated red shale and olive saprolite.	
34						Silt, pale olive, dry, with laminated red shale and olive saprolite. Refusal at 34.5 feet.	1790
36							1788
38							1786
40							1784
42							1782
44							1780
46							1778
48							1776
50							1774
52							1772
54							1770
56							

DRILLING LOG Rev: 11/8/04 SWMU 51.GPJ SHAW IT.GDT 11/8/04

Drilling Log

Soil Boring **51SBC25**

Project SWMU 51 RFI — Owner Radford Army Ammunition Plant

Location SWMU 51 — Proj. No. 839197-050

Surface Elev. 1828.4 ft. — Total Hole Depth 33.8 ft. — North 3600951.29 ft — East 10892902.48 ft.

Top of Casing NA — Water Level Initial NA — Static NA — Diameter 2 in.

Screen: Dia NA — Length NA — Type/Size NA

Casing: Dia NA — Length NA — Type NA

Fill Material bentonite — Rig/Core Bobcat-mounted/NA

Drill Co. Marshall Miller — Method Direct Push

Driller K. Carr — Log By J. Choynowski — Date 3/31/04 — Permit # NA

Checked By M. Thomas — License No.

COMMENTS
Stratigraphic characterization boring

51SBC25

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
0					CL	Clay, brown, very soft, damp, low plasticity, with roots extending to a depth of 7-inches.	1828.40
						Clay, yellowish brown, very soft, damp, low plasticity, with little silt.	1828
2					ML	Silt, strong brown, friable, slightly moist, with some black staining.	1826
					CL ML	Silt and clay, reddish yellow, slightly damp, clay is stiff.	
4					ML	Silt, yellowish brown, stiff, slightly moist, with trace of clay.	1824
6							1822
					SP	Sand, yellowish red, poorly graded, fine-medium grained, loose, micaceous, damp.	
8					SC	Sandy clay, yellowish red, poorly graded, fine grained, medium dense, damp.	1820
10					SP	Sand, strong brown, poorly graded, fine-medium grained, loose, micaceous, damp, with black staining and trace of clay.	1818
						Same as above with trace of gravel.	
12						Sand, strong brown, poorly graded, fine-medium grained, loose, damp, with black staining.	1816
14						Same as above with trace of clay.	1814
16						Same as above without the clay and with a trace of fine grained gravel.	
						Same as above except no gravel and with a trace of clay.	1812
18					GW	Gravel, strong brown, well graded, fine-coarse grained, quartz >1.0-inch diameter, loose, with medium-coarse grained sand.	
						Gravel, strong brown, well graded, fine-coarse grained, damp, loose, with coarse grained sand.	1810
20					GM	Silty gravel, strong brown, well graded, fine-coarse grained, with some silt and clay, and with some medium-coarse grained sand.	
					ML	Silt, brownish yellow, dry, interbedded with laminated dark red shale.	1808
22					GM	Silty gravel, strong brown, well graded, fine-coarse grained, loose, with medium-coarse grained sand.	
					GP	Gravel, strong brown, poorly graded, fine grained, with quartz > 1.0-inch diamter, with some coarse grained sand.	1806
24					SP	Sand strong brown, poorly graded, fine-medium grained, loose,	

Continued Next Page

Drilling Log

Soil Boring **51SBC25**

Project *SWMU 51 RFI* Owner *Radford Army Ammunition Plant*

Location *SWMU 51* Proj. No. *839197-050*

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	Blow Count / Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.	Elevation (ft.)
						Continued	
24					ML	damp.	1804
					SP SM	Silt, brownish yellow, friable, dry, interbedded with layers of laminated red and olive shale.	
26						Sand and silt, strong brown, poorly graded, fine grained, loose, saturated.	1802
					ML	Silt, brownish yellow, friable, dry, with layers of laminated shale.	
28					CL	Clay, strong brown, very soft, damp, low plasticity.	1800
					GM	Silty gravel, poorly graded, fine grained, with some medium-coarse grained sand, with some silt and a trace of clay.	
30						Silt, light yellowish brown, with interbedded layers of red shale and olive saprolite.	1798
32					ML	Silt, pale oilve, dry, with interbedded layers of red shale and olive saprolite. Refusal at 33.8 feet.	1796
34							1794
36							1792
38							1790
40							1788
42							1786
44							1784
46							1782
48							1780
50							1778
52							1776
54							1774
56							

Appendix B-2

Geophysical Report

B.1 INTRODUCTION

SWMU 51 is located in the southeast section of the Horseshoe Area and adjacent to SWMU 30. Background information indicates that the site consists of a 20x200-ft trench that has been filled to grade, and is weed and grass covered. An unknown quantity of TNT neutralization sludge from the treatment of red water was disposed in this unlined trench in the 1970s, and an estimated 10 tons of red water ash was reportedly disposed in the trench from 1968 to 1972 (Dames & Moore, 1992). The trench is reported to be centrally located between two-adjacent trenches that are part of SWMU 30.

Surface geophysical surveys using two-dimensional resistivity profiling, seismic refraction tomography, and EM-31/34 terrain-conductivity mapping were performed at SWMU 51 during the time period of August through September 2002. Additional downhole seismic velocity measurements were collected in four monitoring wells adjacent SWMU 51 to help guide the seismic interpretations, and downhole electrical logging was collected by USACE New England District personnel to help constrain the resistivity models.

B.2 OBJECTIVE

The primary objective of the SWMU 51 surveys was to provide both the lateral and vertical extent of the former trench used for the TNT neutralization sludge disposal. Information obtained by the geophysical surveys will be used to develop the CSM and focus the proposed sampling activities to assess the nature and extent of TNT neutralized sludge disposed at SWMU 51.

B.3 TECHNICAL APPROACH

Site conditions are critical in assessing what geophysical techniques are appropriate for an investigation. SWMU 51 is underlain by carbonate rock (limestone and dolomite) that in places is structurally complex (folded and faulted) and contains clastic interbeds and tectonic breccias. Overburden sediments range from 0 to 60+ feet in thickness, and in landfill areas, the overburden may contain a considerable thickness (>10-ft) of red water ash, as well as other debris associated with dump activities.

Two-dimensional electrical resistivity imaging (2D-ERI), seismic refraction profiling/tomography, electromagnetic (EM) terrain-conductivity mapping are applicable techniques that can map changes in the electrical (2D-ERI and EM) and acoustic (seismic) characteristics of the underlying soil and rock. **Appendix B-2** describes in more detail the theory and operation of these methods.

In general, the underlying rock should have a higher seismic-velocity than the overburden sediment, and should be readily distinguishable on the resulting tomographic sections. A decrease in seismic velocity will occur where the rock is fractured (weak zones), less competent, or dominated by void and cavity development.

The electrical response of the rock is more complex and depends on the type of strata present and the electrical properties of the pore fluid. Higher electrical-resistivity should occur if carbonate rock is present, though the presence of an electrically conductive pore-fluid, or a significant clay fraction, could alternately yield lower-resistivities than expected. Air-filled fractures and voids would likely increase the electrical resistivity.

The trench work within the overburden sediment is expected to produce a zone of slightly lower seismic-velocity and lower electrical resistivity. In addition, the presence of waste material and degradation products may also lower the electrical response in the vicinity of the trench. Metallic debris deposited within the trench will also have a significant electromagnetic response during the EM surveys.

B.4 GEOPHYSICAL SURVEYS

Geophysical surveys for SWMU 51 consisted of 3 seismic-refraction profiles, 4 two-dimensional resistivity (2D-ERI) profiles, and one EM grid **(Figure B-1)**. Also shown on Figure 1 are the locations of the main boundary fence for SWMU 30, the interior fence outlining the TNT sludge disposal trench, and the areal coverage provided by the EM grid (~33 ft major survey lines are shown). Two of the profiles (L-2 and L-3) were collected parallel to the long axis of the trench, and the other two profiles (L-1 and L-4) were collected perpendicular to the long axis.

B.4.1 Geophysical Profiling (Seismic and Resistivity)

Both seismic and two-dimensional resistivity data (2D-ERI) were collected along profiles L-1, L-2, and L-4, and only a resistivity survey was conducted along Profile L-3. Each profile was extended beyond the fence boundaries in order to verify whether or not the fenced area truly marks the limits of the TNT sludge disposal trench. Profile L-4 was also extended further to the west and outside the limits SWMU 30 fence to allow contrasting presumed natural conditions with the geophysical response within SWMUs 30 and 51.

Resistivity data were collected using both Schlumberger and dipole-dipole array surveys (see **Appendix B-3** for further explanation). Use of both array types allows discerning whether observed anomalies are modeling or data collection artifacts, and more credence is given to the results where models constructed from both array types show similar features.

The seismic data were processed using both refractor-layer (earth-layer) and tomographic models. Earth-layer models provide discreet boundaries between horizontal zones (layers) of different seismic velocity, and are limited to a single velocity per model layer. Tomographic models do not have this restriction, and attempt to show both horizontal and vertical changes in velocity. The tomographic cross-section was developed using several different velocity models including the earth-layer solution. Modeling generally resolved into similar solutions, of which one is shown for each profile.

The resistivity and seismic results are presented as color-contoured cross-sectional models with magenta-to-blue colors representing lower values, and red-to-white colors higher values. The same color-contour scheme is used throughout for all four profiles to allow a direct comparison of anomaly magnitudes. For each profile, three model panels are shown, with the upper two panels representing the dipole-dipole and Schlumberger array results, and the bottom panel the seismic refraction results. The seismic model for Profile L-2 is used as comparison with the resistivity data collected on Profile L-3. Also shown on each panel, are the intersecting points of cross-lines, the refractor-layer seismic model (orange trace lines), and the relative position of the SWMU 51 fence (magenta rectangle near ground surface labeled as the “SWMU 51 fenced area”).

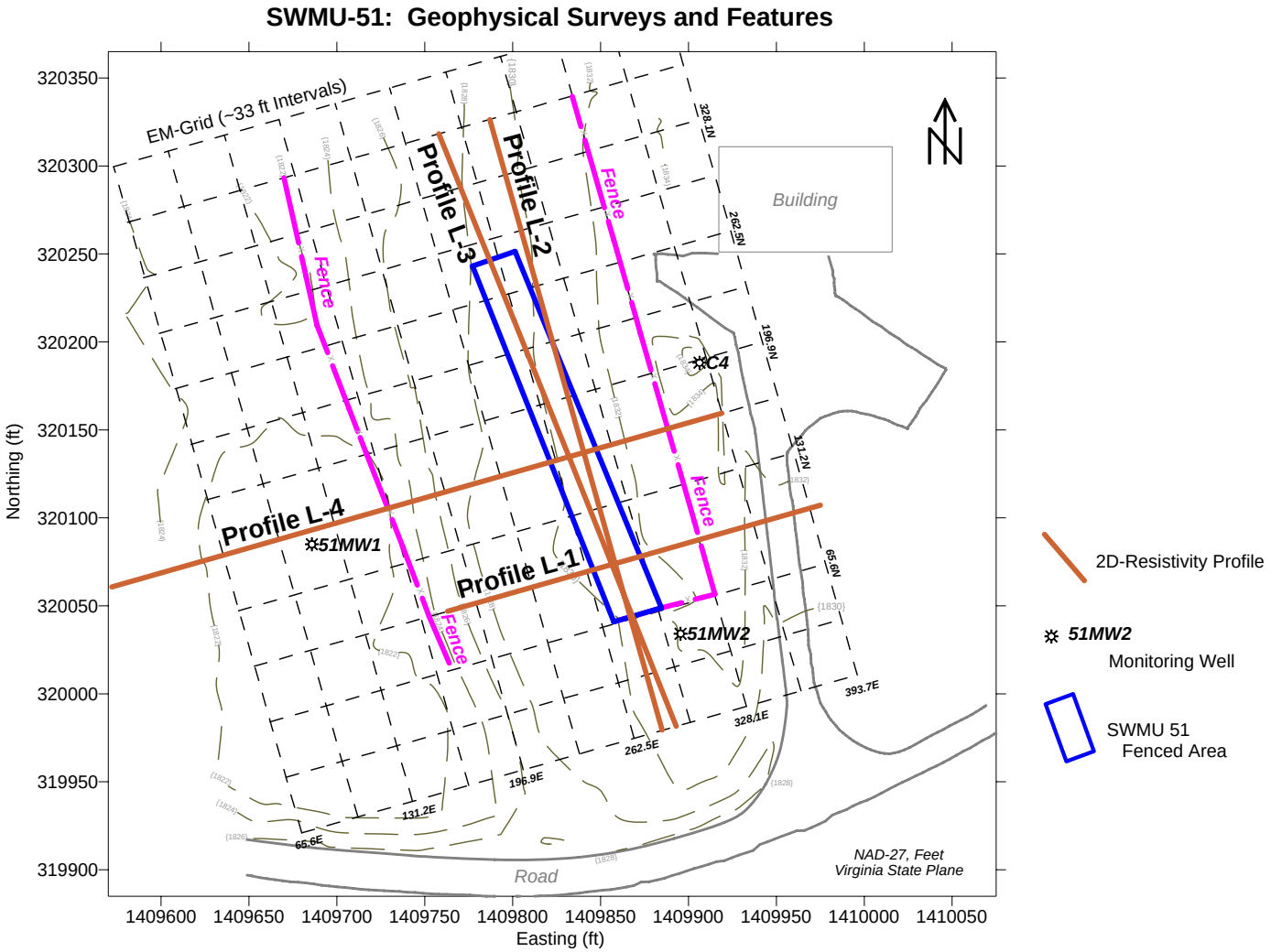


Figure B-1. Base Map for SWMU 51.

Profile L-1

Profile L-1 was acquired along a WSW-ENE transect near the southern end of the SWMU 51 area, along a line perpendicular to the long axis of the TNT trench (**Figure B-1**). Both 2D-ERI and seismic surveys were collect on this profile. The resistivity survey used an electrode spacing of 6.56 ft (2 m) and a total of 28 electrodes, and the seismic profile used a single array of 48 geophones spaced at a 3.28ft (1 m) interval. The resulting geophysical models are shown in **Figure B-2**.

A distinct zone of low-resistivity (<80 ohm-m) is present on the 2D-ERI models (upper 2 panels) of **Figure B-2**. The lateral extent of this low-resistivity zone coincides roughly with the area bounded by the SWMU 51 fence (264X to 292X on the profile). Low-resistivities within this zone are tentatively interpreted as waste and/or waste byproduct resulting from activities at SWMU 51. Depth to top of this low-resistivity zone ranges from 5 to 7 ft below ground surface (bgs), with the shallower depth-to-top near the western and eastern edges of this feature. The base of the low-resistivity occurs at approximately 16 ft bgs, giving 9-11 ft in total thickness.

Material of higher resistivity caps the low-resistivity zone, and is interpreted to correlate with the blocky (cobbles) rubble observed on the ground surface during data collection. Note also that a zone of low-to-moderate resistivity (100-300 ohm-m) occurs in the upper 10 ft of the subsurface in the approximate position of one of the SWMU 30 trenches (profile coordinates 212-250X).

The short length of the resistivity profile was not able to resolve the overburden-bedrock interface. The bedrock surface is approximately 1,780 ft in elevation near well 51MW2, and ~1,782 ft beneath well 51MW1.

A three-layer solution was used to construct the earth-layer model for Profile L-1 using seismic velocities of 400, 700, and 2,000 m/s. The tomographic solution yielded a slightly different set of average velocities (550, 970, 1,550 m/s) for the same range of depths on the earth layer model.

The uppermost refractor surface indicates a broader area of lower velocity material than that indicated by the SWMU 51 fenced area (and corresponding resistivity anomaly). This surface deepens to approximately 15 ft bgs immediately west of the SWMU 51 fence. The tomography model also depicts a zone of low seismic velocity (stippled pattern of velocity less than 450 m/s). The low-velocity zone, however, is much broader than the resistivity anomaly (and location marked by the fence), and extends in depth to approximately the top of the low-resistivity anomaly (base of cap material). The most likely interpretation is that this low-velocity zone is a result of backfilling and capping, and not representative of the waste material within the trench.

The lowermost refractor surface likely corresponds to an interface above the bedrock surface. Note that well 51MW2 (50 ft to the south) places the bedrock approximately 8-to-10 ft deeper than this refractor. The highest velocities observed on tomographic model for Profile L-1 are significantly lower (1,800 m/s versus 2,400-2,700 m/s) than seismic velocities observed for the bedrock on the other three profiles.

Profile L-2

Profile L-2 was collected along a transect sub-parallel to the long axis of the SWMU 51 fenced area, along the 278E axis line of the EM grid **(Figure B-1)**. Both 2D-ERI and seismic

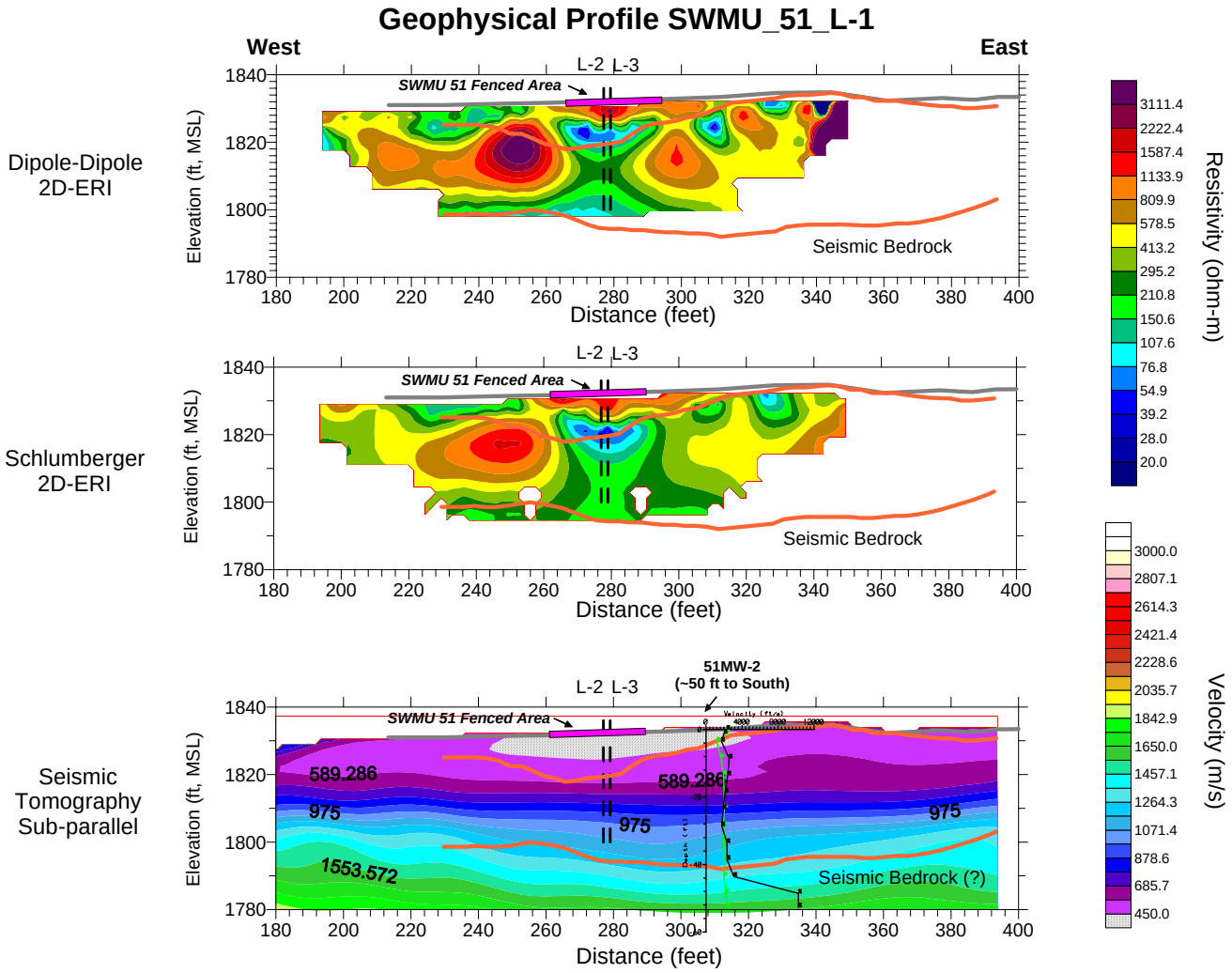


Figure B-2. Geophysical Results for Profile L-1

data were collected. The resistivity survey used an electrode spacing of 13.12 ft (4 m) and a total of 28 electrodes. The seismic profile used two adjacent spreads of 48 geophones spaced at a 3.28 ft (1 m) interval. The resulting geophysical models are shown in **Figure B-3**.

Both resistivity models (upper two panels, **Figure B-3**) show a zone of low-resistivity (<80 ohm-m) extending from 100X to 205X. The electrical response of this zone is interpreted to be caused by the waste and/or waste byproduct based on its position relative to the SWMU 51 fence area (note that Profile L-2 exits the fence enclosure approximately three-quarters the length of the N-S fence length) and similarity to responses observed on the other three profiles. The top of this feature ranges from 6-9 ft bgs and the base from 16 to 21 ft bgs, with a general deepening towards the north. The Schlumberger model (middle panel) does not provide a sharp boundary for the base of this anomaly, but instead models a zone of intermediate resistivity (100-300 ohm-m) immediately beneath the suspected location of the trench.

A three-layer model was used to construct the earth-layer solution for Profile L-2. Layer velocities are higher than that indicated for L-1, and are (top to bottom) 521, 1,046, and 3,035 m/s. The resulting tomographic solution yielded overburden velocities consistent with the earth-layer model, but with a lower bedrock velocity (2,421 m/s).

The uppermost refractor surface exhibits a slight depression in the vicinity of the trench, but the tomographic solution models this interface as a horizontal surface. A distinct zone of low velocity (<450 m/s, stippled area), with a thickness of 5-6 ft, is modeled over the southern two-thirds of the resistivity defined trench location. The upper refractor surface appears to approximate the base of the low-resistivity anomaly within the central part of the profile (150X), but is more likely corresponding to natural changes in subsurface conditions. As with the L-1 Profile, the L-2 seismic data cannot be used to resolve the waste thickness within the SWMU 51 trench.

The top of bedrock, as defined by the earth-layer model, is interpreted as a relatively flat surface ranging approximately 55-60 ft in depth, and with a slight rise to 50 ft bgs near profile coordinate 80X. The corresponding tomographic model images the bedrock as a horizontal surface at approximately 60 ft in depth. A slight decrease in velocity is observed in the bedrock between profile coordinates 50X and 90X.

Profile L-3

Profile L-3 was collected along the long axis of the SWMU 51 fenced area, extending approximately 66 ft to the south of the fenced area and 70 ft to the north. Only resistivity data were collected using 56 electrodes at a spacing of 6.56 ft (2m), which provided a line length of 360.9 ft (110 m). It was hoped that the finer electrode spacing and co-linearity with the trench's long axis would yield a better definition of the trench boundaries. The resulting dipole-dipole and Schlumberger array models are shown in **Figure B-4** (upper two panels), and the seismic model results for Profile L-2 (lower panel) are shown for comparison.

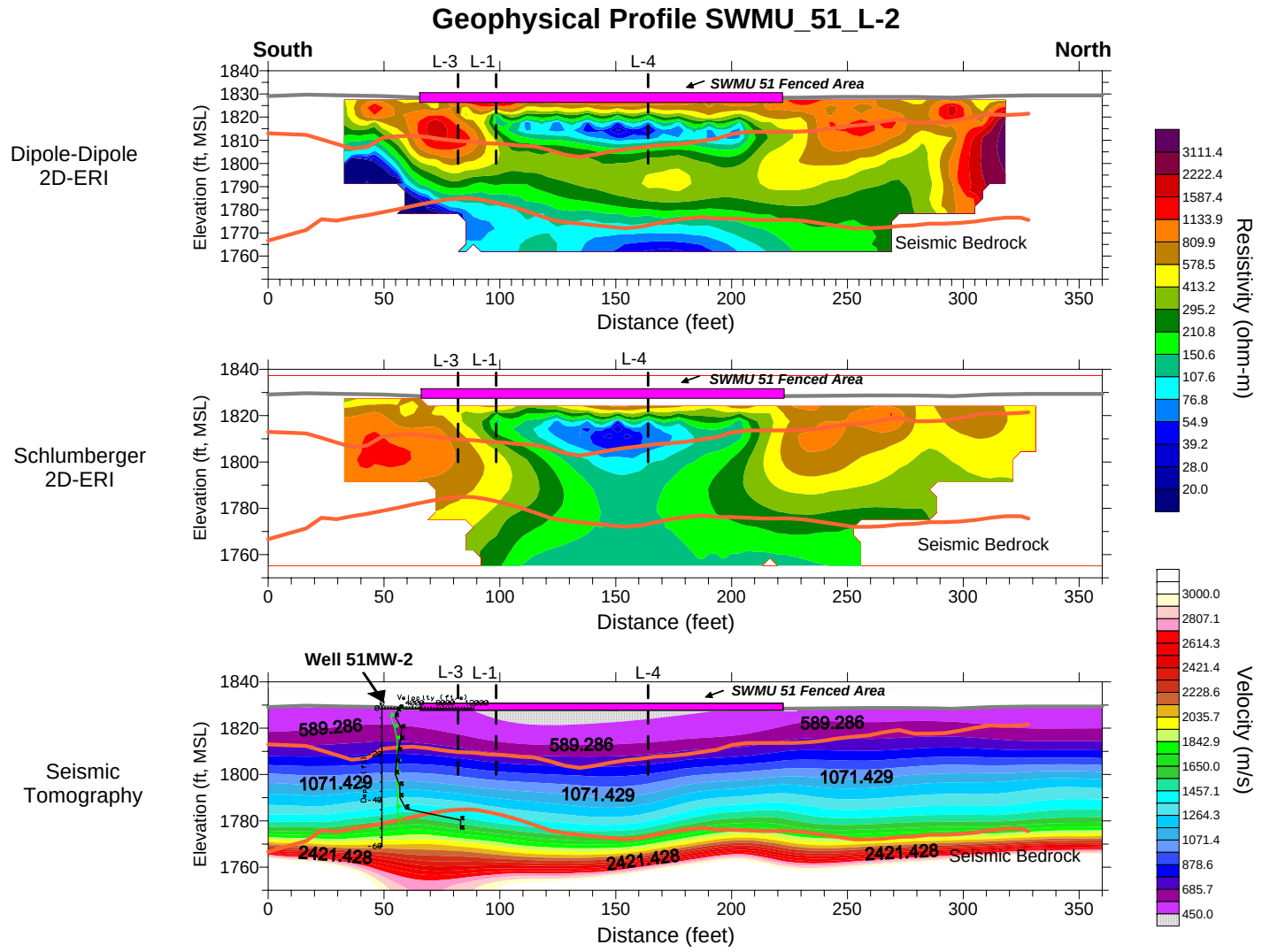


Figure B-3. Geophysical Results for Profile L-2

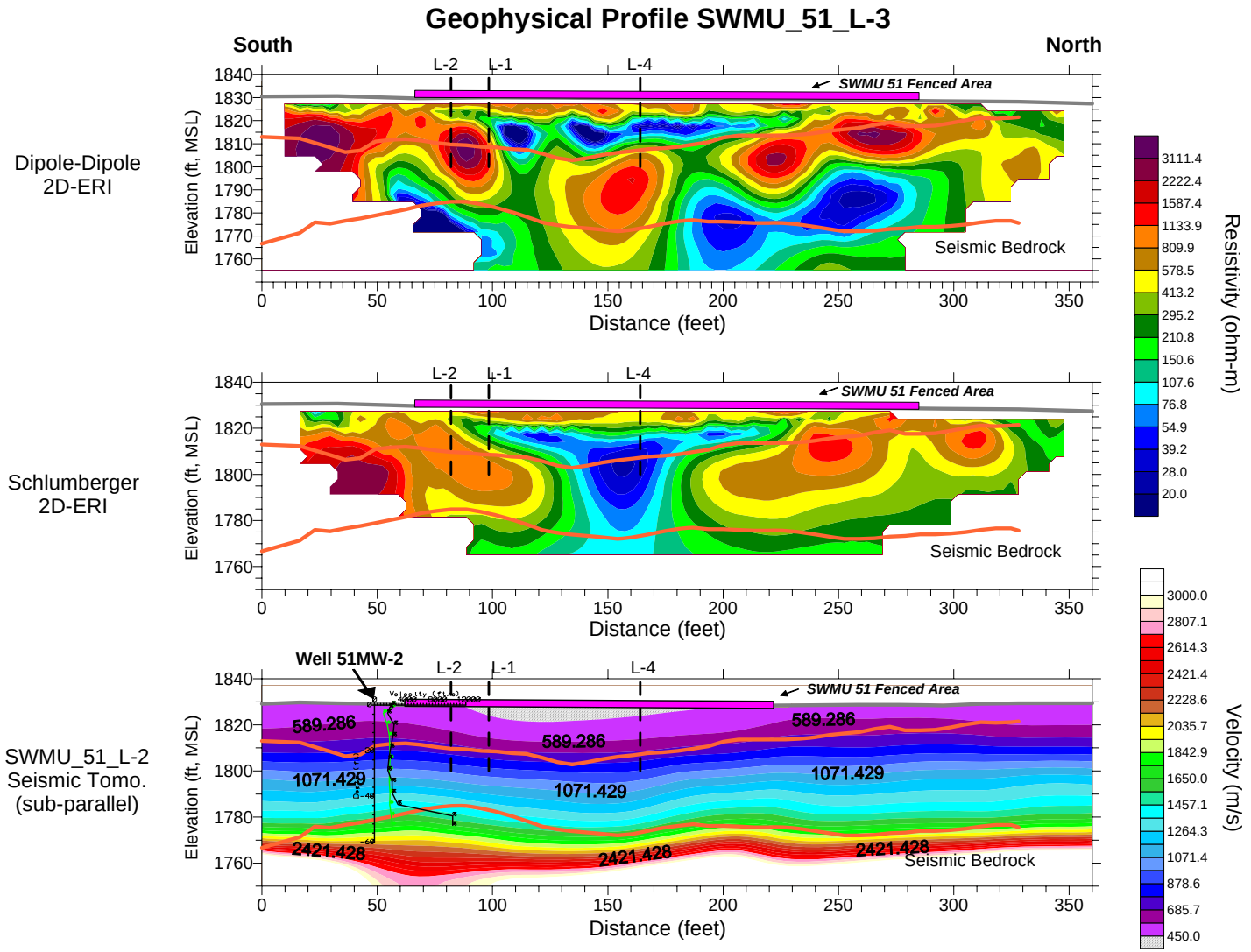


Figure B-4. Geophysical Results for Profile L-3

The resistivity models depict a zone of low-resistivity (<80 ohm-m) between profile coordinates 90X to 225X, with a depth to top ranging from 7-to-9 ft bgs and depth-to-base from 15-to-25 ft (average is approximately 18 ft bgs). Following interpretations for Profiles L-1 and L-2, this low-resistivity zone is probably the electrical response of the waste and/or waste byproduct. The dipole-dipole model indicates less lateral continuity in the trench, exhibiting a break in the low-resistivity near profile coordinate 120X. This low-resistivity zone extends to its greatest depth immediately adjacent to this break. The Schlumberger model does not resolve the base of this anomaly in the central part of the profile, although the upper refractor of the L-2 seismic model appears to mimic the base of the low-resistivity zone.

Other zones of low-resistivity are modeled by the dipole-dipole data near the southern end and northern third of the SWMU 51 fenced area. The Schlumberger model does not image these same features suggesting that they are most likely modeling artifacts.

Profile L-4

Profile L-4 was collected on a line perpendicular to the long axis of the trench along EM grid axis 164N. The profile was extended to the west so that well 51MW1 could be used to help guide the interpretation, and so the electrical and seismic character of the "undisturbed" area west of SWMU 30 could be used as a contrast. The resistivity data were collected with 56 electrodes at a spacing of 6.56 ft (2 m), providing a profile length of approximately 360 ft. Two adjacent spreads of 48 geophones, spaced at 3.28 ft (1m) intervals, were used for seismic data collection. The resulting geophysical models are shown in **Figure B-5**.

A distinct, low-resistivity anomaly (<80 ohm-m) is centered beneath the SWMU 51 fenced area, located between profile coordinates 265X and 280X. The depth-to-top of this anomaly is approximately 7 ft, and the depth-to-bottom, though not fully resolved, is estimated at approximately 20 ft. This depth estimate is based on the Schlumberger model at the point where the upper seismic refractor crosses the base of the low-resistivity anomaly. Note that unlike the results for the other three profiles, the dipole-dipole array did not resolve the base of the low-resistivity zone.

Two other zones of low-resistivity are present at depth to the west of the SWMU 51 fenced area. The zone of low-resistivity occurring between coordinates 170X and 200X is interpreted to correlate with the SWMU 30 trenches. The source for the furthest west zone of low-resistivity is not known, but may be due to the general decrease in resistivity observed near the overburden-bedrock interface.

The seismic model for Profile L-4 (bottom panel **Figure B-5**) shows a relatively flat bedrock surface, and a broad area of lower velocity underlying SWMU 30 and SWMU 51. A three-layer solution was required for the earth-layer model, using velocities of 500, 800, and 2,550 m/s. The tomographic model yielded similar velocities (550, 878, and 2,421 m/s) for equivalent depth ranges. A zone of low-velocity (<450 m/s) is modeled by the tomographic solution as a broad swale underlying the SWMU 51 fenced area. The base of this low-velocity zone corresponds with the top of the low-resistivity anomaly, suggesting that this is related to the cap and/or backfill material.

B.4.2 EM-31 and EM-34 Conductivity Surveys

Electromagnetic (EM) surveys were performed in the grid area shown on **Figure B-1** with the objective of mapping the lateral extent of the SWMU 51 trench, and to determine

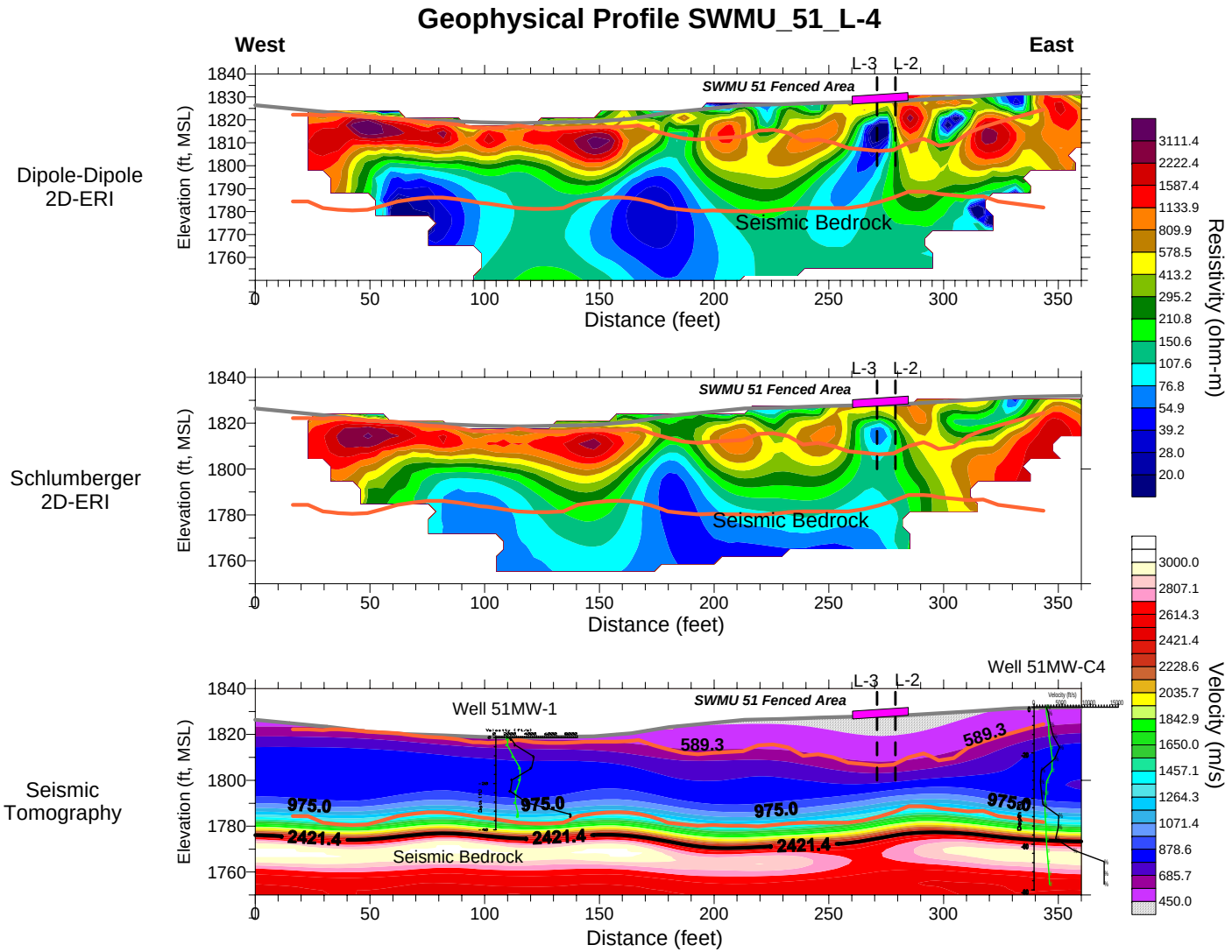


Figure B-5. Geophysical Results for Profile L-4

whether a significant quantity of metallic debris has been buried. It was expected that the activities involved in the construction of and disposal within the trench would alter the subsurface electrical properties, yielding a distinguishable anomalous area associated with the trench. Prior to performing the surveys, the barbed wire fence enclosure surrounding SWMU 51 was removed to the extent practicable, with only the corner fence posts and possibly some rusted fencing material within the vegetation at the site remaining in place.

Both the EM-31 and EM-34 terrain-conductivity meters were used to collect EM measurements at SWMU 51 (see **Appendix B-3** for a further description). EM-31 measurements were collected along profiles spaced at 8 ft (2.5 m) in the approximate north-south direction and along profiles spaced at 33 ft (10 m) in the approximate east-west direction. Both quad-phase (electrical-conductivity) and inphase (percent metals) data were collected with the EM-31. EM-34 surveys were collected along profiles spaced at 33 ft (10 m) in the approximate north-south direction, and along 66 ft (20 m) spaced profiles in the approximate east-west direction (except for profiles along 164E and 328.1E, which were excluded to reduce interference from the SWMU 30 fence lines). The EM-34 collects only quad-phase (electrical conductivity) data.

EM measurements reflect a weighted average with greater weight given to shallower depths. The EM-31 was operated in the vertical dipole mode, and 80% of the measured response correlates with the upper 10 ft (3 m) of subsurface material, with the peak response occurring in the 1.6 to 8.2 ft (0.5-2.5 m) depth range. The EM-34 meter was operated in the horizontal dipole mode using a coil spacing of 66 ft (20 m), which resulted in 80% of the response (also peak response) coming from the upper 33 ft (10 m) of subsurface material.

Figure B-6 shows the conductivity anomaly map constructed from the EM-31 survey. Red-to-white colors indicate areas of relatively higher electrical conductivity, whereas blue-to-magenta colors areas of lower conductivity. The locations of the 4 geophysical profiles are shown as heavy brown lines, and the interpreted area of the trench (from 2D ERI profiles) as a crosshatched region. Site features including roads, fences, wells, and ground-surface topography are also shown. Some of the EM-31 data were not included in construction of the map due to their proximity to the fence lines. Natural or background conditions are inferred on **Figure B-6** for the western side of the grid (west of the fence line) where conductivity values range from 5-to-7 mS/m.

The high conductivity anomalies (>12 mS/m) located to the west of Profile L-3, and north of Profile L-1 (grid area: 99N-to-396N; 164E-to-260E), are most likely related to one or more of the SWMU 30 disposal trenches. Another zone of high conductivity parallels the easternmost fence line, and may be related to another SWMU 30 trench. Profile data collected within 10 ft of this easternmost fence were excluded from the plot, and thus the observed anomalous character cannot fully be due to the fence. Note that the original description of SWMU 51 cites that the neutralization sludge trench lies between two adjacent SWMU 30 trenches, supporting this interpretation of the EM-31 plot.

Inspection of the EM-31 anomaly map reveals a slight increase in conductivity within the southern two-thirds of the SWMU 51 fenced area. This increase, related to changes in electrical properties within the upper 10 ft (3 m) at the site, is approximately 1-2 mS/m higher than background levels, and is roughly coincident with the trench area defined by the resistivity profiles. All four resistivity profiles indicate an electrically conductive zone from 5-9 ft bgs, which is near the practicable depth limits of the EM-31 instrument.

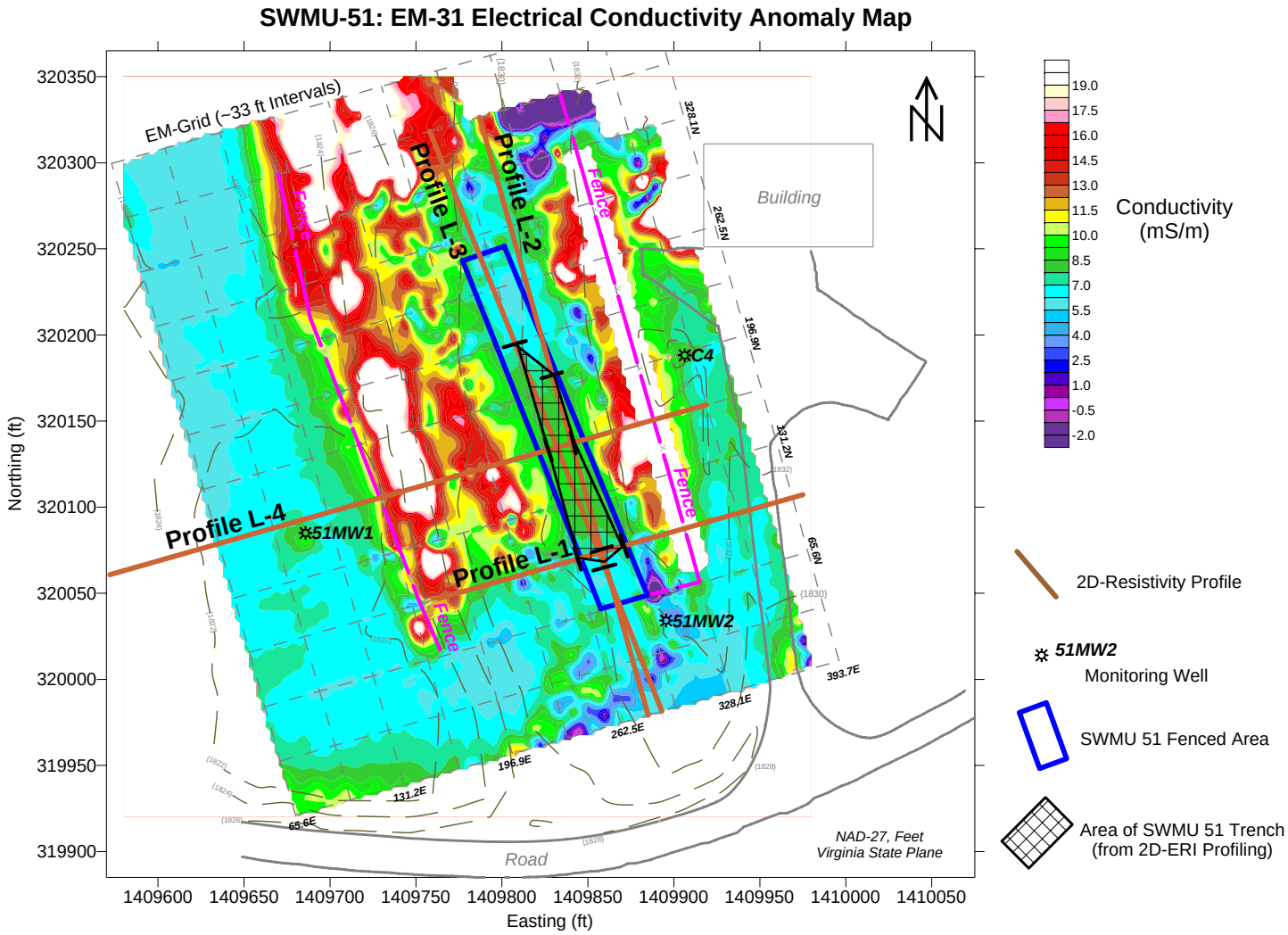


Figure B-6. EM-31 Conductivity Anomaly Map

In-phase (metals) data were collected concurrently with the EM-31 conductivity data, and the resulting anomaly map is shown in **Figure B-7**. No metal response is indicated in the areas west, south, and east of the SWMU 30 fence (outer fence lines). No metal (other than a couple fence posts at the inner fence corners) was detected within the fenced boundary of SWMU 51 (blue outlined rectangle). Metal related anomalies associated with other site activities were detected to the west, north, and east of SWMU 51 corresponding with anomalous areas shown on the conductivity plot **(Figure B-6)**.

The EM-34 conductivity anomaly map is shown in **Figure B-8** using the same color scale as that used in **Figure B-6** (EM-31 conductivity). The relatively higher "background" conductivity (8-10 mS/m vs. 5-7 mS/m) is interpreted to result from the EM-34 sampling to a greater depth, and thus including presumably wetter soils in the measurement (depth to bedrock is great enough to have little impact on the EM measurements).

An area of increase in conductivity (~4 mS/m) is observed within the southern two-thirds of the SWMU 51 fenced area. This relative high area is in the approximate location as a conductivity increase observed in the EM-31 data, though of greater relative magnitude. Therefore, it is likely that the conductive material (possibly the waste itself or leached material) delineated by the EM surveys extend to depths greater than 10 ft (~3 m). The north-south extent of this anomaly is less than the areal coverage indicated by the 2D-ERI profiles (crosshatched polygon). Other areas of high-conductivity, the grid area between 164E-260E, 99N-230N, and those north of grid 250N are most likely related to the trenches of SWMU 30.

B.5 SUMMARY

Seismic refraction profiling, two-dimensional electrical-resistivity imaging (2D-ERI), and electromagnetic terrain-conductivity surveying were conducted at SWMU 51 in order to delineate the boundaries of the disposal trench. The geophysical data suggest that the SWMU 51 related trenching and disposal is contained within the current SWMU 51 fence, and restricted to the southern two-thirds of the fenced area.

Seismic refraction tomography mapped a low-velocity zone interpreted to be due to the capping or backfilled material, but did not map the base of the trench. Earth-layer models constructed for the profiles indicate an intra-overburden increase in velocity, which occurs near the base of the trenching, and may indicate a maximum boundary for trenching. No significant structural features were indicated for the bedrock, and top-of-bedrock was mapped as a relatively horizontal surface.

2D-ERI profiling modeled a zone of low-resistivity (<80 ohm-m) underlying the SWMU 51 fenced area. The source for the low-resistivity is interpreted to be either the waste or waste byproducts (leachate or leached material). Depth-to-top of this low-resistivity zone ranged from 5-9 ft bgs, and averaged 6-7 ft bgs. Therefore it is argued that the waste material deposited in the SWMU 51 trench is at least 5 ft bgs.

Depth to the true base of waste is the issue. The resistivity data indicate a range of 15-to-25 ft bgs for the base, though it is possible that a downward migration of leachate (or leached material) has increased thickness of the low-resistivity zone, thus overstating the thickness of the waste. At best, the base of the low-resistivity zone can serve as an upper boundary for estimating the thickness of the waste material.

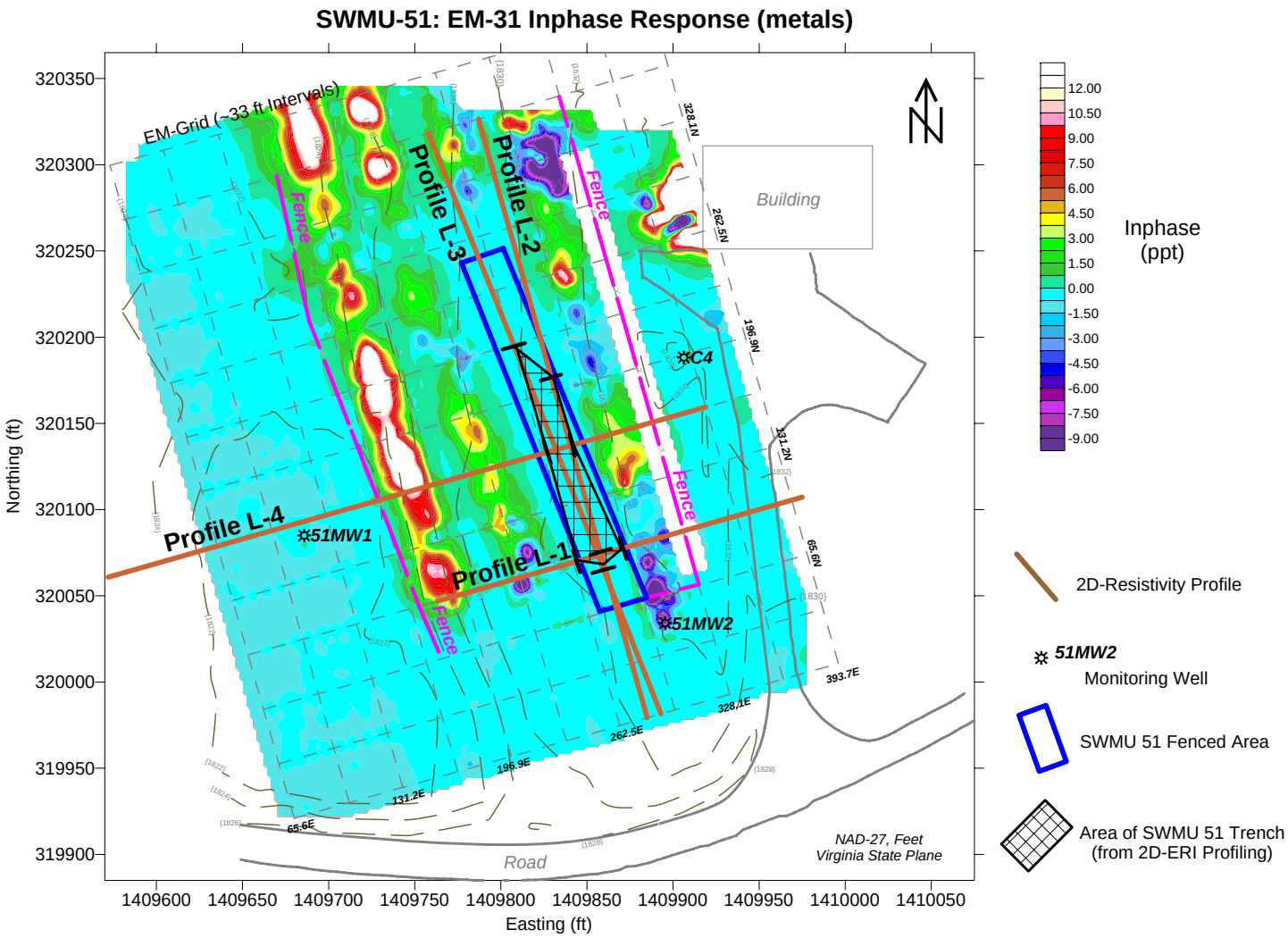


Figure B-7. EM-31 Inphase Response (Metals) Anomaly Map

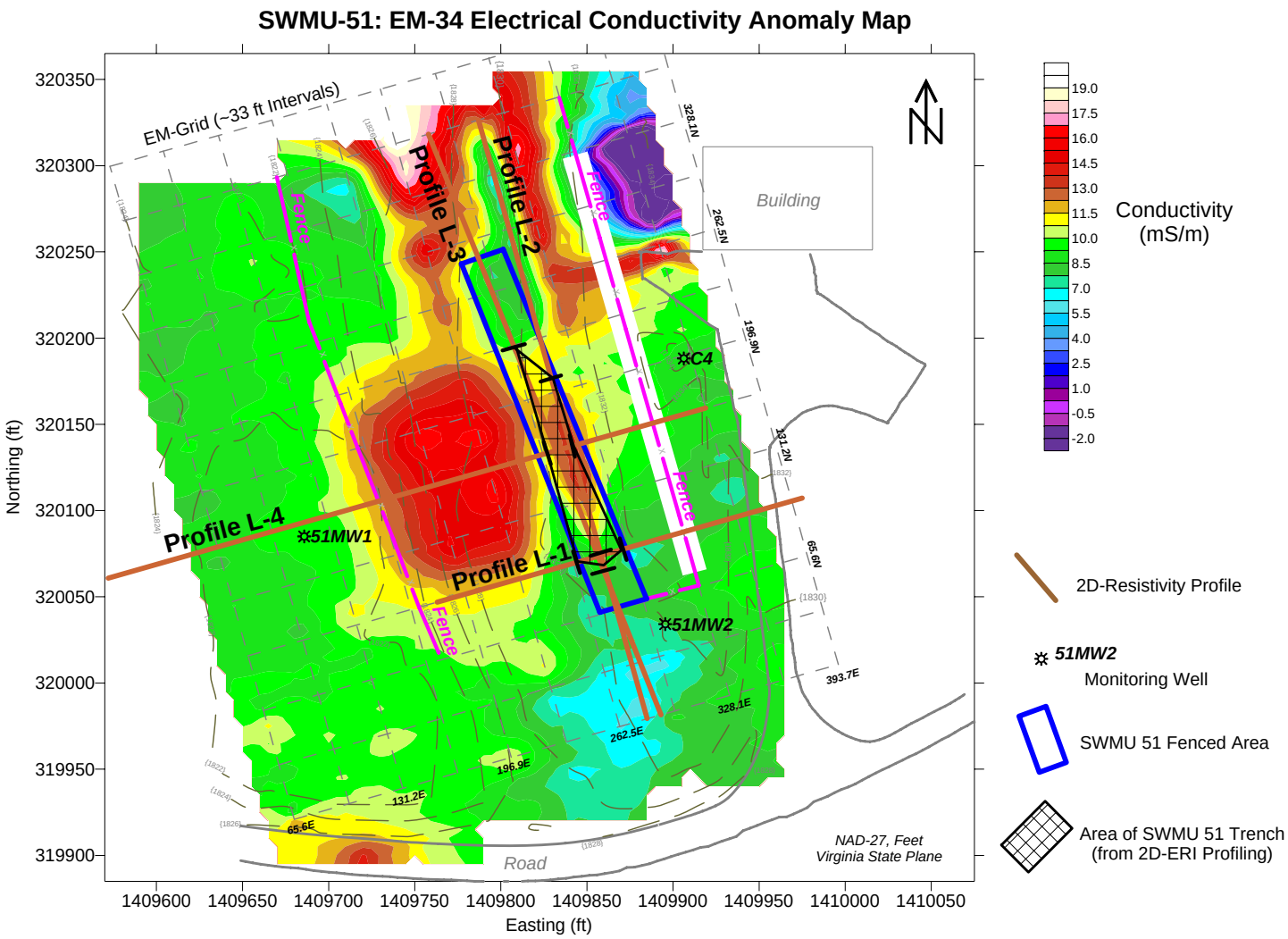


Figure B-8. EM-34 Conductivity Anomaly Map

Electromagnetic surveys using the EM-31 and EM-34 instruments mapped a zone of increased electrical-conductivity (decreased resistivity) within the southern two-thirds of the SWMU 51 fenced area. A 1-2 mS/m increase was measured by the EM-31, and suggests that the top of the anomalous region must be within the upper 10 ft (3 m) of the subsurface. The EM-34 instrument yielded a greater electromagnetic response than the EM-31, indicating that the source of this electrically conductivity zone (low-resistivity) extends below 10 ft (~3 m in depth). The anomalous area mapped by the EM-34 is approximately two-thirds that indicated by the 2D-ERI profiles.

The volume of waste is estimated as follows:

- The maximum areal extent of the trench defined by the 2D-ERI data is approximately 2,300 square feet (115 ft x 20 ft). The minimum areal extent can be estimated from the EM-34 conductivity anomaly map, and is 1,800 square feet (90 ft x 20 ft).
- Depth to top of the low-resistivity (electrically conductive) zone ranges from 5-9 ft, and averages 6-7 ft. Depth to bottom ranges from 15-25 ft, with an average of approximately 18 ft. The range in thickness is 6-20 ft, and averages approximately 11 ft.
- Using the average thickness (indicated on the 2D-ERI sections) and the areal extent, a volume range of 19,800 (11 ft x 90 ft x 20 ft) to 25,300 (11 ft x 115 ft x 20 ft) cubic ft or 733 to 937 cubic yards is calculated.

Appendix B-3

Geophysical Methods

GEOPHYSICAL METHODS

2D Electrical Resistivity Imaging

Two-dimensional electrical resistivity imaging (2D-ERI) measures horizontal and vertical variations in the electrical-resistance of the subsurface. For RFAAP, the underlying carbonate rock was expected to be of higher-electrical resistivity than the overburden sediment. The electrical response of the rock is probably more complex, depending on the type of strata present and the electrical properties of the pore fluid. Higher electrical-resistivity should occur if carbonate rock is present, though the presence of an electrically conductive pore-fluid, or a significant clay fraction, could alternately yield lower-resistivities than expected. In addition, weak or fractured zones within the carbonate rock should display changes in electrical character, from either an increase in resistivity for air-filled regions, to a decrease in resistivity for clayey intervals. The trench work within the overburden sediment is expected to produce a zone of lower electrical resistivity. In addition, the presence of waste material and degradation products may also lower the electrical response in the vicinity of the trench.

The Advanced Geosciences, Inc. (AGI) Sting/Swift™ system is an automatic multi-electrode system and earth resistivity meter that acquires data by passing an electric current between two electrodes and measuring the potential difference (voltage) between two separate electrodes. The measured voltage is a factor of the resistance of the earth material and the geometry of the electrode array. Resistivity, an intrinsic property of the earth, is then calculated using the measured voltage, the electric current strength, and a geometric factor for the electrode array. The calculated resistivity value is actually an "apparent-resistivity" because it includes the resistances of all the material that the electrical current passes through. A modeling procedure is then used to convert the measured apparent-resistivity data into earth-layer resistivity sections.

The electrodes used to measure the voltage difference are arranged in various geometries called arrays, and the calculated apparent-resistivity value is interpreted to represent a depth point at the center of an individual array. Depth of measurement is related to width of electrode separation, with greater electrode separation resulting in greater depths of penetration. Classically, two different techniques are used to determine the electrical resistivity of earth materials. In vertical electrical sounding (VES), electrodes are expanded about the center of an array to generate a layered electrical section at a single point (vertical profile). The lateral profiling technique uses an array with a fixed electrode separation, which is marched along a line to image lateral variations at a constant depth.

Two-dimensional electrical-resistivity imaging (2D-ERI) combines VES and lateral profiling into a single survey without the time-consuming process of constantly moving electrodes and reconnecting cables. In 2D-ERI a single cable connects a linear array of electrodes, which are turned on and off using a preprogrammed sequence via a controller box. The raw apparent-resistivity data are typically displayed as a pseudosection where the lateral position of the measurement point is placed at the center of the corresponding electrode array, and the depth of the measurement increases with increasing electrode spacing. Apparent-resistivity pseudosections are useful for performing quality-control checks and for examining whether manmade objects have impacted the data set.

Apparent-resistivity pseudosections are converted, through a process termed inversion, into an electrical-resistivity cross-section showing true earth-layer resistivities. RES2DINV (Loke,

1996), a commercially available program, was used to perform the two-dimensional inversion modeling. During the inversion, the subsurface is divided into a number of blocks equal to or less than the number of measurement points. A smoothness-constrained, least-squares inversion routine is used to estimate the resistivity value of each block, and finite-element or finite-difference forward modeling is used to calculate the resulting pseudosection. The model is iteratively corrected until an apparent-resistivity pseudosection calculated from the model converges with the measured apparent-resistivity pseudosection. A root-mean-square (RMS) error calculation of the difference between the two apparent-resistivity pseudosections is used as a measure of the degree of fit for the model. Maximum convergence often occurs within 3 to 5 iterations, after which RMS values do not change significantly and the model may start to become unstable.

Electromagnetic Terrain-Conductivity Surveying

Electromagnetic-induction instruments (EM-31 and EM-34) are used to measure the electrical conductivity of the near surface, and can also be used to locate buried metallic objects. A transmitter coil is used to induce an electrical current into the ground, and the receiver coil measures the strength of the secondary magnetic field generated by these currents. Two components of the secondary magnetic field are recorded: 1) the quadrature-phase component which is used to measure the ground conductivity, and 2) the inphase component which is used for metallic detection due to its extreme sensitivity to large metallic objects (Geonics Ltd., 1991). The electrical conductivity of the ground is nearly linearly proportional to strength of the quadrature-phase component and is given in units of milli-siemens per meter (mS/m). The inphase measurement is the ratio of the secondary magnetic field to the primary field, and is expressed in parts per thousands (ppt).

The coils can be oriented in either a vertical dipole or horizontal dipole configuration. For the vertical dipole case, the axes of the coils are oriented perpendicular to the ground surface, and for the horizontal dipole, the axes are parallel to the ground surface. For both cases, the coils are maintained in a coplanar state. The vertical dipole orientation is generally preferred over the horizontal dipole because it provides for a greater investigative depth and is less sensitive to near surface variations.

The separation between the transmitter and receiver coils is the primary component that determines the depth of penetration. **Table B-1** lists the depth of investigation for different coil orientations and separations for the Geonics EM-31 and EM-34 meters. The “Practical Depth” is roughly the depth at which 80% of the instrument response has occurred, and the “Effective Depth Range” is the where the instrument’s overall response is the greatest. Thus, layers within the “Effective Depth Range” contribute most to the measured conductivity. The bolded numbers are for configurations used in this study.

Table B-1
Effective Penetration Depth of the EM-31 and EM-34 Instruments

Instrument	Coil Orientation	Practical Depth	Effective Depth Range
EM-31 (3.3 m)	Horizontal Dipole	5.5 ft (1.7 m)	0-5.5 ft (0-1.7 m)
	Vertical Dipole	10 ft (3 m)	1.6-8.2 ft (0.5-2.5 m)
EM-34 (20 m)	Horizontal Dipole	33 ft (10 m)	0-33 ft (0-10 m)
	Vertical Dipole	59 ft (18 m)	10-49 ft (3-15 m)

Conductivity values obtained in EM surveying represent weighted mean values of all the layer conductivities from the ground surface to the maximum depth that is sensed by the EM instrument (McNeill, 1980). If the underlying rock or sediment is uniform, the measured conductivity value will be the true conductivity. The amount of contribution to the measured conductivity from a single layer depends on its conductivity, depth, and thickness. In general, deeper layers contribute less to the final value than do near-surface layers, as do layers outside the effective depth range.

Geonics EM-31. The EM-31 transmitter and receiver coils are housed in a 3.5m long sensor boom, and a single person can operate the instrument (Geonics, 1991). A nominal depth of investigation of 18-ft (5.5-m) is realized when measurements are made using the vertical-dipole mode. Measurements are collected at ½ second intervals, and the quadrature and inphase components are collected simultaneously. This allows discrimination between anomalies sourced by buried metallic objects from those that are either lithologically or hydrologically controlled. Additional information consisting of the profile position, starting, and ending points, as well as fiducial mark locations along the profile, were recorded with an OMNI 720 data logger (Polycorder). This information is then downloaded to a personal computer for processing and display.

Geonics EM-34. The EM-34 is a two-person operable instrument that can measure terrain conductivities to depths of 150-ft (Geonics, 1991). Data were collected at approximately 1 sample per two-feet, and fiducial marker points are recorded at 20-to-50-ft intervals to help mitigate measurement point location errors due to uneven walking speeds. A Polycorder data logger is used to record the line geometry and profile data, which are downloaded to a personal computer for processing and display.

Seismic Refraction Tomography

Seismic refraction provides acoustic velocity and layer depth information (Redpath, 1973). The refraction method generally depends on an increase in seismic-wave velocity (speed of sound through earth material) with depth, though the newer tomographic codes presently available have the capability of handling a velocity inversion (zones of lower seismic velocity underlying zones of higher velocity). Both a tomographic model and an earth-layer (refractor) cross-section are planned as processing outputs from the refraction profiling. The commercially available SeisOpt2D code will be used to construct the tomographic model, and the SIPT software package was used to generate the earth-layer cross-section.

In the refraction method, the seismic energy (or wave) bends (refracts) at interfaces between layers of different velocities. In the special case where the seismic wave has been refracted parallel to the interface, the seismic energy travels along this interface, generating a head wave

that returns to the surface. A linear array of acoustic receivers (geophones) is used to record the travel-time of the first returning seismic signal. This information is plotted on a time-distance graph; for the case of plane layer geometry, the time-distance plot will show distinct linear segments for each layer where the inverse of the slope of a segment is equivalent to the apparent seismic velocity for a particular layer.

A multi-channel, engineering seismograph was used to record the seismic refraction information, and either a 500-lb weight drop (EWG) or a 16-lb. sledgehammer were used as the energy source. Geophones (seismic-receivers) were spaced at a 3.28-ft (1-m) interval during surveying. Shot points were acquired at every fifth geophone position, which allows input to the tomographic modeling software.

The processing sequence for the refraction data consists of:

- Picking first arrival times of return energy for each shot;
- Assigning the array-geometric to the first arrival data;
- Inverting the first-arrival information for velocity and depth using the SIPT algorithm (delay-time method); and
- Constructing a tomographic model of the first-arrival information using the either the SeisOpt2D code available from Optim Software, or the GeoCT-II code from GeoTomo.

The SIPT method takes advantage of the reverse-spread geometry and far offset shot points of the survey to compute depths to interfaces below each geophone. The algorithm employs the delay-time method of Pakiser and Black (1957) to calculate depth and position of refraction horizons. The generated refraction model is further refined using a ray-tracing algorithm which overcomes difficulties associated with dipping or undulating horizons.

The SeisOpt2D software achieves a globally optimized, velocity model using only first arrival travel time data and array geometry as input. SeisOpt2D requires no prior assumptions of subsurface structure, or any other subjective data, as input. A controlled Monte-Carlo inversion method is employed where the derived models are conditionally accepted or rejected based on a probability criterion. The criterion allows the algorithm to escape from non-unique, local, travel time minima to achieve a unique, globally optimized model of subsurface velocity structure. The algorithm makes no assumptions on the orientation of the subsurface velocity gradient, and can therefore reveal vertical structures and strong lateral gradients, if present.

The GeoCT-II inversion code also uses the geometry and first-arrival information as a starting point to apply a nonlinear continuum inversion in order to achieve a velocity-depth model. This package also allows providing a priori constraints such as known velocities from downhole surveys, and using earth-layer models as starting points.

Vertical Seismic Profiling

Vertical seismic profiles (check shots) are used to measure the in-situ velocity of the underlying sediment and rock, and these data provide confirmatory velocity information for the refraction models. The general configuration for recording the downhole seismic data consists of a three-component geophone, implementing 40Hz receiver elements. The downhole geophone is moved in 5-ft increments within the borehole (5-ft receiver spacing). A sledgehammer is used as the energy source, and is placed at offsets up to 15-ft from the borehole. Three additional geophones are placed on the surface at offsets up to 20-ft from the borehole, and are required to resolve any shot-timing variations that occur when using impact sources. Data are recorded at a 0.1 ms

interval (10,000 samples per second), which is required so that very small changes in arrival time (up to 0.2 milli-seconds) can be detected. The small arrival time changes are due to the presence of fast-velocity limestones and dolomites and correspond to a seismic wave traveling from 10,000 to 25,000-ft/s (yields arrival-time changes of 0.2 to 0.5milliseconds over a 5 foot interval).

Data processing consisted of the following:

- Pick first arrival energy for the downhole and reference geophones;
- Sort the arrival-time data by depth point;
- Compute and apply shot-timing corrections using the arrival time picks obtained from the reference geophones;
- Compute the average velocity to a receiver station using the straight-line distance from the shot to the receiver and the corrected arrival time;
- Convert to vertical travel-time using the depth point for the receiver and the computed average velocities; and
- Compute interval velocities using least squares line-fitting algorithm to estimate the slope (inverse of velocity) between measurement points. The least-squares operator has the advantage of smoothing over small time-picking errors.
- Where available, the data are correlated with the lithologic information and other available borehole geophysical data.

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Appendix B-4

Monitoring Well Purge Forms

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 16-4 Date 4/10/06
Field Personnel M. Thomas, E. Malarek
Sample Organization Shaw Environmental
Identify MP Protective Case
Depth to 45 (top) / 80 (bottom) of screen (below MP)
Pump Intake at (ft. below MP) 65
Purging Device (e.g., Redi Flo2) QED MicroPurge
PID Reading (ppm) 0.0

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1] CPM/ID	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
1840	~~53.80~~ 53.81	2/50	200	~~7.6~~	7.65	0.207	111	12.76	14.99	128	Air pressure 80 psi
1845	53.19	2/50	200	~~0.4~~ 1.60	7.69	0.219	~~89~~ 96	13.62	14.64	123	
1850	53.34	2/50	200	~~0.6~~ 2.0	7.81	0.215	144	13.97	14.04	109	
1855	53.40	2/50	225	~~0.8~~ 3.13	8.06	0.213	165	12.88	13.85	91	
1900	53.48	2/50	150	3.88	8.31	0.214	~~1~~67	12.71	13.78	81	↑ Air pressure 90 psi
1905	53.51	2/50	~~150~~ 175	4.75	8.42	0.213	213	9.44	13.76	76	
1910	53.53	2/50	180	5.65	8.56	0.212	217	6.26	13.72	67	
1915	53.54	2/50	185	6.58	8.73	0.212	221	8.74	13.68	63	
1920	53.56	2/50	185	7.50	8.75	0.211	228	8.48	13.66	57	
1925	53.56	2/50	175	8.38	8.78	0.211	240	8.15	13.59	55	
1930	53.56	2/50	185	9.30	8.78	0.211	251	6.03	13.55	56	
1935	53.56	2/50	185	10.23	8.81	0.212	252	8.46	13.55	53	
1940	53.56	2/50	185	11.15	8.81	0.212	250	8.23	13.54	53	
1940	Collect sample 16-4 for VOCs, SVOCs, Explosives, Pest/PCB, TAL metals, diox/furans, PAHs										

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number C1 Date 4/12/06
Field Personnel M. Thomas, E. Malarek
Sample Organization Shaw Environmental
Identify MP ~~Top~~ Cap on top of well

Depth to 55 (top) / 70 (bottom) of screen (below MP)
Pump Intake at (ft. below MP) 70
Purging Device (e.g., Redi Flo2) Bladder pump
PID Reading (ppm) 0.0

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1] CPM	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO % ~~mg/L~~	Temp. deg. C	ORP/Eh[2] mv	Comments
1140	50.78	4	250	—	6.74	0.729	N/A	18.6	13.65	173	
1145	50.81	4	325	1.63	6.74	0.730		10.5	13.58	168	
1150	50.80	4	200	2.63	6.74	0.731		7.8	13.91	164	
1155	50.81	4	375	4.50	6.74	0.731		7.1	13.78	162	
1200	50.81	4	350	6.25	6.74	0.729		6.0	13.58	161	
1205	50.81	4	350	8.00	6.74	0.728		5.6	13.48	160	
1210	50.81	4	350	9.75	6.75	0.725		7.1	13.36	161	
1215	50.81	4	350	11.50	6.77	0.724		8.8	13.81	161	
1220	50.81	4	365	13.33	6.77	0.726		9.6	13.82	160	
1225	50.81	4	450	15.58	6.77	0.725		10.3	13.52	162	
1230	50.81	4	300	17.08	6.77	0.725	↓	10.4	13.86	162	
1240	Collect sample C1 for VOCs, SVOCs, PAHs, Pest/PCBs, Explosives, TAL metals, Dioxins/Furans										

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 48MW1 Date 4/13/06
Field Personnel M. Thomas, E. Malarek
Sample Organization Shaw Environmental
Identify MP Notch

Depth to 110 (top) / 140 (bottom) of screen (below MP)
Pump Intake at (ft. below MP) 135
Purging Device (e.g., Redi Flo2) QED MicroPurge
PID Reading (ppm) 0.0

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1] CPM/10	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
0900	111.39	2/50	175	—	5.94	0.376	131	10.45	12.57	186	
0905	112.27	3/82	200	1.00	7.76	0.386	97.6	9.74	12.73	90	
0910	112.50	3/82	200	2.00	8.37	0.384	94.2	8.50	12.92	63	
0915	112.60	3/82	200	3.00	8.52	0.381	83.3	7.62	12.81	61	
0920	112.84	3/82	200	4.00	8.62	0.375	83.7	7.06	12.82	57	
0925	113.05	3/82	200	5.00	8.68	0.369	84.1	6.58	12.82	52	
0930	113.19	3/82	200	6.00	8.65	0.367	86.8	6.24	12.82	56	
0935	113.35	3/82	200	7.00	8.52	0.367	92.0	5.91	12.89	64	
0940	113.48	3/82	~~200~~ 175	7.88	8.55	0.370	95.0	5.61	12.93	61	↕ air pressure
0945	113.59	3/82	175	8.75	8.51	0.371	95.9	5.43	12.99	66	↑ air pressure
0950	113.68	3/82	175	9.63	8.51	0.373	98.2	5.36	13.02	63	
0955	Collect samples 48MW1 ~~(MS/MSD)~~ and TM48MW1 (duplicate) for VOCs, SVOCs, PAHs, Pest/PCBs, Explosives, TAL metals, dioxins/furans										

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 48MW2 Date 4/13/06
Field Personnel M. Thomas, E. Maldrek
Sample Organization Shaw Environmental
Identify MP Notch

Depth to 113.7 (top) / 133.7 (bottom) of screen (below MP)
Pump Intake at (ft. below MP) ~~128~~ (MT) 133
Purging Device (e.g., Redi Flo2) Micropurge-(QED)
PID Reading (ppm) 0.0

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1]	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
1150	125.30 well went dry prior to obtaining readings										
1725	Collect sample 48MW2 for VOCs, SVOCs, PAHs, Explosives, Pest/PCBs, TAL metals, Dioxins/furans (1 bottle for each only)										
	following recharge of well										

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 48MW3 Date 4/13/06
Field Personnel M. Thomas, E. Malarek
Sample Organization Shaw Environmental
Identify MP Notch

Depth to 100 / 120 of screen (below MP) (top / bottom)
Pump Intake at (ft. below MP) 115
Purging Device (e.g., Redi Flo2) QED MicroPurge
PID Reading (ppm) 0.0

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1] CPM/ID	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
1500	96.75	2/50	175	—	6.52	0.495	113	12.92	15.69	150	↑ air pressure
1505	97.55	2/50	215	1.08	7.02	0.505	96.2	12.16	14.60	109	
1510	97.74	2/50	215	2.15	7.88	0.505	58.1	9.44	14.30	84	
1515	97.96	2/50	215	3.23	8.16	0.505	58.5	9.32	13.89	72	
1520	98.15	2/50	215	4.30	8.32	0.506	46.8	9.72	14.00	71	
1525	98.33	2/50	215	5.38	8.37	0.503	59.2	9.54	13.95	71	
1530	98.41	2/50	225	6.50	8.38	0.502	68.7	9.41	14.31	74	
1535	98.61	2/50	225	7.63	8.34	0.500	78.8	9.38	13.98	75	
1540	98.81	2/50	225	8.75	8.34	0.503	14.4	9.31	14.02	73	
1545	98.95	2/50	225	9.88	8.35	0.504	19.2	9.12	14.05	75	
1550	99.10	2/50	225	11.00	8.38	0.503	23.7	9.17	13.94	73	
1555	99.30	2/50	225	12.13	8.37	0.504	24.3	9.14	13.93	74	
1600	Collect sample 48MW3 (plus MS/MSD) for VOCs, SVOCs, PAHs, Pest/PCBs, Explosives, TAL metals, Dioxins/furans										

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 5(MW)1 **Date** 4/10/06
Field Personnel M. Thomas, E. Malarek
Sample Organization Shaw Environmental
Identify MP Mark

Depth to 25 (top) / 35 (bottom) **of screen (below MP)**
Pump Intake at (ft. below MP) 34
Purging Device (e.g., Redi Flo2) QED MicroPurge
PID Reading (ppm) 0.0 ppm

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1] CPM/ID	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
1150	33.08	1/20	150	+	6.67	0	270	8.9	22.70	115	
1200	33.18	1/20	150	1.50	6.61	0	268	10.61	18.40	112	
1205	33.28	1/20	150	2.25	6.67	0	283	11.13	16.41	102	
1210	33.44	1/18	100	2.75	6.71	0	285	11.51	15.39	99	
1215	33.53	1/18	100	3.25	6.71	0	287	11.48	14.96	99	
1220	33.64	1/16	50	3.50	6.86	0	289	11.49	15.07	98	
1225	33.70	1/16	50	3.75	6.87	0	289	11.48	15.36	90	~~Well~~ Pump stopped pumping water
1230	33.65	1/16	50	4.00	7.05	0	299	11.17	16.53	83	Lowered pump to bottom of well
1235	33.79	1/12	200	5.00	7.02	0	69.9	11.14	16.39	80	
1240	33.85	1/10	~~225~~ 175	5.38	6.24	0	4.7	11.55	15.99	137	
1245	33.93	1/5	50	5.63	6.89	0	4.1	11.49	16.06	116	
1250	33.95	1/8	50	5.88	7.54	0.002	~~0~~3.8	11.32	16.48	86	
1255	33.99	1/8	50	6.13	8.00	0.099	4.8	11.32	16.82	69	
1300	34.02	1/8	~~50~~ 65	6.45	7.95	0.099	2.2	11.30	16.73	67	
1305	34.11	1/8	75	6.83	7.98	0.103	1.4	10.89	16.55	66	
1310	34.18	1/8	100	7.33	7.88	0.104	0.4	10.29	16.37	70	
1315	34.23	1/8	100	7.83	7.77	0.104	1.5	10.18	16.12	76	
1318	Well went dry - pump stopped pumping water - will sample after well recharges										
4/11/06	1820	Collect sample 5(MW)1 for VOCs, SVOCs, PAHs, Pest/PCBs, Explosives, TAL metals, Dioxins/furans									

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

* refill

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 51 MW2 Date 4/10/06
Field Personnel M. Thomas, E. Malarek
Sample Organization Shaw Environmental
Identify MP Mark

Depth to 43 (top) / 53 (bottom) of screen (below MP)
Pump Intake at (ft. below MP) 52
Purging Device (e.g., Redi Flo2) QED Micropurge
PID Reading (ppm) 0.0

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1] CPM/ID	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
1535	50.07	1/15	125	—	6.20	0.223	162.0	9.93	17.87	187	
1540	50.11	1/15	125	0.63	6.33	0.238	194	11.01	17.24	182	
1545	50.09	1/15	115	1.20	6.60	0.232	158	11.12	15.45	168	
1550	50.09	1/20	175	2.08	6.82	0.224	172	12.36	14.96	158	
1555	50.11	1/20	175	2.95	7.13	0.236	133	11.86	14.16	144	
1600	50.12	1/22	200	3.95	7.26	0.233	116	12.62	14.10	139	
1605	50.12	1/22	225	5.08	7.61	0.235	120	12.69	13.83	118	
1610	50.11	1/22	225	6.20	7.81	0.233	181	12.13	13.82	109	
1615	50.11	1/20	150	6.95	7.90	0.235	82.4	11.56	13.95	104	
1625	50.12	1/20	215	9.10	8.07	0.227	172	12.55	13.84	92	
1630	50.11	1/20	200	10.10	8.28	0.231	120	11.94	13.81	85	
1635	50.12	1/20	200	11.10	8.37	0.234	138	12.54	13.80	84	
1640	50.12	1/20	200	12.10	8.37	0.232	130	12.86	13.74	84	
1645	50.12	1/20	200	13.10	8.37	0.232	148	12.45	13.71	83	
1645	Collect sample 51MW2 for VOCs, SVOCs, Explosives, Pest/PCBs, Metals, PAHs, Diox/Fur										

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 48MW1 Date 8-29-07
Field Personnel CJ, BS
Sample Organization Shaw Environmental
Identify MP

Depth to 110 (top) / 140 (bottom) of screen (below MP)
Pump Intake at (ft. below MP)
Purging Device (e.g., Redi Flo2)
PID Reading (ppm)

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1]	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
740	107.05	—									
750	108.57	244.1	300	—	7.71	.511	251	4.24	13.66	137	
755		244.1	300		7.57	.509	240	1.81	13.54	133	
800		244.1	300		7.49	.505	240	1.65	14.00	122	
805	109.42	244.1	300		7.45	.499	234	1.48	14.95	105	
810		244.1	300		7.46	.502	227	1.47	14.97	100	
815					7.46	.503	227	1.48	14.99	91	
820		Sample	Taken								

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 48MW2 Date 8.29.07
Field Personnel RD
Sample Organization Shaw Environmental
Identify MP TOC

Depth to 113.7 (top) / 133.7 (bottom) of screen (below MP)
Pump Intake at (ft. below MP)
Purging Device (e.g., Redi Flo2) RF2
PID Reading (ppm) 0

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1]	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
	124.47										
0805	128.47	265	300		6.93	0.441	-5.0	9.33	14.96	97	silty
0810	129.0	265	300		6.98	0.421	-5.0	7.44	19.47	84	silty - cloudy
0815	129.0	265	300		7.05	0.436	-5.0	8.02	18.74	77	cloudy/silty
0820	129.0	265	300		7.07	0.437	-5.0	8.01	18.59	72	cloudy/silty
0825	129.0	265	300		7.08	0.436	-5.0	7.97	18.35	75	cloudy/silty

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 48MW3 Date 8.29.07
Field Personnel PS
Sample Organization Shaw Environmental
Identify MP TOC

Depth to 100 / 120 of screen (below MP)
top bottom
Pump Intake at (ft. below MP)
Purging Device (e.g., Redi Flo2) RF2
PID Reading (ppm) 0

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1]	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
	97.60										
0955	98.90	226.0	300		7.15	0.658	347	10.37	15.07	153	
1000	98.90	226.0	300		7.02	0.655	202	8.65	14.13	149	
1005	98.90	226	300		6.90	0.649	208	7.22	14.89	122	clear
1010	98.90	226	300		6.89	0.650	226	7.52	15.41	116	clear
1015	98.90	226	300		6.88	0.650	206	7.34	15.83	114	clear
1020	98.90	226	300		6.88	0.650	207	7.30	15.91	114	clear

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 48MW06 Date 8.30.07
Field Personnel JR/CS
Sample Organization Shaw Environmental
Identify MP TOC

Depth to 58 (top) / 78 (bottom) of screen (below MP)
Pump Intake at (ft. below MP)
Purging Device (e.g., Redi Flo2)
PID Reading (ppm) 0

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1]	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
	66.65										
1110	69.20	188.5	300		7.75	0.381	-5.0	6.13	18.30	131	silty
1115	69.30	187.3	300		7.70	0.352	-5.0	4.05	16.56	126	silty/cloudy
1120	69.20	187.3	300		7.61	0.351	-5.0	3.51	16.91	124	silty/cloudy
1125	69.20	187.3	300		7.41	0.349	-5.0	3.25	18.14	120	silty/cloudy
1130	69.25	187.3	300		7.32	0.402	-5.0	2.99	20.11	118	silty
1135	69.25	187.3	300		7.26	0.419	-5.0	2.99	20.23	118	silty
1140	69.25	187.3	300		7.21	0.442	-5.0	3.03	20.12	119	silty

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 48MW07 Date 8.30.07
Field Personnel BS
Sample Organization Shaw Environmental
Identify MP TOC

Depth to 62 (top) / 82 (bottom) of screen (below MP)
Pump Intake at (ft. below MP)
Purging Device (e.g., Redi Flo2) RF2
PID Reading (ppm) 0

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1]	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
	48.24										
0945	48.62	161.5	300		8.02	0.184	-5.0	11.01	15.43	125	cloudy
0950	48.62	161.5	300		7.93	0.181	-5.0	10.62	15.52	126	cloudy
0955	48.62	161.5	300		7.77	0.179	-5.0	10.10	15.90	132	cloudy
1000	48.62	161.5	300		7.66	0.178	-5.0	9.90	16.24	138	cloudy → clearing
1005	48.62	156.6	300		7.58	0.179	745	9.52	16.75	142	clear
1010	48.62	156.6	300		7.59	0.179	692	9.61	17.14	143	clear
1015	48.62	156.6	300		7.60	0.179	642	9.54	17.32	143	clear

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 49MW01 Date 8-29-07
Field Personnel CS BS
Sample Organization Shaw Environmental
Identify MP

Depth to 91 (top) / 121 (bottom) of screen (below MP)
Pump Intake at (ft. below MP) Bailor
Purging Device (e.g., Redi Flo2)
PID Reading (ppm)

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1]	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
1340		—	—	—	7.73	.510	131	3.20	13.54	93	

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Well Purging-Field Water Quality Measurements Form

Location (Site / Facility Name) RFAAP
Well Number 59MW01 Date 8-29-07
Field Personnel CJ / BS
Sample Organization Shaw Environmental
Identify MP

Depth to 68 (top) / 82 (bottom) of screen (below MP)
Pump Intake at (ft. below MP)
Purging Device (e.g., Redi Flo2)
PID Reading (ppm)

Clock Time 24 HR	Water Depth ft. below MP	Pump Setting[1]	Purge Rate mL/min	Cum. Volume Purged liters	pH	Spec. Cond. mS/cm	Turbidity NTU	DO mg/L	Temp. deg. C	ORP/Eh[2] mv	Comments
0540	45.9										
0555	49.95	167	350		6.10	.342	999	2.64	13.57	119	
0600	[illegible]	167	350		6.50	.345	999	2.20	14.62	97	
0605	50.00	167	350		6.93	.347	999	1.88	14.87	82	
0610		167	350		7.16	.345	999	1.71	14.95	71	
0615	50.35	167	350		7.33	.345	685	1.54	15.05	59	
0620		167	350		7.43	.347	410	1.36	15.11	48	
0625	50.40	167	350		7.47	.347	345	1.29	15.09	41	
0630		167	350		7.50	.347	300	1.23	15.19	36	
0635		167	350		7.52	.346	268	1.20	15.21	33	
0640		167	350		7.53	.347	265	1.16	15.27	32	
0645		167	350		7.55	.347	243	1.11	15.30	28	
0650		Sample Taken									

[1] Pump dial setting (e.g., hertz, cycles/min., etc.)
[2] Oxidation reduction potential (stand in for Eh)

Appendix C

Sample Location Coordinates and Elevations

Boring ID	Northing	Easting	Elevation
51SB1	3601086.89	10892807.89	1824.55
51SB2	3601055.78	10892820.11	1824.26
51SB3	3601032.50	10892828.72	1825.56
51SB4	3601009.55	10892838.08	1826.55
51SB5	3600986.38	10892846.61	1827.18
51SB6	3600964.45	10892862.82	1827.00
51SB7	3600941.05	10892869.70	1827.06
51SB8	3600991.50	10892861.73	1828.53
51SB9	3601036.91	10892843.24	1825.76
51SB10	3600982.86	10892828.13	1826.35
51SB11	3601027.95	10892810.92	1824.40
51SBC1	3601077.48	10892790.06	1824.69
51SBC2	3601079.76	10892792.40	1825.50
51SBC3	3601089.27	10892814.79	1824.93
51SBC4	3601093.84	10892824.60	1825.67
51SBC5	3601049.94	10892802.29	1825.74
51SBC6	3601051.30	10892806.98	1823.43
51SBC7	3601057.94	10892828.08	1824.81
51SBC8	3601060.52	10892837.64	1825.95
51SBC9	3601029.12	10892815.84	1824.25
51SBC10	3601035.31	10892838.36	1825.94
51SBC11	3601005.66	10892820.24	1825.16
51SBC12	3601006.78	10892825.97	1825.60
51SBC13	3601012.47	10892847.69	1827.32
51SBC14	3601014.08	10892852.44	1827.40
51SBC15	3600984.87	10892833.35	1826.90
51SBC16	3600989.46	10892857.17	1827.67
51SBC17	3600961.22	10892839.74	1827.43
51SBC18	3600962.94	10892842.86	1828.17
51SBC19	3600964.55	10892858.62	1828.62
51SBC20	3600973.93	10892862.57	1827.48
51SBC21	3600974.57	10892866.55	1828.12
51SBC22	3600935.98	10892863.10	1825.63
51SBC23	3600937.53	10892867.31	1824.70
51SBC24	3600952.00	10892896.78	1824.183
51SBC25	3600951.29	10892902.48	1828.4
NB1	3601071.39	10892799.29	1827.02
NB2	3601078.89	10892802.59	1827.75
NB3	3601083.60	10892809.53	1828.28
NB4	3601080.37	10892816.27	1828.80
SB1	3600953.08	10892849.14	1828.46
SB2	3600954.33	10892855.05	1829.06
SB3	3600957.52	10892862.38	1829.21
SB4	3600960.88	10892868.91	1829.24

Appendix D

Contaminant Fate and Transport

CONTAMINANT FATE AND TRANSPORT

D.1 TRANSFORMATION AND FATE OF CONTAMINANTS

When contaminants are exposed to the environment, the potential for transformations of the chemical exists. The endpoint of the transformation process is referenced as the “fate” of the chemical. The ultimate "fate" refers to the expected final state that an element, compound, or group of compounds will achieve following release to the environment. The fate processes for organic contaminants may include sorption, volatilization, hydrolysis, and abiotic and biotic degradation, while the fate processes for inorganic contaminants may include ion exchange, chemical speciation, and oxidation/reduction. These fate processes dictate how contaminants will be transported in the environment. Contaminants can be transported with little attenuation or retardation due to these fate processes, or they can be delayed or transformed so that little migration occurs. Various fate processes, as well as the properties that may affect the fate of contaminants, are discussed below.

D.1.1 Contaminant Properties Affecting Fate

The physical and chemical properties of contaminants play a large role in determining their fate after release to the environment. The following section provides a discussion of several of these key properties.

D.1.1.1 Specific Gravity

Specific gravity is the ratio of the density of a compound to the density of water. It is a measure of the tendency of a compound to float (specific gravity <1) or sink (specific gravity >1) in water. Contaminants that are immiscible in water can exist as separate phase liquids and are referred to as Light Non-Aqueous Phase Liquids (LNAPLs) if their specific gravity is less than one, or Dense Non-Aqueous Phase Liquids (DNAPLs) if their specific gravity is greater than one.

D.1.1.2 Water Solubility

The solubility of a compound in water is the maximum or saturated concentration of the compound in pure water at a specific temperature. Compounds with high solubility in water tend to remain in the aqueous phase and not partition to soil or sediment, are less likely to volatilize from water, and are generally more likely to biodegrade. Conversely, compounds with low water solubilities tend to partition to soil or sediment, volatilize more readily from water, and are less likely to be biodegradable. The solubility of inorganic chemicals varies widely from insoluble to greater than 100,000 mg/L, depending on temperature, pH, ORP, and the concentrations of dissolved constituents such as humic and fulvic acids.

D.1.1.3 Vapor Pressure

Vapor pressure is a property of a chemical in its pure state, which indicates how readily it will volatilize to the atmosphere. Volatilization from water is dependent upon vapor pressure and Henry’s Law Constant. Vapor pressures for chemicals in their pure states range from 0.001 to 760 mm mercury (mm Hg) for liquids to less than 10^{-10} mm Hg for solids.

D.1.1.4 Henry's Law Constant

The Henry's Law Constant of a compound is essentially the air/water partition coefficient. In dimensional form, the Henry's Law Constant is the ratio of the vapor pressure to the water

solubility (in atm-m^3/mole). The Henry's Law Constant indicates how a chemical will partition between air and water at equilibrium, and can be used to calculate the rate of volatilization of a chemical from water.

D.1.1.5 Organic Carbon/Water Partition Coefficient

The organic carbon/water partition coefficient (K_{oc}) is a measure of the tendency for a chemical to be sorbed to the organic fraction of soil and sediment. Normal K_{oc} values range from 1 to 10^7 L/kg, with higher values indicating greater sorption potential by the soil and lower values indicating high leaching capabilities for the contaminants from the waste source into surface runoff and groundwater.

D.1.1.6 Octanol/Water Partition Coefficient

The octanol/water partition coefficient (K_{ow}) is a measure of the distribution of a compound at equilibrium between n-octanol and water. The octanol/water partition coefficient, K_{ow}, gives an indication of how a compound will preferentially distribute into a solvent or water, and is a measure of how hydrophobic a compound is. A chemical with a high K_{ow} is hydrophobic and may be relatively immobile in an aqueous system (e.g., contaminant sorbs to soil particles), but may be mobilized in the presence of an organic solvent.

D.1.2 Fate of Organic Contaminants

D.1.2.1 Sorption

Sorption and desorption are two major mechanisms affecting the fate of contaminants in the subsurface. Sorption includes both adsorption and absorption. Adsorption is defined as the accumulation occurring at an interface, while absorption is the partitioning between two phases (Knox et al., 1993).

Sorption is the process by which a compound is retained onto a solid particle rather than remaining dissolved in solution. The sorption of contaminants to the soil matrix is an important factor affecting their transport in terrestrial environments. The sorption of contaminants to suspended sediments and bottom sediment is an important factor affecting chemical transport in aquatic environments.

In general, sorption reactions may be classified as either sorbent or solvent-motivated. Sorbent-motivated sorption occurs when an attraction between the sorbent (subsurface material) and the solute (contaminant), and the contaminant accumulates at the surface due to the affinity of the surface for the contaminant. An example of sorbent-motivated sorption would be a highly polar or ionizable contaminant interaction with the cation exchange sites of clay minerals. This type of sorption typically occurs with inorganics and is more commonly referred to as ion exchange. Solvent-motivated sorption occurs when the contaminant is hydrophobic, such as nonpolar organics, which prefer nonpolar phases to the polar water phase. Hydrophobic contaminants will accumulate at an interface or partition into a nonpolar phase (e.g., associate with the organic content of the subsurface medium) rather than partition into the water phase. The sorption of most neutral organic constituents falls into the category of hydrophobic, or solvent-motivated sorption (Knox et al., 1993). The best indicators of the partitioning of a compound between soil and water are the organic carbon/water partition coefficient (K_{oc}), the soil/water distribution coefficient (K_d), the octanol/water partition coefficient (K_{ow}), and the retardation factor (R).

For nonionic organic chemicals and aquifer materials, sorption is largely controlled by the clay and organic carbon content of the soil. The distribution of an organic chemical between water

and a specific soil matrix is characterized by the organic carbon/water partition coefficient, K_{oc}. This coefficient, which is based on the specific organic carbon content of the soil, is typically measured empirically using a linear adsorption isotherm where the partitioning between the two phases is determined by the following equation (Olsen and Davis, 1990):

$$K_d = \frac{C_s}{C_w} \qquad \textit{Equation 1}$$

where:

K_d = Soil/water distribution coefficient (L/kg)
C_s = Mass of the solute on the solid phase per unit mass of the solid phase (mg/kg)
C_w = Mass of the solute per unit volume of solution (mg/L)

The soil/water distribution coefficient, K_d, obtained from the above equation is then normalized to correct for variations in the organic carbon content of differing soil matrices to calculate K_{oc}:

$$K_{oc} = \frac{K_d}{f_{oc}} \qquad \textit{Equation 2}$$

where:

K_{oc} = Organic carbon/water partition coefficient (L/kg)
K_d = Soil/water distribution coefficient (L/kg)
f_{oc} = Fraction of organic carbon in the soil

The normalization of the adsorption coefficient to ascertain K_{oc} correlates well with other adsorption coefficient estimation methods which use other properties of the chemical such as water solubility or octanol/water partitioning (Callahan et al., 1979).

If the empirical K_d or K_{oc} value for the chemical is not available, the most widely accepted method of estimating the organic carbon/water partition coefficient involves the octanol/water partition coefficient, K_{ow}. The octanol/water partition coefficient, K_{ow}, has been correlated to water solubility, the organic carbon/water partition coefficient, and bioconcentration factors for aquatic life and represents the extent of partitioning by a chemical between organic and aqueous phases (Lyman et al., 1990). The relationship between K_{oc} and K_{ow} is expressed as a regression equation:

$$\log K_{oc} = a \log K_{ow} + b \qquad \textit{Equation 3}$$

where a and b are constants derived from specific data sets which represent differing classes of chemicals such as pesticides, aromatic compounds, and chlorinated hydrocarbons. Chemicals with low K_{ow} (i.e., less than 10 L/kg) are considered relatively hydrophilic and tend to have high water solubilities and small K_{oc} values. Conversely, hydrophobic compounds typically have K_{ow} values greater than 10^4 L/kg (Lyman et al., 1990). In general, the more hydrophobic a contaminant is, the more likely the contaminant will be sorbed to soil.

From Equation 1, when C_s is equal to zero, K_d also equals zero. Under this condition, no adsorption or retardation of the chemical occurs. This implies that the contaminant moves at the same velocity as the groundwater and in this case, the contaminant is termed a conservative or nonreactive solute. However, the velocity of the contaminant front can be substantially different for solutes that are adsorbed within the soil matrix. The retardation factor is defined as the ratio of the groundwater flow velocity to the contaminant front velocity:

$$R = 1 + \rho_b \frac{K_d}{n_e} \qquad \textit{Equation 4}$$

where:

R	=	Retardation factor (dimensionless)
θ_b	=	Bulk density of the soil (g/mL)
K_d	=	Distribution coefficient (mL/g)
n_e	=	Effective porosity of the soil (dimensionless)

The retardation factor indicates the extent of retardation of contaminant migration in groundwater due to adsorption. A retardation factor of 1.0 indicates that the contaminant has little tendency to bind to soils and, hence, moves freely in the groundwater. By contrast, the larger the R, the greater the tendency for a contaminant to bind to the soil matrix and the slower it will move in the groundwater. The retardation factor cannot fall below 1.0.

Other factors which affect the adsorption of chemicals to the soil matrix include temperature, pH of the soil and water, particle size distribution, and surface area of solids. The value of the distribution coefficient K_d usually decreases with increasing temperature because adsorption is an exothermic process. Neutral and slightly polarized organic compounds are somewhat affected by pH. Chemicals that tend to ionize are significantly affected by pH (Lyman et al., 1990). When the pH of the groundwater is approximately 1.0 to 1.5 units above the negative log of the acid dissociation constant (pK_a), adsorption becomes significant. A comparison of the pK_a of an organic acid with the pH of the groundwater indicates the potential importance of the dissociation of the organic compound in determining the degree of partitioning. The size of affected soil particles also plays a role in a contaminant's sorption characteristics. Particles of small size, such as particles of fine silt or clay, will have a greater tendency to adsorb chemicals.

D.1.2.2 Volatilization

Volatilization is a process whereby a compound changes state from the aqueous phase to the vapor phase. Compounds that do not adsorb onto soil/sediment or dissolve in water have the greatest tendency to volatilize. The volatility of a compound can be evaluated from its K_{oc} and by assessing its Henry's Law Constant. The value of K_{oc} indicates the degree of sorption of a compound to soil/sediment. A compound with a high K_{oc} value will have a reduced volatility because the compound sorbs extensively to the soil/sediment surface. The Henry's Law Constant can be considered the partition coefficient of the contaminant between the aqueous phase and the gas phase. A Henry's Law Constant of greater than 10^{-3} atm-m^3/mol indicates a high volatility, and a Henry's Law Constant of less than 10^{-5} atm-m^3/mol indicates a low volatility. **Table D-1** provides a rough outline of relative volatility of a solute according to its Henry's Law Constant.

Table D-1
Volatility of Compounds Based on Henry's Law Constants

Volatility	Henry's Law Constant
Volatilization is very slow, at a rate controlled by slow diffusion through air	$< 10^{-5}$ atm-m^3/mol
Volatilization is not rapid but significant	10^{-5} atm-m^3/mol to 10^{-3} atm-m^3/mol
Volatilization is rapid	$> 10^{-3}$ atm-m^3/mol

The Henry's Law Constant is related to other physical properties of the compound, the most important of which are vapor pressure and water solubility. Compounds exhibiting high vapor pressures and low water solubilities tend to have high volatilization rates. In fact, in the absence of literature values, Henry's Law Constants can be estimated from the following equation (Olsen and Davis, 1990):

$$H = \frac{(V_p)(MW)(16.04)}{(WS)(T)} \qquad \textit{Equation 5}$$

where:

V_p = Vapor pressure of the chemical (mm Hg)
MW = Molecular weight of the chemical (g/mol)
WS = Solubility in water (mg/L)
T = Temperature (^oK)
H = Henry's Law Constant ([mg/L]/[mg/L])

From this equation, it is evident that the volatilization of a compound to air will depend on its vapor pressure, water solubility, and temperature. Other important factors affecting volatilization include wind speed, the depth of the aquifer, and the geology of the unsaturated zone.

D.1.2.3 Hydrolysis

Hydrolysis is the reaction of a compound with water. It usually involves the introduction of a hydroxyl (-OH) group into an organic compound, usually at a point of unbalanced charge distribution (Cherry et al., 1983). The hydrolysis reaction can displace halogens, and may be catalyzed by the presence of acids, bases, or metal ions. Therefore, the rate of hydrolysis is pH and metal-ion concentration dependent. Surface effects also may affect the rate of hydrolysis. Halogenated aliphatics are susceptible to hydrolysis, with reactions proceeding most rapidly for monohalogenated compounds, and much more slowly as the number of halogen ions increases (Fetter, 1993).

Hydrolysis applies to a limited number of chemicals. These contain hydrolyzable groups, such as esters, aliphatic halogens, amides, carbamates, and phosphate esters (Howard, 1991). Compounds that are not susceptible include: alkanes, alkenes, aldehydes, amines, and carboxy-containing compounds (Olsen and Davis, 1990).

D.1.2.4 Abiotic Degradation

Abiotic degradation is the chemical degradation of compounds without the assistance of biological activities. In the natural environment, the most common abiotic degradation processes are hydrolysis and hydroxyl radical reactions. Other abiotic degradation processes include direct photolysis, dehydrohalogenation, and oxidation.

Hydrolysis, as mentioned above, is a chemical reaction in which compounds react with water molecules in the environment, resulting in the introduction of a hydroxyl group (-OH) and the loss of a leaving group (-X), typically a halogen.

$$RX + H_2O \rightarrow ROH + HX \ (or\ H^+, X^-) \qquad Equation\ 6$$

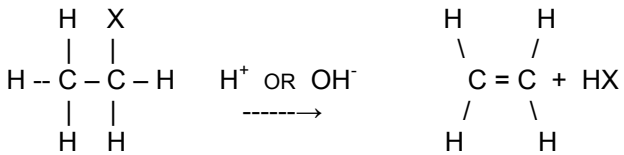
These reactions are catalyzed mainly by hydronium (H_3O^+) and/or hydroxyl ions (OH^-). Therefore, as mentioned above, hydrolysis reactions are pH dependent. Selected metals may also catalyze a hydrolysis reaction (Olsen and Davis, 1990).

Hydroxyl radical reactions are reactions with hydroxyl radicals photochemically generated from sunlight. These reactions may occur mostly in the atmosphere and to a lesser degree in surface water. Once the free radicals are formed, they will react with organic molecules to form an intermediate organic-free radical, which usually reacts further with other compounds. For most chemicals in the atmosphere, reaction with photochemically-generated hydroxyl radicals is the most common degradation process. For many chemicals, experimental reaction rate constants for reactions involving hydroxyl radicals are available in the scientific literature and are used to calculate an estimated half-life by assuming an average hydroxyl radical concentrations of $5x10^5$ molecules/cm^3 in non-smog conditions (Howard, 1991).

Occasionally, other reactions besides hydroxyl radical reactions occur in the atmosphere such as ozone oxidation and direct photolysis. Direct photolysis is a photochemical alteration of the compound as a result of the compound absorbing direct sunlight. The possibility of direct photolysis in air or water can be partially assessed by examining the UV spectrum of the chemical. If the chemical does not absorb sunlight at wavelengths greater than 290 nm, the chemical cannot directly photolyze.

Dehydrohalogenation is an elimination reaction in which an alkyl derivative will eliminate HX to form an alkene, where X is commonly a halogen, hydroxyl radical, or ester group:

Equation 7



D.1.2.5 Biotic Degradation

Biodegradation is the process in which the chemical degradation of a compound is assisted by soil microorganisms (e.g., fungi, bacteria). Reactions include oxidation, reduction, hydrolysis, and sometimes rearrangement of the molecule. Though biodegradation may occur very slowly for some compounds, the eventual mineralization of almost every organic compound in the

terrestrial and aquatic environment can be attributed to biodegradation (Alexander, 1978). A typical range of half lives for different degradation rates are summarized in **Table D-2**.

Rates of biotic degradation depend on many factors. Microorganisms require a carbon source (e.g., organic matter), an electron acceptor (e.g., oxygen, nitrate), nutrients (e.g., nitrogen, phosphorus), and various trace elements in order to maintain existing cells and produce new cells. Many environmental factors can also serve to limit the occurrence of microbial metabolism in the subsurface. These factors include pH, temperature, toxics, substrate concentration, and the presence of microbes. Most bacteria find the optimum pH range to be 6.5 to 7.5 and are not able to survive at pH values greater than 9.5 or below 4.0 (Knox et al., 1993). Microbial activity generally increases with increasing temperature. The presence of certain compounds may also be toxic to microorganisms. Heavy metals, acids, bases, or high concentrations of the substrate can serve to limit microbial activity. Finally, for biotic degradation to occur in the subsurface, microbes capable of metabolizing (or cometabolizing) the substrate must be present.

Table D-2
Rate of Biodegradation Based on Half Lives

Biodegradation Rate	Approximate Biodegradation Half-Life
Fast	1 day to 7 days
Moderately Fast	7 days to 4 weeks
Slow	4 weeks to 6 months
Resistant	6 months to 1 year

Complete biotic degradation of organic chemicals by microorganisms, utilizing enzymes to facilitate degradation, ultimately produces microbial cells, water, and carbon dioxide, which eventually lead to mineralization of the compound. Whether or not a chemical is transformed by enzymes depends on the configuration alignment of the enzyme with the organic chemical during the reaction. If an ideal configuration of the enzyme with organic chemicals occurs, the reaction will occur. Persistent chemicals have less favorable alignments, and non-reacting or recalcitrant chemicals fail to bond or produce favorable alignments.

Biotic degradation can be either aerobic or anaerobic. An aerobic reaction occurs in the presence of oxygen. Aerobic reactions occur in oxygen-rich environments such as surface soil (i.e., 0 to 6 inches bgs) and upper layers of sediment. An aerobic reaction is usually an oxidation reaction. An anaerobic reaction occurs in the absence of oxygen. Anaerobic reactions occur in such places as the saturated zone in terrestrial environments and the bottom layer of sediment in aquatic environments. Because of the lack of oxygen in these environments, an anaerobic reaction usually favors dehydrohalogenation reactions or reductive reactions.

D.1.3 Fate of Inorganic Contaminants

D.1.3.1 Ion Exchange

Metals in soil are generally immobile, particularly under neutral or alkaline conditions, and tend to sorb to soil particles. As described in *Section D.1.2.1*, sorption can be considered as either

sorbent- or solvent-motivated. Solvent-motivated sorption (partitioning) typically occurs for nonpolar, hydrophobic organic chemicals in groundwater by accumulation occurring on the organic content of the media. Ion exchange is sorbent-motivated sorption and occurs for inorganic chemicals due to an affinity of the solid surface for the compound. Typically, the sorbent surface contains a charge deficiency and requires the accumulation of ions near the solid/liquid interface to neutralize the surface charge. In subsurface media, the mineral fraction most commonly involved in ion exchange is the clay fraction (Knox et al., 1993). Ion exchange occurs when the sorbent charge deficiency can be neutralized more efficiently by ions in solution than by those ions currently adsorbed. For example, if sodium ions (monovalent) have accumulated and calcium ions (divalent) suddenly appear, the excess surface charge can be more efficiently neutralized by the calcium ions than by sodium. Thus, the sodium ions will desorb, the calcium ions will adsorb, and an exchange of ions occurs. The cation exchange capacity of a given aquifer material indicates the probable type and amount of clay minerals present, and can be used as an indication of the ability of a soil to attenuate cations found in the groundwater (Makeig, 1982).

D.1.3.2 Chemical Speciation

Most inorganic chemicals occur in more than one ionic form, or species, in soils and groundwater. These species, which form as a result of hydrolysis, oxidation/reduction, and complexation reactions, may have different valences and mobilities in groundwater due to different affinities for adsorption and different solubility controls. Simple ionic species often combine with ligands to form ionic or neutral-charge aqueous complexes. The major inorganic ligands in groundwater are generally Cl^-, HCO_3^{-2}, CO_2, and SO_4^{-2}, and in some cases, NH_3, NO_3^- and F^- (Cherry et al., 1983). Environmental conditions which affect speciation of inorganic chemicals include pH, redox potential, and inorganic ligands.

D.1.3.3 Oxidation/Reduction

Oxidation and reduction ("redox") refers to the transfer of electrons and the resultant species change of ions or compounds. Oxidation is the loss of electrons, while reduction is the gain of electrons. Redox processes are important because they can cause changes in the mobility of many inorganic compounds. The ability of a redox reaction to occur is a function of the redox potential. The redox potential is defined in terms of the negative logarithm of the free-electron activity and is referred to as pE. The redox potential can also be expressed in terms of volts (E_h). Low values of pE indicate high electron activity and favor electron-rich species (reduced). High values of pE indicate low electron activity and favor electron-poor species (oxidized).

D.2 TRANSPORT OF CONTAMINANTS

Contaminant transport refers to the mechanisms and rates of migration of contaminants away from the source area. Migration pathways often include air, water, soil, and the interfaces between the phases of the contaminant (i.e., solid, liquid, or gas). Mechanisms controlling the movement of contaminants include advection, dispersion, diffusion, volatilization, and sorption. These mechanisms are dictated by the physical and chemical nature of the environmental media and their interaction with the potential COCs. Water pathways include surface water, storm water runoff, groundwater, infiltration/percolation, and precipitation. The air pathways include uptake into the atmosphere and deposition from it either in a dry or wet form. The soil pathways include sediment and soil transported by erosion or by site activities such as construction and movement through the vadose zone as soil gas. Transport across an interface is primarily due to

partitioning. The degree of partitioning will depend on the volatility, solubility, and sorptive capacity of the phases. The primary transport mechanism across the water-air and soil-air interfaces are volatilization and sorption, while transport across the soil-water interface is controlled by sorption/desorption and dissolution (solubilization).

D.2.1 Advection

Contaminant transport by advection occurs when the contaminant is moved in and with the bulk flow of either water or the atmosphere. The primary advective transport pathway at Building 4343 is migration into surface water.

D.2.2 Diffusion

Transport by diffusion is the result of a concentration gradient in the contaminant plume or the soil gas within the vadose zone. The rate of diffusion is expressed by the diffusivity coefficient, which is affected by temperature, pressure, density, and soil porosity. Diffusion in soil is strongly dependent on the effective porosity of the soil. Residual clays have high porosity but low effective (interconnected) porosity. Transport due to diffusion in clays is usually minimal.

D.2.3 Volatilization

Volatilization occurs when a liquid changes its phase to a gas. This is primarily a mechanism for organic contaminants migrating from the soil or surface water to the air. Volatilization is a mass transfer process that is limited by a compound's solubility in water, molecular weight, vapor pressure, K_{oc} value, and by the local temperature.

D.2.4 Sorption

As discussed previously, sorption is a general term used in place of the specific terms absorption or adsorption. Adsorption describes the process whereby a contaminant is bound to the surface of a medium, whereas absorption occurs when the contaminant is bound within the medium. The distinction between the two is not always relevant, but the fact that a contaminant has been sorbed indicates that it has been bound to its new medium and will be transported with this new medium. This transport mechanism may be significant when a high concentration of suspended solids is found in water samples.

Desorption is the release (leaching) of a contaminant from the sorbent phase. Sorption/desorption is a primary mechanism of transport for water and soil pathways. In a water-soil environment, soil is the adsorbent and the contaminants are the adsorbates. Sorption/desorption of organic and inorganic compounds within soil-water systems is assessed by several physical and chemical properties of both the compound and the soil or sediment (*Section D.1.2.1*).

Appendix E

HHRA Tables and Statistical Comparison Results

Appendix E-1

RAGS Part D Tables

Table E.1-1
Selection of Exposure Pathways

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Surface Soil	Surface Soil	SWMU 51	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at SWMU 51 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at SWMU 51 and be exposed to COPCs via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	SWMU 51	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMU 51.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	SWMU 51	None	None	None	On-site	None	Current excavation or construction activities are not occurring at SWMU 51.
	Groundwater	Groundwater	SWMU 51	None	None	None	On-site	None	Groundwater is not currently being used at SWMU 51. Therefore, there is currently no direct exposure to groundwater.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
Future	Surface Soil	Surface Soil	SWMU 51	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact surface soil at SWMU 51 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact surface soil at SWMU 51 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact surface soil at SWMU 51 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact surface soil at SWMU 51 and be exposed to COPCs via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	SWMU 51	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMU 51.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from surface soil at SWMU 51.
				Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.

Table E.1-1
Selection of Exposure Pathways

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Total Soil (Surface and Subsurface)	Total Soil (Surface and Subsurface)	SWMU 51	Maintenance Worker	Adult	Ingestion	On-site	Quant	Maintenance workers could contact soil at SWMU 51 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Maintenance workers could contact soil at SWMU 51 and be exposed to COPCs via dermal absorption.
				Industrial Worker	Adult	Ingestion	On-site	Quant	Industrial workers could contact soil at SWMU 51 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Industrial workers could contact soil at SWMU 51 and be exposed to COPCs via dermal absorption.
				Excavation Worker	Adult	Ingestion	On-site	Quant	Excavation workers could contact soil at SWMU 51 and be exposed to COPCs via incidental ingestion.
						Dermal	On-site	Quant	Excavation workers could contact soil at SWMU 51 and be exposed to COPCs via dermal absorption.
				Resident	Adult	Ingestion	On-site	Quant	If SWMU 51 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 51 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
					Child	Ingestion	On-site	Quant	If SWMU 51 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 51 were to be further developed for residential purposes, residents could be exposed to COPCs in total soil via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
						Dermal	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.
		Air	SWMU 51	Maintenance Worker	Adult	Inhalation	On-site	Quant	Maintenance workers could be exposed to airborne volatiles or particulate matter released from soils at SWMU 51.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Industrial workers could be exposed to airborne volatiles or particulate matter released from soils at SWMU 51.
				Excavation Worker	Adult	Inhalation	On-site	Quant	Excavation workers could be exposed to airborne volatiles or particulate matter released from soils at SWMU 51.
				Resident	Adult	Inhalation	On-site	Quant	If SWMU 51 were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
					Child	Inhalation	On-site	Quant	If SWMU 51 were to be further developed for residential purposes, residents could be exposed to airborne volatiles or particulate matter released from total soil.
				Trespasser	Adolescent	Inhalation	On-site	None	Given the industrial nature of the site, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be experienced by a trespasser.

Table E.1-1
Selection of Exposure Pathways

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Groundwater	SWMU 51	Maintenance Worker	Adult	Ingestion	On-site	None	Maintenance workers would not contact groundwater at SWMU 51.
						Dermal	On-site	None	Maintenance workers would not contact groundwater at SWMU 51.
				Industrial Worker	Adult	Ingestion	On-site	Quant	If SWMU 51 were to be further developed for industrial purposes and groundwater wells were installed at the site, site workers could be exposed to COPCs in groundwater via ingestion.
						Dermal	On-site	None	Although site worker dermal exposures to groundwater could occur, the exposed body surface area of a worker (i.e., hands and arms) would be small and exposures would be infrequent.
				Excavation Worker	Adult	Ingestion	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at SWMU 51.
						Dermal	On-site	None	Based on the depth to groundwater, excavation workers would not contact groundwater at SWMU 51.
				Resident	Adult	Ingestion	On-site	Quant	If SWMU 51 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 51 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	On-site	Quant	If SWMU 51 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via ingestion. The residential scenario is not considered to be a reasonably anticipated land use; however, it is being included in this evaluation to meet "clean closure" requirements under RCRA.
						Dermal	On-site	Quant	If SWMU 51 were to be further developed for residential purposes, residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
						Dermal	On-site	None	Due to security at the installation, trespasser exposures are unlikely.
		Homegrown fruits and vegetables	SWMU 51	Resident	Adult	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	On-site	Quant	Residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
		Air	Volatile groundwater COPCs released to ambient air	Maintenance Worker	Adult	Inhalation	On-site	Quant	Volatiles could be released from groundwater into ambient air. Maintenance workers could be exposed via inhalation.
			Indoor Vapors	Industrial Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into buildings via vapor intrusion. Workers could be exposed while working indoors.
			Trench Vapors	Excavation Worker	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into a construction or utility trench via vapor intrusion.
			Volatiles at Showerhead	Resident	Adult	Inhalation	On-site	Quant	If groundwater wells were installed for residential purposes, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	On-site	Quant	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.
			Indoor Vapors	Resident	Adult	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.
					Child	Inhalation	On-site	Quant	Volatiles in groundwater could potentially migrate into residences via vapor intrusion.

Table E.1-1
Selection of Exposure Pathways

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater	Air	Volatile groundwater COPCs released to ambient air	Trespasser	Adolescent	Inhalation	On-site	None	Due to security at the installation, trespasser exposures are unlikely. However, the maintenance worker scenario would be protective of the limited exposures that would be
		Groundwater	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from SWMU 51 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from SWMU 51 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
					Child	Ingestion	Off-site	Quant	If COPCs from SWMU 51 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via ingestion.
						Dermal	Off-site	Quant	If COPCs from SWMU 51 groundwater were to migrate off-site in the future, off-site residents could be exposed to COPCs in groundwater via dermal absorption.
				Trespasser	Adolescent	Ingestion	Off-site	None	Due to security at the installation, trespasser exposures are unlikely.
						Dermal	Off-site	None	Due to security at the installation, trespasser exposures are unlikely.
		Homegrown fruits and vegetables	Off-site	Resident	Adult	Ingestion	Off-site	Quant	If COPCs from SWMU 51 groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
					Child	Ingestion	Off-site	Quant	If COPCs from SWMU 51 groundwater were to migrate off-site in the future, off-site residents could ingest COPCs in groundwater that had been taken up by homegrown fruits and vegetables.
		Air	Volatiles at Showerhead	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 51 groundwater were to migrate to off-site wells in the future, adult residents could contact volatiles in groundwater via showering.
					Child	Inhalation	Off-site	Quant	Children are assumed to bathe rather than shower. Therefore, inhalation exposure is assessed using only indoor air.
			Indoor Vapors	Resident	Adult	Inhalation	Off-site	Quant	If COPCs from SWMU 51 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.
					Child	Inhalation	Off-site	Quant	If COPCs from SWMU 51 groundwater were to migrate off-site in the future, volatiles in groundwater could potentially migrate into off-site residences via vapor intrusion.

Table E.1-2
Occurrence, Distribution and Selection of Chemicals of Potential Concern
Current/Future - Surface Soil - SWMU 51

Scenario Timeframe: Currrent/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	N/A	2,3,7,8-TCDD-TE	7.70E-07	3.31E-06	mg/kg	51SB1A	6/6	N/A	3.31E-06	N/A	4.3E-06 C	N/A	N/A	No	BSL
Surface Soil	35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	2.00E-05	3.80E-05	mg/kg	51SB5A	5/5	N/A	3.80E-05	N/A	N/A	N/A	N/A	No	TEQ
	67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.20E-06 J	1.20E-06 J	mg/kg	51SB3A	1/5	9.40E-07 - 9.90E-07	1.20E-06	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Heptachlorodibenzo-p-dioxin	4.20E-05	7.10E-05	mg/kg	51SB5A	5/5	N/A	7.10E-05	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Heptachlorodibenzofuran	1.20E-06 J	1.20E-06 J	mg/kg	51SB3A	1/5	9.40E-07 - 9.90E-07	1.20E-06	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Hexachlorodibenzo-p-dioxin	2.60E-06 J	6.50E-06	mg/kg	51SB5A	5/5	N/A	6.50E-06	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Pentachlorodibenzo-p-dioxin	2.60E-06 J	2.60E-06 J	mg/kg	51SB5A	1/5	9.40E-07 - 9.90E-07	2.60E-06	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Tetrachlorodibenzo-p-dioxin	2.60E-07 J	2.50E-06	mg/kg	51SB5A	2/5	1.90E-07 - 2.00E-07	2.50E-06	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Tetrachlorodibenzofuran	2.20E-07 J	2.20E-07 J	mg/kg	51SB6A	1/5	1.90E-07 - 2.00E-07	2.20E-07	N/A	N/A	N/A	N/A	No	TEQ
	1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	2.40E-07	2.40E-07	mg/kg	51SB2A	1/5	1.90E-07 - 2.00E-07	2.40E-07	N/A	N/A	N/A	N/A	No	TEQ
	3268-87-9	Octachlorodibenzodioxin	1.90E-03	5.90E-03	mg/kg	51SB5A	5/5	N/A	5.90E-03	N/A	N/A	N/A	N/A	No	TEQ
	39001-02-0	Octachlorodibenzofuran	2.10E-06 J	2.30E-06	mg/kg	51SB6A	2/5	9.00E-07 - 2..0E-06	2.30E-06	N/A	N/A	N/A	N/A	No	TEQ
	99-65-0	1,3-Dinitrobenzene	8.00E-02 J	7.70E-01 J	mg/kg	51SB2A	4/11	1.00E-01 - 1.00E-01	7.70E-01	N/A	7.8E-01 N	N/A	N/A	No	BSL
	118-96-7	2,4,6-Trinitrotoluene	4.00E-02 J	1.30E+00	mg/kg	51SB7A	10/11	1.00E-01 - 1.00E-01	1.30E+00	N/A	3.9E+00 N	N/A	N/A	No	BSL
	121-14-2	2,4-Dinitrotoluene	9.00E-02 J	2.50E+00	mg/kg	51SB4A	9/11	1.00E-01 - 1.00E-01	2.50E+00	N/A	9.4E-01 C	N/A	N/A	Yes	ASL
	606-20-2	2,6-Dinitrotoluene	5.50E-02 J	1.70E+00 J	mg/kg	51SB4A	5/7	1.00E-01 - 1.00E-01	1.70E+00	N/A	9.4E-01 C	N/A	N/A	Yes	ASL
	91-57-6	2-Methylnaphthalene	2.00E-02	2.00E-02	mg/kg	51SB10A	1/11	7.70E-03 - 8.10E-03	2.00E-02	N/A	3.1E+01 N	N/A	N/A	No	BSL
	88-72-2	2-Nitrotoluene	1.40E-01 J	1.10E+02	mg/kg	51SB4A	9/11	2.00E-01 - 2.00E-01	1.10E+02	N/A	7.8E+01 N	N/A	N/A	Yes	ASL
	99-08-1	3-Nitrotoluene	1.05E-01 J	9.20E+00 J	mg/kg	51SB4A	8/11	2.00E-01 - 2.00E-01	9.20E+00	N/A	N/A	N/A	N/A	Yes	NTX
	99-99-0	4-Nitrotoluene	4.45E-01 J	6.20E+01	mg/kg	51SB4A	8/11	2.00E-01 - 2.00E-01	6.20E+01	N/A	3.1E+01 N	N/A	N/A	Yes	ASL
	56-55-3	Benzo(a)anthracene	2.00E-02 J	2.00E-02 J	mg/kg	51SB8A	1/11	7.70E-03 - 8.10E-03	2.00E-02	N/A	2.2E-01 C	N/A	N/A	No	BSL
	50-32-8	Benzo(a)pyrene	8.48E-03 J	8.48E-03 J	mg/kg	51SB8A	1/11	7.70E-03 - 8.10E-03	8.48E-03	N/A	2.2E-02 C	N/A	N/A	No	BSL
	205-99-2	Benzo(b)fluoranthene	2.90E-02 J	2.90E-02 J	mg/kg	51SB8A	1/11	7.70E-03 - 8.10E-03	2.90E-02	N/A	2.2E-01 C	N/A	N/A	No	BSL
	191-24-2	Benzo(g,h,i)perylene	2.60E-02 J	2.60E-02 J	mg/kg	51SB8A	1/11	7.70E-03 - 8.10E-03	2.60E-02	N/A	2.3E+02 N	N/A	N/A	No	BSL
	207-08-9	Benzo(k)fluoranthene	3.70E-02 J	3.70E-02 J	mg/kg	51SB8A	1/11	7.70E-03 - 8.10E-03	3.70E-02	N/A	2.2E+00 C	N/A	N/A	No	BSL
	218-01-9	Chrysene	3.95E-02 J	3.95E-02 J	mg/kg	51SB8A	1/11	7.70E-03 - 8.10E-03	3.95E-02	N/A	2.2E+01 C	N/A	N/A	No	BSL
	53-70-3	Dibenz(a,h)anthracene	4.45E-02 J	4.45E-02 J	mg/kg	51SB8A	1/11	7.70E-03 - 8.10E-03	4.45E-02	N/A	2.2E-02 C	N/A	N/A	Yes	ASL
	84-66-2	Diethyl phthalate	1.20E+00	1.20E+00	mg/kg	51SB7A	1/11	3.90E-01 - 4.10E-01	1.20E+00	N/A	6.3E+03 N	N/A	N/A	No	BSL
	206-44-0	Fluoranthene	1.10E-02 J	2.70E-02	mg/kg	51SB9A	4/11	7.70E-03 - 8.10E-03	2.70E-02	N/A	3.1E+02 N	N/A	N/A	No	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	3.15E-02 J	3.15E-02 J	mg/kg	51SB8A	1/11	7.70E-03 - 8.10E-03	3.15E-02	N/A	2.2E-01 C	N/A	N/A	No	BSL
	98-95-3	Nitrobenzene	4.50E-02 J	1.25E-01	mg/kg	51SB1A	4/11	1.00E-01 - 1.00E-01	1.25E-01	N/A	3.9E+00 N	N/A	N/A	No	BSL
	85-01-8	Phenanthrene	9.95E-03 J	3.00E-02	mg/kg	51SB10A	9/11	7.90E-03 - 7.90E-03	3.00E-02	N/A	2.3E+02 N	N/A	N/A	No	BSL
	129-00-0	Pyrene	7.90E-03	1.35E-02 J	mg/kg	51SB8A	4/11	7.70E-03 - 8.10E-03	1.35E-02	N/A	2.3E+02 N	N/A	N/A	No	BSL
	7429-90-5	Aluminum	1.06E+04	2.81E+04	mg/kg	51SB4A	11/11	N/A	2.81E+04	N/A	7.8E+03 N	N/A	N/A	Yes	ASL
	7440-36-0	Antimony	2.50E-01 J	6.40E-01 L	mg/kg	51SB6A	2/11	4.40E-01 - 8.20E-01	6.40E-01	N/A	3.1E+00 N	N/A	N/A	No	BSL
	7440-38-2	Arsenic	2.80E+00	5.70E+00	mg/kg	51SB5A	11/11	N/A	5.70E+00	N/A	4.3E-01 C	N/A	N/A	Yes	ASL
	7440-39-3	Barium	4.96E+01	1.20E+02	mg/kg	51SB9A	11/11	N/A	1.20E+02	N/A	1.6E+03 N	N/A	N/A	No	BSL
	7440-41-7	Beryllium	4.10E-01	8.00E-01	mg/kg	51SB9A	11/11	N/A	8.00E-01	N/A	1.6E+01 N	N/A	N/A	No	BSL
	7440-43-9	Cadmium	1.30E-01 J	3.60E-01 J	mg/kg	51SB3A	3/6	3.95E-02 - 4.10E-02	3.60E-01	N/A	7.8E+00 N	N/A	N/A	No	BSL
	7440-70-2	Calcium	2.28E+02	4.83E+02	mg/kg	51SB7A	8/8	N/A	4.83E+02	N/A	N/A	1.00E+06	RDA	No	BSL
	7440-47-3	Chromium VI	1.72E+01	3.46E+01	mg/kg	51SB5A	11/11	N/A	3.46E+01	N/A	2.3E+01 N	N/A	N/A	Yes	ASL
	7440-48-4	Cobalt	3.30E+00	1.39E+01	mg/kg	51SB7A	11/11	N/A	1.39E+01	N/A	N/A	N/A	N/A	Yes	NTX

Table E.1-2
Occurrence, Distribution and Selection of Chemicals of Potential Concern
Current/Future - Surface Soil - SWMU 51

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Surface Soil	7440-50-8	Copper	4.70E+00	1.74E+01	mg/kg	51SB5A	11/11	N/A	1.74E+01	N/A	3.1E+02 N	N/A	N/A	No	BSL
	7439-89-6	Iron	1.15E+04	3.16E+04	mg/kg	51SB5A	11/11	N/A	3.16E+04	N/A	5.5E+03 N	N/A	N/A	Yes	ASL
	7439-92-1	Lead	1.10E+01	3.41E+01	mg/kg	51SB7A	11/11	N/A	3.41E+01	N/A	N/A	4.00E+02	USEPA	No	BSL
	7439-95-4	Magnesium	4.83E+02	1.93E+03	mg/kg	51SB5A	11/11	N/A	1.93E+03	N/A	N/A	1.00E+06	RDA	No	BSL
	7439-96-5	Manganese	2.51E+02	7.07E+02	mg/kg	51SB9A	11/11	N/A	7.07E+02	N/A	1.6E+02 N	N/A	N/A	Yes	ASL
	7439-97-6	Mercury	2.40E-02 J	1.00E-01	mg/kg	51SB3A	7/8	1.60E-02 - 1.60E-02	1.00E-01	N/A	2.3E+00 N	N/A	N/A	No	BSL
	7440-02-0	Nickel	4.40E+00	1.32E+01	mg/kg	51SB5A	11/11	N/A	1.32E+01	N/A	1.6E+02 N	N/A	N/A	No	BSL
	7440-09-7	Potassium	3.60E+02	1.61E+03	mg/kg	51SB5A	11/11	N/A	1.61E+03	N/A	N/A	1.00E+06	RDA	No	BSL
	7782-49-2	Selenium	6.05E-01 J	6.05E-01 J	mg/kg	51SB1A	1/11	1.50E-01 - 4.40E-01	6.05E-01	N/A	3.9E+01 N	N/A	N/A	No	BSL
	7440-28-0	Thallium	6.50E-01 J	1.10E+00 J	mg/kg	51SB3A	2/7	3.55E-01 - 5.60E-01	1.10E+00	N/A	5.5E-01 N	N/A	N/A	Yes	ASL
	7440-62-2	Vanadium	2.75E+01	6.41E+01	mg/kg	51SB5A	11/11	N/A	6.41E+01	N/A	7.8E+00 N	N/A	N/A	Yes	ASL
	7440-66-6	Zinc	1.95E+01	3.76E+01	mg/kg	51SB5A	11/11	N/A	3.76E+01	N/A	2.3E+03 N	N/A	N/A	No	BSL

(1) Maximum concentration used for screening.

(2) N/A - Refer to supporting information for background discussion.
Background values derived from site-specific statistical analysis. See text for supporting information.

(3) Screening toxicity values from USEPA Region 3 RBC Table (October 2007). See text for derivation of Nutrient RDAs.

(4) Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Break Down Product (BDP)
No Toxicity Information (NTX)

Deletion Reason: Infrequent Detection (<= 5%, IFD)
Below Background Levels (BKG)
Below Screening and/or ARAR/TBC Level (BSL)

Definitions:
N/A = Not Applicable or Not Available
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
J, K, L = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic
RDA = Recommended Daily Allowance

Table E.1-3
Comparison of Maximum Detection Limits of Non-Detected Compounds to Screening Criteria
Current/Future - Surface Soil - SWMU 51

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Max ND Greater than Screening Value (Y/N)
	99-35-4	1,3,5-Trinitrobenzene			mg/kg		0/12	1.00E-01 - 1.00E-01	1.00E-01	N/A	2.3E+02 N	No
	39638-32-9	2,2'-Oxybis(2-Chloropropane)			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	N/A	NTX
	35572-78-2	2-amino-4,6-Dinitrotoluene			mg/kg		0/12	1.00E-01 - 1.00E-01	1.00E-01	N/A	1.6E+01 N	No
	19406-51-0	4-amino-2,6-Dinitrotoluene			mg/kg		0/12	1.00E-01 - 1.00E-01	1.00E-01	N/A	1.6E+01 N	No
	100-51-6	Benzyl alcohol			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	3.9E+03 N	No
	156-59-2	cis-1,2-Dichloroethene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	7.8E+01 N	No
	121-82-4	Cyclonite			mg/kg		0/12	2.00E-01 - 2.00E-01	2.00E-01	N/A	5.8E+00 C	No
	2691-41-0	HMX			mg/kg		0/12	2.00E-01 - 2.00E-01	2.00E-01	N/A	3.9E+02 N	No
	LHAAP-04	m&p-Xylenes			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	1.6E+03 N	No
	55-63-0	Nitroglycerin			mg/kg		0/12	5.80E+00 - 6.10E+00	6.10E+00	N/A	7.8E-01 N	Yes
	95-47-6	o-Xylene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	1.6E+03 N	No
	78-11-5	Pentaerythritol tetranitrate			mg/kg		0/12	1.00E-01 - 5.00E-01	5.00E-01	N/A	N/A	NTX
	110-86-1	Pyridine			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	7.8E+00 N	No
	479-45-8	Tetryl			mg/kg		0/12	2.00E-01 - 2.00E-01	2.00E-01	N/A	3.1E+01 N	No
	156-60-5	trans-1,2-Dichloroethene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	1.6E+02 N	No
	7440-22-4	Silver			mg/kg		0/12	1.20E-01 - 1.30E-01	1.30E-01	N/A	3.9E+01 N	No
	7440-23-5	Sodium			mg/kg		0/12	6.19E+01 - 8.45E+01	8.45E+01	N/A	N/A	No
	57-12-5	Total Cyanide			mg/kg		0/12	1.50E-01 - 1.80E-01	1.80E-01	N/A	1.6E+02 N	No
	93-76-5	2,4,5-T			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	7.8E+01 N	No
	93-72-1	2,4,5-TP (Silvex)			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	6.3E+01 N	No
	94-75-7	2,4-D			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	7.8E+01 N	No
	94-82-6	2,4-DB			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	6.3E+01 N	No
	72-54-8	4,4'-DDD			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	2.7E+00 C	No
	72-55-9	4,4'-DDE			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.9E+00 C	No
	50-29-3	4,4'-DDT			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.9E+00 C	No
	309-00-2	Aldrin			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	3.8E-02 C	No
	319-84-6	alpha-BHC			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.0E-01 C	No
	5103-71-9	alpha-Chlordane			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.8E+00 C	No
	319-85-7	beta-BHC			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	3.5E-01 C	No
	75-99-0	Dalapon			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	2.3E+02 N	No
	319-86-8	delta-BHC			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	N/A	No
	1918-00-9	Dicamba			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	2.3E+02 N	No
	120-36-5	Dichloroprop			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	N/A	NTX
	959-98-8	Endosulfan I			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	4.7E+01 N	No
	33213-65-9	Endosulfan II			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	4.7E+01 N	No
	1031-07-8	Endosulfan sulfate			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	4.7E+01 N	No
	72-20-8	Endrin			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	2.3E+00 N	No

Table E.1-3
Comparison of Maximum Detection Limits of Non-Detected Compounds to Screening Criteria
Current/Future - Surface Soil - SWMU 51

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Max ND Greater than Screening Value (Y/N)
	7421-93-4	Endrin aldehyde			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	2.3E+00 N	No
	53494-70-5	Endrin ketone			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	2.3E+00 N	No
	58-89-9	gamma-BHC (Lindane)			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	4.9E-01 C	No
	5103-74-2	gamma-Chlordane			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.8E+00 C	No
	76-44-8	Heptachlor			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.4E-01 C	No
	1024-57-3	Heptachlor epoxide			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	7.0E-02 C	No
	94-74-6	MCPA			mg/kg		0/6	1.20E+01 - 1.20E+01	1.20E+01	N/A	3.9E+00 N	Yes
	93-65-2	MCPP			mg/kg		0/6	1.20E+01 - 1.20E+01	1.20E+01	N/A	7.8E+00 N	Yes
	72-43-5	Methoxychlor			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	3.9E+01 N	No
	8001-35-2	Toxaphene			mg/kg		0/6	3.90E-02 - 4.10E-02	4.10E-02	N/A	5.8E-01 C	No
	12674-11-2	Aroclor 1016			mg/kg		0/6	3.90E-02 - 4.10E-02	4.10E-02	N/A	5.5E-01 N	No
	11104-28-2	Aroclor 1221			mg/kg		0/6	3.90E-02 - 4.10E-02	4.10E-02	N/A	3.2E-01 C	No
	11141-16-5	Aroclor 1232			mg/kg		0/6	3.90E-02 - 4.10E-02	4.10E-02	N/A	3.2E-01 C	No
	53469-21-9	Aroclor 1242			mg/kg		0/6	3.90E-02 - 4.10E-02	4.10E-02	N/A	3.2E-01 C	No
	12672-29-6	Aroclor 1248			mg/kg		0/6	3.90E-02 - 4.10E-02	4.10E-02	N/A	3.2E-01 C	No
	11097-69-1	Aroclor 1254			mg/kg		0/6	3.90E-02 - 4.10E-02	4.10E-02	N/A	1.6E-01 N	No
	11096-82-5	Aroclor 1260			mg/kg		0/6	3.90E-02 - 4.10E-02	4.10E-02	N/A	3.2E-01 C	No
	131-11-3	Dimethylphthalate			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	N/A	NTX
	120-82-1	1,2,4-Trichlorobenzene			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	7.8E+01 N	No
	95-50-1	1,2-Dichlorobenzene			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	7.0E+02 N	No
	541-73-1	1,3-Dichlorobenzene			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	2.3E+01 N	No
	106-46-7	1,4-Dichlorobenzene			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	2.7E+01 C	No
	95-95-4	2,4,5-Trichlorophenol			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	7.8E+02 N	No
	88-06-2	2,4,6-Trichlorophenol			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	7.8E+00 N	No
	120-83-2	2,4-Dichlorophenol			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	2.3E+01 N	No
	105-67-9	2,4-Dimethylphenol			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	1.6E+02 N	No
	51-28-5	2,4-Dinitrophenol			mg/kg		0/12	7.70E-01 - 8.10E-01	8.10E-01	N/A	1.6E+01 N	No
	91-58-7	2-Chloronaphthalene			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	6.3E+02 N	No
	95-57-8	2-Chlorophenol			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	3.9E+01 N	No
	88-74-4	2-Nitroaniline			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	N/A	NTX
	88-75-5	2-Nitrophenol			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	N/A	NTX
	88-85-7	2-sec-butyl-4,6-dinitrophenol			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	7.8E+00 N	No
	91-94-1	3,3'-Dichlorobenzidine			mg/kg		0/12	7.70E-01 - 8.10E-01	8.10E-01	N/A	1.4E+00 C	No
	99-09-2	3-Nitroaniline			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	N/A	NTX
	534-52-1	4,6-Dinitro-o-cresol			mg/kg		0/12	7.70E-01 - 8.10E-01	8.10E-01	N/A	N/A	No
	100-01-6	4-Nitroaniline			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	N/A	NTX
	100-02-7	4-Nitrophenol			mg/kg		0/12	7.70E-01 - 8.10E-01	8.10E-01	N/A	N/A	NTX

Table E.1-3
Comparison of Maximum Detection Limits of Non-Detected Compounds to Screening Criteria
Current/Future - Surface Soil - SWMU 51

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Max ND Greater than Screening Value (Y/N)
	83-32-9	Acenaphthene			mg/kg		0/12	7.70E-03 - 8.10E-03	8.10E-03	N/A	4.7E+02 N	No
	208-96-8	Acenaphthylene			mg/kg		0/12	7.70E-03 - 8.10E-03	8.10E-03	N/A	N/A	NTX
	120-12-7	Anthracene			mg/kg		0/12	7.70E-03 - 8.10E-03	8.10E-03	N/A	2.3E+03 N	No
	65-85-0	Benzoic Acid			mg/kg		0/12	7.70E-01 - 8.10E-01	8.10E-01	N/A	3.1E+04 N	No
	111-91-1	bis(2-Chloroethoxy)methane			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	N/A	NTX
	111-44-4	bis(2-Chloroethyl)ether			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	5.8E-01 C	No
	117-81-7	bis(2-Ethylhexyl) phthalate			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	4.6E+01 C	No
	85-68-7	Butyl benzyl phthalate			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	1.6E+03 N	No
	86-74-8	Carbazole			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	3.2E+01 C	No
	132-64-9	Dibenzofuran			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	7.8E+00 N	No
	84-74-2	Di-n-butyl phthalate			mg/kg		0/10	3.90E-01 - 4.10E-01	4.10E-01	N/A	7.8E+02 N	No
	117-84-0	Di-n-octyl phthalate			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	N/A	NTX
	86-73-7	Fluorene			mg/kg		0/12	7.70E-03 - 8.10E-03	8.10E-03	N/A	3.1E+02 N	No
	118-74-1	Hexachlorobenzene			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	4.0E-01 C	Yes
	87-68-3	Hexachlorobutadiene			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	7.8E+00 N	No
	77-47-4	Hexachlorocyclopentadiene			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	4.7E+01 N	No
	67-72-1	Hexachloroethane			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	7.8E+00 N	No
	78-59-1	Isophorone			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	6.7E+02 C	No
	91-20-3	Naphthalene			mg/kg		0/10	7.70E-03 - 8.10E-03	8.10E-03	N/A	1.6E+02 N	No
	621-64-7	n-Nitroso-di-n-propylamine			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	9.1E-02 C	Yes
	86-30-6	n-Nitrosodiphenylamine			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	1.3E+02 C	No
	95-48-7	o-Cresol			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	3.9E+02 N	No
	106-47-8	p-Chloroaniline			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	3.1E+01 N	No
	59-50-7	p-Chloro-m-cresol			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	N/A	NTX
	106-44-5	p-Cresol			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	3.9E+01 N	No
	87-86-5	Pentachlorophenol			mg/kg		0/12	7.70E-01 - 8.10E-01	8.10E-01	N/A	5.3E+00 C	No
	108-95-2	Phenol			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	2.3E+03 N	No
	71-55-6	1,1,1-Trichloroethane			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	1.6E+04 N	No
	79-34-5	1,1,2,2-Tetrachloroethane			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	3.2E+00 C	No
	79-00-5	1,1,2-Trichloroethane			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	1.1E+01 C	No
	75-34-3	1,1-Dichloroethane			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	1.6E+03 N	No
	75-35-4	1,1-Dichloroethene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	3.9E+02 N	No
	107-06-2	1,2-Dichloroethane			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	7.0E+00 C	No
	78-87-5	1,2-Dichloropropane			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	9.4E+00 C	No
	78-93-3	2-Butanone			mg/kg		1/2	9.75E-03 - 9.75E-03	9.75E-03	N/A	4.7E+03 N	No
	591-78-6	2-Hexanone			mg/kg		0/12	9.20E-03 - 1.10E-02	1.10E-02	N/A	N/A	NTX
	101-55-3	4-Bromophenyl phenylether			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	N/A	NTX

Table E.1-3
Comparison of Maximum Detection Limits of Non-Detected Compounds to Screening Criteria
Current/Future - Surface Soil - SWMU 51

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Max ND Greater than Screening Value (Y/N)
	7005-72-3	4-Chlorophenyl phenylether			mg/kg		0/12	3.90E-01 - 4.10E-01	4.10E-01	N/A	N/A	NTX
	108-10-1	4-Methyl-2-pentanone			mg/kg		0/12	9.20E-03 - 1.10E-02	1.10E-02	N/A	N/A	NTX
	67-64-1	Acetone			mg/kg		0/12	1.40E-02 - 1.10E-01	1.10E-01	N/A	7.0E+03 N	No
	71-43-2	Benzene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	1.2E+01 C	No
	75-27-4	Bromodichloromethane			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	1.0E+01 C	No
	74-83-9	Bromomethane			mg/kg		0/12	9.20E-03 - 1.10E-02	1.10E-02	N/A	1.1E+01 N	No
	75-15-0	Carbon disulfide			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	7.8E+02 N	No
	56-23-5	Carbon tetrachloride			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	4.9E+00 C	No
	108-90-7	Chlorobenzene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	1.6E+02 N	No
	75-00-3	Chloroethane			mg/kg		0/12	9.20E-03 - 1.10E-02	1.10E-02	N/A	2.2E+02 C	No
	67-66-3	Chloroform			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	7.8E+01 C	No
	74-87-3	Chloromethane			mg/kg		0/12	9.20E-03 - 1.10E-02	1.10E-02	N/A	N/A	NTX
	10061-01-5	cis-1,3-Dichloro-1-propene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	6.4E+00 C	No
	124-48-1	Dibromochloromethane			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	7.6E+00 C	No
	100-41-4	Ethylbenzene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	7.8E+02 N	No
	75-09-2	Methylene chloride			mg/kg		0/12	1.15E-03 - 1.00E-02	1.00E-02	N/A	8.5E+01 C	No
	100-42-5	Styrene			mg/kg		0/10	4.60E-03 - 5.20E-03	5.20E-03	N/A	1.6E+03 N	No
	127-18-4	Tetrachloroethene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	1.2E+00 C	No
	108-88-3	Toluene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	6.3E+02 N	No
	10061-02-6	trans-1,3-Dichloropropene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	6.4E+00 C	No
	75-25-2	Tribromomethane			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	8.1E+01 C	No
	79-01-6	Trichloroethene			mg/kg		0/12	4.60E-03 - 5.50E-03	5.50E-03	N/A	1.6E+00 C	No
	75-01-4	Vinyl Chloride			mg/kg		0/12	9.20E-03 - 1.10E-02	1.10E-02	N/A	9.0E-02 C	No

(1) Maximum concentration used for screening.

(2) N/A - Refer to supporting information for background discussion.
Background values derived from site-specific statistical analysis. See text for supporting information.

(3) Screening toxicity values from USEPA Region 3 RBC Table (October 2007).
RBCs are based on a risk level of 1.0E-06 and an HQ = 0.1. See text for derivation of Nutrient RDAs.

Definitions:
N/A = Not Applicable or Not Available
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogenic
N = Non-Carcinogenic
RDA = Recommended Daily Allowance
NTX = No Toxicity Information

Table E.1-4
Occurrence, Distribution and Selection of Chemicals of Potential Concern
Future - Total Soil - SWMU 51

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Total Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Total Soil	N/A	2,3,7,8-TCDD TE	1.53E-07	1.48E-04	mg/kg	51SB6B	14/14	N/A	1.48E-04	N/A	4.3E-06 C	N/A	N/A	Yes	ASL
	67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.20E-06 J	9.70E-04	mg/kg	51SB6B	9/14	9.40E-01 - 9.90E-01	9.70E-04	N/A	N/A	N/A	N/A	No	TEQ
	35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	6.60E-06	2.80E-03	mg/kg	51SB6B	14/14	N/A	2.80E-03	N/A	N/A	N/A	N/A	No	TEQ
	55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	3.10E-05 J	5.50E-05	mg/kg	51SB6B	5/14	9.40E-01 - 9.30E+00	5.50E-05	N/A	N/A	N/A	N/A	No	TEQ
	70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	7.40E-05	1.30E-04 J	mg/kg	51SB6B	5/14	9.40E-01 - 9.30E+00	1.30E-04	N/A	N/A	N/A	N/A	No	TEQ
	39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	1.00E-05 J	4.60E-05	mg/kg	51SB6B	5/14	9.40E-01 - 9.30E+00	4.60E-05	N/A	N/A	N/A	N/A	No	TEQ
	57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.20E-05 J	4.10E-05	mg/kg	51SB6B	5/14	9.40E-01 - 9.30E+00	4.10E-05	N/A	N/A	N/A	N/A	No	TEQ
	57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	1.20E-06 J	1.20E-04	mg/kg	51SB6B	6/14	9.40E-01 - 9.30E+00	1.20E-04	N/A	N/A	N/A	N/A	No	TEQ
	72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	1.00E-05	1.70E-05	mg/kg	51SB4B	5/14	9.40E-01 - 9.30E+00	1.70E-05	N/A	N/A	N/A	N/A	No	TEQ
	19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	2.20E-06 J	8.60E-05	mg/kg	51SB6B	6/14	9.40E-01 - 9.30E+00	8.60E-05	N/A	N/A	N/A	N/A	No	TEQ
	57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	2.20E-05 J	4.30E-05	mg/kg	51SB4B	5/14	9.40E-01 - 9.30E+00	4.30E-05	N/A	N/A	N/A	N/A	No	TEQ
	40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	4.60E-06 J	2.70E-05	mg/kg	51SB6B	4/14	9.40E-01 - 9.70E+00	2.70E-05	N/A	N/A	N/A	N/A	No	TEQ
	51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	4.70E-07 J	1.60E-04	mg/kg	51SB5B	8/14	1.90E-01 - 2.00E-01	1.60E-04	N/A	N/A	N/A	N/A	No	TEQ
	Shaw 05	Total Heptachlorodibenzofuran	1.20E-06 J	2.90E-03	mg/kg	51SB6B	9/14	9.40E-01 - 9.90E-01	2.90E-03	N/A	N/A	N/A	N/A	No	TEQ
	Shaw 04	Total Heptachlorodibenzo-p-dioxin	1.20E-05	4.90E-03	mg/kg	51SB6B	14/14	N/A	4.90E-03	N/A	N/A	N/A	N/A	No	TEQ
	Shaw 07	Total Hexachlorodibenzofuran	1.30E-06 J	1.40E-03	mg/kg	51SB6B	8/14	9.40E-01 - 9.90E-01	1.40E-03	N/A	N/A	N/A	N/A	No	TEQ
	Shaw 06	Total Hexachlorodibenzo-p-dioxin	1.50E-06 J	7.80E-04	mg/kg	51SB6B	12/14	9.80E-01 - 9.30E+00	7.80E-04	N/A	N/A	N/A	N/A	No	TEQ
	Shaw 09	Total Pentachlorodibenzofuran	1.40E-06 J	6.00E-04	mg/kg	51SB5B	6/14	9.40E-01 - 9.30E+00	6.00E-04	N/A	N/A	N/A	N/A	No	TEQ
	Shaw 08	Total Pentachlorodibenzo-p-dioxin	2.60E-06 J	1.00E-04	mg/kg	51SB6B	6/14	9.40E-01 - 9.70E+00	1.00E-04	N/A	N/A	N/A	N/A	No	TEQ
	Shaw 11	Total Tetrachlorodibenzofuran	2.20E-07 J	6.90E-04	mg/kg	51SB2B	10/14	1.90E-01 - 2.00E-01	6.90E-04	N/A	N/A	N/A	N/A	No	TEQ
	Shaw 10	Total Tetrachlorodibenzo-p-dioxin	2.60E-07 J	8.90E-06	mg/kg	51SB6B	6/14	1.90E-01 - 1.90E+00	8.90E-06	N/A	N/A	N/A	N/A	No	TEQ
	60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	2.60E-05	5.20E-05	mg/kg	51SB6B	5/14	9.40E-01 - 9.30E+00	5.20E-05	N/A	N/A	N/A	N/A	No	TEQ
	57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	4.90E-05 J	9.00E-05	mg/kg	51SB3B	5/14	9.40E-01 - 9.30E+00	9.00E-05	N/A	N/A	N/A	N/A	No	TEQ
	1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	2.40E-07	4.50E-06	mg/kg	51SB2B	6/14	1.90E-01 - 1.90E+00	4.50E-06	N/A	N/A	N/A	N/A	No	TEQ
	3268-87-9	Octachlorodibenzodioxin	1.30E-04	2.30E-02	mg/kg	51SB6B	14/14	N/A	2.30E-02	N/A	N/A	N/A	N/A	No	TEQ
	39001-02-0	Octachlorodibenzofuran	2.10E-06 J	2.40E-03	mg/kg	51SB6B	11/14	1.90E+00 - 2.00E+00	2.40E-03	N/A	N/A	N/A	N/A	No	TEQ
	71-55-6	1,1,1-Trichloroethane	1.70E-03 J	4.90E-02	mg/kg	51SB3B	4/25	4.60E-03 - 2.90E-02	4.90E-02	N/A	1.6E+04 N	N/A	N/A	No	BSL
	99-35-4	1,3,5-Trinitrobenzene	7.00E-02 L	8.50E+02	mg/kg	51SB6B	11/25	1.00E-01 - 1.00E+02	8.50E+02	N/A	2.3E+02 N	N/A	N/A	Yes	ASL
	99-65-0	1,3-Dinitrobenzene	8.00E-02 J	4.60E+02 J	mg/kg	51SB2B	12/25	1.00E-01 - 1.00E+01	4.60E+02	N/A	7.8E-01 N	N/A	N/A	Yes	ASL
	118-96-7	2,4,6-Trinitrotoluene	4.00E-02 J	6.10E+04 J	mg/kg	51SB6B	23/25	1.00E-01 - 1.00E-01	6.10E+04	N/A	3.9E+00 N	N/A	N/A	Yes	ASL
	51-28-5	2,4-Dinitrophenol	5.50E-01 J	5.50E-01 J	mg/kg	51SB4C	1/25	7.50E-01 - 1.80E+03	5.50E-01	N/A	1.6E+01 N	N/A	N/A	No	BSL
	121-14-2	2,4-Dinitrotoluene	4.00E-02 J	4.40E+04	mg/kg	51SB3B	22/25	1.00E-01 - 1.00E-01	4.40E+04	N/A	9.4E-01 C	N/A	N/A	Yes	ASL
	606-20-2	2,6-Dinitrotoluene	5.50E-02 J	1.10E+04 J	mg/kg	51SB3B	14/18	1.00E-01 - 1.00E-01	1.10E+04	N/A	9.4E-01 C	N/A	N/A	Yes	ASL
	35572-78-2	2-amino-4,6-Dinitrotoluene	5.00E-02 J	3.20E+01 L	mg/kg	51SB3C	2/25	1.00E-01 - 1.00E+02	3.20E+01	N/A	N/A	N/A	N/A	Yes	NTX
	591-78-6	2-Hexanone	6.20E-03 J	2.10E-02 J	mg/kg	51SB4B	4/25	9.20E-03 - 5.80E-02	2.10E-02	N/A	N/A	N/A	N/A	Yes	NTX
	91-57-6	2-Methylnaphthalene	2.00E-02	2.00E-02	mg/kg	51SB10A	1/25	7.50E-03 - 9.00E+02	2.00E-02	N/A	3.1E+01 N	N/A	N/A	No	BSL
	88-74-4	2-Nitroaniline	4.50E+01	4.50E+01	mg/kg	51SB6B	1/25	3.70E-01 - 9.00E+02	4.50E+01	N/A	N/A	N/A	N/A	Yes	NTX
	88-72-2	2-Nitrotoluene	1.40E-01 J	2.50E+04	mg/kg	51SB3B	21/25	2.00E-01 - 2.00E-01	2.50E+04	N/A	7.8E+01 N	N/A	N/A	Yes	ASL
	99-08-1	3-Nitrotoluene	1.05E-01 J	2.10E+03 J	mg/kg	51SB3B	19/25	2.00E-01 - 2.00E-01	2.10E+03	N/A	N/A	N/A	N/A	Yes	NTX
	534-52-1	4,6-Dinitro-o-cresol	2.10E+00	2.70E+00 J	mg/kg	51SB3C	2/25	7.50E-01 - 1.80E+03	2.70E+00	N/A	N/A	N/A	N/A	Yes	NTX
	108-10-1	4-Methyl-2-pentanone	6.90E-03 J	1.60E-01	mg/kg	51SB3B	6/25	9.20E-03 - 5.80E-02	1.60E-01	N/A	N/A	N/A	N/A	Yes	NTX
	99-99-0	4-Nitrotoluene	1.90E-01 J	1.60E+04 J	mg/kg	51SB3B	20/25	2.00E-01 - 2.00E-01	1.60E+04	N/A	3.1E+01 N	N/A	N/A	Yes	ASL
	7429-90-5	Aluminum	8.62E+03	2.97E+04	mg/kg	51SB2B	25/25	N/A	2.97E+04	N/A	7.8E+03 N	N/A	N/A	Yes	ASL
	7440-36-0	Antimony	2.50E-01 J	5.40E+00 J	mg/kg	51SB3B	4/18	3.00E-01 - 8.20E-01	5.40E+00	N/A	3.1E+00 N	N/A	N/A	Yes	ASL
	7440-38-2	Arsenic	1.50E+00 J	1.53E+01	mg/kg	51SB3B	21/21	N/A	1.53E+01	N/A	4.3E-01 C	N/A	N/A	Yes	ASL
	7440-39-3	Barium	3.36E+01	1.77E+02	mg/kg	51SB3B	25/25	N/A	1.77E+02	N/A	1.6E+03 N	N/A	N/A	No	BSL
	71-43-2	Benzene	1.30E-01	1.90E-01	mg/kg	51SB3B	3/23	4.60E-03 - 2.90E-02	1.90E-01	N/A	1.2E+01 C	N/A	N/A	No	BSL
	56-55-3	Benzo(a)anthracene	2.00E-02 J	2.00E-02 J	mg/kg	51SB8A	1/25	7.50E-03 - 9.00E+02	2.00E-02	N/A	2.2E-01 C	N/A	N/A	No	BSL

Table E.1-4
Occurrence, Distribution and Selection of Chemicals of Potential Concern
Future - Total Soil - SWMU 51

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Total Soil	50-32-8	Benzo(a)pyrene	8.48E-03 J	8.48E-03 J	mg/kg	51SB8A	1/25	7.50E-03 - 9.00E+02	8.48E-03	N/A	2.2E-02 C	N/A	N/A	No	BSL
	205-99-2	Benzo(b)fluoranthene	2.90E-02 J	2.90E-02 J	mg/kg	51SB8A	1/25	7.50E-03 - 9.00E+02	2.90E-02	N/A	2.2E-01 C	N/A	N/A	No	BSL
	191-24-2	Benzo(g,h,i)perylene	2.60E-02 J	2.60E-02 J	mg/kg	51SB8A	1/25	7.50E-03 - 9.00E+02	2.60E-02	N/A	2.3E+02 N	N/A	N/A	No	BSL
	207-08-9	Benzo(k)fluoranthene	3.70E-02 J	3.70E-02 J	mg/kg	51SB8A	1/25	7.50E-03 - 9.00E+02	3.70E-02	N/A	2.2E+00 C	N/A	N/A	No	BSL
	7440-41-7	Beryllium	3.30E-01	1.20E+00	mg/kg	51SB2B	25/25	N/A	1.20E+00	N/A	1.6E+01 N	N/A	N/A	No	BSL
	117-81-7	bis(2-Ethylhexyl) phthalate	4.70E-02 J	3.20E+01 J	mg/kg	51SB4B	4/23	3.70E-01 - 9.00E+02	3.20E+01	N/A	4.6E+01 C	N/A	N/A	No	BSL
	7440-43-9	Cadmium	1.30E-01 J	6.50E+00	mg/kg	51SB2B	9/16	3.60E-02 - 4.30E-02	6.50E+00	N/A	7.8E+00 N	N/A	N/A	No	BSL
	7440-70-2	Calcium	1.67E+02	2.96E+04	mg/kg	51SB6B	16/16	N/A	2.96E+04	N/A	N/A	1.00E+06	RDA	No	BSL
	67-66-3	Chloroform	6.90E-03 J	6.90E-03 J	mg/kg	51SB3B	1/25	4.60E-03 - 2.90E-02	6.90E-03	N/A	7.8E+01 N	N/A	N/A	No	BSL
	7440-47-3	Chromium VI	1.30E+01	5.33E+02	mg/kg	51SB5B	25/25	N/A	5.33E+02	N/A	2.3E+01 N	N/A	N/A	Yes	ASL
	218-01-9	Chrysene	3.95E-02 J	3.95E-02 J	mg/kg	51SB8A	1/25	7.50E-03 - 9.00E+02	3.95E-02	N/A	2.2E+01 C	N/A	N/A	No	BSL
	7440-48-4	Cobalt	3.20E+00	1.79E+02	mg/kg	51SB7B	25/25	N/A	1.79E+02	N/A	N/A	N/A	N/A	Yes	NTX
	7440-50-8	Copper	4.60E+00	3.60E+02	mg/kg	51SB6B	25/25	N/A	3.60E+02	N/A	3.1E+02 N	N/A	N/A	Yes	ASL
	121-82-4	Cyclonite	1.20E+00 J	5.30E+00 J	mg/kg	51SB4C	3/25	2.00E-01 - 2.00E+02	5.30E+00	N/A	5.8E+00 C	N/A	N/A	No	BSL
	53-70-3	Dibenz(a,h)anthracene	4.45E-02 J	4.45E-02 J	mg/kg	51SB8A	1/25	7.50E-03 - 9.00E+02	4.45E-02	N/A	2.2E-02 C	N/A	N/A	Yes	ASL
	84-66-2	Diethyl phthalate	1.20E+00	4.40E+02	mg/kg	51SB6B	2/25	3.70E-01 - 9.00E+02	4.40E+02	N/A	6.3E+03 N	N/A	N/A	No	BSL
	100-41-4	Ethylbenzene	2.40E-02	4.60E-02	mg/kg	51SB3B	3/25	4.60E-03 - 2.90E-02	4.60E-02	N/A	7.8E+02 N	N/A	N/A	No	BSL
	206-44-0	Fluoranthene	1.10E-02 J	2.50E+00 J	mg/kg	51SB6B	5/25	7.50E-03 - 9.00E+02	2.50E+00	N/A	3.1E+02 N	N/A	N/A	No	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	3.15E-02 J	3.15E-02 J	mg/kg	51SB8A	1/25	7.50E-03 - 9.00E+02	3.15E-02	N/A	2.2E-01 C	N/A	N/A	No	BSL
	7439-89-6	Iron	1.15E+04	1.91E+05	mg/kg	51SB2B	25/25	N/A	1.91E+05	N/A	5.5E+03 N	N/A	N/A	Yes	ASL
	7439-92-1	Lead	4.20E+00	4.18E+03	mg/kg	51SB6B	25/25	N/A	4.18E+03	N/A	N/A	4.00E+02	USEPA	Yes	ASL
	LHAAP-04	m&p-Xylenes	1.80E-02 J	1.40E-01	mg/kg	51SB3B	4/24	4.60E-03 - 2.90E-02	1.40E-01	N/A	1.6E+03 N	N/A	N/A	No	BSL
	7439-95-4	Magnesium	4.83E+02	4.95E+03	mg/kg	51SB6B	25/25	N/A	4.95E+03	N/A	N/A	1.00E+06	RDA	No	BSL
	7439-96-5	Manganese	1.40E+02	3.59E+03	mg/kg	51SB7B	25/25	N/A	3.59E+03	N/A	1.6E+02 N	N/A	N/A	Yes	ASL
	7439-97-6	Mercury	2.30E-02 J	1.10E+00	mg/kg	51SB3B	13/21	1.50E-02 - 1.60E-02	1.10E+00	N/A	2.3E+00 N	N/A	N/A	No	BSL
	7440-02-0	Nickel	4.40E+00	1.29E+02	mg/kg	51SB2B	25/25	N/A	1.29E+02	N/A	1.6E+02 N	N/A	N/A	No	BSL
	98-95-3	Nitrobenzene	4.50E-02 J	9.30E-01 L	mg/kg	51SB3C	8/25	1.00E-01 - 1.00E+02	9.30E-01	N/A	3.9E+00 N	N/A	N/A	No	BSL
	55-63-0	Nitroglycerin	3.30E+03	3.30E+03	mg/kg	51SB6B	1/25	5.60E+00 - 2.70E+04	3.30E+03	N/A	7.8E-01 N	N/A	N/A	Yes	ASL
	86-30-6	n-Nitrosodiphenylamine	4.50E-02 J	4.50E-02 J	mg/kg	51SB7B	1/25	3.70E-01 - 9.00E+02	4.50E-02	N/A	1.3E+02 C	N/A	N/A	No	BSL
	95-47-6	o-Xylene	8.20E-03 J	3.90E-02	mg/kg	51SB3B	4/24	4.60E-03 - 2.90E-02	3.90E-02	N/A	1.6E+03 N	N/A	N/A	No	BSL
	78-11-5	Pentaerythritol tetranitrate	6.20E+01 J	6.20E+01 J	mg/kg	51SB5B	1/25	1.00E-01 - 5.00E-01	6.20E+01	N/A	N/A	N/A	N/A	Yes	NTX
	85-01-8	Phenanthrene	8.40E-03 J	3.00E-02	mg/kg	51SB10A	14/25	7.60E-03 - 9.00E+02	3.00E-02	N/A	2.3E+02 N	N/A	N/A	No	BSL
	7440-09-7	Potassium	3.60E+02	1.61E+03	mg/kg	51SB5A	25/25	N/A	1.61E+03	N/A	N/A	1.00E+06	RDA	No	BSL
	129-00-0	Pyrene	7.90E-03	2.00E+00 J	mg/kg	51SB6B	5/25	7.50E-03 - 9.00E+02	2.00E+00	N/A	2.3E+02 N	N/A	N/A	No	BSL
	7782-49-2	Selenium	6.05E-01 J	6.05E-01 J	mg/kg	51SB1A	1/22	1.40E-01 - 1.30E+00	6.05E-01	N/A	3.9E+01 N	N/A	N/A	No	BSL
	7440-22-4	Silver	2.40E-01 J	7.30E-01 K	mg/kg	51SB3B	5/25	1.10E-01 - 6.30E-01	7.30E-01	N/A	3.9E+01 N	N/A	N/A	No	BSL
	7440-23-5	Sodium	2.71E+03	2.71E+03	mg/kg	51SB2B	1/25	6.19E+01 - 3.06E+03	2.71E+03	N/A	N/A	1.00E+06	RDA	No	BSL
	127-18-4	Tetrachloroethene	9.30E-03 J	1.50E-02 J	mg/kg	51SB3B	3/25	4.60E-03 - 2.90E-02	1.50E-02	N/A	1.2E+00 C	N/A	N/A	No	BSL
	7440-28-0	Thallium	6.50E-01 J	5.90E+00 J	mg/kg	51SB3B	5/17	3.55E-01 - 2.80E+00	5.90E+00	N/A	5.5E-01 N	N/A	N/A	Yes	ASL
	108-88-3	Toluene	2.80E-02 J	5.10E+01	mg/kg	51SB3B	5/22	4.60E-03 - 2.90E-02	5.10E+01	N/A	6.3E+02 N	N/A	N/A	No	BSL
	57-12-5	Total Cyanide	2.10E-01	2.20E+01	mg/kg	51SB4B	8/25	1.50E-01 - 3.20E-01	2.20E+01	N/A	1.6E+02 N	N/A	N/A	No	BSL
	79-01-6	Trichloroethene	1.70E-03 J	3.20E-02	mg/kg	51SB3B	5/24	4.60E-03 - 2.90E-02	3.20E-02	N/A	1.6E+00 C	N/A	N/A	No	BSL
	7440-62-2	Vanadium	2.12E+01	6.61E+01	mg/kg	51SB7B	25/25	N/A	6.61E+01	N/A	7.8E+00 N	N/A	N/A	Yes	ASL
	7440-66-6	Zinc	1.90E+01	5.73E+02	mg/kg	51SB6B	24/24	N/A	5.73E+02	N/A	2.3E+03 N	N/A	N/A	No	BSL

(1) Maximum concentration used for screening.

(2) N/A - Refer to supporting information for background discussion.
Background values derived from site-specific statistical analysis. See text for supporting information.

(3) Screening toxicity values from USEPA Region 3 RBC Table (October 2007). See text for derivation of Nutrient RDAs.

(4) Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Break Down Product (BDP)
No Toxicity Information (NTX)

Deletion Reason: Infrequent Detection (<= 5%, IFD)
Below Screening and/or ARAR/TBC Level (BSL)

Definitions:
N/A = Not Applicable or Not Available
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
J, K, L = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic
RDA = Recommended Daily Allowance

Table E.1-5
Comparison of Maximum Detection Limits of Non-Detected Compounds to Screening Criteria
Future - Total Soil - SWMU 51

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Total Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Max ND Greater than Screening Value (Y/N)
	39638-32-9	2,2'-Oxybis(2-Chloropropane)			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	N/A	NTX
	19406-51-0	4-amino-2,6-Dinitrotoluene			mg/kg		0/25	1.00E-01 - 1.00E+02	1.00E+02	N/A	1.6E+01 N	Yes
	100-51-6	Benzyl alcohol			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	3.9E+03 N	No
	156-59-2	cis-1,2-Dichloroethene			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	7.8E+01 N	No
	2691-41-0	HMX			mg/kg		0/25	2.00E-01 - 2.00E+02	2.00E+02	N/A	3.9E+02 N	No
	110-86-1	Pyridine			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	7.8E+00 N	Yes
	479-45-8	Tetryl			mg/kg		0/25	2.00E-01 - 2.00E+02	2.00E+02	N/A	3.1E+01 N	Yes
	156-60-5	trans-1,2-Dichloroethene			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	1.6E+02 N	No
	93-76-5	2,4,5-T			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	7.8E+01 N	No
	93-72-1	2,4,5-TP (Silvex)			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	6.3E+01 N	No
	94-75-7	2,4-D			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	7.8E+01 N	No
	94-82-6	2,4-DB			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	6.3E+01 N	No
	72-54-8	4,4'-DDD			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	2.7E+00 C	No
	72-55-9	4,4'-DDE			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.9E+00 C	No
	50-29-3	4,4'-DDT			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.9E+00 C	No
	309-00-2	Aldrin			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	3.8E-02 C	No
	319-84-6	alpha-BHC			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.0E-01 C	No
	5103-71-9	alpha-Chlordane			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.8E+00 C	No
	319-85-7	beta-BHC			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	3.5E-01 C	No
	75-99-0	Dalapon			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	2.3E+02 N	No
	319-86-8	delta-BHC			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	N/A	No
	1918-00-9	Dicamba			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	2.3E+02 N	No
	120-36-5	Dichloroprop			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	N/A	NTX
	959-98-8	Endosulfan I			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	4.7E+01 N	No
	33213-65-9	Endosulfan II			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	4.7E+01 N	No
	1031-07-8	Endosulfan sulfate			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	4.7E+01 N	No
	72-20-8	Endrin			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	2.3E+00 N	No
	7421-93-4	Endrin aldehyde			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	2.3E+00 N	No
	53494-70-5	Endrin ketone			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	2.3E+00 N	No
	58-89-9	gamma-BHC (Lindane)			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	4.9E-01 C	No
	5103-74-2	gamma-Chlordane			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.8E+00 C	No
	76-44-8	Heptachlor			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	1.4E-01 C	No
	1024-57-3	Heptachlor epoxide			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	7.0E-02 C	No
	94-74-6	MCPA			mg/kg		0/6	1.20E+01 - 1.20E+01	1.20E+01	N/A	3.9E+00 N	Yes
	93-65-2	MCPP			mg/kg		0/6	1.20E+01 - 1.20E+01	1.20E+01	N/A	7.8E+00 N	Yes
	72-43-5	Methoxychlor			mg/kg		0/6	1.90E-03 - 2.00E-03	2.00E-03	N/A	3.9E+01 N	No

Table E.1-5
Comparison of Maximum Detection Limits of Non-Detected Compounds to Screening Criteria
Future - Total Soil - SWMU 51

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Max ND Greater than Screening Value (Y/N)
	8001-35-2	Toxaphene			mg/kg		0/6	3.90E-02 - 4.10E-02	4.10E-02	N/A	5.8E-01 C	No
	12674-11-2	Aroclor 1016			mg/kg		0/14	3.70E-02 - 1.00E-01	1.00E-01	N/A	5.5E-01 N	No
	11104-28-2	Aroclor 1221			mg/kg		0/14	3.70E-02 - 1.00E-01	1.00E-01	N/A	3.2E-01 C	No
	11141-16-5	Aroclor 1232			mg/kg		0/14	3.70E-02 - 1.00E-01	1.00E-01	N/A	3.2E-01 C	No
	53469-21-9	Aroclor 1242			mg/kg		0/14	3.70E-02 - 1.00E-01	1.00E-01	N/A	3.2E-01 C	No
	12672-29-6	Aroclor 1248			mg/kg		0/14	3.70E-02 - 1.00E-01	1.00E-01	N/A	3.2E-01 C	No
	11097-69-1	Aroclor 1254			mg/kg		0/14	3.70E-02 - 1.00E-01	1.00E-01	N/A	1.6E-01 N	No
	11096-82-5	Aroclor 1260			mg/kg		0/14	3.70E-02 - 1.00E-01	1.00E-01	N/A	3.2E-01 C	No
	131-11-3	Dimethylphthalate			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	N/A	NTX
	120-82-1	1,2,4-Trichlorobenzene			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	7.8E+01 N	Yes
	95-50-1	1,2-Dichlorobenzene			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	7.0E+02 N	Yes
	541-73-1	1,3-Dichlorobenzene			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	2.3E+01 N	Yes
	106-46-7	1,4-Dichlorobenzene			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	2.7E+01 C	Yes
	95-95-4	2,4,5-Trichlorophenol			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	7.8E+02 N	Yes
	88-06-2	2,4,6-Trichlorophenol			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	7.8E+00 N	Yes
	120-83-2	2,4-Dichlorophenol			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	2.3E+01 N	Yes
	105-67-9	2,4-Dimethylphenol			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	1.6E+02 N	Yes
	91-58-7	2-Chloronaphthalene			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	6.3E+02 N	Yes
	95-57-8	2-Chlorophenol			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	3.9E+01 N	Yes
	88-75-5	2-Nitrophenol			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	N/A	NTX
	88-85-7	2-sec-butyl-4,6-dinitrophenol			mg/kg		0/6	1.20E-01 - 1.20E-01	1.20E-01	N/A	7.8E+00 N	No
	91-94-1	3,3'-Dichlorobenzidine			mg/kg		0/25	7.50E-01 - 1.80E+03	1.80E+03	N/A	1.4E+00 C	Yes
	99-09-2	3-Nitroaniline			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	N/A	NTX
	100-01-6	4-Nitroaniline			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	N/A	NTX
	100-02-7	4-Nitrophenol			mg/kg		0/25	7.50E-01 - 1.80E+03	1.80E+03	N/A	N/A	NTX
	83-32-9	Acenaphthene			mg/kg		0/25	7.50E-03 - 9.00E+02	9.00E+02	N/A	4.7E+02 N	Yes
	208-96-8	Acenaphthylene			mg/kg		0/25	7.50E-03 - 9.00E+02	9.00E+02	N/A	N/A	NTX
	120-12-7	Anthracene			mg/kg		0/25	7.50E-03 - 9.00E+02	9.00E+02	N/A	2.3E+03 N	No
	65-85-0	Benzoic Acid			mg/kg		0/25	7.50E-01 - 1.80E+03	1.80E+03	N/A	3.1E+04 N	No
	111-91-1	bis(2-Chloroethoxy)methane			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	N/A	NTX
	111-44-4	bis(2-Chloroethyl)ether			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	5.8E-01 C	Yes
	85-68-7	Butyl benzyl phthalate			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	1.6E+03 N	No
	86-74-8	Carbazole			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	3.2E+01 C	Yes
	132-64-9	Dibenzofuran			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	7.8E+00 N	Yes
	84-74-2	Di-n-butyl phthalate			mg/kg		0/21	3.70E-01 - 9.00E+02	9.00E+02	N/A	7.8E+02 N	Yes
	117-84-0	Di-n-octyl phthalate			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	N/A	NTX
	86-73-7	Fluorene			mg/kg		0/25	7.50E-03 - 9.00E+02	9.00E+02	N/A	3.1E+02 N	Yes
	118-74-1	Hexachlorobenzene			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	4.0E-01 C	Yes
	87-68-3	Hexachlorobutadiene			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	7.8E+00 N	Yes
	77-47-4	Hexachlorocyclopentadiene			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	4.7E+01 N	Yes
	67-72-1	Hexachloroethane			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	7.8E+00 N	Yes
	78-59-1	Isophorone			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	6.7E+02 C	Yes

Table E.1-5
Comparison of Maximum Detection Limits of Non-Detected Compounds to Screening Criteria
Future - Total Soil - SWMU 51

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Max ND Greater than Screening Value (Y/N)
	91-20-3	Naphthalene			mg/kg		0/24	7.50E-03 - 9.00E+02	9.00E+02	N/A	1.6E+02 N	Yes
	621-64-7	n-Nitroso-di-n-propylamine			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	9.1E-02 C	Yes
	95-48-7	o-Cresol			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	3.9E+02 N	Yes
	106-47-8	p-Chloroaniline			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	3.1E+01 N	Yes
	59-50-7	p-Chloro-m-cresol			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	N/A	NTX
	106-44-5	p-Cresol			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	3.9E+01 N	Yes
	87-86-5	Pentachlorophenol			mg/kg		0/25	7.50E-01 - 1.80E+03	1.80E+03	N/A	5.3E+00 C	Yes
	108-95-2	Phenol			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	2.3E+03 N	No
	79-34-5	1,1,2,2-Tetrachloroethane			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	3.2E+00 C	No
	79-00-5	1,1,2-Trichloroethane			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	1.1E+01 C	No
	75-34-3	1,1-Dichloroethane			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	1.6E+03 N	No
	75-35-4	1,1-Dichloroethene			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	3.9E+02 N	No
	107-06-2	1,2-Dichloroethane			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	7.0E+00 C	No
	78-87-5	1,2-Dichloropropane			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	9.4E+00 C	No
	78-93-3	2-Butanone			mg/kg		1/6	8.30E-03 - 3.70E-02	3.70E-02	N/A	4.7E+03 N	No
	101-55-3	4-Bromophenyl phenylether			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	N/A	NTX
	7005-72-3	4-Chlorophenyl phenylether			mg/kg		0/25	3.70E-01 - 9.00E+02	9.00E+02	N/A	N/A	NTX
	67-64-1	Acetone			mg/kg		0/25	5.15E-03 - 1.10E-01	1.10E-01	N/A	7.0E+03 N	No
	75-27-4	Bromodichloromethane			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	1.0E+01 C	No
	74-83-9	Bromomethane			mg/kg		0/25	9.20E-03 - 5.80E-02	5.80E-02	N/A	1.1E+01 N	No
	75-15-0	Carbon disulfide			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	7.8E+02 N	No
	56-23-5	Carbon tetrachloride			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	4.9E+00 C	No
	108-90-7	Chlorobenzene			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	1.6E+02 N	No
	75-00-3	Chloroethane			mg/kg		0/25	9.20E-03 - 5.80E-02	5.80E-02	N/A	2.2E+02 C	No
	74-87-3	Chloromethane			mg/kg		0/25	9.20E-03 - 5.80E-02	5.80E-02	N/A	N/A	NTX
	10061-01-5	cis-1,3-Dichloro-1-propene			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	6.4E+00 C	No
	124-48-1	Dibromochloromethane			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	7.6E+00 C	No
	75-09-2	Methylene chloride			mg/kg		0/25	1.15E-03 - 5.80E-02	5.80E-02	N/A	8.5E+01 C	No
	100-42-5	Styrene			mg/kg		0/22	4.60E-03 - 2.90E-02	2.90E-02	N/A	1.6E+03 N	No
	10061-02-6	trans-1,3-Dichloropropene			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	6.4E+00 C	No
	75-25-2	Tribromomethane			mg/kg		0/25	4.60E-03 - 2.90E-02	2.90E-02	N/A	8.1E+01 C	No
	75-01-4	Vinyl Chloride			mg/kg		0/25	9.20E-03 - 5.80E-02	5.80E-02	N/A	9.0E-02 C	No

(1) Maximum detection limit used for screening.

(2) N/A - Refer to supporting information for background discussion.
Background values derived from site-specific statistical analysis. See text for supporting information.

(3) Screening toxicity values from USEPA Region 3 RBC Table (October 2007).
RBCs are based on a risk level of 1.0E-06 and an HQ = 0.1. See text for derivation of Nutrient RDAs.

Definitions:
N/A = Not Applicable or Not Available
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogenic
N = Non-Carcinogenic
RDA = Recommended Daily Allowance
NTX = No Toxicity Information

Scenario Timeframe: Current/Future
Medium: Water
Exposure Medium: Groundwater

Table E.1-6
Occurrence, Distribution and Selection of Chemicals of Potential Concern
Current/Future - Groundwater - SWMU 51

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	N/A	2,3,7,8-TCDD-TE	4.38E-12	3.30E-08	mg/L	59MW01	3/4	N/A	3.30E-08	N/A	4.5E-10 C	3.00E-08	MCL	Yes	ASL
Groundwater	67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	7.20E-06 J	7.20E-06 J	mg/l	59MW01	1/4	5.41E-09 - 4.94E-06	7.20E-06	N/A	N/A	N/A	N/A	No	TEQ
	55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	6.60E-06 J	6.60E-06 J	mg/l	59MW01	1/4	7.01E-09 - 5.94E-06	6.60E-06	N/A	N/A	N/A	N/A	No	TEQ
	39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	8.25E-06 J	8.25E-06 J	mg/l	59MW01	1/4	8.90E-09 - 4.94E-06	8.25E-06	N/A	N/A	N/A	N/A	No	TEQ
	57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	7.65E-06 J	7.65E-06 J	mg/l	59MW01	1/4	8.21E-09 - 4.94E-06	7.65E-06	N/A	N/A	N/A	N/A	No	TEQ
	57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.08E-05 J	1.08E-05 J	mg/l	59MW01	1/4	3.40E-09 - 4.94E-06	1.08E-05	N/A	N/A	N/A	N/A	No	TEQ
	60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	6.45E-06 J	6.45E-06	mg/l	59MW01	1/4	5.28E-09 - 4.94E-06	6.45E-06	N/A	N/A	N/A	N/A	No	TEQ
	57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	8.24E-06 J	8.24E-06 J	mg/l	59MW01	1/4	3.32E-09 - 4.94E-06	8.24E-06	N/A	N/A	N/A	N/A	No	TEQ
	51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	2.40E-06 J	2.40E-06 J	mg/l	59MW01	1/4	3.29E-09 - 2.53E-06	2.40E-06	N/A	N/A	N/A	N/A	No	TEQ
	3268-87-9	Octachlorodibenzodioxin	3.76E-08 J	1.46E-05 J	mg/l	48MW07	3/4	2.08E-08 - 2.08E-08	1.46E-05	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Heptachlorodibenzofuran	1.24E-05	1.24E-05	mg/l	59MW01	1/4	7.01E-09 - 5.94E-06	1.24E-05	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Heptachlorodibenzo-p-dioxin	7.40E-06	7.40E-06	mg/l	59MW01	1/4	8.75E-09 - 8.01E-06	7.40E-06	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Hexachlorodibenzofuran	3.17E-05	3.17E-05	mg/l	59MW01	1/4	6.31E-09 - 4.94E-06	3.17E-05	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Hexachlorodibenzo-p-dioxin	2.10E-05	2.10E-05	mg/l	59MW01	1/4	9.01E-09 - 4.94E-06	2.10E-05	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Pentachlorodibenzofuran	1.90E-05	1.90E-05	mg/l	59MW01	1/4	3.40E-09 - 4.94E-06	1.90E-05	N/A	N/A	N/A	N/A	No	TEQ
	35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	7.40E-09 J	7.40E-09 J	mg/l	59MW01	1/4	8.75E-12 - 8.01E-09	7.40E-09	N/A	N/A	N/A	N/A	No	TEQ
	70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	8.74E-09 J	8.74E-09 J	mg/l	59MW01	1/4	5.29E-12 - 4.94E-09	8.74E-09	N/A	N/A	N/A	N/A	No	TEQ
	57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	8.41E-09 J	8.41E-09 J	mg/l	59MW01	1/4	4.66E-12 - 4.94E-09	8.41E-09	N/A	N/A	N/A	N/A	No	TEQ
	72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	8.12E-09 J	8.12E-09 J	mg/l	59MW01	1/4	6.31E-12 - 4.94E-09	8.12E-09	N/A	N/A	N/A	N/A	No	TEQ
	19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	7.90E-09 J	7.90E-09 J	mg/l	59MW01	1/4	9.01E-12 - 4.94E-09	7.90E-09	N/A	N/A	N/A	N/A	No	TEQ
	40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	9.96E-09 J	9.96E-09 J	mg/l	59MW01	1/4	6.10E-12 - 4.94E-09	9.96E-09	N/A	N/A	N/A	N/A	No	TEQ
	1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	3.76E-09 J	3.76E-09 J	mg/l	59MW01	1/4	3.32E-12 - 3.69E-09	3.76E-09	N/A	N/A	N/A	N/A	No	TEQ
	39001-02-0	Octachlorodibenzofuran	1.17E-08 J	1.17E-08 J	mg/l	59MW01	1/4	1.66E-11 - 1.27E-08	1.17E-08	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Pentachlorodibenzo-p-dioxin	9.96E-09	9.96E-09	mg/l	59MW01	1/4	6.10E-12 - 4.94E-09	9.96E-09	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Tetrachlorodibenzofuran	2.40E-09	2.40E-09	mg/l	59MW01	1/4	3.29E-12 - 2.53E-09	2.40E-09	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Tetrachlorodibenzo-p-dioxin	3.76E-09	3.76E-09	mg/l	59MW01	1/4	3.32E-12 - 3.69E-09	3.76E-09	N/A	N/A	N/A	N/A	No	TEQ
	14797-73-0	Perchlorate	2.61E-04 J	3.13E-04 J	mg/l	48MW07	2/2	N/A	3.13E-04	N/A	2.6E-03 N	N/A	N/A	No	BSL
	127-18-4	Tetrachloroethene	9.30E-04 J	9.30E-04 J	mg/l	51MW1	1/4	1.00E-03 - 1.00E-03	9.30E-04	N/A	1.0E-04 C	5.00E-03	MCL	Yes	ASL
	7429-90-5	Aluminum	4.57E-01	7.56E-01	mg/l	59MW01	2/2	N/A	7.56E-01	N/A	3.7E+00 N	5.00E-02	SMCL (lower end)	No	BSL
	7440-39-3	Barium	4.08E-02 J	2.30E-01	mg/l	59MW01	4/4	N/A	2.30E-01	N/A	7.3E-01 N	2.00E+00	MCL	No	BSL
	7440-70-2	Calcium	1.89E+01	5.37E+01	mg/l	51MW2	4/4	N/A	5.37E+01	N/A	N/A	5.00E+02	Nutrient RDA	No	BSL
	7440-47-3	Chromium VI	5.90E-04 J	1.19E-02	mg/l	48MW07	4/4	N/A	1.19E-02	N/A	1.1E-02 N	1.00E-01	MCL	Yes	ASL
	7439-89-6	Iron	5.47E-01	8.61E-01	mg/l	48MW07	3/3	N/A	8.61E-01	N/A	2.6E+00 N	3.00E-01	SMCL	No	BSL
	7439-95-4	Magnesium	7.44E+00	2.48E+01	mg/l	59MW01	4/4	N/A	2.48E+01	N/A	N/A	1.75E+02	Nutrient RDA	No	BSL
	7439-96-5	Manganese	2.16E-02	6.06E-02	mg/l	51MW1	3/3	N/A	6.06E-02	N/A	7.3E-02 N	5.00E-02	SMCL	No	BSL
	7440-02-0	Nickel	1.10E-03 U	6.90E-03 J	mg/l	48MW07	3/4	1.10E-03 - 1.10E-03	6.90E-03	N/A	7.3E-02 N	N/A	N/A	No	BSL
	7440-09-7	Potassium	1.07E+00 J	1.22E+00 J	mg/l	51MW2	2/2	N/A	1.22E+00	N/A	N/A	1.00E+03	Nutrient RDA	No	BSL
	7440-23-5	Sodium	1.36E+00 J	1.36E+00 J	mg/l	59MW01	1/4	2.56E-01 - 2.47E+00	1.36E+00	N/A	N/A	2.00E+01	Nutrient RDA	No	BSL
	7440-62-2	Vanadium	1.70E-03 J	1.70E-03 J	mg/l	59MW01	1/4	6.00E-04 - 1.10E-03	1.70E-03	N/A	3.7E-03 N	N/A	N/A	No	BSL
	7440-66-6	Zinc	2.10E-03 J	3.40E-03 J	mg/l	51MW1	2/4	5.00E-03 - 5.00E-03	3.40E-03	N/A	1.1E+00 N	N/A	N/A	No	BSL

(1) Maximum concentration used for screening.
(2) Site specific background values.
(3) Screening toxicity values from USEPA Region 3 RBC Table (October 2007).
Criteria are based on a risk level of 1.0E-06 and a hazard index of 0.1. See text for derivation of nutrient RDAs.
(4) Rationale Codes

Selection Reason: No Toxicity Information (NTX)
Above Screening Levels (ASL)

Deletion Reason: Below Screening and/or ARAR/TBC Level (BSL)
Physical/Chemical (PHYS)
Below Upgradient (background) Concentration (BKG)

Definitions:
N/A = Not Applicable or Not Available
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
MCL = Federal Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic
RDA = Recommended Daily Allowance

Table E.1-7
Comparison of Maximum Detection Limits of Non-Detected Compounds to Screening Criteria
Current/Future - Groundwater - SWMU 51

Scenario Timeframe: Current/Future
Medium: Water
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Max ND Greater than Screening Value (Y/N)
	71-55-6	1,1,1-Trichloroethane			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	9.1E-01 N	No
	79-34-5	1,1,2,2-Tetrachloroethane			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	5.3E-05 C	Yes
	79-00-5	1,1,2-Trichloroethane			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	1.9E-04 C	Yes
	75-34-3	1,1-Dichloroethane			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	9.0E-02 N	No
	75-35-4	1,1-Dichloroethene			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	3.5E-02 N	No
	120-82-1	1,2,4-Trichlorobenzene			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	6.1E-03 N	Yes
	95-50-1	1,2-Dichlorobenzene			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	2.7E-02 N	No
	107-06-2	1,2-Dichloroethane			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	1.2E-04 C	Yes
	78-87-5	1,2-Dichloropropane			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	2.6E-04 C	Yes
	99-35-4	1,3,5-Trinitrobenzene			mg/l		0/4	2.00E-04 - 2.20E-04	2.20E-04	N/A	1.1E-01 N	No
	541-73-1	1,3-Dichlorobenzene			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	1.8E-03 N	Yes
	99-65-0	1,3-Dinitrobenzene			mg/l		0/4	2.00E-04 - 2.20E-04	2.20E-04	N/A	3.7E-04 N	No
	106-46-7	1,4-Dichlorobenzene			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	2.8E-04 C	Yes
	90-12-0	1-Methylnaphthalene			mg/l		0/4	9.80E-04 - 1.40E-03	1.40E-03	N/A	NVA	NTX
	93-76-5	2,4,5-T			mg/l		0/2	2.00E-04 - 2.00E-04	2.00E-04	N/A	3.7E-02 N	No
	93-72-1	2,4,5-TP (Silvex)			mg/l		0/2	2.00E-04 - 2.00E-04	2.00E-04	N/A	2.9E-02 N	No
	95-95-4	2,4,5-Trichlorophenol			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	3.7E-01 N	No
	88-06-2	2,4,6-Trichlorophenol			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	3.6E_03 N	Yes
	118-96-7	2,4,6-Trinitrotoluene			mg/l		0/4	2.00E-04 - 2.20E-04	2.20E-04	N/A	1.8E-03 N	No
	94-75-7	2,4-D			mg/l		0/2	1.50E-03 - 1.50E-03	1.50E-03	N/A	3.7E-02 N	No
	94-82-6	2,4-DB			mg/l		0/2	2.00E-03 - 2.00E-03	2.00E-03	N/A	2.9E-02 N	No
	120-83-2	2,4-Dichlorophenol			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	1.1E-02 N	No
	105-67-9	2,4-Dimethylphenol			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	7.3E-02 N	No
	51-28-5	2,4-Dinitrophenol			mg/l		0/4	2.50E-02 - 3.40E-02	3.40E-02	N/A	7.3E-03 N	Yes
	121-14-2	2,4-Dinitrotoluene			mg/l		0/10	2.00E-04 - 6.80E-03	6.80E-03	N/A	7.3E-03 N	No
	606-20-2	2,6-Dinitrotoluene			mg/l		0/10	2.00E-04 - 6.80E-03	6.80E-03	N/A	3.7E-03 N	Yes
	35572-78-2	2-amino-4,6-Dinitrotoluene			mg/l		0/4	2.00E-04 - 2.20E-04	2.20E-04	N/A	NVA	NTX
	78-93-3	2-Butanone			mg/l		0/4	5.00E-03 - 5.00E-03	5.00E-03	N/A	7.0E-01 N	No
	91-58-7	2-Chloronaphthalene			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	4.9E-02 N	No
	95-57-8	2-Chlorophenol			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	3.0E-03 N	Yes
	591-78-6	2-Hexanone			mg/l		0/4	5.00E-03 - 1.00E-02	1.00E-02	N/A	NVA	NTX
	91-57-6	2-Methylnaphthalene			mg/l		0/4	9.80E-04 - 1.40E-03	1.40E-03	N/A	2.4E-03 N	No
	88-74-4	2-Nitroaniline			mg/l		0/4	9.80E-03 - 1.40E-02	1.40E-02	N/A	NVA	NTX
	88-75-5	2-Nitrophenol			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	NVA	NTX
	88-72-2	2-Nitrotoluene			mg/l		0/4	2.00E-04 - 2.20E-04	2.20E-04	N/A	6.1E-03 N	No
	88-85-7	2-sec-butyl-4,6-dinitrophenol			mg/l		0/2	2.00E-04 - 2.00E-04	2.00E-04	N/A	3.7E-03 N	No
	N/A	3&4-Methylphenol			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	N/A	No
	91-94-1	3,3'-Dichlorobenzidine			mg/l		0/4	9.80E-03 - 1.40E-02	1.40E-02	N/A	1.5E-04 C	Yes
	99-09-2	3-Nitroaniline			mg/l		0/4	9.80E-03 - 1.40E-02	1.40E-02	N/A	NVA	NTX
	99-08-1	3-Nitrotoluene			mg/l		0/4	2.00E-04 - 2.20E-04	2.20E-04	N/A	NVA	NTX
	72-54-8	4,4'-DDD			mg/l		0/4	9.80E-05 - 1.30E-04	1.30E-04	N/A	2.8E-04 C	No
	72-55-9	4,4'-DDE			mg/l		0/4	9.80E-05 - 1.30E-04	1.30E-04	N/A	2.0E-04 C	No
	50-29-3	4,4'-DDT			mg/l		0/4	9.80E-05 - 1.30E-04	1.30E-04	N/A	2.0E-04 C	No

Table E.1-7
Comparison of Maximum Detection Limits of Non-Detected Compounds to Screening Criteria
Current/Future - Groundwater - SWMU 51

Scenario Timeframe: Current/Future
Medium: Water
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Max ND Greater than Screening Value (Y/N)
	534-52-1	4,6-Dinitro-o-cresol			mg/l		0/4	9.80E-03 - 1.40E-02	1.40E-02	N/A	NVA	NTX
	19406-51-0	4-amino-2,6-Dinitrotoluene			mg/l		0/4	2.00E-04 - 2.20E-04	2.20E-04	N/A	N/A	No
	101-55-3	4-Bromophenyl phenylether			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	NVA	NTX
	7005-72-3	4-Chlorophenyl phenylether			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	NVA	NTX
	108-10-1	4-Methyl-2-pentanone			mg/l		0/4	5.00E-03 - 5.00E-03	5.00E-03	N/A	6.3E-01 N	No
	100-01-6	4-Nitroaniline			mg/l		0/4	9.80E-03 - 1.40E-02	1.40E-02	N/A	NVA	NTX
	100-02-7	4-Nitrophenol			mg/l		0/4	2.50E-02 - 3.40E-02	3.40E-02	N/A	NVA	NTX
	99-99-0	4-Nitrotoluene			mg/l		0/4	2.00E-04 - 2.20E-04	2.20E-04	N/A	4.2E-03 C	No
	83-32-9	Acenaphthene			mg/l		0/4	9.80E-04 - 1.40E-03	1.40E-03	N/A	3.7E-02 N	No
	208-96-8	Acenaphthylene			mg/l		0/4	9.80E-04 - 1.40E-03	1.40E-03	N/A	N/A	No
	67-64-1	Acetone			mg/l		0/4	2.50E-02 - 2.50E-02	2.50E-02	N/A	5.5E-01 N	No
	309-00-2	Aldrin			mg/l		0/4	4.90E-05 - 6.60E-05	6.60E-05	N/A	3.9E-06 C	Yes
	319-84-6	alpha-BHC			mg/l		0/4	4.90E-05 - 6.60E-05	6.60E-05	N/A	1.1E-05 C	Yes
	5103-71-9	alpha-Chlordane			mg/l		0/4	4.90E-05 - 6.60E-05	6.60E-05	N/A	1.9E-04 C	No
	120-12-7	Anthracene			mg/l		0/4	9.80E-04 - 1.40E-03	1.40E-03	N/A	1.8E-01 N	No
	7440-36-0	Antimony			mg/l		0/3	2.20E-03 - 3.30E-03	3.30E-03	0.354	1.5E-03 N	Yes
	12674-11-2	Aroclor 1016			mg/l		0/4	4.90E-04 - 6.60E-04	6.60E-04	N/A	2.5E-04 N	No
	11104-28-2	Aroclor 1221			mg/l		0/4	4.90E-04 - 6.60E-04	6.60E-04	N/A	3.3E-05 C	Yes
	11141-16-5	Aroclor 1232			mg/l		0/4	4.90E-04 - 6.60E-04	6.60E-04	N/A	3.3E-05 C	Yes
	53469-21-9	Aroclor 1242			mg/l		0/4	4.90E-04 - 6.60E-04	6.60E-04	N/A	3.3E-05 C	Yes
	12672-29-6	Aroclor 1248			mg/l		0/4	4.90E-04 - 6.60E-04	6.60E-04	N/A	3.3E-05 C	Yes
	11097-69-1	Aroclor 1254			mg/l		0/4	4.90E-04 - 6.60E-04	6.60E-04	N/A	3.3E-05 C	Yes
	11096-82-5	Aroclor 1260			mg/l		0/4	4.90E-04 - 6.60E-04	6.60E-04	N/A	3.3E-05 C	Yes
	7440-38-2	Arsenic			mg/l		0/4	2.90E-03 - 3.70E-03	3.70E-03	16	4.5E-05 C	Yes
	71-43-2	Benzene			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	3.4E-04 C	Yes
	56-55-3	Benzo(a)anthracene			mg/l		0/4	2.00E-04 - 2.70E-04	2.70E-04	N/A	3.0E-05 C	Yes
	50-32-8	Benzo(a)pyrene			mg/l		0/4	2.00E-04 - 2.70E-04	2.70E-04	N/A	3.0E-06 C	Yes
	205-99-2	Benzo(b)fluoranthene			mg/l		0/4	2.00E-04 - 2.70E-04	2.70E-04	N/A	3.0E-05 C	Yes
	191-24-2	Benzo(g,h,i)perylene			mg/l		0/4	2.00E-04 - 2.70E-04	2.70E-04	N/A	N/A	No
	207-08-9	Benzo(k)fluoranthene			mg/l		0/4	2.00E-04 - 2.70E-04	2.70E-04	N/A	3.0E-04 C	No
	65-85-0	Benzoic Acid			mg/l		0/4	2.50E-02 - 3.40E-02	3.40E-02	N/A	1.5E+01 N	No
	100-51-6	Benzyl alcohol			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	1.8E+00 N	No
	7440-41-7	Beryllium			mg/l		0/2	1.00E-03 - 1.00E-03	1.00E-03	1.55	7.3E-03 N	No
	319-85-7	beta-BHC			mg/l		0/4	4.90E-05 - 6.60E-05	6.60E-05	N/A	3.7E-05 C	Yes
	111-91-1	bis(2-Chloroethoxy)methane			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	NVA	NTX
	111-44-4	bis(2-Chloroethyl)ether			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	9.6E-06 C	Yes
	108-60-1	bis(2-Chloroisopropyl)ether			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	2.6E-04 C	Yes
	117-81-7	bis(2-Ethylhexyl) phthalate			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	4.8E-03 C	Yes
	75-27-4	Bromodichloromethane			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	1.7E-04 C	Yes
	74-83-9	Bromomethane			mg/l		0/4	2.00E-03 - 2.00E-03	2.00E-03	N/A	8.5E-04 N	Yes
	85-68-7	Butyl benzyl phthalate			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	7.3E-01 N	No
	7440-43-9	Cadmium			mg/l		0/4	6.00E-04 - 1.00E-03	1.00E-03	1.7	3.7E-03 N	No
	86-74-8	Carbazole			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	3.3E-03 C	Yes

Table E.1-7
Comparison of Maximum Detection Limits of Non-Detected Compounds to Screening Criteria
Current/Future - Groundwater - SWMU 51

Scenario Timeframe: Current/Future
Medium: Water
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Max ND Greater than Screening Value (Y/N)
	75-15-0	Carbon disulfide			mg/l		0/4	2.00E-03 - 2.00E-03	2.00E-03	N/A	1.0E-01 N	No
	56-23-5	Carbon tetrachloride			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	1.6E-04 C	Yes
	108-90-7	Chlorobenzene			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	9.0E-03 N	No
	75-00-3	Chloroethane			mg/l		0/4	2.00E-03 - 2.00E-03	2.00E-03	N/A	3.6E-03 C	No
	67-66-3	Chloroform			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	1.5E-04 C	Yes
	74-87-3	Chloromethane			mg/l		0/4	2.00E-03 - 2.00E-03	2.00E-03	N/A	1.9E-02 N	No
	218-01-9	Chrysene			mg/l		0/4	2.00E-04 - 2.70E-04	2.70E-04	N/A	3.0E-03 C	No
	156-59-2	cis-1,2-Dichloroethene			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	6.1E-03 N	No
	10061-01-5	cis-1,3-Dichloro-1-propene			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	NVA	NTX
	7440-48-4	Cobalt			mg/l		0/4	4.00E-04 - 1.00E-03	1.00E-03	10.2	NVA	NTX
	7440-50-8	Copper			mg/l		0/3	8.00E-04 - 1.20E-03	1.20E-03	27.2	1.5E-01 N	No
	121-82-4	Cyclonite			mg/l		0/4	2.00E-04 - 2.20E-04	2.20E-04	N/A	6.1E-04 C	No
	75-99-0	Dalapon			mg/l		0/1	1.00E-03 - 1.00E-03	1.00E-03	N/A	1.1E-01 N	No
	319-86-8	delta-BHC			mg/l		0/4	4.90E-05 - 6.60E-05	6.60E-05	N/A	NVA	NTX
	53-70-3	Dibenz(a,h)anthracene			mg/l		0/4	2.00E-04 - 2.70E-04	2.70E-04	N/A	3.0E-06 C	Yes
	132-64-9	Dibenzofuran			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	3.7E-03 N	Yes
	124-48-1	Dibromochloromethane			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	1.3E-04 C	Yes
	1918-00-9	Dicamba			mg/l		0/2	2.00E-04 - 2.00E-04	2.00E-04	N/A	1.1E-01 N	No
	120-36-5	Dichloroprop			mg/l		0/2	1.00E-03 - 1.00E-03	1.00E-03	N/A	N/A	No
	60-57-1	Dieldrin			mg/l		0/4	4.90E-05 - 6.60E-05	6.60E-05	N/A	4.2E-06 C	Yes
	84-66-2	Diethyl phthalate			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	2.9E+00 N	No
	131-11-3	Dimethylphthalate			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	NVA	NTX
	84-74-2	Di-n-butyl phthalate			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	3.7E-01 N	No
	117-84-0	Di-n-octyl phthalate			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	NVA	NTX
	959-98-8	Endosulfan I			mg/l		0/4	4.90E-05 - 6.60E-05	6.60E-05	N/A	2.2E-02 N	No
	33213-65-9	Endosulfan II			mg/l		0/4	9.80E-05 - 1.30E-04	1.30E-04	N/A	2.2E-02 N	No
	1031-07-8	Endosulfan sulfate			mg/l		0/4	9.80E-05 - 1.30E-04	1.30E-04	N/A	2.2E-02 N	No
	72-20-8	Endrin			mg/l		0/4	9.80E-05 - 1.30E-04	1.30E-04	N/A	1.1E-03 N	No
	7421-93-4	Endrin aldehyde			mg/l		0/4	9.80E-05 - 1.30E-04	1.30E-04	N/A	1.1E-03 N	No
	53494-70-5	Endrin ketone			mg/l		0/4	9.80E-05 - 1.30E-04	1.30E-04	N/A	1.1E-03 N	No
	100-41-4	Ethylbenzene			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	1.3E-01 N	No
	206-44-0	Fluoranthene			mg/l		0/4	9.80E-04 - 1.40E-03	1.40E-03	N/A	1.5E-01 N	No
	86-73-7	Fluorene			mg/l		0/4	9.80E-04 - 1.40E-03	1.40E-03	N/A	2.4E-02 N	No
	58-89-9	gamma-BHC (Lindane)			mg/l		0/4	4.90E-05 - 6.60E-05	6.60E-05	N/A	5.2E-05 C	Yes
	5103-74-2	gamma-Chlordane			mg/l		0/4	4.90E-05 - 6.60E-05	6.60E-05	N/A	1.9E-04 C	No
	76-44-8	Heptachlor			mg/l		0/4	4.90E-05 - 6.60E-05	6.60E-05	N/A	1.5E-05 C	Yes
	1024-57-3	Heptachlor epoxide			mg/l		0/4	4.90E-05 - 6.60E-05	6.60E-05	N/A	7.4E-06 C	Yes
	118-74-1	Hexachlorobenzene			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	4.2E-05 C	Yes
	87-68-3	Hexachlorobutadiene			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	8.6E-04 C	Yes
	77-47-4	Hexachlorocyclopentadiene			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	2.2E-02 N	No
	67-72-1	Hexachloroethane			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	3.7E+00 N	Yes
	2691-41-0	HMX			mg/l		0/4	2.00E-04 - 2.20E-04	2.20E-04	N/A	1.8E-01 N	No
	193-39-5	Indeno(1,2,3-cd)pyrene			mg/l		0/4	2.00E-04 - 2.70E-04	2.70E-04	N/A	3.0E-05 C	Yes

Table E.1-7
Comparison of Maximum Detection Limits of Non-Detected Compounds to Screening Criteria
Current/Future - Groundwater - SWMU 51

Scenario Timeframe: Current/Future
Medium: Water
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Max ND Greater than Screening Value (Y/N)
	78-59-1	Isophorone			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	7.0E-02 C	No
	7439-92-1	Lead			mg/l		0/2	1.20E-03 - 2.10E-03	2.10E-03	38.8	NVA	NTX
	N/A	m+p-Xylenes			mg/l		0/2	2.00E-03 - 2.00E-03	2.00E-03	N/A	2.1E-02 N	No
	94-74-6	MCPA			mg/l		0/2	5.00E-02 - 5.00E-02	5.00E-02	N/A	1.8E-03 N	Yes
	93-65-2	MCPP			mg/l		0/2	5.00E-02 - 5.00E-02	5.00E-02	N/A	3.7E-03 N	Yes
	7439-97-6	Mercury (Inorganic)			mg/l		0/4	8.00E-05 - 1.10E-04	1.10E-04	0.249	1.1E-03 N	No
	72-43-5	Methoxychlor			mg/l		0/4	9.80E-05 - 1.30E-04	1.30E-04	N/A	1.8E-02 N	No
	75-09-2	Methylene chloride			mg/l		0/4	5.00E-03 - 5.00E-03	5.00E-03	N/A	4.1E-03 C	Yes
	91-20-3	Naphthalene			mg/l		0/4	9.80E-04 - 1.40E-03	1.40E-03	N/A	6.5E-04 N	Yes
	98-95-3	Nitrobenzene			mg/l		0/10	2.00E-04 - 6.80E-03	6.80E-03	N/A	3.5E-04 N	Yes
	55-63-0	Nitroglycerin			mg/l		0/4	2.00E-03 - 2.20E-03	2.20E-03	N/A	3.7E-04 N	Yes
	621-64-7	n-Nitroso-di-n-propylamine			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	9.6E-06 C	Yes
	86-30-6	n-Nitrosodiphenylamine			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	1.4E-02 C	No
	95-48-7	o-Cresol			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	1.8E-01 N	No
	95-47-6	o-Xylene			mg/l		0/2	1.00E-03 - 1.00E-03	1.00E-03	N/A	2.1E-02 N	No
	106-47-8	p-Chloroaniline			mg/l		0/4	4.90E-03 - 1.40E-02	1.40E-02	N/A	1.5E-02 N	No
	59-50-7	p-Chloro-m-cresol			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	NVA	NTX
	87-86-5	Pentachlorophenol			mg/l		0/8	5.00E-05 - 3.40E-02	3.40E-02	N/A	5.6E-04 C	Yes
	78-11-5	Pentaerythritol tetranitrate			mg/l		0/4	2.00E-03 - 2.20E-03	2.20E-03	N/A	NVA	NTX
	85-01-8	Phenanthrene			mg/l		0/4	9.80E-04 - 1.40E-03	1.40E-03	N/A	N/A	No
	108-95-2	Phenol			mg/l		0/4	4.90E-03 - 6.80E-03	6.80E-03	N/A	1.1E+00 N	No
	129-00-0	Pyrene			mg/l		0/4	9.80E-04 - 1.40E-03	1.40E-03	N/A	1.8E-02 N	No
	7782-49-2	Selenium			mg/l		0/4	2.40E-03 - 4.00E-03	4.00E-03	0.955	1.8E-02 N	No
	7440-22-4	Silver			mg/l		0/4	7.70E-04 - 9.00E-04	9.00E-04	0.801	1.8E-02 N	No
	100-42-5	Styrene			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	1.6E-01 N	No
	479-45-8	Tetryl			mg/l		0/4	2.00E-04 - 2.20E-04	2.20E-04	N/A	1.5E-02 N	No
	7440-28-0	Thallium			mg/l		0/4	3.80E-03 - 6.50E-03	6.50E-03	0.844	2.6E-04 N	Yes
	108-88-3	Toluene			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	2.3E-01 N	No
	8001-35-2	Toxaphene			mg/l		0/4	2.50E-03 - 3.30E-03	3.30E-03	N/A	6.1E-05 C	Yes
	156-60-5	trans-1,2-Dichloroethene			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	1.1E-02 N	No
	10061-02-6	trans-1,3-Dichloropropene			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	NVA	NTX
	75-25-2	Tribromomethane			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	8.5E-03 C	No
	79-01-6	Trichloroethene			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	2.6E-05 C	Yes
	75-01-4	Vinyl Chloride			mg/l		0/4	1.00E-03 - 1.00E-03	1.00E-03	N/A	1.5E-05 C	Yes
	1330-20-7	Xylenes (total)			mg/l		0/2	3.00E-03 - 3.00E-03	3.00E-03	N/A	2.1E-02 N	No

(1) Maximum non-detect concentration used for screening.

(2) N/A - Refer to supporting information for background discussion.
Background values derived from site-specific statistical analysis. See text for supporting information.

(3) Screening toxicity values from USEPA Region 3 RBC Table (October 2007).
Criteria are based on a risk level of 1x10-6 and a hazard index of 0.1. See text for derivation of nutrient RDAs.

Definitions: N/A = Not Applicable
COPC = Chemical of Potential Concern
NVA = No Value Available
NTX = No Toxicity Information

Table E.1-8
Medium-Specific Exposure Point Concentration Summary for SWMU 51

Scenario Timeframe: Current/ Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean of Detects	Multiple Detection Limits? (Yes/No) [1]	95% UCL (Distribution) [2]	Maximum Concentration	Exposure Point Concentration			
							Value	Units	Statistic [3]	Rationale [4]
Surface Soil	2,4-Dinitrotoluene	mg/kg	8.06E-01	No	1.99E+00 (NP)	2.50E+00	1.99E+00	mg/kg	97.5% KM-Cheby	Test (3)
	2,6-Dinitrotoluene	mg/kg	5.47E-01	No	8.65E-01 (N)	1.70E+00	8.65E-01	mg/kg	95% KM-t	Test (4)
	Dibenz(a,h)anthracene [5]	mg/kg	7.63E-03	Yes	1.16E-02 (NP)	4.45E-02	1.16E-02	mg/kg	95% UCL-Bst	Test (3)
	2-Nitrotoluene	mg/kg	2.37E+01	No	6.27E+01 (G)	1.10E+02	6.27E+01	mg/kg	95% KM-Cheby	Test (6)
	3-Nitrotoluene	mg/kg	2.17E+00	No	5.17E+00 (G)	9.20E+00	5.17E+00	mg/kg	95% KM-Cheby	Test (6)
	4-Nitrotoluene	mg/kg	1.40E+01	No	3.44E+01 (G)	6.20E+01	3.44E+01	mg/kg	95% KM-Cheby	Test (6)
	Aluminum	mg/kg	1.93E+04	No	2.28E+04 (N)	2.81E+04	2.28E+04	mg/kg	95% Student's-t	Test (4)
	Arsenic	mg/kg	3.89E+00	No	4.41E+00 (N)	5.70E+00	4.41E+00	mg/kg	95% Student's-t	Test (4)
	Chromium VI	mg/kg	2.55E+01	No	2.82E+01 (N)	3.46E+01	2.82E+01	mg/kg	95% Student's-t	Test (4)
	Cobalt	mg/kg	7.51E+00	No	9.17E+00 (N)	1.39E+01	9.17E+00	mg/kg	95% Student's-t	Test (4)
	Iron	mg/kg	2.34E+04	No	2.74E+04 (N)	3.16E+04	2.74E+04	mg/kg	95% Student's-t	Test (4)
	Manganese	mg/kg	4.43E+02	No	5.30E+02 (N)	7.07E+02	5.30E+02	mg/kg	95% Student's-t	Test (4)
	Thallium	mg/kg	8.75E-01	Yes	1.10E+01 (NP)	1.10E+00	1.10E+00	mg/kg	95% KM-% Btstrp	Test (1)
	Vanadium	mg/kg	4.94E+01	No	5.63E+01 (N)	6.41E+01	5.63E+01	mg/kg	95% Student's-t	Test (4)

[1] ProUCL software (version 4.0, USEPA, 2007) recommends use of Kaplan-Meier method if there are multiple detection limits.

[2] Statistical Distribution and 95% UCL as determined by ProUCL (unless otherwise noted): (G) the data were determined to follow gamma distribution; (L) the data were determined to follow lognormal distribution; (NP) the data were determined to be non-parametric; (N) the data were determined to be normally distributed.

[3] Statistic: Maximum Detected Value (Max); 95% KM Chebyshev (95% KM-Cheby); 97.5% KM Chebyshev (97.5% KM-Cheby); 99% KM Chebyshev (99% KM-Cheby); 95% KM Percentile Bootstrap (95% KM-% Btstrp); 95% KM-t (95% KM-t); 95% KM-BCA (95% KM-BCA) 97.5% Chebyshev -Mean, SD- UCL (97.5% Cheby, Mean, SD); 99% Chebyshev -Mean, SD- UCL (99% Cheby, Mean, SD); 95% UCL of Log-transformed Data (95% UCL-T) 95% Student's-t (95% Student's-t); 95% Modified-t (95% Modified-t); 95% UCL based on bootstrap statistic (95% UCL-Bst).

[4] Unless otherwise noted (see footnote 5), ProUCL EPC selection rationale based on, detection limit values, distribution, standard deviation, and sample size (see ProUCL output in appendix for further details):

Test (1): Kaplan-Meier method recommended by ProUCL due to multiple detection limits.
Test (2): 95% UCL recommended by ProUCL exceeds maximum detected concentration, therefore, maximum concentration used for EPC.
Test (3): Shapiro-Wilk W test, Kolmogorov-Smirnov (K-S), and Anderson-Darling (A-D) tests, indicate data follow nonparametric distribution.
Test (4): Shapiro-Wilk W test indicates data are normally distributed.
Test (5): Shapiro-Wilk W test indicates data are log-normally distributed.
Test (6): Kolmogorov-Smirnov (K-S) and/or Anderson-Darling (A-D) tests indicate data follow gamma distribution.
Test (7): Sample size is less than or equal to 5, therefore, maximum concentration used for EPC.

[5] Infrequent detection resulted in ProUCL modeling error for this constituent, therefore distribution, average, and UCL determined using non-ProUCL bootstrap method with random numbers for NDs (see text for details).

Table E.1-9
Medium Specific Exposure Point Concentration Summary for SWMU 51

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Total Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean of Detects	Multiple Detection Limits? (Yes/No) [1]	95% UCL (Distribution) [2]	Maximum Concentration	Exposure Point Concentration			
							Value	Units	Statistic [3]	Rationale [4]
Total Soil	2,3,7,8-TCDD TE	mg/kg	3.96E-05	No	1.85E-04 (NP)	1.48E-04	1.48E-04	mg/kg	Max	Test (2)
	1,3,5-Trinitrobenzene	mg/kg	1.77E+02	Yes	1.52E+02 (G)	8.50E+02	1.52E+02	mg/kg	95% KM-t	Test (1)
	1,3-Dinitrobenzene	mg/kg	5.08E+01	Yes	2.13E+02 (NP)	4.60E+02	2.13E+02	mg/kg	99% KM-Cheby	Test (1)
	2,4,6-Trinitrotoluene	mg/kg	7.90E+03	No	4.21E+04 (NP)	6.10E+04	4.21E+04	mg/kg	99% KM-Cheby	Test (3)
	2,4-Dinitrotoluene	mg/kg	4.81E+03	No	2.59E+04 (NP)	4.40E+04	2.59E+04	mg/kg	99% KM-Cheby	Test (3)
	2,6-Dinitrotoluene	mg/kg	1.54E+03	No	4.17E+03 (G)	1.10E+04	4.17E+03	mg/kg	95% KM-Cheby	Test (6)
	2-Amino-4,6-Dinitrotoluene	mg/kg	1.60E+01	Yes	2.15E+01 (NP)	3.20E+01	2.15E+01	mg/kg	99% KM-Cheby	Test (1)
	2-Hexanone	mg/kg	1.33E-02	Yes	1.84E-02 (N)	2.10E-02	1.84E-02	mg/kg	95% KM-% Btstrp	Test (1)
	2-Nitroaniline [5]	mg/kg	2.60E+01	Yes	4.78E+01 (NP)	4.50E+01	4.50E+01	mg/kg	Max	Test (2)
	4,6-dinitro-o-cresol	mg/kg	2.40E+00	Yes	2.70E+00 (NP)	2.70E+00	2.70E+00	mg/kg	95% KM-% Btstrp	Test (1)
	4-Methyl-2-Pentanone	mg/kg	6.13E-02	Yes	4.71E-02 (N)	1.60E-01	4.71E-02	mg/kg	95% KM-% Btstrp	Test (1)
	Aluminum	mg/kg	1.77E+04	No	1.98E+04 (N)	2.97E+04	1.98E+04	mg/kg	95% Student's-t	Test (4)
	Antimony	mg/kg	2.50E+00	Yes	3.89E+00 (N)	5.40E+00	3.89E+00	mg/kg	95% KM-% Btstrp	Test (1)
	Arsenic	mg/kg	5.82E+00	No	1.04E+01 (NP)	1.53E+01	1.04E+01	mg/kg	95% Cheby, Mean, SD	Test (3)
	Chromium	mg/kg	1.04E+02	No	4.48E+02 (NP)	5.33E+02	4.48E+02	mg/kg	99% Cheby, Mean, SD	Test (3)
	Cobalt	mg/kg	1.44E+01	No	4.44E+01 (NP)	1.79E+02	4.44E+01	mg/kg	95% Cheby, Mean, SD	Test (3)
	Copper	mg/kg	3.30E+01	No	1.77E+02 (NP)	3.60E+02	1.77E+02	mg/kg	99% Cheby, Mean, SD	Test (3)
	Dibenz(a,h)anthracene [5]	mg/kg	2.10E+01	Yes	4.06E+01 (NP)	4.45E-02	4.45E-02	mg/kg	Max	Test (2)
	Iron	mg/kg	5.08E+04	No	1.03E+05 (NP)	1.91E+05	1.03E+05	mg/kg	95% Cheby, Mean, SD	Test (3)
	Lead	mg/kg	6.98E+02	No	3.57E+03 (NP)	4.18E+03	3.57E+03	mg/kg	99% Cheby, Mean, SD	Test (3)
	Manganese	mg/kg	5.06E+02	No	1.08E+03 (NP)	3.59E+03	1.08E+03	mg/kg	95% Cheby, Mean, SD	Test (3)
	2-Nitrotoluene	mg/kg	2.33E+03	No	1.31E+04 (L)	2.50E+04	1.31E+04	mg/kg	99% KM-Cheby	Test (5)
	3-Nitrotoluene	mg/kg	3.24E+02	No	1.38E+03 (L)	2.10E+03	1.38E+03	mg/kg	99% KM-Cheby	Test (5)
	4-Nitrotoluene	mg/kg	1.68E+03	No	8.87E+03 (L)	1.60E+04	8.87E+03	mg/kg	99% KM-Cheby	Test (5)
	Nitroglycerin [5]	mg/kg	1.27E+03	Yes	2.26E+03 (NP)	3.30E+03	2.26E+03	mg/kg	95% UCL-Bst	Test (3)
	Pentaerythritol Tetranitrate [5]	mg/kg	2.68E+00	Yes	5.16E+00 (NP)	6.20E+01	5.16E+00	mg/kg	95% UCL-Bst	Test (3)
	Thallium	mg/kg	1.90E+00	Yes	1.67E+00 (L)	5.90E+00	1.67E+00	mg/kg	95% KM-% Btstrp	Test (1)
	Vanadium	mg/kg	4.27E+01	No	4.76E+01 (N)	6.61E+01	4.76E+01	mg/kg	95% Student's-t	Test (4)

Table E.1-9
Medium Specific Exposure Point Concentration Summary for SWMU 51

[1] ProUCL software (version 4.0, USEPA, 2007) recommends use of Kaplan-Meier method if there are multiple detection limits.

[2] Statistical Distribution and 95% UCL as determined by ProUCL (unless otherwise noted): (G) the data were determined to follow gamma distribution;
(L) the data were determined to follow lognormal distribution; (NP) the data were determined to be non-parametric; (N) the data were determined to be normally distributed.

[3] Statistic: Maximum Detected Value (Max); 95% KM Chebyshev (95% KM-Cheby); 97.5% KM Chebyshev (97.5% KM-Cheby); 99% KM Chebyshev (99% KM-Cheby);
95% KM Percentile Bootstrap (95% KM-% Btstrp); 95% KM-t (95% KM-t); 95% KM-BCA (95% KM-BCA)
95% Chebyshev -Mean, SD- UCL (95% Cheby, Mean, SD); 97.5% Chebyshev -Mean, SD- UCL (97.5% Cheby, Mean, SD); 99% Chebyshev -Mean, SD- UCL (99% Cheby, Mean, SD);
95% UCL of Log-transformed Data (95% UCL-T); 95% Student's-t (95% Student's-t); 95% Modified-t (95% Modified-t); 95% UCL based on bootstrap statistic (95% UCL-Bst).

[4] Unless otherwise noted (see footnote 5), ProUCL EPC selection rationale based on, detection limit values, distribution, standard deviation, and sample size (see ProUCL output in appendix for further details):

Test (1): Kaplan-Meier method recommended by ProUCL due to multiple detection limits.
Test (2): 95% UCL recommended by ProUCL exceeds maximum detected concentration, therefore, maximum concentration used for EPC.
Test (3): Shapiro-Wilk W test, Kolmogorov-Smirnov (K-S), and Anderson-Darling (A-D) tests, indicate data follow nonparametric distribution.
Test (4): Shapiro-Wilk W test indicates data are normally distributed.
Test (5): Shapiro-Wilk W test indicates data are log-normally distributed.
Test (6): Kolmogorov-Smirnov (K-S) and/or Anderson-Darling (A-D) tests indicate data follow gamma distribution.
Test (7): Sample size is less than or equal to 5, therefore, maximum concentration used for EPC.

[5] Infrequent detection resulted in ProUCL modeling error for this constituent, therefore distribution, average, and UCL determined using non-ProUCL bootstrap method with random numbers for NDs (see text for details).

Table E.1-10
Medium-Specific Exposure Point Concentration Summary for SWMU 51

Scenario Timeframe: Current/ Future
Medium: Water
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Groundwater	2,3,7,8-TCDD-TE	mg/l	8.82E-09	N/A	3.30E-08	3.30E-08	mg/l	Max	Test (7)
	Chromium	mg/l	5.95E-03	N/A	1.19E-02	1.19E-02	mg/l	Max	Test (7)
	Tetrachloroethylene	mg/l	6.08E-04	N/A	9.30E-04	9.30E-04	mg/l	Max	Test (7)

[1] ProUCL software (version 4.0, USEPA, 2007) recommends use of Kaplan-Meier method if there are multiple detection limits.

[2] Statistical Distribution and 95% UCL as determined by ProUCL (unless otherwise noted): (G) the data were determined to follow gamma distribution; (L) the data were determined to follow lognormal distribution; (NP) the data were determined to be non-parametric; (N) the data were determined to be normally distributed.

[3] Statistic: Maximum Detected Value (Max); 95% KM Chebyshev (95% KM-Cheby); 97.5% KM Chebyshev (97.5% KM-Cheby); 99% KM Chebyshev (99% KM-Cheby); 95% KM Percentile Bootstrap (95% KM-% Btstrp); 95% KM-t (95% KM-t); 95% KM-BCA (95% KM-BCA) 95% Chebyshev -Mean, SD- UCL (95% Cheby, Mean, SD); 97.5% Chebyshev -Mean, SD- UCL (97.5% Cheby, Mean, SD); 99% Chebyshev -Mean, SD- UCL (99% Cheby, Mean, SD); 95% UCL of Log-transformed Data (95% UCL-T); 95% Student's-t (95% Student's-t); 95% Modified-t (95% Modified-t); 95% UCL based on bootstrap statistic (95% UCL-Bst).

[4] Unless otherwise noted (see footnote 5), ProUCL EPC selection rationale based on, detection limit values, distribution, standard deviation, and sample size (see ProUCL output in appendix for further details):

Test (1): Kaplan-Meier method recommended by ProUCL due to multiple detection limits.

Test (2): 95% UCL recommended by ProUCL exceeds maximum detected concentration, therefore, maximum concentration used for EPC.

Test (3): Shapiro-Wilk W test, Kolmogorov-Smirnov (K-S), and Anderson-Darling (A-D) tests, indicate data follow nonparametric distribution.

Test (4): Shapiro-Wilk W test indicates data are normally distributed.

Test (5): Shapiro-Wilk W test indicates data are log-normally distributed.

Test (6): Kolmogorov-Smirnov (K-S) and/or Anderson-Darling (A-D) tests indicate data follow gamma distribution.

Test (7): Sample size is less than or equal to 5, therefore, maximum concentration used for EPC.

Table E.1-11
Medium-Specific Exposure Point Concentration Summary -
Inhalation of Groundwater Contaminants in Outdoor Ambient Air
by Industrial and Maintenance Workers at SWMU 51

Medium: Groundwater
Exposure Medium: Air (Outdoor Ambient Air)
Receptor Populations: Industrial and Maintenance Workers

Chemical of Potential Concern	Exposure Point Concentration (Groundwater)	Units	Exposure Medium	Exposure Medium Concentration	Units	Reference for Exposure Medium Calculation
Tetrachloroethene	9.30E-04	mg/L	Air	3.52E-10	mg/m^3	ASTM, 1995

Table E.1-12
Medium-Specific Exposure Point Concentration Summary -
Inhalation of Groundwater Contaminants in Trench Air
by Excavation Workers at SWMU 51

Medium: Groundwater
Exposure Medium: Air (Trench Air)
Receptor Populations: Excavation Workers

Chemical of Potential Concern	Exposure Point Concentration (Groundwater)	Units	Exposure Medium	Exposure Medium Concentration	Units	Reference for Exposure Medium Calculation
Tetrachloroethene	9.30E-04	mg/L	Air	1.91E-05	mg/m^3	VDEQ, 2007

Table E.1-13
Medium-Specific Exposure Point Concentration Summary -
Inhalation of Groundwater Contaminants in Indoor Air (via Vapor Intrusion)
by Industrial Workers and Residents at SWMU 51

Medium: Groundwater
Exposure Medium: Air (Indoor Air - Vapor Intrusion)
Receptor Populations: Industrial Workers and Future Residents

Chemical of Potential Concern	Exposure Point Concentration (Groundwater)	Units	Exposure Medium	Exposure Medium Concentration[a]	Units	Reference for Exposure Medium Calculation
Tetrachloroethene	9.30E-04	mg/L	Air	2.65E-05	mg/m^3	Johnson & Ettinger, 1991

[a] Value from $C_{building}$ term from the Johnson & Ettinger Model (1991).

Table E.1-14
Medium-Specific Exposure Point Concentration Summary - Inhalation of Groundwater Contaminants in Shower Air by Adult Residents at SWMU 51

Medium: Groundwater
Exposure Medium: Air (Shower Air)
Receptor Populations: Future Adult Resident

Chemical of Potential Concern	Exposure Point Concentration (Groundwater)	Units	Exposure Medium	Exposure Medium Concentration	Units	Reference for Exposure Medium Calculation
Tetrachloroethene	9.30E-04	mg/L	Air	1.30E-03	mg/m^3	Foster and Chrostowski, 1987, 2003

Table E.1-15
Values Used for Daily Intake Calculations - Current and Future Exposures to Surface Soil
SWMU 51

Scenario Timeframe:	Current and Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Maintenance Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 2002	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	50	days/year	(1)	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	$\frac{CS \times IR\text{-}S \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF2	Conversion Factor 2	365	days/year	---	
Dermal Absorption	Maintenance Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				SSAF	Soil to Skin Adherence Factor	0.2	mg/cm^2-day	USEPA, 1997, 2002	Internal (Lifetime) Average Daily Dose
				DABS	Dermal Absorption Factor (Solid)	(2)	--	USEPA, 1995, 2003	$[(L)ADD_{int}]$ (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	3,300 (3)	cm^2	USEPA, 1997	
				EF	Exposure Frequency	50	days/year	(1)	$\frac{CS \times SSAF \times DABS \times SA \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				ED	Exposure Duration	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF2	Conversion Factor 2	365	days/year	---	

(1) Best professional judgement. Based on site maintenance/inspection activities conducted 1day/week and assuming 2 weeks on vacation.
(2) Dermal absorption factors are presented in **Table E.1-25.**
(3) Value derived from data presented in USEPA (1997), averaging across gender and age. It is assumed that head, hands, and forearms are exposed to surface soil.

USEPA, 1995: Assessing Dermal Exposure from Soil Hazardous Waste Management Division. Office of Superfund Programs, Region III, Philadelphia, PA.
USEPA, 1997: Exposure Factors Handbook, Volume I. EPA/600/P-95/002Fa.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.
USEPA, 2003: Updated Dermal Exposure Assessment Guidance. Office of Superfund Programs, Region III, Philadelphia, PA.

Table E.1-16
Values Used for Daily Intake Calculations - Future Exposures to Total Soil
SWMU 51

Scenario Timeframe:	Future
Medium:	Total Soil
Exposure Medium:	Total Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Maintenance Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 2002	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	50	days/year	(1)	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	$\frac{CS \times IR\text{-}S \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF2	Conversion Factor 2	365	days/year	---	
	Excavation Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				IR-S	Ingestion Rate of Soil	330	mg/day	USEPA, 2002	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	250	days/year	USEPA, 2002	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	1	years	USEPA, 2002	
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	$\frac{CS \times IR\text{-}S \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	1	years	USEPA, 2002	
				CF2	Conversion Factor 2	365	days/year	---	
	Resident	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 1991a	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	30	years	USEPA, 1991a	
				EDc	Exposure Duration	24	years	USEPA, 1991b	
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	$\frac{CS \times IR\text{-}S \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				BW	Body Weight	70	kg	USEPA, 1991a	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a	
				AT-N	Averaging Time (Non-Cancer)	30	years	USEPA, 1991a	
				CF2	Conversion Factor 2	365	days/year	---	
		Child	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				IR-S	Ingestion Rate of Soil	200	mg/day	USEPA, 1991a	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	6	years	USEPA, 1991a	
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	$\frac{CS \times IR\text{-}S \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				BW	Body Weight	15	kg	USEPA, 1991a	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a	
				AT-N	Averaging Time (Non-Cancer)	6	years	USEPA, 1991a	
				CF2	Conversion Factor 2	365	days/year	---	
Dermal Absorption	Maintenance Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				SSAF	Soil to Skin Adherence Factor	0.2	mg/cm^2-day	USEPA, 1997, 2002	Internal (Lifetime) Average Daily Dose
				DABS	Dermal Absorption Factor (Solid)	(2)	--	USEPA, 1995, 2003	$[(L)ADD_{int}]$ (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	3,300 (3)	cm^2	USEPA, 1997	
				EF	Exposure Frequency	50	days/year	(1)	$\frac{CS \times SSAF \times DABS \times SA \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				ED	Exposure Duration	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF2	Conversion Factor 2	365	days/year	---	
	Excavation Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				SSAF	Soil to Skin Adherence Factor	0.3	mg/cm^2-day	USEPA, 2002	Internal (Lifetime) Average Daily Dose
				DABS	Dermal Absorption Factor (Solid)	(2)	--	USEPA, 1995, 2003	$[(L)ADD_{int}]$ (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	3,300 (3)	cm^2	USEPA, 1997	
				EF	Exposure Frequency	250	days/year	USEPA, 2002	$\frac{CS \times SSAF \times DABS \times SA \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				ED	Exposure Duration	1	years	USEPA, 2002	
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	1	years	USEPA, 2002	
				CF2	Conversion Factor 2	365	days/year	---	

Table E.1-16
Values Used for Daily Intake Calculations - Future Exposures to Total Soil
SWMU 51

Scenario Timeframe:	Future
Medium:	Total Soil
Exposure Medium:	Total Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal Absorption (con't)	Resident	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				SSAF	Soil to Skin Adherence Factor	0.07	mg/cm^2-day	USEPA, 1997, 2004	Internal (Lifetime) Average Daily Dose
				DABS	Dermal Absorption Factor (Solid)	(2)	--	USEPA, 1995, 2003	$[(L)ADD_{int}]$ (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	5,700 (4)	cm^2	USEPA, 1997	
				EF	Exposure Frequency	350	days/year	USEPA, 1991a	CS x SSAF x DABS x SA x EF x ED x CF1
				ED	Exposure Duration	30	years	USEPA, 1991a	BW x AT x CF2
				EDc	Exposure Duration	24	years	USEPA, 1991b	
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	
				BW	Body Weight	70	kg	USEPA, 1991a	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a	
				AT-N	Averaging Time (Non-Cancer)	30	years	USEPA, 1991a	
				CF2	Conversion Factor 2	365	days/year	---	
		Child	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				SSAF	Soil to Skin Adherence Factor	0.2	mg/cm^2-day	USEPA, 1997, 2004	Internal (Lifetime) Average Daily Dose
				DABS	Dermal Absorption Factor (Solid)	(2)	--	USEPA, 1995, 2003	$[(L)ADD_{int}]$ (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	2,800 (5)	cm^2	USEPA, 1997	
				EF	Exposure Frequency	350	days/year	USEPA, 1991	CS x SSAF x DABS x SA x EF x ED x CF1
				ED	Exposure Duration	6	years	USEPA, 1991	BW x AT x CF2
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	
				BW	Body Weight	15	kg	USEPA, 1991	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991	
				AT-N	Averaging Time (Non-Cancer)	6	years	USEPA, 1991	
				CF2	Conversion Factor 2	365	days/year	---	

(1) Best professional judgement. Based on site maintenance/inspection activities conducted 1day/week and assuming 2 weeks on vacation.
(2) Dermal absorption factors are presented in **Table E.1-25.**
(3) Value derived from data presented in USEPA (1997), averaging across gender and age. It is assumed that head, hands, and forearms are exposed to soil.
(4) Value derived from data presented in USEPA (1997), averaging across gender and age. It is assumed that head, hands, forearms, and lower legs are exposed to soil.
(5) Value derived from data presented in USEPA (1997), averaging across gender and age. It is assumed that head, hands, forearms, lower legs, and feet are exposed to soil.

USEPA, 1991a: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.
USEPA, 1991b: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). OSWER 9285.7-01 B.
USEPA, 1995: Assessing Dermal Exposure from Soil Hazardous Waste Management Division. Office of Superfund Programs, Region III, Philadelphia, PA.
USEPA, 1997: Exposure Factors Handbook, Volume I. EPA/600/P-95/002Fa.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.
USEPA, 2003: Updated Dermal Exposure Assessment Guidance. Office of Superfund Programs, Region III, Philadelphia, PA.
USEPA, 2004: Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final.

Table E.1-17
Values Used for Daily Intake Calculations - Current/Future Exposures to Surface Soil - Air
SWMU 51

Scenario Timeframe:	Current and Future
Medium:	Surface Soil
Exposure Medium:	Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation (Particulates)	Maintenance Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				PEF	Particulate Emission Factor	7.81E+08	m^3/kg	Site-Specific PEF	
				IN	Inhalation Rate	2.5	m^3/h	(1)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	50	days/year	(2)	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2002	
				ET	Exposure Time	8	hr/day	USEPA, 2002	$\frac{CS \times (1/PEF) \times IN \times EF \times ED \times ET}{BW \times AT \times CF1}$
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	365	days/year	---	
Inhalation (Volatiles)	Maintenance Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				VF	Volatilization Factor	Chemical-Specific	m^3/kg	Chemical-Specific	
				IN	Inhalation Rate	2.5	m^3/h	(1)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	50	days/year	(2)	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2002	
				ET	Exposure Time	8	hr/day	USEPA, 2002	$\frac{CS \times (1/VF) \times IN \times EF \times ED \times ET}{BW \times AT \times CF1}$
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	365	days/year	---	

(1) The hourly inhalation rate was derived by dividing the adult's daily 20 m^3/day USEPA (1991) inhalation rate by 8 hours per day.
(2) Best professional judgement. Based on site maintenance/inspection activities conducted 1day/week and assuming 2 weeks on vacation.

USEPA, 1991: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

Table E.1-18
Values Used for Daily Intake Calculations - Future Exposures to Total Soil - Air
SWMU 51

Scenario Timeframe:	Future
Medium:	Total Soil
Exposure Medium:	Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation (Particulates)	Maintenance Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				PEF	Particulate Emission Factor	7.81E+08	m^3/kg	Site-Specific PEF	
				IN	Inhalation Rate	2.5	m^3/h	(1)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	50	days/year	(2)	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2002	
				ET	Exposure Time	8	hr/day	USEPA, 2002	CS x (1/PEF) x IN x EF x ED x ET
				BW	Body Weight	70	kg	USEPA, 2002	BW x AT x CF1
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	365	days/year	---	
	Excavation Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				PEF	Particulate Emission Factor	1.94E+06	m^3/kg	Site-Specific PEF	
				IN	Inhalation Rate	2.5	m^3/h	(1)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	250	days/year	USEPA, 2002	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	1	years	USEPA, 2002	
				ET	Exposure Time	8	hr/day	USEPA, 2002	CS x (1/PEF) x IN x EF x ED x ET
				BW	Body Weight	70	kg	USEPA, 2002	BW x AT x CF1
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	1	years	USEPA, 2002	
				CF1	Conversion Factor 1	365	days/year	---	
	Resident	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				PEF	Particulate Emission Factor	7.81E+08	m^3/kg	Site-Specific PEF	
				IN	Inhalation Rate	0.83	m^3/h	(3)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	30	years	USEPA, 1991a	
				EDc	Exposure Duration	24	years	USEPA, 1991b	
				ET	Exposure Time	1	hr/day	(4)	CS x (1/PEF) x IN x EF x ED x ET
				BW	Body Weight	70	kg	USEPA, 1991a	BW x AT x CF1
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a	
				AT-N	Averaging Time (Non-Cancer)	30	years	USEPA, 1991a	
				CF1	Conversion Factor 1	365	days/year	---	
		Child	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				PEF	Particulate Emission Factor	7.81E+08	m^3/kg	Site-Specific PEF	
				IN	Inhalation Rate	1	m^3/h	(5)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	6	years	USEPA, 1991a	
				ET	Exposure Time	1	hr/day	(6)	CS x (1/PEF) x IN x EF x ED x ET
				BW	Body Weight	15	kg	USEPA, 1991a	BW x AT x CF1
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a	
				AT-N	Averaging Time (Non-Cancer)	6	years	USEPA, 1991a	
				CF1	Conversion Factor 1	365	days/year	---	
Inhalation (Volatiles)	Maintenance Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				VF	Volatilization Factor	Chemical-Specific	m^3/kg	Chemical-Specific	
				IN	Inhalation Rate	2.5	m^3/h	(1)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	50	days/year	(2)	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2002	
				ET	Exposure Time	8	hr/day	USEPA, 2002	CS x (1/VF) x IN x EF x ED x ET
				BW	Body Weight	70	kg	USEPA, 2002	BW x AT x CF1
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	365	days/year	---	

Table E.1-18
Values Used for Daily Intake Calculations - Future Exposures to Total Soil - Air
SWMU 51

Scenario Timeframe:	Future
Medium:	Total Soil
Exposure Medium:	Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation (Volatiles) (con't)	Excavation Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				VF	Volatilization Factor	Chemical-Specific	m^3/kg	Chemical-Specific	
				IN	Inhalation Rate	2.5	m^3/h	(1)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	250	days/year	USEPA, 2002	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	1	years	USEPA, 2002	
				ET	Exposure Time	8	hr/day	USEPA, 2002	$\frac{CS \times (1/VF) \times IN \times EF \times ED \times ET}{BW \times AT \times CF1}$
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	1	years	USEPA, 2002	
				CF1	Conversion Factor 1	365	days/year	---	
	Resident	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				VF	Volatilization Factor	Chemical-Specific	m^3/kg	Chemical-Specific	
				IN	Inhalation Rate	0.83	m^3/h	(3)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	30	years	USEPA, 1991a	
				EDc	Exposure Duration	24	years	USEPA, 1991b	
				ET	Exposure Time	1	hr/day	(4)	$\frac{CS \times (1/VF) \times IN \times EF \times ED \times ET}{BW \times AT \times CF1}$
				BW	Body Weight	70	kg	USEPA, 1991a	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a	
				AT-N	Averaging Time (Non-Cancer)	30	years	USEPA, 1991a	
				CF1	Conversion Factor 1	365	days/year	---	
		Child	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				VF	Volatilization Factor	Chemical-Specific	m^3/kg	Chemical-Specific	
				IN	Inhalation Rate	1	m^3/h	(5)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	6	years	USEPA, 1991a	
				ET	Exposure Time	1	hr/day	(6)	$\frac{CS \times (1/VF) \times IN \times EF \times ED \times ET}{BW \times AT \times CF1}$
				BW	Body Weight	15	kg	USEPA, 1991a	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a	
				AT-N	Averaging Time (Non-Cancer)	6	years	USEPA, 1991a	
				CF1	Conversion Factor 1	365	days/year	---	

(1) The maintenance worker and excavation worker hourly inhalation rate was derived by dividing the adult's daily 20 m^3/day USEPA (1991) inhalation rate by 8 hours per day.
(2) Best professional judgement. Based on site maintenance/inspection activities conducted 1day/week and assuming 2 weeks on vacation.
(3) The adult resident hourly inhalation rate was derived by dividing the adult daily 20 m^3/day USEPA (1991) inhalation rate by 24 hours per day.
(4) Exposure time is based upon the average time an adult spends outdoors, assuming 1.5 hours/day (USEPA, 1997) with the exception of the three coldest months of the year.
(5) The child resident hourly inhalation rate was based on light activities (USEPA, 1997).
(6) Exposure time is based upon the assumption that children (ages 6 years and under) would be accompanied or supervised by an adult during time spent outdoors. Therefore, the exposure time for the child is is equivalent to the adult, i.e., an average time of 1.5 hours/day (USEPA, 1997) with the exception of the coldest months of the year.

USEPA, 1991a: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.
USEPA, 1991b: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). OSWER 9285.7-01 B.
USEPA, 1997: Exposure Factors Handbook, Volume I. EPA/600/P-95/002Fa.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

Table E.1-19
Values Used for Daily Intake Calculations - Future Exposures to Surface and Total Soil
SWMU 51

Scenario Timeframe:	Future
Medium:	Surface and Total Soil
Exposure Medium:	Surface and Total Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Industrial Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 2002	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	225	days/year	USEPA, 2002	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	$\frac{CS \times IR\text{-}S \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF2	Conversion Factor 2	365	days/year	---	
Dermal	Industrial Worker	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				SSAF	Soil to Skin Adherence Factor	0.2	mg/cm^2-day	USEPA, 1997, 2002	Internal (Lifetime) Average Daily Dose
				DABS	Dermal Absorption Factor (Solid)	(1)	--	USEPA, 1995, 2003	$[(L)ADD_{int}]$ (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	3,300 (2)	cm^2	USEPA, 1997, 2004	
				EF	Exposure Frequency	225	days/year	USEPA, 2002	$\frac{CS \times SSAF \times DABS \times SA \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				ED	Exposure Duration	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	$1/10^6$	kg/mg	---	
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF2	Conversion Factor 2	365	days/year	---	

(1) Dermal absorption factors are presented in **Table E.1-25.**
(2) Value derived from data presented in USEPA (1997), averaging across gender and age. It is assumed that head, hands, and forearms are exposed to surface soil.

USEPA, 1995: Assessing Dermal Exposure from Soil Hazardous Waste Management Division. Office of Superfund Programs, Region III, Philadelphia, PA.
USEPA, 1997: Exposure Factors Handbook, Volume I. EPA/600/P-95/002Fa.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.
USEPA, 2003: Updated Dermal Exposure Assessment Guidance. Office of Superfund Programs, Region III, Philadelphia, PA.
USEPA, 2004: Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final.

Table E.1-20
Values Used for Daily Intake Calculations - Future Exposures to Surface and Total Soil - Air
SWMU 51

Scenario Timeframe:	Future
Medium:	Surface and Total Soil
Exposure Medium:	Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation (Particulates)	Industrial Worker (Outdoor)	Adult	SWMU 51	CS	Chemical Concentration in Soil	See site-specific EPC tables	mg/kg	See site-specific EPC tables	
				PEF	Particulate Emission Factor	7.81E+08	m^3/kg	Site-Specific PEF	
				IN	Inhalation Rate	2.5	m^3/h	(1)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	225	days/year	USEPA, 2002	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2002	
				ET	Exposure Time	8	hr/day	USEPA, 2002	$\frac{CS \times (1/PEF) \times IN \times EF \times ED \times ET}{BW \times AT \times CF1}$
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	365	days/year	---	

(1) The hourly inhalation rate was derived by dividing the worker's daily 20 m^3/day USEPA (2002) inhalation rate by 8 hours per day.

USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

Table E.1-21
Values Used for Daily Intake Calculations - Current/Future Exposures to Groundwater, Inhalation
SWMU 51

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Maintenance Worker	Adult	SWMU 51	CA	Modeled Ambient Air Concentration	(1)	mg/m^3	(1)	
				IN	Inhalation Rate	2.5	m^3/hr	(2)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	50	days/year	(3)	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2002	
				ET	Exposure Time (Ambient Air)	8	hr/day	USEPA, 2002	CA x IN x EF x ED x ET
				BW	Body Weight	70	kg	USEPA, 2002	BW x AT x CF1
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	365	days/year	---	

(1) Ambient air concentrations were modeled by a volatilization model (ASTM, 1995). A discussion of the model is provided in **Table E.1-28.**

(2) The hourly inhalation rate was derived by dividing the adult's daily 20 m^3/day USEPA (1991) inhalation rate by 8 hours per day.

(3) Best professional judgement. Based on site maintenance/inspection activities conducted 1 day/week and assuming 2 weeks for vacation.

ASTM, 1995: Standard Guide for Risk-Based Corrective Action at Petroleum Release Sites, ASTM Committee E-50 on Environmental Assessment, Report No. E1739-95, West Conshohocken, Pennsylvania.
USEPA, 1991: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

Table E.1-22
Values Used for Daily Intake Calculations - Future Exposures to Groundwater
SWMU 51

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Industrial Worker	Adult	SWMU 51	CW	Chemical Concentration in Groundwater	See site-specific EPC tables	µg/l	See site-specific EPC tables	
				IR-W	Ingestion Rate of Groundwater	1	liters/day	USEPA, 1991a	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	225	days/year	USEPA, 2002	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	$1/10^3$	mg/µg	---	$\frac{CW \times IR\text{-}W \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				BW	Body Weight	70	kg	USEPA, 2002	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF2	Conversion Factor 2	365	days/year	---	
	Resident (On-site and Off-site)	Adult	SWMU 51	CW	Chemical Concentration in Groundwater	See site-specific EPC tables	µg/l	See site-specific EPC tables	
				IR-W	Ingestion Rate of Groundwater	2	liters/day	USEPA, 1991a, 2003	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a, 2003	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	30	years	USEPA, 1991a, 2003	
				EDc	Exposure Duration (Cancer)	24	years	USEPA, 1991b	
				CF1	Conversion Factor 1	$1/10^3$	mg/µg	---	$\frac{CW \times IR\text{-}W \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				BW	Body Weight	70	kg	USEPA, 1991a, 2003	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a, 2003	
				AT-N	Averaging Time (Non-Cancer)	30	years	USEPA, 1991a, 2003	
				CF2	Conversion Factor 2	365	days/year	---	
		Child	SWMU 51	CW	Chemical Concentration in Groundwater	See site-specific EPC tables	µg/l	See site-specific EPC tables	
				IR-W	Ingestion Rate of Groundwater	1	liters/day	USEPA, 2003	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a, 2003	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	6	years	USEPA, 1991a, 2003	
				CF1	Conversion Factor 1	$1/10^3$	mg/µg	---	$\frac{CW \times IR\text{-}W \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				BW	Body Weight	15	kg	USEPA, 1991a, 2003	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a, 2003	
				AT-N	Averaging Time (Non-Cancer)	6	years	USEPA, 1991a, 2003	
				CF2	Conversion Factor 2	365	days/year	---	
Dermal Absorption	Resident (On-site and Off-site)	Adult	SWMU 51	DA	Dose Absorbed per Unit Area per Event	--	mg/cm^2-event	(1)	
				SA	Skin Surface Area Available for Contact	18,000	cm^2	USEPA, 2004	Internal (Lifetime) Average Daily Dose
				EV	Event Frequency	1	events/day	USEPA, 2004	$[(L)ADD_{int}]$ (mg/kg-day) =
				EF	Exposure Frequency	350	days/year	USEPA, 1991a, 2003	
				ED	Exposure Duration	30	years	USEPA, 1991a, 2003	
				EDc	Exposure Duration (Cancer)	24	years	USEPA, 1991b, 2003	$\frac{DA \times SA \times EV \times EF \times ED}{BW \times AT \times CF1}$
				BW	Body Weight	70	kg	USEPA, 1991a, 2003	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a, 2003	
				AT-N	Averaging Time (Non-Cancer)	30	years	USEPA, 1991a, 2003	
				CF1	Conversion Factor 1	365	days/year	---	
		Child	SWMU 51	DA	Dose Absorbed per Unit Area per Event	--	mg/cm^2-event	(2)	
				SA	Skin Surface Area Available for Contact	6,600	cm^2	USEPA, 2004	Internal (Lifetime) Average Daily Dose
				EV	Event Frequency	1	events/day	USEPA, 2004	$[(L)ADD_{int}]$ (mg/kg-day) =
				EF	Exposure Frequency	350	days/year	USEPA, 1991a, 2003	
				ED	Exposure Duration	6	years	USEPA, 1991a, 2003	$\frac{DA \times SA \times EV \times EF \times ED}{BW \times AT \times CF1}$
				BW	Body Weight	15	kg	USEPA, 1991a, 2003	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a, 2003	
				AT-N	Averaging Time (Non-Cancer)	6	years	USEPA, 1991a, 2003	
				CF1	Conversion Factor 1	365	days/year	---	

Table E.1-22
Values Used for Daily Intake Calculations - Future Exposures to Groundwater
SWMU 51

(1) Value is calculated using the equations presented in **Table E.1-** and assuming an exposure time of 35 minutes (ET = 0.58 hr; USEPA, 2004). Region III has adopted the high-end shower/bath times presented in RAGs E as default recommendations (USEPA, 2005).
(2) Value is calculated using the equations presented in **Table E.1-** and assuming an exposure time of 60 minutes (ET = 1.0 hr; USEPA, 2004). Region III has adopted the high-end shower/bath times presented in RAGs E as default recommendations (USEPA, 2005).

USEPA, 1991a: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.
USEPA, 1991b: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). OSWER 9285.7-01B.
USEPA, 2003: EPA Region 3 Risk-Based Concentration Table: Technical Background Information, Region 3, Philadelphia, PA.
USEPA, 2004: Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final.
USEPA, 2005: EPA Region 3 web site - http://www.epa.gov/reg3hwmd/risk/human/index.htm.

Table E.1-23
Values Used for Daily Intake Calculations - Future Exposures to Groundwater, Inhalation
SWMU 51

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Industrial Worker	Adult	SWMU 51	CA	Modeled Ambient Air Concentration or Indoor Air Concentration	(1, 2)	mg/m^3	(1, 2)	
				IN	Inhalation Rate	2.5	m^3/hr	(3)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	225	days/year	USEPA, 2002	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	25	years	USEPA, 2002	
				ET	Exposure Time (Ambient Air)	8	hr/day	USEPA, 2002	CA x IN x EF x ED x ET
				BW	Body Weight	70	kg	USEPA, 2002	BW x AT x CF1
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	25	years	USEPA, 2002	
				CF1	Conversion Factor 1	365	days/year	---	
	Excavation Worker	Adult	SWMU 51	CA	Modeled Trench Air Concentration	(4)	mg/m^3	(4)	
				IN	Inhalation Rate	2.5	m^3/hr	(5)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	250	days/year	(6)	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	1	years	(6)	
				ET	Exposure Time (Trench Air)	4	hr/day	(6)	CA x IN x EF x ED x ET
				BW	Body Weight	70	kg	USEPA, 2002	BW x AT x CF1
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 2002	
				AT-N	Averaging Time (Non-Cancer)	1	years	USEPA, 2002	
				CF1	Conversion Factor 1	365	days/year	---	
	Resident (On-site and Off-site)	Adult	SWMU 51	CA	Indoor Air Concentration or Modeled Shower Room Air Concentration	(2, 7)	mg/m^3	(2, 7)	
				IN	Inhalation Rate	0.83	m^3/hr	(8)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	30	years	USEPA, 1991a	
				EDc	Exposure Duration (Cancer)	24	years	USEPA, 1991b	
				ET	Exposure Time (Shower Room Air/Indoor Air)	1.08/24	hr/day	(9); Johnson and Ettinger (1991)	CA x IN x EF x ED x ET
				BW	Body Weight	70	kg	USEPA, 1991a	BW x AT x CF1
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a	
				AT-N	Averaging Time (Non-Cancer)	30	years	USEPA, 1991a	
				CF1	Conversion Factor 1	365	days/year	---	
		Child	SWMU 51	CA	Modeled Indoor Air Concentration	(2)	mg/m^3	(2)	
				IN	Inhalation Rate	1	m^3/hr	(10)	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	6	years	USEPA, 1991a	
				ET	Exposure Time (Indoor Air)	24	hr/day	Johnson and Ettinger (1991)	CA x IN x EF x ED x ET
				BW	Body Weight	15	kg	USEPA, 1991a	BW x AT x CF1
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a	
				AT-N	Averaging Time (Non-Cancer)	6	years	USEPA, 1991a	
				CF1	Conversion Factor 1	365	days/year	---	

(1) Ambient air concentrations were modeled by a volatilization model (ASTM, 1995). A discussion of the model is provided in **Table E.1-28.**
(2) Indoor air concentrations were modeled using the Johnson and Ettinger (1991) model. A discussion of the model is provided in **Table E.1-30.**
(3) The hourly inhalation rate was derived by dividing the adult's daily 20 m^3/day USEPA (1991a) inhalation rate by 8 hours per day.
(4) Trench air concentrations were modeled by the Trench Model (VDEQ, 2007). A discussion of the model is provided in **Table E.1-31.**
(5) The construction worker inhalation rate is based on the outdoor worker inhalation rate (i.e., the mean value for heavy activities from Table 5-23; USEPA, 1997).
(6) The default construction scenario is based on a worker working on a construction project for 250 days per year for 1 year. The construction worker is assumed to be exposed to groundwater for 4 hrs a day (VDEQ, 2006).
(7) Shower room air concentrations were modeled using the Foster and Chrostowski (1987) Shower Inhalation Model. Modeled concentrations were calculated in **Table E.1-32** using data from site-specific EPC tables.
(8) The adult resident hourly inhalation rate was derived by dividing the adult daily 20 m^3/day USEPA (1991a) inhalation rate by 24 hours per day.
(9) An exposure time of 65 minutes (ET = 1.08 hr) is assumed - 35 minutes spent showering (based on the 95th percentile value for overall showering time; Table 15-21, USEPA 2004) with an additional 30 minutes in the shower room (USEPA, 2004). Region III has adopted the high-end shower/bath times presented in RAGS E as default recommendations (USEPA, 2005). The exposure time for indoor air exposure to COCs via vapor intrusion is 24 hours/day.
(10) The child resident hourly inhalation rate was based on light activities (USEPA, 1997).

American Society for Testing and Materials (ASTM). 1995. Standard Guide for Risk-Based Corrective Action at Petroleum Release Sites. ASTM Committee E-50 on Environmental Assessment, Report No. E1739-95. West Conshohocken, Pennsylvania.
Foster, S.A. and P.C. Chrostowski. 1987. Inhalation Exposures to Volatile Organic Contaminants in the Shower. In the proceedings of the 80th Annual Meeting of the Air Pollution Control Association (APCA), June 21-26, New York.
Johnson, P.C. and Ettinger, R.A. 1991: Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings. Environmental Science & Technology. 25:1445-1452.
USEPA, 1991a: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.
USEPA, 1991b: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). OSWER 9285.7-01B.
USEPA, 1997: Exposure Factors Handbook, Volume I. EPA/600/P-95/002Fa.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening for Superfund Sites. OSWER 9355.4-24.
USEPA, 2004: Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final.
USEPA, 2005: EPA Region 3 web site - http://www.epa.gov/reg3hwmd/risk/human/index.htm.
VDEQ, 2006: Voluntary Remediation Program Risk Assessment Guidance, Virginia Department of Environmental Quality.

Table E.1-24
Values Used for Daily Intake Calculations
Future Exposures to Home Grown Produce for Residents
SWMU 51

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Home Grown Produce

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident (On-site and Off-site)	Adult	SWMU 51	CV	Chemical Concentration in Produce	---	mg/kg	(1)	
				ABS	Chemical-Specific	---	unitless	(1)	
				IR-P	Ingestion Rate of Produce	18.6 (3)	g/d	USEPA, 1997	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a, 2003	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	30	years	USEPA, 1991a, 2003	
				EDc	Exposure Duration (Cancer)	24	years	USEPA, 1991b	
				CF1	Conversion Factor 1	$1/10^3$	mg/µg	---	$\frac{CV \times ABS \times IR\text{-}P \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				BW	Body Weight	70	kg	USEPA, 1991a, 2003	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a, 2003	
				AT-N	Averaging Time (Non-Cancer)	30	years	USEPA, 1991a, 2003	
				CF2	Conversion Factor 2	365	days/year	---	
		Child	SWMU 51	CV	Chemical Concentration in Produce	---	mg/kg	(1)	
				ABS	Chemical-Specific	---	unitless	(2)	
				IR-P	Ingestion Rate of Produce	18.6 (3)	g/d	USEPA, 1997	Potential (Lifetime) Average Daily Dose
				EF	Exposure Frequency	350	days/year	USEPA, 1991a, 2003	$[(L)ADD_{pot}]$ (mg/kg-day) =
				ED	Exposure Duration	6	years	USEPA, 1991a, 2003	
				CF1	Conversion Factor 1	$1/10^3$	mg/µg	---	$\frac{CV \times ABS \times IR\text{-}P \times EF \times ED \times CF1}{BW \times AT \times CF2}$
				BW	Body Weight	15	kg	USEPA, 1991a, 2003	
				AT-C	Averaging Time (Cancer)	70	years	USEPA, 1991a, 2003	
				AT-N	Averaging Time (Non-Cancer)	6	years	USEPA, 1991a, 2003	
				CF2	Conversion Factor 2	365	days/year	---	

(1) No COPCs were identified for this pathway
(2) Value includes 7.5 g/d of vegetables and 11.1 g/d of fruit. The ingestion rate is based on 95th percentile values for home grown food intake (Table 1-2; USEPA, 1997).

USEPA, 1991a: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.
USEPA, 1991b: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). OSWER 9285.7-01B.
USEPA, 1997: Exposure Factors Handbook, Volume I. EPA/600/P-95/002Fa.
USEPA 2003: EPA Region 3 Risk-Based Concentration Table: Technical Background Information, Region 3, Philadelphia, PA.

Table E.1-25
Dermal Absorption Fractions and Volatilization Factors for Soil - SWMU 51
Radford Army Ammunition Plant, Radford, Virginia

Analyte	CAS NO.	ABS_d [a] (m^3/kg)	D_i (cm^2/s)	D_w (cm^2/s)	K_{oc} (cm^3/g)	K_d (cm^3/g)	H (unitless)	D_A (cm^2/s)	VF (m^3/kg) [b]
Aluminum	7429-90-5	1.0E-02							
Antimony	7440-36-0	1.0E-02							
Arsenic	7440-38-2	3.0E-02							
Cadmium	7440-43-9	1.0E-03							
Chromium III	7440-47-3	1.0E-02							
Cobalt	7440-48-4	1.0E-02							
Copper	7440-50-8	1.0E-02							
Iron	7439-89-6	1.0E-02							
Lead	7439-92-1	1.0E-02							
Manganese	7439-96-5	1.0E-02							
Thallium	7440-28-0	1.0E-02							
Vanadium	7440-62-2	1.0E-02							
Dibenz(a,h)anthracene	53-70-3	1.3E-01							
4-Methyl-2-pentanone	108-10-1	3.0E-02	7.50E-02	7.80E-06	1.30E+02	8.00E-01	5.70E-03	2.46E-05	1.98E+04
2-Nitrotoluene	88-72-2	3.0E-02	7.60E-02	8.60E-06	6.46E+01	3.90E-01	9.84E-04	8.01E-06	3.47E+04
3-Nitrotoluene	99-08-1	3.0E-02	7.60E-02	8.60E-06	6.46E+01	3.90E-01	9.84E-04	8.01E-06	3.47E+04
4-Nitrotoluene	99-99-0	3.0E-02	7.60E-02	8.60E-06	6.46E+01	3.90E-01	9.84E-04	8.01E-06	3.47E+04
1,3-Dinitrobenzene	99-65-0	1.0E-01							
2,4-Dinitrotoluene	121-14-2	1.02E-01							
2,6-Dinitrotoluene	606-20-2	9.9E-02							
2-Hexanone	591-78-6	1.0E-01							
2-Nitroaniline	88-74-4	1.0E-01							
PETN	78-11-5	1.0E-01							
1,3,5-Trinitrobenzene	99-35-4	1.9E-02							
2,4,6-Trinitrotoluene	118-96-7	3.2E-02							
Nitroglycerin	55-63-0	1.0E-01							
TCDD TE		3.0E-02							

CAS No. = Chemical Abstract Service No.
ABS_d = Dermal Absorption Factor
VF = Volatilization Factor
D_A = Apparent Diffusivity
m^3/kg = cubic meters per kilogram
cm^2/s = centimeter squared per second

[a] ABS_d values are taken from Exhibit 3-4, Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation and Manual, Part E; Supplemental Guidance for Dermal Risk Assessment, July 2004, and Region III Technical Guidance, Assessing Dermal Exposure in Soil, December 1995.

[b] VF calculations are provided in **Table E.1-26.**

Table E.1-26
Equations for Dermal Absorption Fractions and Volatilization Factors for Soil - SWMU 51
Radford Army Ammunition Plant, Radford, Virginia

D_A values calculated using the following equation and values from the Supplemental Guidance for Developing Soil Screening Levels at Superfund Sites. OSWER 9355.4-24. USEPA, 2002.
Equation 4-8 from USEPA, 2002.

$$D_A = \frac{[(\theta_a^{10/3} \; x \; D_i \; x \; H + \theta_w^{10/3} \; x \; D_w) \; / \; n^2]}{\rho_b \; x \; K_d + \theta_w + \theta_a \; x \; H}$$

where:

$\theta_{a(Lair/Lsoil)}$ =	0.28	default
$\theta_{w(Lwater/Lsoil)}$ =	0.15	default
D_i (cm^2/s) =	varies	chemical-specific
D_w (cm^2/s) =	varies	chemical-specific
H (unitless)	varies	chemical-specific
$n_{(Lpore/Lsoil)}$ =	0.43	default
ρ_b (g/cm^3) =	1.5	default
K_d (cm^3/g) =	varies	
K_{oc} (cm^3/g) =	varies	
f_{oc} (g/g) =	0.006	

VF (soil only) values for commercial/industrial worker, adult resident and child resident calculated using Equation 4-8 from the Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. USEPA, 2002.

$$VF = \frac{Q/C \; x \; (3.14 x D_A \; x \; T)^{1/2} \; x \; CF}{2 \; x \; \rho_b \; x \; D_A}$$

Q/C (g/m^2-s)/kg/m^3) =	53.89	calculated value
D_A (cm^2/s) =	varies	chemical specific
T (seconds) =	varies	receptor-specific exposure interval (T= ED (yrs)*365 days/yr*24hr/day*60 min/hr*60 sec/min)
CF (m^2/cm^2) =	1.00E-04	default
ρ_b (g/cm^3) =	1.5	default

Table E.1-27
Equations for Particulate Emission Factors (PEFs) for Soil - SWMU 51
Radford Army Ammuntion Plant, Radford, Virginia

Commercial/Industrial Worker

Equation 4-5 from Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24, USEPA, 2002

$$PEF = \frac{Q}{C} \times \frac{3{,}600 \ \frac{sec}{hr}}{0.036 \times (1 - V) \times \left(\frac{U_m}{U_t}\right)^3 \times F(x)}$$

Where:	Value	
PEF (m^3/kg)=	7.81E+08	
Q/C_{wind} (g/m^2-s/kg/m^3) =	53.89	Inverse of the mean concentration at the center of a 0.5-acre source (Soil Screening Guidance User's Guide (USEPA, 1996), Exhibit 11, Value for Huntington, West Virginia)
V (unitless) =	0.5	fraction of vegetative cover (default)
U_m (m/s) =	4.69	mean annual wind speed (default)
U_t (m/s) =	11.32	equivalent threshold value of windspeed at 7 m (default)
F(x) (unitless) =	0.194	function dependent on U_m/U_t derived using Cowherd et al (1985) (default)
Site area (acres) =	0.5	Represents contaminated site ares of 0.16 acres

Table E.1-27
Equations for Particulate Emission Factors (PEFs) for Soil - SWMU 51
Radford Army Ammuntion Plant, Radford, Virginia

Construction Worker

Equation 5-5 from Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24, USEPA, 2002

$$PEF_{sc} = Q / C_{sr} \; x \; \frac{1}{F_D} \; x \left[\frac{T \; x \; A_R}{556 \; x \; (W/3)^{0.4} \; x \; \frac{365 \; day/yr - p)}{365 \; day/yr} \; x \; \sum VKT} \right]$$

Where:

		Value	
PEF (m^3/kg)=		1.94E+06	Subchronic road particulate emission factor (calculated)
Q/C_{sr} (g/m^2-s/kg/m^3) =		28.75	Inverse of the ratio of the 1-hour geometric mean concentration to the emission flux along a straight road segment bisecting a square site (calculated)
F_D (unitless) =		0.185	Dispersion correction factor (default)
T (seconds) =		7,488,000	Receptor-specific exposure interval (T = ED (yrs)*365 days/yr*8hr/day*60 min/hr*60 sec/min) (site specific) Assume ED for construction worker = 52 weeks (1 yr)
A_R (m^2) =		155.10	Contaminated surface area (L_R*W_R) (calculated)
	L_R (m) =	25.4	length of road (site specific)
	W_R (m) =	6.10	width of roadway (site specific)
W (tons) =		8	Mean vehicle weight = X cars*2 ton/car +Y trucks*20 tons/truck/(X+Y) (site specific)
	cars =	20	
	trucks =	10	
p (days/year) =		160	Number of days with at least 0.1 inches of precipitation (Exhibit 5-2) (site specific)
ΣVKT (km) =		198.5	Sum of fleet vehicle kilometers traveled during the exposure duration (site specific)

Equation 5-6 from USEPA, 2002:

$$Q / C_{sr} = A \; x \; \exp \left[\frac{(\ln A_s - B)^2}{C} \right]$$

Q/C_{sr} =	28.75	g/m^2-s/kg/m^3
A =	12.9351	Default
B =	5.7383	Default
C =	71.7711	Default
A_s (acres) =	0.16	Contaminated site area

Table E.1-28
Calculation of Ambient Air Concentration from Groundwater

Spreadsheet to calculate outdoor air vapor concentration from groundwater, based on ASTM method.

Constituent	Henry's Law Const.	Wind Speed	Mixing Zone Height	Thickness of Capillary Fringe	Thickness of Vadose Zone	Depth to Groundwater	Effec. Diffus. Coeff. from GW to Soil	Width of Source Area Parallel to Wind	Effec. Diffus. Coeff. in Cap-illary Fringe	Effec. Diffus. Coeff. in Soil	Total Soil Porosity	Vol. Air Cont. in Capillary Fringe Soil	Vol. Water Cont. in Capillary Fringe Soil	Vol. Air Cont. in Vadose Zone Soil	Vol. H2O Cont. in Vadose Zone Soil	Diffusion Coeff. in Air	Diffusion Coeff. in H2O	**OUTPUT** Volatilization Factor
symbol:	(H)	(Uair)	(ht)	(hcap)	(hv)	(Lgw)	(DwsEff)	(W)	(DcapEff)	(DsEff)	(0t)	(0acap)	(0wcap)	(0as)	(0ws)	(Dair)	(Dwat)	(VFamb)
units:	cm3-H2O / cm3-Air	(cm/sec)	(cm)	(cm)	(cm)	(cm)	(cm^2/sec)	(cm)	(cm^2/sec)	(cm^2/sec)	cm3 / cm3-soil	cm3-Air / cm3-soil	cm3-H2O / cm3-soil	cm3-Air / cm3-soil	cm3-H2O / cm3-soil	cm2/sec	cm2/sec	mg/m3-Air / mg/L-H2O
PCE	7.50E-01	402	200	122	381	1265	0.0000	1,097	0.000011	0.0056	0.38	0.038	0.342	0.26	0.12	7.20E-02	8.20E-06	3.79E-07

Source: ASTM, 1994

Constituents	Groundwater Concentration (mg/L)	VFamb	**"Ca"** Concentration (mg/m^3)
PCE	9.30E-04	3.79E-07	3.52E-10

Table E.1-28
Calculation of Ambient Air Concentration from Groundwater

$$VF_{wamb} = (H\ /1 + (U_a d_{air} L_{GW}\ /WD_{effws}))\ X\ 10^3\ L/m^3$$

Where:

VF_{wamb} (mg/m^3 air per mg/L water) =	calculated	Volatilization factor
H (cm^3-water per cm^3-air) =	chemical-specific	Henry's Law Constant ($7.5x10^{-1}$ for tetrachloroethene)
U_a (cm/sec) =	402	Wind speed above ground surface (NOAA, 1991)
d_{air} (cm) =	200	Ambient air mixing zone height (ASTM, 1995)
L_{GW} (cm) =	457	Depth to groundwater - site specific
W (cm) =	1,097	Width of source area parallel to wind flow direction (site-specific)
D_{effws} (cm^2/sec) =	calculated	Effective diffusion coefficient between groundwater and soil surface

$$D_{effws} = \left(h_{cap} + h_v\right)\left[\frac{h_{cap}}{D_{effcap}} + \frac{h_v}{D_{effs}}\right]^{-1}$$

Where:

D_{effws} (cm^2/sec) =	calculated	Effective diffusion coefficient between groundwater and soil surface
h_{cap} (cm) =	122	Thickness of capillary fringe (site specific)
h_v (cm) =	381	Thickness of vadose zone (site specific)
D_{effcap} (cm^2/sec) =	calculated	Effective diffusion coefficient through capillary fringe
D_{effs} (cm^2/sec) =	calculated	Effective diffusion coefficient in soil based on vapor phase concentration

Table E.1-28
Calculation of Ambient Air Concentration from Groundwater

$$D_{effcap} = D^{air} \frac{\theta_{acap}^{3.33}}{\theta_T^2} + D^{wat} \frac{1}{H} \frac{\theta_{wcap}^{3.33}}{\theta_T^2}$$

Where:

D_{effcap} (cm^2/sec) =	calculated	Effective diffusion coefficient through capillary fringe
D_{air} (cm^2/sec) =	7.20E-02	Diffusion coefficient in air (chemical-specific)
D_{wat} (cm^2/sec) =	8.20E-06	Diffusion coefficient in water (chemical-specific)
θ_{acap} (cm^3-air/cm^3-soil)	0.038	Volumetric air content in capillary fringe soils
θ_{wcap} (cm^3-water/cm^3-soil)	0.342	Volumetric water content in capillary fringe soils
θ_T (cm^3/cm^3-soil)	0.38	Total soil porosity

$$D_{effs} = D^{air} \frac{\theta_{as}^{3.33}}{\theta_T^2} + D^{wat} \frac{1}{H} \frac{\theta_{ws}^{3.33}}{\theta_T^2}$$

Where:

D_{effs} (cm^2/sec) =	calculated	Effective diffusion coefficient in soil based on vapor phase concentration
D_{air} (cm^2/sec) =	7.20E-02	Diffusion coefficient in air (chemical-specific)
D_{wat} (cm^2/sec) =	8.20E-06	Diffusion coefficient in water (chemical-specific)
θ_{as} (cm^3-air/cm^3-soil)	0.26	Volumetric air content in vadose zone soils
θ_{ws} (cm^3-water/cm^3-soil)	0.12	Volumetric water content in vadose zone soils
H (cm^3-water per cm^3-air) =	chemical-specific	Henry's Law Constant ($7.5x10^{-1}$ for tetrachloroethene)
θ_T (cm^3/cm^3-soil)	0.38	Total soil porosity

Table E.1-28
Calculation of Ambient Air Concentration from Groundwater

The concentration of the COPC in the ambient air is calculated using the following equation:

$$C_{air} = C_{GW} \times VF_{wamb}$$

Where:

C_{air} (mg/m^3) =	calculated	Concentration of chemical in ambient air
C_{GW} (mg/L) =	site-specific	Concentration of chemical in groundwater
VF_{wamb} (mg/m^3 air per mg/L water) =	calculated	Volatilization factor

Table E.1-29
Parameter Values Used for Groundwater - SWMU 51
Radford Army Ammunition Plant, Radford, Virginia

Dermal Absorption - Chemicals of Potential Concern in Groundwater

Analyte	CAS No.	FA	Kp (cm/hr)	tau_{event}	B	t* (hr)
Organics						
Tetrachloroethene	127-18-4	1.0	3.3E-02	8.91E-01	1.62E-01	2.14E+00
TCDD	N/A	0.5	8.1E-01	6.92E+00	5.60E+00	3.01E+01
Inorganics						
Chromium III	16065-83-1	N/A	1.0E-03	N/A	N/A	N/A

Notes:
Organic parameter values are taken from Organic values from Organic Chemicals in Water spreadsheet (http://ww.epa.gov/oswer/riskassessment/ragse/index.htm)

Table E.1-30
Groundwater Inhalation Indoor Air Concentration Summary - SWMU 51
Radford Army Ammunition Plant, Radford, Virginia

Chemicals of Potential Concern in Groundwater and Indoor Air

Analyte	CAS No.	Cw ug/L	Ca mg/m^3
Organics			
Tetrachloroethene	127-18-4	9.30E-01	2.65E-05

Notes:
Indoor air concentrations modeled using Johnson and Ettinger Model
Model output provided in Appendix E.4

Non-default model inputs (based on site-specific data):
Average Groundwater Temperature (16.1º C)
Depth to Groundwater (1,003 cm)
Soil Type (Sandy Clay Loam)
Soil Properties ("Lookup" values from model; see Appendix E.4.)

Table E.1-31
Groundwater Inhalation Construction Worker Trench Gas Concentration Calculations - SWMU 51
Radford Army Ammunition Plant, Radford, Virginia

Analyte	CAS No.	C_w ug/L	H_i atm-m^3/mole	D_{air} cm^2/sec	VF L/min^3	C_a mg/m^3
Tetrachloroethene	127-18-4	9.30E-01	1.84E-02	7.20E-02	2.05E-02	1.91E-05

Exposure point calculations calculated using trench model for construction worker/ utility worker in a trench where average depth to groundwater is greater than 15 feet (VDEQ,2007).

$$VF = \frac{(H_i \times D_{air} \times AC_{vad}^{3.33} \times A \times F \times 10^{-3} \times 10^{4} \times 3600)}{(R \times T \times L_d \times ACH \times V \times Por_{vad}^{2})}$$

where:

Parameters	Value	
H_i (atm-m^3/mol) =	chemical-specific	Henry's Law constant for contaminant
D_{air} (cm^2/s) =	chemical-specific	Diffusion coefficient in air
AC_{vad} (cm^3/cm^3) =	0.25	Volumetric air content in vadose zone soil
A (m^2) =	2.22	Area of trench (default)
F (unitless) =	1	Fraction of floor through which contaminant can enter
R (atm-m^3/mole-°K) =	8.2×10^{-5}	ideal gas constant
T (°K) =	289	Average system absolute temperature
L_d (cm) =	1,003	Distance between trench bottom and groundwater (site-specific)
ACH (h^{-1}) =	2	Air changes per hour
V (m^3) =	10.14	Volume of trench (length x width x depth)
Por_{vad} (cm^3/cm^3) =	0.44	Total soil porosity in vadose zone (default)
Conversion Factor (L/cm^3) =	0.001	
Conversion Factor (cm^2/m^2) =	10,000	
Conversion Factor (s/hr) =	3,600	

Table E.1-31
Groundwater Inhalation Construction Worker Trench Gas Concentration Calculations - SWMU 51
Radford Army Ammunition Plant, Radford, Virginia

$$C_a = C_w \times VF \times 0.001$$

C_a (µg/m^3) =	chemical-specific	Concentration in trench air
C_w (µg/L) =	chemical-specific	Concentration in groundwater
VF (L/min^3) =	chemical-specific	Volatilization factor
Conversion Factor (mg/µg) =	0.001	

Table E.1-32
Groundwater Inhalation Shower Air Concentration Calculations - SWMU 51
Radford Army Ammunition Plant, Radford, Virginia

Analyte	CAS No.	Cw ug/L	MW g/mole	H atm-m^3/mole	k_l cm/hr	k_g cm/hr	K_L cm/hr	K_{aL} cm/hr	C_{wd} ug/L	S ug/m^3-min	Ca mg/m^3
Organics											
Tetrachloroethene	127-18-4	9.30E-01	1.66E+02	1.84E-02	#######	9.88E+02	1.02E+01	1.37E+01	1.01E-01	8.38E-02	1.31E-03

Variable	Equations:	
k_l (cm/hr) =	$20 \times (44/MW)^{0.5}$	Liquid-film transfer coefficient
k_g (cm/hr) =	$3000 \times (18/MW)^{0.5}$	Gas-film transfer coefficient
K_L (cm/hr) =	$(1/k_l + (R \times t/H^* k_g))^{-1}$	overall mass transfer coefficient
K_{aL} (cm/hr) =	$K_L \times ((T \times \mu_s/T_s \times \mu_l)^{-0.5}$	overall mass transfer coefficient adjusted to shower water temperature
C_{wd} (µg/L) =	$C_w \times (1-\exp(-K_{aL} \times t_s/60 \times d)$	VOC concentration leaving shower droplet after time t_s
S (µg/m^3-min) =	$C_{wd} \times FR/SV$	VOC generation rate
C_a (mg/m^3) =	$\left[\frac{S}{R_a x t x CF}\right] x \left[D_s + \frac{e^{(-Ra x t)}}{R_a} - \frac{e^{R_a(D_s - t)}}{R_a}\right]$	VOC concentration in shower air

Constants:	Value	
R (atm-m^3/mole-K) =	8.2×10^{-5}	Gas constant
T (K) =	293	Room Temperature
T_s (K) =	318	Water Temperature
μ_s (centapoise) =	0.596	Water viscosity at Ts
μ_l (centapoise) =	1.002	Water viscosity at T
t_s (sec) =	0.5	Shower droplet drop time
d (mm) =	1	Droplet diameter
FR (L/min) =	10	Shower flow rate
SV (m^3) =	12	Shower room air volume
R_a (per min) =	0.01667	Air exchange rate
D_s (min) =	30	Shower Duration
t (min) =	60	Total time in shower room
CF (µg/mg) =	1,000	Conversion factor

Table E.1-33
Cancer Toxicity Data - Oral/Dermal

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source	Date (3) (MM/DD/YY)
Organics								
2-Amino-4,6-Dinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenz(a,h) anthracene	7.3E+00	$(mg/kg\text{-}day)^{-1}$	100%	7.3E+00	$(mg/kg\text{-}day)^{-1}$	B2	EPA, 2007; NCEA	12/3/07: 3/1/94
1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	N/A	D	IRIS	12/3/07:2/1/93
4,6-Dinitro-o-cresol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrotoluene (4)	6.8E-01	$(mg/kg\text{-}day)^{-1}$	100%	6.8E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	12/3/07:9/1/90
2,6-Dinitrotoluene (4)	6.8E-01	$(mg/kg\text{-}day)^{-1}$	100%	6.8E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	12/3/07:9/1/90
2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-pentanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Nitroaniline	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nitroglycerin	1.7E-02	$(mg/kg\text{-}day)^{-1}$	100%	1.7E-02	$(mg/kg\text{-}day)^{-1}$	N/A	EPA, 2007; PPRTV	10/11/07
2-Nitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3-Nitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nitrotoluene	1.6E-02	$(mg/kg\text{-}day)^{-1}$	100%	1.6E-02	$(mg/kg\text{-}day)^{-1}$	N/A	EPA, 2007; PPRTV	10/11/07
PETN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TCDD TE	1.5E+05	$(mg/kg\text{-}day)^{-1}$	100%	1.5E+05	$(mg/kg\text{-}day)^{-1}$	B2	HEAST	1997
Tetrachloroethene	5.4E-01	$(mg/kg\text{-}day)^{-1}$	100%	5.4E-01	$(mg/kg\text{-}day)^{-1}$	C	EPA, 2007	10/11/07
1,3,5-Trinitrobenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4,6-Trinitrotoluene	3.0E-02	$(mg/kg\text{-}day)^{-1}$	100%	3.0E-02	$(mg/kg\text{-}day)^{-1}$	C	IRIS	12/3/07:7/1/93
Inorganics								
Aluminum	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	1.5E+00	$(mg/kg\text{-}day)^{-1}$	100%	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	12/3/07:4/10/98
Cadmium (food)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (III)	N/A	N/A	N/A	N/A	N/A	D	IRIS	12/3/07:9/3/98
Cobalt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper	N/A	N/A	N/A	N/A	N/A	D	IRIS	12/3/07:8/1/91
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	N/A	N/A	N/A	N/A	N/A	D	IRIS	12/3/07:12/1/96
Thallium	N/A	N/A	N/A	N/A	N/A	D	IRIS	12/3/07:9/1/90
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) Source: Risk Assessment Guidance for Fuperfund Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. Section 4.2 and Exhibit 4-1.

(2) The equation for deriving the adjusted dermal cancer slope factors are presented in the text.

(3) For IRIS values, the date IRIS was searched and the date of the most recent review are provided. For HEAST values, the date of HEAST is provided.

(4) Value is based on dinitrotoluene mixture.

Definitions: N/A = Not Available
IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NCEA = National Center for Environmental Assessment
PPRTV = Provisional Peer-Reviewed Toxicity Values
EPA, 2007 = EPA Region III October 11, 2007 RBC table.

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

Table E.1-34
Non-Cancer Toxicity Data - Oral/Dermal

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral to Dermal Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/ Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Dates of RfD (3): (MM/DD/YY)
Organics										
2-Amino-4,6-Dinitrotoluene	Chronic	2.E-03	mg/kg-day	100%	2.0E-03	mg/kg-day	N/A	N/A	EPA, 2007; NCEA	10/11/07
Dibenz(a,h)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,3-Dinitrobenzene	Chronic	1E-04	mg/kg-day	100%	1.0E-04	mg/kg-day	Spleen	3,000	IRIS	12/3/07:8/22/88
4,6-Dinitro-o-cresol	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrotoluene	Chronic	2E-03	mg/kg-day	100%	2.0E-03	mg/kg-day	CNS, Blood, Liver	100	IRIS	12/3/07:2/1/93
2,6-Dinitrotoluene	Chronic	1E-03	mg/kg-day	100%	1.0E-03	mg/kg-day	CNS, Blood, Liver	3,000	EPA, 2007; VDEQ, 2007;PPRTV	10/11/07
2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-pentanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12/3/07:4/25/03
2-Nitroaniline (4)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nitroglycerin	Chronic	1E-04	mg/kg-day	100%	1.0E-04	mg/kg-day	N/A	N/A	EPA, 2007; PPRTV	10/11/07
2-Nitrotoluene	Chronic	1E-02	mg/kg-day	100%	1.0E-02	mg/kg-day	Erythrocyte	10,000	HEAST	1997
3-Nitrotoluene (4)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nitrotoluene	Chronic	4E-03	mg/kg-day	100%	4.0E-03	mg/kg-day	N/A	N/A	EPA, 2007; PPRTV	10/11/07
PETN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TCDD TE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	Chronic	1E-02	mg/kg-day	100%	1.0E-02	mg/kg-day	Liver	1,000	IRIS	12/3/07: 3/1/88
1,3,5-Trinitrobenzene	Chronic	3E-02	mg/kg-day	100%	3.0E-02	mg/kg-day	Blood, Spleen	100	IRIS	12/3/07:10/1/97
2,4,6-Trinitrotoluene	Chronic	5E-04	mg/kg-day	100%	5.0E-04	mg/kg-day	Liver	1,000	IRIS	12/3/07:2/1/93
Inorganics										
Aluminum	Chronic	1E+00	mg/kg-day	100%	1.0E+00	mg/kg-day	Developmental nervous system	N/A	EPA, 2007; PPRTV	10/11/07
Antimony	Chronic	4E-04	mg/kg-day	15%	6.0E-05	mg/kg-day	Blood Chemistry	1,000	IRIS	12/3/07:2/1/91
Arsenic	Chronic	3E-04	mg/kg-day	100%	3.0E-04	mg/kg-day	Skin, Vascular Effects	3	IRIS	12/3/07:2/1/93
Cadmium (food)	Chronic	1E-03	mg/kg-day	2.5%	2.5E-05	mg/kg-day	Kidney	10	IRIS	12/3/07:2/1/94
Chromium (III)	Chronic	1.5E+00	mg/kg-day	1.3%	2.0E-02	mg/kg-day	NOAEL	1,000	IRIS	12/3/07:9/3/98
Cobalt (4)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper	Chronic	4E-02	mg/kg-day	100%	4.0E-02	mg/kg-day	GI Tract	N/A	HEAST	1997
Iron	Chronic	7E-01	mg/kg-day	100%	7.0E-01	mg/kg-day	Blood, Liver, GI Irritation	N/A	EPA, 2007; VDEQ, 2007; NCEA	10/11/07
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese (non-food)	Chronic	2.0E-02	mg/kg-day	4%	8.0E-04	mg/kg-day	CNS	1	IRIS	12/3/07:5/1/96
Thallium	Chronic	7E-05	mg/kg-day	100%	7.0E-05	mg/kg-day	Blood, Liver, Hair	N/A	EPA, 2007; VDEQ, 2007; NCEA	10/11/07
Vanadium	Chronic	1E-03	mg/kg-day	2.6%	2.6E-05	mg/kg-day	Kidney	N/A	EPA, 2007; VDEQ, 2007; NCEA	10/11/07

(1) Source: Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. Section 4.2 and Exhibit 4-1.
(2) The equation used to derive the adjusted dermal RfD is presented in the text.
(3) For IRIS values, the date IRIS was searched and the date of the most recent review are provided. For HEAST values, the date of HEAST is provided.
(4) USEPA has retired the toxicity value for this COPC. EPA Region III October 25, 2005 RBC Table.

Definitions:
N/A = Not Available
IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NCEA = National Center for Environmental Assessment
PPRTV = Provisional Peer-Reviewed Toxicity Values
EPA, 2007 = EPA Region III October 11, 2007 RBC table.
VDEQ, 2007 = Virginia Department of Environmental Quality, Voluntary Remediation Program, Table 4.1, Non-Cancer Toxicity Data, May 3, 2007.

Table E.1-35
Cancer Toxicity Data - Inhalation

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation CSF	
	Value	Units	Value	Units		Source	Date (1) (MM/DD/YY)
Organics							
2-Amino-4,6-Dinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenz(a,h)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	12/3/07: 3/1/94
1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4,6-Dinitro-o-cresol	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-pentanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Nitroaniline	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nitroglycerin	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Nitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3-Nitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PETN	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TCDD TE	3.30E-11	$(ug/m^3)^{-1}$	1.50E+05	$(mg/kg\text{-}day)^{-1}$	B2	HEAST	1997
Tetrachloroethene	5.70E-03	$(ug/m3)^{-1}$	2.00E-02	$(mg/kg\text{-}day)^{-1}$	C	EPA, 2007	10/11/2007
1,3,5-Trinitrobenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4,6-Trinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inorganics							
Aluminum	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	4.3E-03	$(ug/m^3)^{-1}$	1.5E+01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	12/3/07:4/10/98
Cadmium	1.8E-03	$(ug/m^3)^{-1}$	6.3E+00	$(mg/kg\text{-}day)^{-1}$	B1	IRIS	12/3/07:6/01/92
Chromium (III)	N/A	N/A	N/A	N/A	D	IRIS	12/3/07:9/3/98
Cobalt	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper	N/A	N/A	N/A	N/A	D	IRIS	12/3/07:8/1/91
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	N/A	N/A	N/A	N/A	D	IRIS	12/3/07:12/1/96
Thallium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) For IRIS values, the date IRIS was searched and the date of the most recent review are provided.
For HEAST values, the date of HEAST is provided.

Definitions: N/A = Not Available
IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NCEA = National Center for Environmental Assessment
PPRTV = Provisional Peer-Reviewed Toxicity Values
EPA, 2007 = EPA Region III October 11, 2007 RBC table.

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

Table E.1-36
Non-Cancer Toxicity Data - Inhalation

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ (s)	Combined Uncertainty/ Modifying Factors	RfC:Target Organ(s)	
		Value	Units	Value	Units			Source(s) (2)	Dates of RfD: (MM/DD/YY)
Organics									
2-Amino-4,6-Dinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenz(a,h)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4,6-Dinitro-o-cresol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-pentanone	Chronic	3.0E+00	mg/m^3	8.6E-01	mg/kg-day	Body weight	300	IRIS	12/3/07:4/25/03
2-Nitroaniline (3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nitroglycerin	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Nitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3-Nitrotoluene (3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PETN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TCDD TE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	Chronic	2.8E-01	mg/m^3	8.0E-02	mg/kg-day	CNS	N/A	EPA, 2007; VDEQ, 2007: ATSDR	10/11/07
1,3,5-Trinitrobenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4,6-Trinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inorganics									
Aluminum	Chronic	3.5E-03	mg/m^3	1.0E-03	mg/kg-day	N/A	N/A	EPA, 2007; VDEQ, 2007; PPRTV	10/11/07
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium (food)	Chronic	2.0E-04	mg/m^3	5.7E-05	mg/kg-day	N/A	N/A	EPA, 2007; VDEQ, 2007; NCEA	10/11/07
Chromium (III)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cobalt (3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5.0E-05	mg/m^3	1.43E-05	mg/kg-day	CNS	1,000	IRIS	12/3/07:12/1/93
Thallium	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(1) The adjusted inhalation RfD was derived from the RfC value assuming a 70 kg adult inhales 20 m^3/day as follows: RfD = RfC * (20 m^3/day / 70 kg).

(2) For NCEA values, the date of the article provided by NCEA is provided.
For IRIS values, the date IRIS was searched and the date of the most recent review are provided.
For HEAST values, the date of HEAST is provided.

(3) USEPA has retired the toxicity value for this COPC. EPA Region III, October 25, 2005 RBC Table.

Definitions: N/A = Not Available
ATSDR = Agency for Toxic Substances Disease Registry
IRIS = Integrated Risk Information System
NCEA = National Center for Environmental Assessment
HEAST = Health Effects Assessment Tables
PPRTV = Provisional Peer-Reviewed Toxicity Values
EPA, 2007 = EPA Region III October 11, 2007 RBC table.
VDEQ, 2007 = Virginia Department of Environmental Quality, Voluntary Remediation Program, Table 4.1, Non-Cancer Toxicity Data, May, 3, 2007.

Calculations of Preliminary Remediation Goals (PRGs)

Table E.1-37b
Adult Lead Model - Results
Total Soil - SWMU 51
Maintenance Worker/Industrial Worker

Calculations of Blood Lead Concentrations (PbBs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Exposure Variable	Description of Exposure Variable	Units	Region OR Ethnic GSDi and PbBo Data from NHANES III Analysis							
			All/All	All/White	All/Black	All/Mexican	Northeast/All	Midwest/All	South/All	West/All
PbS	Soil lead concentration	ug/g or ppm	698	698	698	698	698	698	698	698
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	2.1	2.1	2.2	2.3	2.0	2.2	2.1	2.1
PbB_0	Baseline PbB	ug/dL	1.5	1.5	1.8	1.7	2.0	1.5	1.4	1.4
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	--	--	--	--	--	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	--	--	--	--	--	--
K_{SD}	Mass fraction of soil in dust	--	--	--	--	--	--	--	--	--
$AF_{S,D}$	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
$EF_{S,D}$	Exposure frequency (same for soil and dust)	days/yr	219	219	219	219	219	219	219	219
$AT_{S,D}$	Averaging time (same for soil and dust)	days/yr	365	365	365	365	365	365	365	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**ug/dL**	**2.5**	**2.5**	**2.8**	**2.7**	**3.0**	**2.5**	**2.4**	**2.4**
$PbB_{fetal,\ 0.95}$	95th percentile PbB among fetuses of adult workers	ug/dL	7.6	7.6	8.9	9.5	8.4	8.2	7.1	7.4
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**2.2%**	**2.2%**	**3.6%**	**4.4%**	**2.9%**	**2.9%**	**1.7%**	**2.0%**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

Calculations of Preliminary Remediation Goals (PRGs)

Table E.1-38b
Adult Lead Model - Results
Total Soil - SWMU 51
Excavation Worker

Calculations of Blood Lead Concentrations (PbBs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Exposure Variable	Description of Exposure Variable	Units	Region OR Ethnic GSDi and PbBo Data from NHANES III Analysis							
			All/All	All/White	All/Black	All/Mexican	Northeast/All	Midwest/All	South/All	West/All
PbS	Soil lead concentration	ug/g or ppm	698	698	698	698	698	698	698	698
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	2.1	2.1	2.2	2.3	2.0	2.2	2.1	2.1
PbB_0	Baseline PbB	ug/dL	1.5	1.5	1.8	1.7	2.0	1.5	1.4	1.4
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	--	--	--	--	--	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	--	--	--	--	--	--
K_{SD}	Mass fraction of soil in dust	--	--	--	--	--	--	--	--	--
$AF_{S,D}$	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
$EF_{S,D}$	Exposure frequency (same for soil and dust)	days/yr	250	250	250	250	250	250	250	250
$AT_{S,D}$	Averaging time (same for soil and dust)	days/yr	365	365	365	365	365	365	365	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**ug/dL**	**3.8**	**3.8**	**4.1**	**4.0**	**4.3**	**3.8**	**3.7**	**3.7**
$PbB_{fetal,\ 0.95}$	95th percentile PbB among fetuses of adult workers	ug/dL	11.6	11.6	13.0	14.0	12.0	12.4	11.0	11.4
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**7.4%**	**7.4%**	**9.6%**	**10.8%**	**8.4%**	**8.6%**	**6.5%**	**7.0%**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E.1-37a
RAGS D ADULT LEAD WORKSHEET
Radford Army Ammunition Plant – SWMU 51
Calculations of Blood Lead Concentrations – Total Soil – Maintenance and Industrial Workers

1. Lead Screening Questions

Medium	Lead Concentration used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	698	mg/kg	Average Detected Value	800	mg/kg	Recommended Soil Screening Level

2. Lead Model Questions

Question	Response
What lead model was used? Provide reference and version	USEPA Adult Lead Model, Version dated 5/19/05
If the EPA Adult Lead Model (ALM) was not used provide rationale for model selected.	N/A
Where are the input values located in the risk assessment report?	Located in Appendix E, Table E.1-37b
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Exposure point concentration was based on the arithmetic mean of lead concentrations in total soil; See Appendix E
What was the point of exposure and location?	Total Soil – SWMU 51
Where are the output values located in the risk assessment report?	Located in Appendix E, Table E.1-37b
What GSD value was used? If this is outside the recommended range of 1.8-2.1), provide rationale in Appendix <Y>.	GSD = 2.1 as the GSD derived from NHANES III for the South region.
What baseline blood lead concentration (PbB_0) value was used? If this is outside the default range of 1.7 to 2.2 provide rationale in Appendix <Y>	PbB_0 = 1.4 ug/dL as the PbB_0 derived from NHANES III for the South region.
Was the default exposure frequency (EF; 219 days/year) used?	Yes. Default value was used as a conservative estimate for intermittent maintenance activities (50 days/year)
Was the default BKSF used (0.4 ug/dL per ug/day) used?	Yes
Was the default absorption fraction (AF; 0.12) used?	Yes
Was the default soil ingestion rate (IR; 50 mg/day) used?	Yes
If non-default values were used for any of the parameters listed above, where is the rationale for the values located in the risk assessment report?	Discussion of parameters in Section 6.4.1 and Appendix E

3. Final Result

Medium	Result	Comment/RBRG [1]
Total Soil	Input value of 698 ppm in soil results in 1.7% of receptors above a geometric mean blood lead = 2.4 ug/dL. This is below the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children (fetuses of exposed women) exceeding 10 ug/dL blood lead.	PRG not calculated.

1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see www.epa.gov/superfund/programs/lead

TABLE E.1-38a
RAGS D ADULT LEAD WORKSHEET
Radford Army Ammunition Plant – SWMU 51
Calculations of Blood Lead Concentrations – Total Soil – Excavation Worker

1. Lead Screening Questions

Medium	Lead Concentration used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	698	mg/kg	Average Detected Value	800	mg/kg	Recommended Soil Screening Level

2. Lead Model Questions

Question	Response
What lead model was used? Provide reference and version	USEPA Adult Lead Model, Version dated 5/19/05
If the EPA Adult Lead Model (ALM) was not used provide rationale for model selected.	N/A
Where are the input values located in the risk assessment report?	Located in Appendix E.1, Table E.1-38b
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Exposure point concentration was based on the arithmetic mean of lead concentrations in total soil; See Appendix E
What was the point of exposure and location?	Total Soil – SWMU 51
Where are the output values located in the risk assessment report?	Located in Appendix E.1, Table E.1-38b
What GSD value was used? If this is outside the recommended range of 1.8-2.1), provide rationale in Appendix <Y>.	GSD = 2.1 as the GSD derived from NHANES III for the South region
What baseline blood lead concentration (PbB_0) value was used? If this is outside the default range of 1.7 to 2.2 provide rationale in Appendix <Y>	PbB_0 = 1.4 ug/dL as the PbB_0 derived from NHANES III for the South region
Was the default exposure frequency (EF; 219 days/year) used?	EF = 250 days/year based on full-time exposure to soil during excavation
Was the default BKSF used (0.4 ug/dL per ug/day) used?	Yes
Was the default absorption fraction (AF; 0.12) used?	Yes
Was the default soil ingestion rate (IR; 50 mg/day) used?	IR = 100 mg/kg based on contact-intensive excavation activities
If non-default values were used for any of the parameters listed above, where is the rationale for the values located in the risk assessment report?	Discussion of parameters in Section 6.4.1 and Appendix E.1

3. Final Result

Medium	Result	Comment/RBRG [1]
Total Soil	Input value of 698 ppm in soil results in 6.5% of receptors above a geometric mean blood lead = 3.7 ug/dL. This is above the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children (fetuses of exposed women) exceeding 10 ug/dL blood lead.	PRG not calculated.

1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see www.epa.gov/superfund/programs/lead

LEAD MODEL FOR WINDOWS Version 1.0

==========

Model Version: 1.0 Build 264
User Name: Shaw Environmental, Inc.
Date: 12/05/2007
Site Name: Radford AAP
Operable Unit: SWMU 51
Run Mode: Site Risk Assessment

Soil/Dust Data
Arithmetic mean concentration in soil.
Water Data
Action level for drinking water.

==========

The time step used in this model run: 1 - Every 4 Hours (6 times a day).

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (ug Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(ug/day)
.5-1	5.530
1-2	5.780
2-3	6.490
3-4	6.240
4-5	6.010
5-6	6.340
6-7	7.000

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 15.000 ug Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 498.600 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	698.000	498.600
1-2	698.000	498.600
2-3	698.000	498.600
3-4	698.000	498.600
4-5	698.000	498.600
5-6	698.000	498.600
6-7	698.000	498.600

****** Alternate Intake ******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

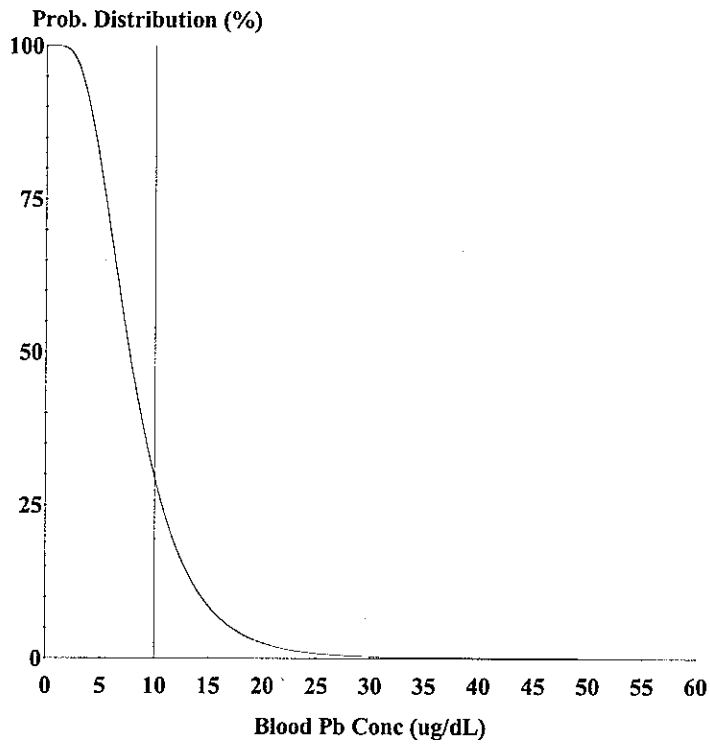
****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (ug/day)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
.5-1	0.021	2.295	0.000	1.245
1-2	0.034	2.318	0.000	3.008
2-3	0.062	2.671	0.000	3.210
3-4	0.067	2.633	0.000	3.355
4-5	0.067	2.660	0.000	3.651
5-6	0.093	2.857	0.000	3.921
6-7	0.093	3.186	0.000	4.028

Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	12.452	16.013	8.5
1-2	19.112	24.473	9.9
2-3	19.610	25.552	9.4
3-4	20.108	26.162	9.0
4-5	15.621	21.998	7.7
5-6	14.318	21.189	6.7
6-7	13.655	20.962	6.0



Cutoff = 10.000 ug/dl
Geo Mean = 8.044
GSD = 1.600
% Above = 32.163

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Site Risk Assessment

TABLE E.1-39
RAGS D IEUBK LEAD WORKSHEET
Radford Army Ammunition Plant – SWMU 51
Child (Age 0 – 84 Months), Exposure to Total Soil

1. Lead Screening Questions

Medium	Lead Concentration Used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	698	mg/kg	Average Detected Value	400	mg/kg	Recommended Soil Screening Level
Water	15	ug/L	Average Detected Value	15	ug/L	Recommended Drinking Water Action Level

2. Lead Model Questions

Question	Response for Residential Lead Model
What lead model (version and date) was used?	Lead Model for Windows, Version 1.0 Build 264
Where are the input values located in the risk assessment report?	Located in Appendix E, IEUBKwin OUTPUT (Attached)
What range of media concentrations were used for the model?	4.2 – 4,180 mg/kg
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Arithmetic Mean Concentration; Data are Located in Appendix E
Was soil sample taken from top 2 cm? If not, why?	No – Future scenario based on assumption that soil would be disturbed. Surface and subsurface data sets were combined to represent total soil.
Was soil sample sieved? What size screen was used? If not sieved, provide rationale.	No -- Soil samples were collected for multiple analyses.
What was the point of exposure/location?	Total soil – SWMU 51
Where are the output values located in the risk assessment report?	IEUBKwin OUTPUT (Attached)
Was the model run using default values only?	No – Assumed site-specific arithmetic mean concentration of lead in soil and concentration of lead in drinking water at action level.
Was the default soil bioavailability used?	Yes -- Default is 30%
Was the default soil ingestion rate used?	Yes -- Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day
If non-default values were used, where is the rationale for the values located in the risk assessment report?	Located in Appendix E.

3. Final Result

Medium	Result	Comment/PRG [1]
Total Soil	Input value of 698 ppm in total soil results in 32.2% of children above a blood lead level of 10 ug/dL. Geometric mean blood lead = 8.0 ug/dL. This is above the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead.	PRG not calculated.

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

Table E.1-40
Calculation of Cancer Risks
Reasonable Maximum Exposure
Current/Future - Maintenance Worker

Scenario Timeframe: Current/Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Surface Soil	Surface Soil	SWMU 51	**Ingestion**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	1.4E-07	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	9.5E-08
				2,6-Dinitrotoluene	8.65E-01	mg/kg	6.0E-08	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	4.1E-08
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	8.1E-10	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	5.9E-09
				2-Nitrotoluene	6.27E+01	mg/kg	4.4E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	5.17E+00	mg/kg	3.6E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	3.44E+01	mg/kg	2.4E-06	mg/kg-day	1.6E-02	$(mg/kg\text{-}day)^{-1}$	3.8E-08
				Inorganics							
				Aluminum	2.28E+04	mg/kg	1.6E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	4.41E+00	mg/kg	3.1E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.6E-07
				Chromium III	2.82E+01	mg/kg	2.0E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	9.17E+00	mg/kg	6.4E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	2.74E+04	mg/kg	1.9E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	5.30E+02	mg/kg	3.7E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.10E+00	mg/kg	7.7E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	5.63E+01	mg/kg	3.9E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								6.4E-07
			Dermal Absorption	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	9.4E-08	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	6.4E-08
				2,6-Dinitrotoluene	8.65E-01	mg/kg	4.0E-08	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	2.7E-08
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	5.4E-10	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	3.9E-09
				2-Nitrotoluene	6.27E+01	mg/kg	8.7E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	5.17E+00	mg/kg	2.4E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	3.44E+01	mg/kg	1.6E-06	mg/kg-day	1.6E-02	$(mg/kg\text{-}day)^{-1}$	2.5E-08
				Inorganics							
				Aluminum	2.28E+04	mg/kg	1.1E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	4.41E+00	mg/kg	6.5E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	9.8E-08
				Chromium III	2.82E+01	mg/kg	1.3E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	9.17E+00	mg/kg	4.2E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	2.74E+04	mg/kg	1.3E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	5.30E+02	mg/kg	2.4E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.10E+00	mg/kg	5.1E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	5.63E+01	mg/kg	2.6E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								2.2E-07
		Exposure Point Total									8.6E-07
	Exposure Media Total										8.6E-07
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	4.1E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,6-Dinitrotoluene	8.65E-01	mg/kg	1.8E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	2.4E-13	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	5.17E+00	mg/kg	1.1E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	3.44E+01	mg/kg	7.0E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Inorganics							
				Aluminum	2.28E+04	mg/kg	4.7E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	4.41E+00	mg/kg	9.0E-11	mg/kg-day	1.5E+01	$(mg/kg\text{-}day)^{-1}$	1.4E-09
				Chromium III	2.82E+01	mg/kg	5.8E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	9.17E+00	mg/kg	1.9E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	2.74E+04	mg/kg	5.6E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	5.30E+02	mg/kg	1.1E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.10E+00	mg/kg	2.2E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	5.63E+01	mg/kg	1.1E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								1.4E-09
		Exposure Point Total									1.4E-09
	Exposure Media Total										1.4E-09

Table E.1-40
Calculation of Cancer Risks
Reasonable Maximum Exposure
Current/Future - Maintenance Worker

Scenario Timeframe: Current/Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics** 2-Nitrotoluene	6.27E+01	mg/kg	2.5E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Surface Soil Total											8.6E-07
Groundwater	Air	SWMU 51	**Inhalation** (Ambient Air)	**Organics** Tetrachloroethene	3.52E-10	mg/m^3	4.9E-12	mg/kg-day	2.0E-02	$(mg/kg\text{-}day)^{-1}$	9.8E-14
			Exp. Route Total								9.8E-14
		Exposure Point Total									9.8E-14
	Exposure Media Total										9.8E-14
Groundwater Total											9.8E-14
										Total of Receptor Risks Across All Media	8.6E-07

N/A = Not Applicable.

Table E.1-41
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Current/Future - Maintenance Worker

Scenario Timeframe: Current/Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard
					Value	Units	Value	Units	Value	Units	Quotient
Surface Soil	Surface Soil	SWMU 51	**Ingestion**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	3.9E-07	mg/kg-day	2.0E-03	mg/kg-day	1.9E-04
				2,6-Dinitrotoluene	8.65E-01	mg/kg	1.7E-07	mg/kg-day	1.0E-03	mg/kg-day	1.7E-04
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	2.3E-09	mg/kg-day	N/A	mg/kg-day	---
				2-Nitrotoluene	6.27E+01	mg/kg	1.2E-05	mg/kg-day	1.0E-02	mg/kg-day	1.2E-03
				3-Nitrotoluene	5.17E+00	mg/kg	1.0E-06	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	3.44E+01	mg/kg	6.7E-06	mg/kg-day	4.0E-03	mg/kg-day	1.7E-03
				Inorganics							
				Aluminum	2.28E+04	mg/kg	4.5E-03	mg/kg-day	1.0E+00	mg/kg-day	4.5E-03
				Arsenic	4.41E+00	mg/kg	8.6E-07	mg/kg-day	3.0E-04	mg/kg-day	2.9E-03
				Chromium III	2.82E+01	mg/kg	5.5E-06	mg/kg-day	1.5E+00	mg/kg-day	3.7E-06
				Cobalt	9.17E+00	mg/kg	1.8E-06	mg/kg-day	N/A	mg/kg-day	---
				Iron	2.74E+04	mg/kg	5.4E-03	mg/kg-day	7.0E-01	mg/kg-day	7.7E-03
				Manganese	5.30E+02	mg/kg	1.0E-04	mg/kg-day	2.0E-02	mg/kg-day	5.2E-03
				Thallium	1.10E+00	mg/kg	2.2E-07	mg/kg-day	7.0E-05	mg/kg-day	3.1E-03
				Vanadium	5.63E+01	mg/kg	1.1E-05	mg/kg-day	1.0E-03	mg/kg-day	1.1E-02
			Exp. Route Total								3.8E-02
			Dermal Absorption	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	2.6E-07	mg/kg-day	2.0E-03	mg/kg-day	1.3E-04
				2,6-Dinitrotoluene	8.65E-01	mg/kg	1.1E-07	mg/kg-day	1.0E-03	mg/kg-day	1.1E-04
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	1.5E-09	mg/kg-day	N/A	mg/kg-day	---
				2-Nitrotoluene	6.27E+01	mg/kg	2.4E-06	mg/kg-day	1.0E-02	mg/kg-day	2.4E-04
				3-Nitrotoluene	5.17E+00	mg/kg	6.7E-07	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	3.44E+01	mg/kg	4.4E-06	mg/kg-day	4.0E-03	mg/kg-day	1.1E-03
				Inorganics							
				Aluminum	2.28E+04	mg/kg	2.9E-04	mg/kg-day	1.0E+00	mg/kg-day	2.9E-04
				Arsenic	4.41E+00	mg/kg	1.8E-07	mg/kg-day	3.0E-04	mg/kg-day	6.1E-04
				Chromium III	2.82E+01	mg/kg	3.6E-07	mg/kg-day	2.0E-02	mg/kg-day	1.9E-05
				Cobalt	9.17E+00	mg/kg	1.2E-07	mg/kg-day	N/A	mg/kg-day	---
				Iron	2.74E+04	mg/kg	3.5E-04	mg/kg-day	7.0E-01	mg/kg-day	5.1E-04
				Manganese	5.30E+02	mg/kg	6.8E-06	mg/kg-day	8.0E-04	mg/kg-day	8.6E-03
				Thallium	1.10E+00	mg/kg	1.4E-08	mg/kg-day	7.0E-05	mg/kg-day	2.0E-04
				Vanadium	5.63E+01	mg/kg	7.3E-07	mg/kg-day	2.6E-05	mg/kg-day	2.8E-02
			Exp. Route Total								4.0E-02
		Exposure Point Total									7.7E-02
	Exposure Media Total										7.7E-02
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	1.1E-10	mg/kg-day	N/A	mg/kg-day	---
				2,6-Dinitrotoluene	8.65E-01	mg/kg	4.9E-11	mg/kg-day	N/A	mg/kg-day	---
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	6.6E-13	mg/kg-day	N/A	mg/kg-day	---
				3-Nitrotoluene	5.17E+00	mg/kg	3.0E-10	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	3.44E+01	mg/kg	2.0E-09	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Aluminum	2.28E+04	mg/kg	1.3E-06	mg/kg-day	1.0E-03	mg/kg-day	1.3E-03
				Arsenic	4.41E+00	mg/kg	2.5E-10	mg/kg-day	N/A	mg/kg-day	---
				Chromium III	2.82E+01	mg/kg	1.6E-09	mg/kg-day	N/A	mg/kg-day	---
				Cobalt	9.17E+00	mg/kg	5.2E-10	mg/kg-day	N/A	mg/kg-day	---
				Iron	2.74E+04	mg/kg	1.6E-06	mg/kg-day	N/A	mg/kg-day	---
				Manganese	5.30E+02	mg/kg	3.0E-08	mg/kg-day	1.4E-05	mg/kg-day	2.1E-03
				Thallium	1.10E+00	mg/kg	6.3E-11	mg/kg-day	N/A	mg/kg-day	---
				Vanadium	5.63E+01	mg/kg	3.2E-09	mg/kg-day	N/A	mg/kg-day	---
			Exp. Route Total								3.4E-03
		Exposure Point Total									3.4E-03
	Exposure Media Total										3.4E-03

Table E.1-41
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Current/Future - Maintenance Worker

Scenario Timeframe: Current/Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Units	Value	Units	Value	Units	
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics** 2-Nitrotoluene	6.27E+01	mg/kg	7.1E-05	mg/kg-day	N/A	mg/kg-day	---
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Surface Soil Total											8.1E-02
Groundwater	Air	SWMU 51	**Inhalation** (Ambient Air)	**Organics** Tetrachloroethene	3.52E-10	mg/m^3	1.4E-11	mg/kg-day	8.0E-02	mg/kg-day	1.7E-10
			Exp. Route Total								1.7E-10
		Exposure Point Total									1.7E-10
	Exposure Media Total										1.7E-10
Groundwater Total											1.7E-10
										Total of Receptor Hazards Across All Media	8.1E-02

N/A = Not Applicable.

Table E.1-42
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Total Soil	Total Soil	SWMU 51	**Ingestion**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	1.0E-11	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.6E-06
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.1E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	3.1E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.3E-08
				1,3-Dinitrobenzene	2.13E+02	mg/kg	1.5E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	1.8E-03	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	1.2E-03
				2,6-Dinitrotoluene	4.17E+03	mg/kg	2.9E-04	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	2.0E-04
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	1.5E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	1.3E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	3.3E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	1.9E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	3.1E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	1.6E-04	mg/kg-day	1.7E-02	$(mg/kg\text{-}day)^{-1}$	2.7E-06
				2-Nitrotoluene	1.31E+04	mg/kg	9.2E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	9.6E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	6.2E-04	mg/kg-day	1.6E-02	$(mg/kg\text{-}day)^{-1}$	9.9E-06
				PETN	5.16E+00	mg/kg	3.6E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	2.9E-03	mg/kg-day	3.0E-02	$(mg/kg\text{-}day)^{-1}$	8.8E-05
				Inorganics							
				Aluminum	1.98E+04	mg/kg	1.4E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	2.7E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	7.3E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.1E-06
				Chromium III	4.48E+02	mg/kg	3.1E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	3.1E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Copper	1.77E+02	mg/kg	1.2E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	1.03E+05	mg/kg	7.2E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Lead	3.57E+03	mg/kg	2.5E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	7.5E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	1.2E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	3.3E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								1.5E-03
			Dermal Absorption	**Organics**							
				TCDD TE	1.48E-04	mg/kg	2.0E-12	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	3.1E-07
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.3E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	2.1E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.5E-08
				1,3-Dinitrobenzene	2.13E+02	mg/kg	9.8E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	1.2E-03	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	8.3E-04
				2,6-Dinitrotoluene	4.17E+03	mg/kg	1.9E-04	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	1.3E-04
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	6.0E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	8.5E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	6.5E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	1.2E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	2.1E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	1.0E-04	mg/kg-day	1.7E-02	$(mg/kg\text{-}day)^{-1}$	1.8E-06
				2-Nitrotoluene	1.31E+04	mg/kg	1.8E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	6.4E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	4.1E-04	mg/kg-day	1.6E-02	$(mg/kg\text{-}day)^{-1}$	6.5E-06
				PETN	5.16E+00	mg/kg	2.4E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	6.2E-04	mg/kg-day	3.0E-02	$(mg/kg\text{-}day)^{-1}$	1.9E-05

Table E.1-42
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Total Soil	Total Soil	SWMU 51	**Dermal Absorption**	**Inorganics**							
				Aluminum	1.98E+04	mg/kg	9.1E-05	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Antimony	3.89E+00	mg/kg	1.8E-08	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Arsenic	1.04E+01	mg/kg	1.5E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	2.3E-07
				Chromium III	4.48E+02	mg/kg	2.1E-06	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Cobalt	4.44E+01	mg/kg	2.0E-07	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Copper	1.77E+02	mg/kg	8.2E-07	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Iron	1.03E+05	mg/kg	4.8E-04	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Lead	3.57E+03	mg/kg	1.6E-05	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Manganese	1.08E+03	mg/kg	5.0E-06	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Thallium	1.67E+00	mg/kg	7.7E-09	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Vanadium	4.76E+01	mg/kg	2.2E-07	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
			Exp. Route Total								9.9E-04
		Exposure Point Total									2.5E-03
	Exposure Media Total										2.5E-03
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	3.0E-15	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	4.5E-10
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	3.1E-09	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	9.1E-13	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	4.3E-09	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	5.3E-07	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				2,6-Dinitrotoluene	4.17E+03	mg/kg	8.5E-08	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	4.4E-10	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	3.8E-13	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	5.5E-11	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	9.2E-10	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	4.6E-08	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	2.8E-08	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	1.8E-07	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				PETN	5.16E+00	mg/kg	1.1E-10	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	8.6E-07	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Inorganics							
				Aluminum	1.98E+04	mg/kg	4.0E-07	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Antimony	3.89E+00	mg/kg	7.9E-11	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Arsenic	1.04E+01	mg/kg	2.1E-10	mg/kg-day	1.5E+01	(mg/kg-day)$^{-1}$	3.2E-09
				Chromium III	4.48E+02	mg/kg	9.1E-09	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Cobalt	4.44E+01	mg/kg	9.1E-10	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Copper	1.77E+02	mg/kg	3.6E-09	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Iron	1.03E+05	mg/kg	2.1E-06	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Lead	3.57E+03	mg/kg	7.3E-08	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Manganese	1.08E+03	mg/kg	2.2E-08	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Thallium	1.67E+00	mg/kg	3.4E-11	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				Vanadium	4.76E+01	mg/kg	9.7E-10	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
			Exp. Route Total								3.7E-09
		Exposure Point Total									3.7E-09
	Exposure Media Total										3.7E-09
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics**							
				2-Nitrotoluene	1.31E+04	mg/kg	5.3E-03	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	3.3E-08	mg/kg-day	N/A	(mg/kg-day)$^{-1}$	---
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Total Soil Total											2.5E-03

Table E.1-42
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Surface Soil	Surface Soil	SWMU 51	**Ingestion**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	1.4E-07	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	9.5E-08
				2,6-Dinitrotoluene	8.65E-01	mg/kg	6.0E-08	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	4.1E-08
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	8.1E-10	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	5.9E-09
				2-Nitrotoluene	6.27E+01	mg/kg	4.4E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	5.17E+00	mg/kg	3.6E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	3.44E+01	mg/kg	2.4E-06	mg/kg-day	1.6E-02	$(mg/kg\text{-}day)^{-1}$	3.8E-08
				Inorganics							
				Aluminum	2.28E+04	mg/kg	1.6E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	4.41E+00	mg/kg	3.1E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.6E-07
				Chromium III	2.82E+01	mg/kg	2.0E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	9.17E+00	mg/kg	6.4E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	2.74E+04	mg/kg	1.9E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	5.30E+02	mg/kg	3.7E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.10E+00	mg/kg	7.7E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	5.63E+01	mg/kg	3.9E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								6.4E-07
			Dermal Absorption	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	9.4E-08	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	6.4E-08
				2,6-Dinitrotoluene	8.65E-01	mg/kg	4.0E-08	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	2.7E-08
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	5.4E-10	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	3.9E-09
				2-Nitrotoluene	6.27E+01	mg/kg	8.7E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	5.17E+00	mg/kg	2.4E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	3.44E+01	mg/kg	1.6E-06	mg/kg-day	1.6E-02	$(mg/kg\text{-}day)^{-1}$	2.5E-08
				Inorganics							
				Aluminum	2.28E+04	mg/kg	1.1E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	4.41E+00	mg/kg	6.5E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	9.8E-08
				Chromium III	2.82E+01	mg/kg	1.3E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	9.17E+00	mg/kg	4.2E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	2.74E+04	mg/kg	1.3E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	5.30E+02	mg/kg	2.4E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.10E+00	mg/kg	5.1E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	5.63E+01	mg/kg	2.6E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								2.2E-07
		Exposure Point Total									8.6E-07
	Exposure Media Total										8.6E-07
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	4.1E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,6-Dinitrotoluene	8.65E-01	mg/kg	1.8E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	2.4E-13	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	5.17E+00	mg/kg	1.1E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	3.44E+01	mg/kg	7.0E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Inorganics							
				Aluminum	2.28E+04	mg/kg	4.7E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	4.41E+00	mg/kg	9.0E-11	mg/kg-day	1.5E+01	$(mg/kg\text{-}day)^{-1}$	1.4E-09
				Chromium III	2.82E+01	mg/kg	5.8E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	9.17E+00	mg/kg	1.9E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	2.74E+04	mg/kg	5.6E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	5.30E+02	mg/kg	1.1E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.10E+00	mg/kg	2.2E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	5.63E+01	mg/kg	1.1E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								1.4E-09
		Exposure Point Total									1.4E-09
	Exposure Media Total										1.4E-09

Table E.1-42
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics** 2-Nitrotoluene	6.27E+01	mg/kg	2.5E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Surface Soil Total											8.6E-07
Groundwater	Air	SWMU 51	**Inhalation** (Ambient Air)	**Organics** Tetrachloroethene	3.52E-10	mg/m^3	4.9E-12	mg/kg-day	2.0E-02	$(mg/kg\text{-}day)^{-1}$	9.8E-14
			Exp. Route Total								9.8E-14
		Exposure Point Total									9.8E-14
	Exposure Media Total										9.8E-14
Groundwater Total											9.8E-14
										Total of Receptor Risks Across All Media	2.5E-03

N/A = Not Applicable.

Since total soil represents the more highly contaminated portion of soil, total risk and hazard estimates are conservatively based on this soil data grouping.

Table E.1-43
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard
					Value	Units	Value	Units	Value	Units	Quotient
Total Soil	Total Soil	SWMU 51	**Ingestion**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	2.9E-11	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	3.0E-05	mg/kg-day	3.0E-02	mg/kg-day	9.9E-04
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	8.7E-09	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	4.2E-05	mg/kg-day	1.0E-04	mg/kg-day	4.2E-01
				2,4-Dinitrotoluene	2.59E+04	mg/kg	5.1E-03	mg/kg-day	2.0E-03	mg/kg-day	2.5E+00
				2,6-Dinitrotoluene	4.17E+03	mg/kg	8.2E-04	mg/kg-day	1.0E-03	mg/kg-day	8.2E-01
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	4.2E-06	mg/kg-day	2.0E-03	mg/kg-day	2.1E-03
				2-Hexanone	1.84E-02	mg/kg	3.6E-09	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	9.2E-09	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	5.3E-07	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	8.8E-06	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	4.4E-04	mg/kg-day	1.0E-04	mg/kg-day	4.4E+00
				2-Nitrotoluene	1.31E+04	mg/kg	2.6E-03	mg/kg-day	1.0E-02	mg/kg-day	2.6E-01
				3-Nitrotoluene	1.38E+03	mg/kg	2.7E-04	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	1.7E-03	mg/kg-day	4.0E-03	mg/kg-day	4.3E-01
				PETN	5.16E+00	mg/kg	1.0E-06	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	8.2E-03	mg/kg-day	5.0E-04	mg/kg-day	1.6E+01
				Inorganics							
				Aluminum	1.98E+04	mg/kg	3.9E-03	mg/kg-day	1.0E+00	mg/kg-day	3.9E-03
				Antimony	3.89E+00	mg/kg	7.6E-07	mg/kg-day	4.0E-04	mg/kg-day	1.9E-03
				Arsenic	1.04E+01	mg/kg	2.0E-06	mg/kg-day	3.0E-04	mg/kg-day	6.8E-03
				Chromium III	4.48E+02	mg/kg	8.8E-05	mg/kg-day	1.5E+00	mg/kg-day	5.8E-05
				Cobalt	4.44E+01	mg/kg	8.7E-06	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	3.5E-05	mg/kg-day	4.0E-02	mg/kg-day	8.7E-04
				Iron	1.03E+05	mg/kg	2.0E-02	mg/kg-day	7.0E-01	mg/kg-day	2.9E-02
				Lead	3.57E+03	mg/kg	7.0E-04	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	2.1E-04	mg/kg-day	2.0E-02	mg/kg-day	1.1E-02
				Thallium	1.67E+00	mg/kg	3.3E-07	mg/kg-day	7.0E-05	mg/kg-day	4.7E-03
				Vanadium	4.76E+01	mg/kg	9.3E-06	mg/kg-day	1.0E-03	mg/kg-day	9.3E-03
			Exp. Route Total								2.5E+01
			Dermal Absorption	**Organics**							
				TCDD TE	1.48E-04	mg/kg	5.7E-12	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	3.7E-06	mg/kg-day	3.0E-02	mg/kg-day	1.2E-04
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	5.7E-09	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	2.8E-05	mg/kg-day	1.0E-04	mg/kg-day	2.8E-01
				2,4-Dinitrotoluene	2.59E+04	mg/kg	3.4E-03	mg/kg-day	2.0E-03	mg/kg-day	1.7E+00
				2,6-Dinitrotoluene	4.17E+03	mg/kg	5.3E-04	mg/kg-day	1.0E-03	mg/kg-day	5.3E-01
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	1.7E-07	mg/kg-day	2.0E-03	mg/kg-day	8.3E-05
				2-Hexanone	1.84E-02	mg/kg	2.4E-09	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	1.8E-09	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	3.5E-07	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	5.8E-06	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	2.9E-04	mg/kg-day	1.0E-04	mg/kg-day	2.9E+00
				2-Nitrotoluene	1.31E+04	mg/kg	5.1E-04	mg/kg-day	1.0E-02	mg/kg-day	5.1E-02
				3-Nitrotoluene	1.38E+03	mg/kg	1.8E-04	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	1.1E-03	mg/kg-day	4.0E-03	mg/kg-day	2.9E-01
				PETN	5.16E+00	mg/kg	6.7E-07	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	1.7E-03	mg/kg-day	5.0E-04	mg/kg-day	3.5E+00

Table E.1-43
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard
					Value	Units	Value	Units	Value	Units	Quotient
Total Soil	Total Soil	SWMU 51	**Dermal**	**Inorganics**							
			Absorption	Aluminum	1.98E+04	mg/kg	2.6E-04	mg/kg-day	1.0E+00	mg/kg-day	2.6E-04
				Antimony	3.89E+00	mg/kg	5.0E-08	mg/kg-day	6.0E-05	mg/kg-day	8.4E-04
				Arsenic	1.04E+01	mg/kg	4.3E-07	mg/kg-day	3.0E-04	mg/kg-day	1.4E-03
				Chromium III	4.48E+02	mg/kg	5.8E-06	mg/kg-day	2.0E-02	mg/kg-day	3.0E-04
				Cobalt	4.44E+01	mg/kg	5.7E-07	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	2.3E-06	mg/kg-day	4.0E-02	mg/kg-day	5.7E-05
				Iron	1.03E+05	mg/kg	1.3E-03	mg/kg-day	7.0E-01	mg/kg-day	1.9E-03
				Lead	3.57E+03	mg/kg	4.6E-05	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	1.4E-05	mg/kg-day	8.0E-04	mg/kg-day	1.7E-02
				Thallium	1.67E+00	mg/kg	2.2E-08	mg/kg-day	7.0E-05	mg/kg-day	3.1E-04
				Vanadium	4.76E+01	mg/kg	6.1E-07	mg/kg-day	2.6E-05	mg/kg-day	2.4E-02
			Exp. Route Total								9.3E+00
		Exposure Point Total									3.5E+01
	Exposure Media Total										3.5E+01
	Air	SWMU 51	**Inhalation**	**Organics**							
	(Particulates)			TCDD TE	1.48E-04	mg/kg	8.5E-15	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	8.7E-09	mg/kg-day	N/A	mg/kg-day	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	2.5E-12	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	1.2E-08	mg/kg-day	N/A	mg/kg-day	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	1.5E-06	mg/kg-day	N/A	mg/kg-day	---
				2,6-Dinitrotoluene	4.17E+03	mg/kg	2.4E-07	mg/kg-day	N/A	mg/kg-day	---
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	2.4E-07	mg/kg-day	N/A	mg/kg-day	---
				2-Hexanone	1.84E-02	mg/kg	1.2E-09	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	1.1E-12	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	2.6E-09	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	1.3E-07	mg/kg-day	N/A	mg/kg-day	---
				3-Nitrotoluene	1.38E+03	mg/kg	7.9E-08	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	5.1E-07	mg/kg-day	N/A	mg/kg-day	---
				PETN	5.16E+00	mg/kg	2.9E-10	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	2.4E-06	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Aluminum	1.98E+04	mg/kg	1.1E-06	mg/kg-day	1.0E-03	mg/kg-day	1.1E-03
				Antimony	3.89E+00	mg/kg	2.2E-10	mg/kg-day	N/A	mg/kg-day	---
				Arsenic	1.04E+01	mg/kg	5.9E-10	mg/kg-day	N/A	mg/kg-day	---
				Chromium III	4.48E+02	mg/kg	2.6E-08	mg/kg-day	N/A	mg/kg-day	---
				Cobalt	4.44E+01	mg/kg	2.5E-09	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	1.0E-08	mg/kg-day	N/A	mg/kg-day	---
				Iron	1.03E+05	mg/kg	5.9E-06	mg/kg-day	N/A	mg/kg-day	---
				Lead	3.57E+03	mg/kg	2.0E-07	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	6.2E-08	mg/kg-day	1.4E-05	mg/kg-day	4.3E-03
				Thallium	1.67E+00	mg/kg	9.5E-11	mg/kg-day	N/A	mg/kg-day	---
				Vanadium	4.76E+01	mg/kg	2.7E-09	mg/kg-day	N/A	mg/kg-day	---
			Exp. Route Total								5.4E-03
		Exposure Point Total									5.4E-03
	Exposure Media Total										5.4E-03
	Air	SWMU 51	**Inhalation**	**Organics**							
	(Volatiles)			2-Nitrotoluene	1.31E+04	mg/kg	1.5E-02	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	9.3E-08	mg/kg-day	8.6E-01	mg/kg-day	1.1E-07
			Exp. Route Total								1.1E-07
		Exposure Point Total									1.1E-07
	Exposure Media Total										1.1E-07
Total Soil Total											3.5E+01

Table E.1-43
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard
					Value	Units	Value	Units	Value	Units	Quotient
Surface Soil	Surface Soil	SWMU 51	**Ingestion**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	3.9E-07	mg/kg-day	2.0E-03	mg/kg-day	1.9E-04
				2,6-Dinitrotoluene	8.65E-01	mg/kg	1.7E-07	mg/kg-day	1.0E-03	mg/kg-day	1.7E-04
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	2.3E-09	mg/kg-day	N/A	mg/kg-day	---
				2-Nitrotoluene	6.27E+01	mg/kg	1.2E-05	mg/kg-day	1.0E-02	mg/kg-day	1.2E-03
				3-Nitrotoluene	5.17E+00	mg/kg	1.0E-06	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	3.44E+01	mg/kg	6.7E-06	mg/kg-day	4.0E-03	mg/kg-day	1.7E-03
				Inorganics							
				Aluminum	2.28E+04	mg/kg	4.5E-03	mg/kg-day	1.0E+00	mg/kg-day	4.5E-03
				Arsenic	4.41E+00	mg/kg	8.6E-07	mg/kg-day	3.0E-04	mg/kg-day	2.9E-03
				Chromium III	2.82E+01	mg/kg	5.5E-06	mg/kg-day	1.5E+00	mg/kg-day	3.7E-06
				Cobalt	9.17E+00	mg/kg	1.8E-06	mg/kg-day	N/A	mg/kg-day	---
				Iron	2.74E+04	mg/kg	5.4E-03	mg/kg-day	7.0E-01	mg/kg-day	7.7E-03
				Manganese	5.30E+02	mg/kg	1.0E-04	mg/kg-day	2.0E-02	mg/kg-day	5.2E-03
				Thallium	1.10E+00	mg/kg	2.2E-07	mg/kg-day	7.0E-05	mg/kg-day	3.1E-03
				Vanadium	5.63E+01	mg/kg	1.1E-05	mg/kg-day	1.0E-03	mg/kg-day	1.1E-02
			Exp. Route Total								3.8E-02
			Dermal Absorption	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	2.6E-07	mg/kg-day	2.0E-03	mg/kg-day	1.3E-04
				2,6-Dinitrotoluene	8.65E-01	mg/kg	1.1E-07	mg/kg-day	1.0E-03	mg/kg-day	1.1E-04
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	1.5E-09	mg/kg-day	N/A	mg/kg-day	---
				2-Nitrotoluene	6.27E+01	mg/kg	2.4E-06	mg/kg-day	1.0E-02	mg/kg-day	2.4E-04
				3-Nitrotoluene	5.17E+00	mg/kg	6.7E-07	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	3.44E+01	mg/kg	4.4E-06	mg/kg-day	4.0E-03	mg/kg-day	1.1E-03
				Inorganics							
				Aluminum	2.28E+04	mg/kg	2.9E-04	mg/kg-day	1.0E+00	mg/kg-day	2.9E-04
				Arsenic	4.41E+00	mg/kg	1.8E-07	mg/kg-day	3.0E-04	mg/kg-day	6.1E-04
				Chromium III	2.82E+01	mg/kg	3.6E-07	mg/kg-day	2.0E-02	mg/kg-day	1.9E-05
				Cobalt	9.17E+00	mg/kg	1.2E-07	mg/kg-day	N/A	mg/kg-day	---
				Iron	2.74E+04	mg/kg	3.5E-04	mg/kg-day	7.0E-01	mg/kg-day	5.1E-04
				Manganese	5.30E+02	mg/kg	6.8E-06	mg/kg-day	8.0E-04	mg/kg-day	8.6E-03
				Thallium	1.10E+00	mg/kg	1.4E-08	mg/kg-day	7.0E-05	mg/kg-day	2.0E-04
				Vanadium	5.63E+01	mg/kg	7.3E-07	mg/kg-day	2.6E-05	mg/kg-day	2.8E-02
			Exp. Route Total								4.0E-02
		Exposure Point Total									7.7E-02
	Exposure Media Total										7.7E-02
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	1.1E-10	mg/kg-day	N/A	mg/kg-day	---
				2,6-Dinitrotoluene	8.65E-01	mg/kg	4.9E-11	mg/kg-day	N/A	mg/kg-day	---
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	6.6E-13	mg/kg-day	N/A	mg/kg-day	---
				3-Nitrotoluene	5.17E+00	mg/kg	3.0E-10	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	3.44E+01	mg/kg	2.0E-09	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Aluminum	2.28E+04	mg/kg	1.3E-06	mg/kg-day	1.0E-03	mg/kg-day	1.3E-03
				Arsenic	4.41E+00	mg/kg	2.5E-10	mg/kg-day	N/A	mg/kg-day	---
				Chromium III	2.82E+01	mg/kg	1.6E-09	mg/kg-day	N/A	mg/kg-day	---
				Cobalt	9.17E+00	mg/kg	5.2E-10	mg/kg-day	N/A	mg/kg-day	---
				Iron	2.74E+04	mg/kg	1.6E-06	mg/kg-day	N/A	mg/kg-day	---
				Manganese	5.30E+02	mg/kg	3.0E-08	mg/kg-day	1.4E-05	mg/kg-day	2.1E-03
				Thallium	1.10E+00	mg/kg	6.3E-11	mg/kg-day	N/A	mg/kg-day	---
				Vanadium	5.63E+01	mg/kg	3.2E-09	mg/kg-day	N/A	mg/kg-day	---
			Exp. Route Total								3.4E-03
		Exposure Point Total									3.4E-03
	Exposure Media Total										3.4E-03

Table E.1-43
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard
					Value	Units	Value	Units	Value	Units	Quotient
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics** 2-Nitrotoluene	6.27E+01	mg/kg	7.1E-05	mg/kg-day	N/A	mg/kg-day	---
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Surface Soil Total											8.1E-02
Groundwater	Air	SWMU 51	**Inhalation** (Ambient Air)	**Organics** Tetrachloroethene	3.52E-10	mg/m^3	1.4E-11	mg/kg-day	8.0E-02	mg/kg-day	1.7E-10
			Exp. Route Total								1.7E-10
		Exposure Point Total									1.7E-10
	Exposure Media Total										1.7E-10
Groundwater Total											1.7E-10
										Total of Receptor Hazards Across All Media	3.5E+01

N/A = Not Applicable.

Since total soil represents the more highly contaminated portion of soil, total risk and hazard estimates are conservatively based on this soil data grouping.

Table E.1-44
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Total Soil	Total Soil	SWMU 51	**Ingestion**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	4.7E-11	mg/kg-day	1.5E+05	$(mg/kg-day)^{-1}$	7.0E-06
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	4.8E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	1.4E-08	mg/kg-day	7.3E+00	$(mg/kg-day)^{-1}$	1.0E-07
				1,3-Dinitrobenzene	2.13E+02	mg/kg	6.7E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	8.1E-03	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	5.5E-03
				2,6-Dinitrotoluene	4.17E+03	mg/kg	1.3E-03	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	8.9E-04
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	6.8E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	5.8E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	1.5E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	8.5E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	1.4E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	7.1E-04	mg/kg-day	1.7E-02	$(mg/kg-day)^{-1}$	1.2E-05
				2-Nitrotoluene	1.31E+04	mg/kg	4.1E-03	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	4.3E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	2.8E-03	mg/kg-day	1.6E-02	$(mg/kg-day)^{-1}$	4.5E-05
				PETN	5.16E+00	mg/kg	1.6E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	1.3E-02	mg/kg-day	3.0E-02	$(mg/kg-day)^{-1}$	4.0E-04
				Inorganics							
				Aluminum	1.98E+04	mg/kg	6.2E-03	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	1.2E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	3.3E-06	mg/kg-day	1.5E+00	$(mg/kg-day)^{-1}$	4.9E-06
				Chromium III	4.48E+02	mg/kg	1.4E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	1.4E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Copper	1.77E+02	mg/kg	5.6E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Iron	1.03E+05	mg/kg	3.2E-02	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Lead	3.57E+03	mg/kg	1.1E-03	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	3.4E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	5.3E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	1.5E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								6.9E-03
			Dermal Absorption	**Organics**							
				TCDD TE	1.48E-04	mg/kg	9.2E-12	mg/kg-day	1.5E+05	$(mg/kg-day)^{-1}$	1.4E-06
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	6.0E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	9.2E-09	mg/kg-day	7.3E+00	$(mg/kg-day)^{-1}$	6.7E-08
				1,3-Dinitrobenzene	2.13E+02	mg/kg	4.4E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	5.5E-03	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	3.7E-03
				2,6-Dinitrotoluene	4.17E+03	mg/kg	8.6E-04	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	5.8E-04
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	2.7E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	3.8E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	2.9E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	5.6E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	9.3E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	4.7E-04	mg/kg-day	1.7E-02	$(mg/kg-day)^{-1}$	8.0E-06
				2-Nitrotoluene	1.31E+04	mg/kg	8.2E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	2.9E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	1.8E-03	mg/kg-day	1.6E-02	$(mg/kg-day)^{-1}$	2.9E-05
				PETN	5.16E+00	mg/kg	1.1E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	2.8E-03	mg/kg-day	3.0E-02	$(mg/kg-day)^{-1}$	8.4E-05

Table E.1-44
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Total Soil	Total Soil	SWMU 51	**Dermal Absorption**	**Inorganics**							
				Aluminum	1.98E+04	mg/kg	4.1E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	8.1E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	6.9E-07	mg/kg-day	1.5E+00	$(mg/kg-day)^{-1}$	1.0E-06
				Chromium III	4.48E+02	mg/kg	9.3E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	9.2E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Copper	1.77E+02	mg/kg	3.7E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Iron	1.03E+05	mg/kg	2.1E-03	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Lead	3.57E+03	mg/kg	7.4E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	2.2E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	3.5E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	9.9E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								4.4E-03
		Exposure Point Total									1.1E-02
	Exposure Media Total										1.1E-02
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	1.4E-14	mg/kg-day	1.5E+05	$(mg/kg-day)^{-1}$	2.0E-09
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.4E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	4.1E-12	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	2.0E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	2.4E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,6-Dinitrotoluene	4.17E+03	mg/kg	3.8E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	2.0E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	1.7E-12	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	2.5E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	4.1E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	2.1E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	1.3E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	8.1E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				PETN	5.16E+00	mg/kg	4.7E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	3.9E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Inorganics							
				Aluminum	1.98E+04	mg/kg	1.8E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	3.6E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	9.6E-10	mg/kg-day	1.5E+01	$(mg/kg-day)^{-1}$	1.4E-08
				Chromium III	4.48E+02	mg/kg	4.1E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	4.1E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Copper	1.77E+02	mg/kg	1.6E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Iron	1.03E+05	mg/kg	9.5E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Lead	3.57E+03	mg/kg	3.3E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	9.9E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	1.5E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	4.4E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								1.6E-08
		Exposure Point Total									1.6E-08
	Exposure Media Total										1.6E-08
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics**							
				2-Nitrotoluene	1.31E+04	mg/kg	2.4E-02	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	1.5E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Total Soil Total											1.1E-02

Table E.1-44
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Surface Soil	Surface Soil	SWMU 51	**Ingestion**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	6.3E-07	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	4.3E-07
				2,6-Dinitrotoluene	8.65E-01	mg/kg	2.7E-07	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	1.8E-07
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	3.6E-09	mg/kg-day	7.3E+00	$(mg/kg-day)^{-1}$	2.7E-08
				2-Nitrotoluene	6.27E+01	mg/kg	2.0E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				3-Nitrotoluene	5.17E+00	mg/kg	1.6E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Nitrotoluene	3.44E+01	mg/kg	1.1E-05	mg/kg-day	1.6E-02	$(mg/kg-day)^{-1}$	1.7E-07
				Inorganics							
				Aluminum	2.28E+04	mg/kg	7.2E-03	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Arsenic	4.41E+00	mg/kg	1.4E-06	mg/kg-day	1.5E+00	$(mg/kg-day)^{-1}$	2.1E-06
				Chromium III	2.82E+01	mg/kg	8.9E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Cobalt	9.17E+00	mg/kg	2.9E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Iron	2.74E+04	mg/kg	8.6E-03	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Manganese	5.30E+02	mg/kg	1.7E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Thallium	1.10E+00	mg/kg	3.5E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Vanadium	5.63E+01	mg/kg	1.8E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								2.9E-06
			Dermal Absorption	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	4.2E-07	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	2.9E-07
				2,6-Dinitrotoluene	8.65E-01	mg/kg	1.8E-07	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	1.2E-07
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	2.4E-09	mg/kg-day	7.3E+00	$(mg/kg-day)^{-1}$	1.8E-08
				2-Nitrotoluene	6.27E+01	mg/kg	3.9E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				3-Nitrotoluene	5.17E+00	mg/kg	1.1E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Nitrotoluene	3.44E+01	mg/kg	7.1E-06	mg/kg-day	1.6E-02	$(mg/kg-day)^{-1}$	1.1E-07
				Inorganics							
				Aluminum	2.28E+04	mg/kg	4.7E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Arsenic	4.41E+00	mg/kg	2.9E-07	mg/kg-day	1.5E+00	$(mg/kg-day)^{-1}$	4.4E-07
				Chromium III	2.82E+01	mg/kg	5.9E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Cobalt	9.17E+00	mg/kg	1.9E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Iron	2.74E+04	mg/kg	5.7E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Manganese	5.30E+02	mg/kg	1.1E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Thallium	1.10E+00	mg/kg	2.3E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Vanadium	5.63E+01	mg/kg	1.2E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								9.8E-07
		Exposure Point Total									3.9E-06
	Exposure Media Total										3.9E-06
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	1.8E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,6-Dinitrotoluene	8.65E-01	mg/kg	7.9E-11	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	1.1E-12	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				3-Nitrotoluene	5.17E+00	mg/kg	4.7E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Nitrotoluene	3.44E+01	mg/kg	3.2E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Inorganics							
				Aluminum	2.28E+04	mg/kg	2.1E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Arsenic	4.41E+00	mg/kg	4.1E-10	mg/kg-day	1.5E+01	$(mg/kg-day)^{-1}$	6.1E-09
				Chromium III	2.82E+01	mg/kg	2.6E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Cobalt	9.17E+00	mg/kg	8.4E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Iron	2.74E+04	mg/kg	2.5E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Manganese	5.30E+02	mg/kg	4.9E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Thallium	1.10E+00	mg/kg	1.0E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Vanadium	5.63E+01	mg/kg	5.2E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								6.1E-09
		Exposure Point Total									6.1E-09
	Exposure Media Total										6.1E-09

Table E.1-44
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics**							
				2-Nitrotoluene	6.27E+01	mg/kg	1.1E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Surface Soil Total											3.9E-06
Groundwater	Groundwater	SWMU 51	**Ingestion**	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	2.9E-06	mg/kg-day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	1.6E-06
				TCDD TE	3.30E-05	µg/L	1.0E-10	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.6E-05
				Inorganics							
				Chromium III	1.19E+01	µg/L	3.7E-14	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								1.7E-05
		Exposure Point Total									1.7E-05
	Exposure Media Total										1.7E-05
	Air	SWMU 51	**Inhalation** (Ambient Air)	**Organics** Tetrachloroethene	3.52E-10	mg/m^3	2.2E-11	mg/kg-day	2.0E-02	$(mg/kg\text{-}day)^{-1}$	4.4E-13
			Exp. Route Total								4.4E-13
		Exposure Point Total									4.4E-13
	Exposure Media Total										4.4E-13
	Air	SWMU 51	**Inhalation** (Indoor Air)	**Organics** Tetrachloroethene	2.65E-05	mg/m^3	1.7E-06	mg/kg-day	2.0E-02	$(mg/kg\text{-}day)^{-1}$	3.3E-08
			Exp. Route Total								3.3E-08
		Exposure Point Total									3.3E-08
	Exposure Media Total										3.3E-08
Groundwater Total											1.7E-05
										Total of Receptor Risks Across All Media	1.1E-02

N/A = Not Applicable.

Since total soil represents the more highly contaminated portion of soil, total risk and hazard estimates are conservatively based on this soil data grouping.

Since indoor air represents the more highly contaminated portion of groundwater, total risk and hazard estimates are conservatively based on this data grouping.

Table E.1-45
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		
					Value	Units	Value	Units	Value	Units	Hazard Quotient
Total Soil	Total Soil	SWMU 51	**Ingestion**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	1.3E-10	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.3E-04	mg/kg-day	3.0E-02	mg/kg-day	4.5E-03
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	3.9E-08	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	1.9E-04	mg/kg-day	1.0E-04	mg/kg-day	1.9E+00
				2,4-Dinitrotoluene	2.59E+04	mg/kg	2.3E-02	mg/kg-day	2.0E-03	mg/kg-day	1.1E+01
				2,6-Dinitrotoluene	4.17E+03	mg/kg	3.7E-03	mg/kg-day	1.0E-03	mg/kg-day	3.7E+00
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	1.9E-05	mg/kg-day	2.0E-03	mg/kg-day	9.5E-03
				2-Hexanone	1.84E-02	mg/kg	1.6E-08	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	4.1E-08	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	2.4E-06	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	4.0E-05	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	2.0E-03	mg/kg-day	1.0E-04	mg/kg-day	2.0E+01
				2-Nitrotoluene	1.31E+04	mg/kg	1.2E-02	mg/kg-day	1.0E-02	mg/kg-day	1.2E+00
				3-Nitrotoluene	1.38E+03	mg/kg	1.2E-03	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	7.8E-03	mg/kg-day	4.0E-03	mg/kg-day	2.0E+00
				PETN	5.16E+00	mg/kg	4.5E-06	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	3.7E-02	mg/kg-day	5.0E-04	mg/kg-day	7.4E+01
				Inorganics							
				Aluminum	1.98E+04	mg/kg	1.7E-02	mg/kg-day	1.0E+00	mg/kg-day	1.7E-02
				Antimony	3.89E+00	mg/kg	3.4E-06	mg/kg-day	4.0E-04	mg/kg-day	8.6E-03
				Arsenic	1.04E+01	mg/kg	9.2E-06	mg/kg-day	3.0E-04	mg/kg-day	3.1E-02
				Chromium III	4.48E+02	mg/kg	3.9E-04	mg/kg-day	1.5E+00	mg/kg-day	2.6E-04
				Cobalt	4.44E+01	mg/kg	3.9E-05	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	1.6E-04	mg/kg-day	4.0E-02	mg/kg-day	3.9E-03
				Iron	1.03E+05	mg/kg	9.1E-02	mg/kg-day	7.0E-01	mg/kg-day	1.3E-01
				Lead	3.57E+03	mg/kg	3.1E-03	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	9.5E-04	mg/kg-day	2.0E-02	mg/kg-day	4.8E-02
				Thallium	1.67E+00	mg/kg	1.5E-06	mg/kg-day	7.0E-05	mg/kg-day	2.1E-02
				Vanadium	4.76E+01	mg/kg	4.2E-05	mg/kg-day	1.0E-03	mg/kg-day	4.2E-02
			Exp. Route Total								1.1E+02
			Dermal Absorption	**Organics**							
				TCDD TE	1.48E-04	mg/kg	2.6E-11	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.7E-05	mg/kg-day	3.0E-02	mg/kg-day	5.6E-04
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	2.6E-08	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	1.2E-04	mg/kg-day	1.0E-04	mg/kg-day	1.2E+00
				2,4-Dinitrotoluene	2.59E+04	mg/kg	1.5E-02	mg/kg-day	2.0E-03	mg/kg-day	7.7E+00
				2,6-Dinitrotoluene	4.17E+03	mg/kg	2.4E-03	mg/kg-day	1.0E-03	mg/kg-day	2.4E+00
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	7.5E-07	mg/kg-day	2.0E-03	mg/kg-day	3.7E-04
				2-Hexanone	1.84E-02	mg/kg	1.1E-08	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	8.2E-09	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	1.6E-06	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	2.6E-05	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	1.3E-03	mg/kg-day	1.0E-04	mg/kg-day	1.3E+01
				2-Nitrotoluene	1.31E+04	mg/kg	2.3E-03	mg/kg-day	1.0E-02	mg/kg-day	2.3E-01
				3-Nitrotoluene	1.38E+03	mg/kg	8.0E-04	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	5.2E-03	mg/kg-day	4.0E-03	mg/kg-day	1.3E+00
				PETN	5.16E+00	mg/kg	3.0E-06	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	7.8E-03	mg/kg-day	5.0E-04	mg/kg-day	1.6E+01

Table E.1-45
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		
					Value	Units	Value	Units	Value	Units	Hazard Quotient
Total Soil	Total Soil	SWMU 51	**Dermal Absorption**	**Inorganics**							
				Aluminum	1.98E+04	mg/kg	1.2E-03	mg/kg-day	1.0E+00	mg/kg-day	1.2E-03
				Antimony	3.89E+00	mg/kg	2.3E-07	mg/kg-day	6.0E-05	mg/kg-day	3.8E-03
				Arsenic	1.04E+01	mg/kg	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	6.4E-03
				Chromium III	4.48E+02	mg/kg	2.6E-05	mg/kg-day	2.0E-02	mg/kg-day	1.3E-03
				Cobalt	4.44E+01	mg/kg	2.6E-06	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	1.0E-05	mg/kg-day	4.0E-02	mg/kg-day	2.6E-04
				Iron	1.03E+05	mg/kg	6.0E-03	mg/kg-day	7.0E-01	mg/kg-day	8.6E-03
				Lead	3.57E+03	mg/kg	2.1E-04	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	6.3E-05	mg/kg-day	8.0E-04	mg/kg-day	7.8E-02
				Thallium	1.67E+00	mg/kg	9.7E-08	mg/kg-day	7.0E-05	mg/kg-day	1.4E-03
				Vanadium	4.76E+01	mg/kg	2.8E-06	mg/kg-day	2.6E-05	mg/kg-day	1.1E-01
			Exp. Route Total								4.2E+01
		Exposure Point Total									1.6E+02
	Exposure Media Total										1.6E+02
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	3.8E-14	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	3.9E-08	mg/kg-day	N/A	mg/kg-day	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	1.1E-11	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	5.5E-08	mg/kg-day	N/A	mg/kg-day	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	6.7E-06	mg/kg-day	N/A	mg/kg-day	---
				2,6-Dinitrotoluene	4.17E+03	mg/kg	1.1E-06	mg/kg-day	N/A	mg/kg-day	---
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	5.5E-09	mg/kg-day	N/A	mg/kg-day	---
				2-Hexanone	1.84E-02	mg/kg	4.7E-12	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	6.9E-10	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	1.2E-08	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	5.8E-07	mg/kg-day	N/A	mg/kg-day	---
				3-Nitrotoluene	1.38E+03	mg/kg	3.5E-07	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	2.3E-06	mg/kg-day	N/A	mg/kg-day	---
				PETN	5.16E+00	mg/kg	1.3E-09	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	1.1E-05	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Aluminum	1.98E+04	mg/kg	5.1E-06	mg/kg-day	1.0E-03	mg/kg-day	5.1E-03
				Antimony	3.89E+00	mg/kg	1.0E-09	mg/kg-day	N/A	mg/kg-day	---
				Arsenic	1.04E+01	mg/kg	2.7E-09	mg/kg-day	N/A	mg/kg-day	---
				Chromium III	4.48E+02	mg/kg	1.2E-07	mg/kg-day	N/A	mg/kg-day	---
				Cobalt	4.44E+01	mg/kg	1.1E-08	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	4.6E-08	mg/kg-day	N/A	mg/kg-day	---
				Iron	1.03E+05	mg/kg	2.6E-05	mg/kg-day	N/A	mg/kg-day	---
				Lead	3.57E+03	mg/kg	9.2E-07	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	2.8E-07	mg/kg-day	1.4E-05	mg/kg-day	1.9E-02
				Thallium	1.67E+00	mg/kg	4.3E-10	mg/kg-day	N/A	mg/kg-day	---
				Vanadium	4.76E+01	mg/kg	1.2E-08	mg/kg-day	N/A	mg/kg-day	---
			Exp. Route Total								2.5E-02
		Exposure Point Total									2.5E-02
	Exposure Media Total										2.5E-02
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics**							
				2-Nitrotoluene	1.31E+04	mg/kg	6.7E-02	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	4.2E-07	mg/kg-day	8.6E-01	mg/kg-day	4.9E-07
			Exp. Route Total								4.9E-07
		Exposure Point Total									4.9E-07
	Exposure Media Total										4.9E-07
Total Soil Total											1.6E+02

Table E.1-45
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		
					Value	Units	Value	Units	Value	Units	Hazard Quotient
Surface Soil	Surface Soil	SWMU 51	**Ingestion**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	1.8E-06	mg/kg-day	2.0E-03	mg/kg-day	8.8E-04
				2,6-Dinitrotoluene	8.65E-01	mg/kg	7.6E-07	mg/kg-day	1.0E-03	mg/kg-day	7.6E-04
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	1.0E-08	mg/kg-day	N/A	mg/kg-day	---
				2-Nitrotoluene	6.27E+01	mg/kg	5.5E-05	mg/kg-day	1.0E-02	mg/kg-day	5.5E-03
				3-Nitrotoluene	5.17E+00	mg/kg	4.6E-06	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	3.44E+01	mg/kg	3.0E-05	mg/kg-day	4.0E-03	mg/kg-day	7.6E-03
				Inorganics							
				Aluminum	2.28E+04	mg/kg	2.0E-02	mg/kg-day	1.0E+00	mg/kg-day	2.0E-02
				Arsenic	4.41E+00	mg/kg	3.9E-06	mg/kg-day	3.0E-04	mg/kg-day	1.3E-02
				Chromium III	2.82E+01	mg/kg	2.5E-05	mg/kg-day	1.5E+00	mg/kg-day	1.7E-05
				Cobalt	9.17E+00	mg/kg	8.1E-06	mg/kg-day	N/A	mg/kg-day	---
				Iron	2.74E+04	mg/kg	2.4E-02	mg/kg-day	7.0E-01	mg/kg-day	3.4E-02
				Manganese	5.30E+02	mg/kg	4.7E-04	mg/kg-day	2.0E-02	mg/kg-day	2.3E-02
				Thallium	1.10E+00	mg/kg	9.7E-07	mg/kg-day	7.0E-05	mg/kg-day	1.4E-02
				Vanadium	5.63E+01	mg/kg	5.0E-05	mg/kg-day	1.0E-03	mg/kg-day	5.0E-02
			Exp. Route Total								1.7E-01
			Dermal Absorption	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	1.2E-06	mg/kg-day	2.0E-03	mg/kg-day	5.9E-04
				2,6-Dinitrotoluene	8.65E-01	mg/kg	5.0E-07	mg/kg-day	1.0E-03	mg/kg-day	5.0E-04
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	6.7E-09	mg/kg-day	N/A	mg/kg-day	---
				2-Nitrotoluene	6.27E+01	mg/kg	3.6E-05	mg/kg-day	1.0E-02	mg/kg-day	3.6E-03
				3-Nitrotoluene	5.17E+00	mg/kg	3.0E-06	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	3.44E+01	mg/kg	2.0E-05	mg/kg-day	4.0E-03	mg/kg-day	5.0E-03
				Inorganics							
				Aluminum	2.28E+04	mg/kg	1.3E-03	mg/kg-day	1.0E+00	mg/kg-day	1.3E-03
				Arsenic	4.41E+00	mg/kg	8.2E-07	mg/kg-day	3.0E-04	mg/kg-day	2.7E-03
				Chromium III	2.82E+01	mg/kg	1.6E-06	mg/kg-day	2.0E-02	mg/kg-day	8.4E-05
				Cobalt	9.17E+00	mg/kg	5.3E-07	mg/kg-day	N/A	mg/kg-day	---
				Iron	2.74E+04	mg/kg	1.6E-03	mg/kg-day	7.0E-01	mg/kg-day	2.3E-03
				Manganese	5.30E+02	mg/kg	3.1E-05	mg/kg-day	8.0E-04	mg/kg-day	3.9E-02
				Thallium	1.10E+00	mg/kg	6.4E-08	mg/kg-day	7.0E-05	mg/kg-day	9.1E-04
				Vanadium	5.63E+01	mg/kg	3.3E-06	mg/kg-day	2.6E-05	mg/kg-day	1.3E-01
			Exp. Route Total								1.8E-01
		Exposure Point Total									3.5E-01
	Exposure Media Total										3.5E-01
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				2,4-Dinitrotoluene	1.99E+00	mg/kg	5.1E-10	mg/kg-day	N/A	mg/kg-day	---
				2,6-Dinitrotoluene	8.65E-01	mg/kg	2.2E-10	mg/kg-day	N/A	mg/kg-day	---
				Dibenz(a,h)anthracene	1.16E-02	mg/kg	3.0E-12	mg/kg-day	N/A	mg/kg-day	---
				3-Nitrotoluene	5.17E+00	mg/kg	1.3E-09	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	3.44E+01	mg/kg	8.8E-09	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Aluminum	2.28E+04	mg/kg	5.9E-06	mg/kg-day	1.0E-03	mg/kg-day	5.9E-03
				Arsenic	4.41E+00	mg/kg	1.1E-09	mg/kg-day	N/A	mg/kg-day	---
				Chromium III	2.82E+01	mg/kg	7.3E-09	mg/kg-day	N/A	mg/kg-day	---
				Cobalt	9.17E+00	mg/kg	2.4E-09	mg/kg-day	N/A	mg/kg-day	---
				Iron	2.74E+04	mg/kg	7.0E-06	mg/kg-day	N/A	mg/kg-day	---
				Manganese	5.30E+02	mg/kg	1.4E-07	mg/kg-day	1.4E-05	mg/kg-day	9.5E-03
				Thallium	1.10E+00	mg/kg	2.8E-10	mg/kg-day	N/A	mg/kg-day	---
				Vanadium	5.63E+01	mg/kg	1.4E-08	mg/kg-day	N/A	mg/kg-day	---
			Exp. Route Total								1.5E-02
		Exposure Point Total									1.5E-02
	Exposure Media Total										1.5E-02

Table E.1-45
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		
					Value	Units	Value	Units	Value	Units	Hazard Quotient
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics**							
				2-Nitrotoluene	6.27E+01	mg/kg	3.2E-04	mg/kg-day	N/A	mg/kg-day	---
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Surface Soil Total											3.7E-01
Groundwater	Groundwater	SWMU 51	**Ingestion**	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	8.2E-06	mg/kg-day	1.0E-02	mg/kg-day	8.2E-04
				TCDD TE	3.30E-05	µg/L	2.9E-10	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Chromium III	1.19E+01	µg/L	1.0E-13	mg/kg-day	1.5E+00	mg/kg-day	7.0E-14
			Exp. Route Total								8.2E-04
		Exposure Point Total									8.2E-04
	Exposure Media Total										8.2E-04
	Air	SWMU 51	**Inhalation** (Ambient Air)	**Organics** Tetrachloroethene	3.52E-10	mg/m^3	6.2E-11	mg/kg-day	8.0E-02	mg/kg-day	7.7E-10
			Exp. Route Total								7.7E-10
		Exposure Point Total									7.7E-10
	Exposure Media Total										7.7E-10
	Air	SWMU 51	**Inhalation** (Indoor Air)	**Organics** Tetrachloroethene	2.65E-05	mg/m^3	4.7E-06	mg/kg-day	8.0E-02	mg/kg-day	5.8E-05
			Exp. Route Total								5.8E-05
		Exposure Point Total									5.8E-05
	Exposure Media Total										5.8E-05
Groundwater Total											8.8E-04
										Total of Receptor Hazards Across All Media	1.6E+02

N/A = Not Applicable.

Since total soil represents the more highly contaminated portion of soil, total risk and hazard estimates are conservatively based on this soil data grouping.

Since indoor air represents the more highly contaminated portion of groundwater, total risk and hazard estimates are conservatively based on this data grouping.

Table E.1-46
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Excavation Worker

Scenario Timeframe: Future
Receptor Population: Excavation Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Total Soil	Total Soil	SWMU 51	**Ingestion**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	6.8E-12	mg/kg-day	1.5E+05	$(mg/kg-day)^{-1}$	1.0E-06
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	7.0E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	2.1E-09	mg/kg-day	7.3E+00	$(mg/kg-day)^{-1}$	1.5E-08
				1,3-Dinitrobenzene	2.13E+02	mg/kg	9.8E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	1.2E-03	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	8.1E-04
				2,6-Dinitrotoluene	4.17E+03	mg/kg	1.9E-04	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	1.3E-04
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	9.9E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	8.5E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	2.2E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	1.2E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	2.1E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	1.0E-04	mg/kg-day	1.7E-02	$(mg/kg-day)^{-1}$	1.8E-06
				2-Nitrotoluene	1.31E+04	mg/kg	6.0E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	6.4E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	4.1E-04	mg/kg-day	1.6E-02	$(mg/kg-day)^{-1}$	6.5E-06
				PETN	5.16E+00	mg/kg	2.4E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	1.9E-03	mg/kg-day	3.0E-02	$(mg/kg-day)^{-1}$	5.8E-05
				Inorganics							
				Aluminum	1.98E+04	mg/kg	9.1E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	1.8E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	4.8E-07	mg/kg-day	1.5E+00	$(mg/kg-day)^{-1}$	7.2E-07
				Chromium III	4.48E+02	mg/kg	2.1E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	2.0E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Copper	1.77E+02	mg/kg	8.2E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Iron	1.03E+05	mg/kg	4.8E-03	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Lead	3.57E+03	mg/kg	1.6E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	5.0E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	7.7E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	2.2E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								1.0E-03
			Dermal Absorption	**Organics**							
				TCDD TE	1.48E-04	mg/kg	6.1E-13	mg/kg-day	1.5E+05	$(mg/kg-day)^{-1}$	9.2E-08
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	4.0E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	6.2E-10	mg/kg-day	7.3E+00	$(mg/kg-day)^{-1}$	4.5E-09
				1,3-Dinitrobenzene	2.13E+02	mg/kg	2.9E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	3.7E-04	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	2.5E-04
				2,6-Dinitrotoluene	4.17E+03	mg/kg	5.7E-05	mg/kg-day	6.8E-01	$(mg/kg-day)^{-1}$	3.9E-05
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	1.8E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	2.5E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	2.0E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	3.7E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	6.2E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	3.1E-05	mg/kg-day	1.7E-02	$(mg/kg-day)^{-1}$	5.3E-07
				2-Nitrotoluene	1.31E+04	mg/kg	5.4E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	1.9E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	1.2E-04	mg/kg-day	1.6E-02	$(mg/kg-day)^{-1}$	2.0E-06
				PETN	5.16E+00	mg/kg	7.1E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	1.9E-04	mg/kg-day	3.0E-02	$(mg/kg-day)^{-1}$	5.6E-06

Table E.1-46
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Excavation Worker

Scenario Timeframe: Future
Receptor Population: Excavation Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Total Soil	Total Soil	SWMU 51	**Dermal Absorption**	**Inorganics**							
				Aluminum	1.98E+04	mg/kg	2.7E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	5.4E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	4.6E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	6.9E-08
				Chromium III	4.48E+02	mg/kg	6.2E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	6.1E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Copper	1.77E+02	mg/kg	2.4E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	1.03E+05	mg/kg	1.4E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Lead	3.57E+03	mg/kg	4.9E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	1.5E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	2.3E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	6.6E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								3.0E-04
		Exposure Point Total									1.3E-03
	Exposure Media Total										1.3E-03
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	2.1E-13	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	3.2E-08
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	2.2E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	6.4E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	3.1E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	3.7E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,6-Dinitrotoluene	4.17E+03	mg/kg	6.0E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	3.1E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	2.7E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	3.9E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	6.5E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	3.3E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	2.0E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	1.3E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				PETN	5.16E+00	mg/kg	7.4E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	6.1E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Inorganics							
				Aluminum	1.98E+04	mg/kg	2.9E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	5.6E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	1.5E-08	mg/kg-day	1.5E+01	$(mg/kg\text{-}day)^{-1}$	2.3E-07
				Chromium III	4.48E+02	mg/kg	6.5E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	6.4E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Copper	1.77E+02	mg/kg	2.6E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	1.03E+05	mg/kg	1.5E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Lead	3.57E+03	mg/kg	5.1E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	1.6E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	2.4E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	6.9E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								2.6E-07
		Exposure Point Total									2.6E-07
	Exposure Media Total										2.6E-07
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics**							
				2-Nitrotoluene	1.31E+04	mg/kg	1.1E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	6.7E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Total Soil Total											1.3E-03

Table E.1-46
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Excavation Worker

Scenario Timeframe: Future
Receptor Population: Excavation Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Groundwater	Air	SWMU 51	**Inhalation** (Trench Air)	**Organics** Tetrachloroethene	1.91E-05	mg/m^3	2.7E-08	mg/kg-day	2.0E-02	$(mg/kg\text{-}day)^{-1}$	5.3E-10
			Exp. Route Total								5.3E-10
		Exposure Point Total									5.3E-10
	Exposure Media Total										5.3E-10
Groundwater Total											5.3E-10
										Total of Receptor Risks Across All Media	1.3E-03

N/A = Not Applicable.

Table E.1-47
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Excavation Worker

Scenario Timeframe: Future
Receptor Population: Excavation Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		
					Value	Units	Value	Units	Value	Units	Hazard Quotient
Total Soil	Total Soil	SWMU 51	**Ingestion**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	4.8E-10	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	4.9E-04	mg/kg-day	3.0E-02	mg/kg-day	1.6E-02
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	1.4E-07	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	6.9E-04	mg/kg-day	1.0E-04	mg/kg-day	6.9E+00
				2,4-Dinitrotoluene	2.59E+04	mg/kg	8.4E-02	mg/kg-day	2.0E-03	mg/kg-day	4.2E+01
				2,6-Dinitrotoluene	4.17E+03	mg/kg	1.3E-02	mg/kg-day	1.0E-03	mg/kg-day	1.3E+01
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	6.9E-05	mg/kg-day	2.0E-03	mg/kg-day	3.5E-02
				2-Hexanone	1.84E-02	mg/kg	5.9E-08	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	1.5E-07	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	8.7E-06	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	1.5E-04	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	7.3E-03	mg/kg-day	1.0E-04	mg/kg-day	7.3E+01
				2-Nitrotoluene	1.31E+04	mg/kg	4.2E-02	mg/kg-day	1.0E-02	mg/kg-day	4.2E+00
				3-Nitrotoluene	1.38E+03	mg/kg	4.5E-03	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	2.9E-02	mg/kg-day	4.0E-03	mg/kg-day	7.2E+00
				PETN	5.16E+00	mg/kg	1.7E-05	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	1.4E-01	mg/kg-day	5.0E-04	mg/kg-day	2.7E+02
				Inorganics							
				Aluminum	1.98E+04	mg/kg	6.4E-02	mg/kg-day	1.0E+00	mg/kg-day	6.4E-02
				Antimony	3.89E+00	mg/kg	1.3E-05	mg/kg-day	4.0E-04	mg/kg-day	3.1E-02
				Arsenic	1.04E+01	mg/kg	3.4E-05	mg/kg-day	3.0E-04	mg/kg-day	1.1E-01
				Chromium III	4.48E+02	mg/kg	1.4E-03	mg/kg-day	1.5E+00	mg/kg-day	9.6E-04
				Cobalt	4.44E+01	mg/kg	1.4E-04	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	5.7E-04	mg/kg-day	4.0E-02	mg/kg-day	1.4E-02
				Iron	1.03E+05	mg/kg	3.3E-01	mg/kg-day	7.0E-01	mg/kg-day	4.8E-01
				Lead	3.57E+03	mg/kg	1.2E-02	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	3.5E-03	mg/kg-day	2.0E-02	mg/kg-day	1.7E-01
				Thallium	1.67E+00	mg/kg	5.4E-06	mg/kg-day	7.0E-05	mg/kg-day	7.7E-02
				Vanadium	4.76E+01	mg/kg	1.5E-04	mg/kg-day	1.0E-03	mg/kg-day	1.5E-01
			Exp. Route Total								4.2E+02
			Dermal Absorption	**Organics**							
				TCDD TE	1.48E-04	mg/kg	4.3E-11	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	2.8E-05	mg/kg-day	3.0E-02	mg/kg-day	9.3E-04
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	4.3E-08	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	2.1E-04	mg/kg-day	1.0E-04	mg/kg-day	2.1E+00
				2,4-Dinitrotoluene	2.59E+04	mg/kg	2.6E-02	mg/kg-day	2.0E-03	mg/kg-day	1.3E+01
				2,6-Dinitrotoluene	4.17E+03	mg/kg	4.0E-03	mg/kg-day	1.0E-03	mg/kg-day	4.0E+00
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	1.2E-06	mg/kg-day	2.0E-03	mg/kg-day	6.2E-04
				2-Hexanone	1.84E-02	mg/kg	1.8E-08	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	1.4E-08	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	2.6E-06	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	4.4E-05	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	2.2E-03	mg/kg-day	1.0E-04	mg/kg-day	2.2E+01
				2-Nitrotoluene	1.31E+04	mg/kg	3.8E-03	mg/kg-day	1.0E-02	mg/kg-day	3.8E-01
				3-Nitrotoluene	1.38E+03	mg/kg	1.3E-03	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	8.6E-03	mg/kg-day	4.0E-03	mg/kg-day	2.1E+00
				PETN	5.16E+00	mg/kg	5.0E-06	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	1.3E-02	mg/kg-day	5.0E-04	mg/kg-day	2.6E+01

Table E.1-47
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Excavation Worker

Scenario Timeframe: Future
Receptor Population: Excavation Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		
					Value	Units	Value	Units	Value	Units	Hazard Quotient
Total Soil	Total Soil	SWMU 51	**Dermal Absorption**	**Inorganics**							
				Aluminum	1.98E+04	mg/kg	1.9E-03	mg/kg-day	1.0E+00	mg/kg-day	1.9E-03
				Antimony	3.89E+00	mg/kg	3.8E-07	mg/kg-day	6.0E-05	mg/kg-day	6.3E-03
				Arsenic	1.04E+01	mg/kg	3.2E-06	mg/kg-day	3.0E-04	mg/kg-day	1.1E-02
				Chromium III	4.48E+02	mg/kg	4.3E-06	mg/kg-day	2.0E-02	mg/kg-day	2.2E-04
				Cobalt	4.44E+01	mg/kg	4.3E-06	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	1.7E-05	mg/kg-day	4.0E-02	mg/kg-day	4.3E-04
				Iron	1.03E+05	mg/kg	1.0E-02	mg/kg-day	7.0E-01	mg/kg-day	1.4E-02
				Lead	3.57E+03	mg/kg	3.5E-04	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	1.0E-04	mg/kg-day	8.0E-04	mg/kg-day	1.3E-01
				Thallium	1.67E+00	mg/kg	1.6E-07	mg/kg-day	7.0E-05	mg/kg-day	2.3E-03
				Vanadium	4.76E+01	mg/kg	4.6E-06	mg/kg-day	2.6E-05	mg/kg-day	1.8E-01
			Exp. Route Total								7.0E+01
		Exposure Point Total									4.9E+02
	Exposure Media Total										4.9E+02
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	1.5E-11	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.5E-05	mg/kg-day	N/A	mg/kg-day	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	4.5E-09	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	2.1E-05	mg/kg-day	N/A	mg/kg-day	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	2.6E-03	mg/kg-day	N/A	mg/kg-day	---
				2,6-Dinitrotoluene	4.17E+03	mg/kg	4.2E-04	mg/kg-day	N/A	mg/kg-day	---
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	2.2E-06	mg/kg-day	N/A	mg/kg-day	---
				2-Hexanone	1.84E-02	mg/kg	1.9E-09	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	2.7E-07	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	4.5E-06	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	2.3E-04	mg/kg-day	N/A	mg/kg-day	---
				3-Nitrotoluene	1.38E+03	mg/kg	1.4E-04	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	8.9E-04	mg/kg-day	N/A	mg/kg-day	---
				PETN	5.16E+00	mg/kg	5.2E-07	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	4.2E-03	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Aluminum	1.98E+04	mg/kg	2.0E-03	mg/kg-day	1.0E-03	mg/kg-day	2.0E+00
				Antimony	3.89E+00	mg/kg	3.9E-07	mg/kg-day	N/A	mg/kg-day	---
				Arsenic	1.04E+01	mg/kg	1.0E-06	mg/kg-day	N/A	mg/kg-day	---
				Chromium III	4.48E+02	mg/kg	4.5E-05	mg/kg-day	N/A	mg/kg-day	---
				Cobalt	4.44E+01	mg/kg	4.5E-06	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	1.8E-05	mg/kg-day	N/A	mg/kg-day	---
				Iron	1.03E+05	mg/kg	1.0E-02	mg/kg-day	N/A	mg/kg-day	---
				Lead	3.57E+03	mg/kg	3.6E-04	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	1.1E-04	mg/kg-day	1.4E-05	mg/kg-day	7.6E+00
				Thallium	1.67E+00	mg/kg	1.7E-07	mg/kg-day	N/A	mg/kg-day	---
				Vanadium	4.76E+01	mg/kg	4.8E-06	mg/kg-day	N/A	mg/kg-day	---
			Exp. Route Total								9.6E+00
		Exposure Point Total									9.6E+00
	Exposure Media Total										9.6E+00
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics**							
				2-Nitrotoluene	1.31E+04	mg/kg	7.4E-02	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	4.7E-07	mg/kg-day	8.6E-01	mg/kg-day	5.4E-07
			Exp. Route Total								5.4E-07
		Exposure Point Total									5.4E-07
	Exposure Media Total										5.4E-07
Total Soil Total											5.0E+02

Table E.1-47
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Excavation Worker

Scenario Timeframe: Future
Receptor Population: Excavation Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		
					Value	Units	Value	Units	Value	Units	Hazard Quotient
Groundwater	Air	SWMU 51	**Inhalation** (Trench Air)	**Organics** Tetrachloroethene	1.91E-05	mg/m^3	1.9E-06	mg/kg-day	8.0E-02	mg/kg-day	2.3E-05
			Exp. Route Total								2.3E-05
		Exposure Point Total									2.3E-05
	Exposure Media Total										2.3E-05
Groundwater Total											2.3E-05
										Total of Receptor Hazards Across All Media	5.0E+02

N/A = Not Applicable.

Table E.1-48
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Lifetime Resident

Scenario Timeframe: Future
Receptor Population: Lifetime Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Total Soil	Total Soil	SWMU 51	**Ingestion**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	2.3E-10	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	3.5E-05
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	2.4E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	7.0E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	5.1E-07
				1,3-Dinitrobenzene	2.13E+02	mg/kg	3.3E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	4.1E-02	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	2.8E-02
				2,6-Dinitrotoluene	4.17E+03	mg/kg	6.5E-03	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	4.4E-03
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	3.4E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	2.9E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	7.4E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	4.2E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	7.0E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	3.5E-03	mg/kg-day	1.7E-02	$(mg/kg\text{-}day)^{-1}$	6.0E-05
				2-Nitrotoluene	1.31E+04	mg/kg	2.1E-02	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	2.2E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	1.4E-02	mg/kg-day	1.6E-02	$(mg/kg\text{-}day)^{-1}$	2.2E-04
				PETN	5.16E+00	mg/kg	8.1E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	6.6E-02	mg/kg-day	3.0E-02	$(mg/kg\text{-}day)^{-1}$	2.0E-03
				Inorganics							
				Aluminum	1.98E+04	mg/kg	3.1E-02	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	6.1E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	1.6E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.4E-05
				Chromium III	4.48E+02	mg/kg	7.0E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	7.0E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Copper	1.77E+02	mg/kg	2.8E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	1.03E+05	mg/kg	1.6E-01	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Lead	3.57E+03	mg/kg	5.6E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	1.7E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	2.6E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	7.5E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								3.4E-02
			Dermal Absorption	**Organics**							
				TCDD TE	1.48E-04	mg/kg	2.2E-11	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	3.3E-06
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.4E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	2.4E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.8E-07
				1,3-Dinitrobenzene	2.13E+02	mg/kg	1.1E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	1.3E-02	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	8.9E-03
				2,6-Dinitrotoluene	4.17E+03	mg/kg	2.0E-03	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	1.4E-03
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	6.4E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	9.1E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	7.0E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	1.3E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	2.2E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	1.1E-03	mg/kg-day	1.7E-02	$(mg/kg\text{-}day)^{-1}$	1.9E-05
				2-Nitrotoluene	1.31E+04	mg/kg	1.9E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	6.8E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	4.4E-03	mg/kg-day	1.6E-02	$(mg/kg\text{-}day)^{-1}$	7.0E-05
				PETN	5.16E+00	mg/kg	2.6E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	6.7E-03	mg/kg-day	3.0E-02	$(mg/kg\text{-}day)^{-1}$	2.0E-04

Table E.1-48
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Lifetime Resident

Scenario Timeframe: Future
Receptor Population: Lifetime Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Total Soil	Total Soil	SWMU 51	**Dermal Absorption**	**Inorganics**							
				Aluminum	1.98E+04	mg/kg	9.8E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	1.9E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	1.6E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.4E-06
				Chromium III	4.48E+02	mg/kg	2.2E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	2.2E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Copper	1.77E+02	mg/kg	8.7E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	1.03E+05	mg/kg	5.1E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Lead	3.57E+03	mg/kg	1.8E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	5.3E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	8.3E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	2.4E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								1.1E-02
		Exposure Point Total									4.5E-02
	Exposure Media Total										4.5E-02
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	1.3E-15	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	2.0E-10
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.4E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	4.0E-13	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	1.9E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	2.3E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,6-Dinitrotoluene	4.17E+03	mg/kg	3.7E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	1.9E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	1.7E-13	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	2.4E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	4.0E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	2.0E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	1.2E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	8.0E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				PETN	5.16E+00	mg/kg	4.6E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	3.8E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Inorganics							
				Aluminum	1.98E+04	mg/kg	1.8E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	3.5E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	9.4E-11	mg/kg-day	1.5E+01	$(mg/kg\text{-}day)^{-1}$	1.4E-09
				Chromium III	4.48E+02	mg/kg	4.0E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	4.0E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Copper	1.77E+02	mg/kg	1.6E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	1.03E+05	mg/kg	9.3E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Lead	3.57E+03	mg/kg	3.2E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	9.7E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	1.5E-11	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	4.3E-10	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								1.6E-09
		Exposure Point Total									1.6E-09
	Exposure Media Total										1.6E-09
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics**							
				2-Nitrotoluene	1.31E+04	mg/kg	2.5E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	1.6E-08	mg/kg-day	N/A	$(mg/kg)^{-1}$	---
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Total Soil Total											4.5E-02

Table E.1-48
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Lifetime Resident

Scenario Timeframe: Future
Receptor Population: Lifetime Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Groundwater	Groundwater	SWMU 51	**Ingestion**	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	1.4E-05	mg/kg-day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	7.5E-06
				TCDD TE	3.30E-05	µg/L	4.9E-10	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	7.4E-05
				Inorganics							
				Chromium III	1.19E+01	µg/L	1.8E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								8.1E-05
			Dermal Absorption	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	6.8E-06	mg/kg-day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	3.7E-06
				TCDD TE	3.30E-05	µg/L	7.7E-09	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.2E-03
				Inorganics							
				Chromium III	1.19E+01		4.3E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								1.2E-03
		Exposure Point Total									1.2E-03
	Exposure Media Total										1.2E-03
	Air	SWMU 51	**Inhalation** (Indoor Air)	**Organics** Tetrachloroethene	2.65E-05	mg/m^3	6.0E-06	mg/kg-day	2.0E-02	$(mg/kg\text{-}day)^{-1}$	1.2E-07
			Exp. Route Total								1.2E-07
			Inhalation (Shower Room)	**Organics** Tetrachloroethene	1.30E-03	mg/m^3	5.1E-06	mg/kg-day	2.0E-02	$(mg/kg\text{-}day)^{-1}$	1.0E-07
			Exp. Route Total								1.0E-07
		Exposure Point Total									2.2E-07
	Exposure Media Total										2.2E-07
	Home Grown Produce	SWMU 51	**Ingestion**	**Inorganics** No COPCs							
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Groundwater Total											1.2E-03
										Total of Receptor Risks Across All Media	4.6E-02

N/A = Not Applicable.

Table E.1-49
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Adult Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Units	Value	Units	Value	Units	
Total Soil	Total Soil	SWMU 51	**Ingestion**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	2.0E-10	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	2.1E-04	mg/kg-day	3.0E-02	mg/kg-day	6.9E-03
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	6.1E-08	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	2.9E-04	mg/kg-day	1.0E-04	mg/kg-day	2.9E+00
				2,4-Dinitrotoluene	2.59E+04	mg/kg	3.5E-02	mg/kg-day	2.0E-03	mg/kg-day	1.8E+01
				2,6-Dinitrotoluene	4.17E+03	mg/kg	5.7E-03	mg/kg-day	1.0E-03	mg/kg-day	5.7E+00
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	2.9E-05	mg/kg-day	2.0E-03	mg/kg-day	1.5E-02
				2-Hexanone	1.84E-02	mg/kg	2.5E-08	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	6.5E-08	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	3.7E-06	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	6.2E-05	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	3.1E-03	mg/kg-day	1.0E-04	mg/kg-day	3.1E+01
				2-Nitrotoluene	1.31E+04	mg/kg	1.8E-02	mg/kg-day	1.0E-02	mg/kg-day	1.8E+00
				3-Nitrotoluene	1.38E+03	mg/kg	1.9E-03	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	1.2E-02	mg/kg-day	4.0E-03	mg/kg-day	3.0E+00
				PETN	5.16E+00	mg/kg	7.1E-06	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	5.8E-02	mg/kg-day	5.0E-04	mg/kg-day	1.2E+02
				Inorganics							
				Aluminum	1.98E+04	mg/kg	2.7E-02	mg/kg-day	1.0E+00	mg/kg-day	2.7E-02
				Antimony	3.89E+00	mg/kg	5.3E-06	mg/kg-day	4.0E-04	mg/kg-day	1.3E-02
				Arsenic	1.04E+01	mg/kg	1.4E-05	mg/kg-day	3.0E-04	mg/kg-day	4.7E-02
				Chromium III	4.48E+02	mg/kg	6.1E-04	mg/kg-day	1.5E+00	mg/kg-day	4.1E-04
				Cobalt	4.44E+01	mg/kg	6.1E-05	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	2.4E-04	mg/kg-day	4.0E-02	mg/kg-day	6.1E-03
				Iron	1.03E+05	mg/kg	1.4E-01	mg/kg-day	7.0E-01	mg/kg-day	2.0E-01
				Lead	3.57E+03	mg/kg	4.9E-03	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	1.5E-03	mg/kg-day	2.0E-02	mg/kg-day	7.4E-02
				Thallium	1.67E+00	mg/kg	2.3E-06	mg/kg-day	7.0E-05	mg/kg-day	3.3E-02
				Vanadium	4.76E+01	mg/kg	6.5E-05	mg/kg-day	1.0E-03	mg/kg-day	6.5E-02
			Exp. Route Total								1.8E+02
			Dermal	**Organics**							
			Absorption	TCDD TE	1.48E-04	mg/kg	2.4E-11	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.6E-05	mg/kg-day	3.0E-02	mg/kg-day	5.3E-04
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	2.4E-08	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	1.2E-04	mg/kg-day	1.0E-04	mg/kg-day	1.2E+00
				2,4-Dinitrotoluene	2.59E+04	mg/kg	1.4E-02	mg/kg-day	2.0E-03	mg/kg-day	7.2E+00
				2,6-Dinitrotoluene	4.17E+03	mg/kg	2.3E-03	mg/kg-day	1.0E-03	mg/kg-day	2.3E+00
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	7.1E-07	mg/kg-day	2.0E-03	mg/kg-day	3.5E-04
				2-Hexanone	1.84E-02	mg/kg	1.0E-08	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	7.7E-09	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	1.5E-06	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	2.5E-05	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	1.2E-03	mg/kg-day	1.0E-04	mg/kg-day	1.2E+01
				2-Nitrotoluene	1.31E+04	mg/kg	2.1E-03	mg/kg-day	1.0E-02	mg/kg-day	2.1E-01
				3-Nitrotoluene	1.38E+03	mg/kg	7.5E-04	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	4.8E-03	mg/kg-day	4.0E-03	mg/kg-day	1.2E+00
				PETN	5.16E+00	mg/kg	2.8E-06	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	7.4E-03	mg/kg-day	5.0E-04	mg/kg-day	1.5E+01

Table E.1-49
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Adult Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Units	Value	Units	Value	Units	
Total Soil	Total Soil	SWMU 51	**Dermal Absorption**	**Inorganics**							
				Aluminum	1.98E+04	mg/kg	1.1E-03	mg/kg-day	1.0E+00	mg/kg-day	1.1E-03
				Antimony	3.89E+00	mg/kg	2.1E-07	mg/kg-day	6.0E-05	mg/kg-day	3.5E-03
				Arsenic	1.04E+01	mg/kg	1.8E-06	mg/kg-day	3.0E-04	mg/kg-day	6.1E-03
				Chromium III	4.48E+02	mg/kg	2.4E-05	mg/kg-day	2.0E-02	mg/kg-day	1.3E-03
				Cobalt	4.44E+01	mg/kg	2.4E-06	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	9.7E-06	mg/kg-day	4.0E-02	mg/kg-day	2.4E-04
				Iron	1.03E+05	mg/kg	5.6E-03	mg/kg-day	7.0E-01	mg/kg-day	8.0E-03
				Lead	3.57E+03	mg/kg	2.0E-04	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	5.9E-05	mg/kg-day	8.0E-04	mg/kg-day	7.4E-02
				Thallium	1.67E+00	mg/kg	9.1E-08	mg/kg-day	7.0E-05	mg/kg-day	1.3E-03
				Vanadium	4.76E+01	mg/kg	2.6E-06	mg/kg-day	2.6E-05	mg/kg-day	1.0E-01
			Exp. Route Total								3.9E+01
		Exposure Point Total									2.2E+02
	Exposure Media Total										2.2E+02
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	2.5E-15	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	2.5E-09	mg/kg-day	N/A	mg/kg-day	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	7.4E-13	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	3.5E-09	mg/kg-day	N/A	mg/kg-day	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	4.3E-07	mg/kg-day	N/A	mg/kg-day	---
				2,6-Dinitrotoluene	4.17E+03	mg/kg	6.9E-08	mg/kg-day	N/A	mg/kg-day	---
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	3.6E-10	mg/kg-day	N/A	mg/kg-day	---
				2-Hexanone	1.84E-02	mg/kg	3.1E-13	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	4.5E-11	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	7.5E-10	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	3.8E-08	mg/kg-day	N/A	mg/kg-day	---
				3-Nitrotoluene	1.38E+03	mg/kg	2.3E-08	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	1.5E-07	mg/kg-day	N/A	mg/kg-day	---
				PETN	5.16E+00	mg/kg	8.6E-11	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	7.0E-07	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Aluminum	1.98E+04	mg/kg	3.3E-07	mg/kg-day	1.0E-03	mg/kg-day	3.3E-04
				Antimony	3.89E+00	mg/kg	6.5E-11	mg/kg-day	N/A	mg/kg-day	---
				Arsenic	1.04E+01	mg/kg	1.7E-10	mg/kg-day	N/A	mg/kg-day	---
				Chromium III	4.48E+02	mg/kg	7.4E-09	mg/kg-day	N/A	mg/kg-day	---
				Cobalt	4.44E+01	mg/kg	7.4E-10	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	2.9E-09	mg/kg-day	N/A	mg/kg-day	---
				Iron	1.03E+05	mg/kg	1.7E-06	mg/kg-day	N/A	mg/kg-day	---
				Lead	3.57E+03	mg/kg	5.9E-08	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	1.8E-08	mg/kg-day	1.4E-05	mg/kg-day	1.3E-03
				Thallium	1.67E+00	mg/kg	2.8E-11	mg/kg-day	N/A	mg/kg-day	---
				Vanadium	4.76E+01	mg/kg	7.9E-10	mg/kg-day	N/A	mg/kg-day	---
			Exp. Route Total								1.6E-03
		Exposure Point Total									1.6E-03
	Exposure Media Total										1.6E-03
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics**							
				2-Nitrotoluene	1.31E+04	mg/kg	4.3E-03	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	2.7E-08	mg/kg-day	8.6E-01	mg/kg-day	3.1E-08
			Exp. Route Total								3.1E-08
		Exposure Point Total									3.1E-08
	Exposure Media Total										3.1E-08
Total Soil Total											2.2E+02

Table E.1-49
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Adult Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Units	Value	Units	Value	Units	
Groundwater	Groundwater	SWMU 51	**Ingestion**	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	2.5E-05	mg/kg-day	1.0E-02	mg/kg-day	2.5E-03
				TCDD TE	3.30E-05	µg/L	9.0E-10	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Chromium III	1.19E+01	µg/L	3.3E-04	mg/kg-day	1.5E+00	mg/kg-day	2.2E-04
			Exp. Route Total								2.8E-03
			Dermal Absorption	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	1.4E-05	mg/kg-day	1.0E-02	mg/kg-day	1.4E-03
				TCDD TE	3.30E-05	µg/L	1.6E-08	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Chromium III	1.19E+01	µg/L	2.9E-06	mg/kg-day	2.0E-02	mg/kg-day	1.5E-04
			Exp. Route Total								1.5E-03
		Exposure Point Total									4.3E-03
	Exposure Media Total										4.3E-03
	Air	SWMU 51	**Inhalation** (Indoor Air)	**Organics** Tetrachloroethene	2.65E-05	mg/m³	7.2E-06	mg/kg-day	8.0E-02	mg/kg-day	9.0E-05
			Exp. Route Total								9.0E-05
			Inhalation (Shower Room)	**Organics** Tetrachloroethene	1.30E-03	mg/m³	1.5E-05	mg/kg-day	8.0E-02	mg/kg-day	1.8E-04
			Exp. Route Total								1.8E-04
		Exposure Point Total									2.8E-04
	Exposure Media Total										2.8E-04
	Home Grown Produce	SWMU 51	**Ingestion**	**Inorganics** No COPCs							
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Groundwater Total											4.6E-03
										Total of Receptor Hazards Across All Media	2.2E+02

N/A = Not Applicable.

Table E.1-50
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Child Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Total Soil	Total Soil	SWMU 51	**Ingestion**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	1.6E-10	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	2.4E-05
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.7E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	4.9E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	3.6E-07
				1,3-Dinitrobenzene	2.13E+02	mg/kg	2.3E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	2.8E-02	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	1.9E-02
				2,6-Dinitrotoluene	4.17E+03	mg/kg	4.6E-03	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	3.1E-03
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	2.4E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	2.0E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	5.2E-08	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	3.0E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	4.9E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	2.5E-03	mg/kg-day	1.7E-02	$(mg/kg\text{-}day)^{-1}$	4.2E-05
				2-Nitrotoluene	1.31E+04	mg/kg	1.4E-02	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	1.5E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	9.7E-03	mg/kg-day	1.6E-02	$(mg/kg\text{-}day)^{-1}$	1.6E-04
				PETN	5.16E+00	mg/kg	5.7E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	4.6E-02	mg/kg-day	3.0E-02	$(mg/kg\text{-}day)^{-1}$	1.4E-03
				Inorganics							
				Aluminum	1.98E+04	mg/kg	2.2E-02	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	4.3E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	1.1E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.7E-05
				Chromium III	4.48E+02	mg/kg	4.9E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	4.9E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Copper	1.77E+02	mg/kg	1.9E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Iron	1.03E+05	mg/kg	1.1E-01	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Lead	3.57E+03	mg/kg	3.9E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	1.2E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	1.8E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	5.2E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								2.4E-02
			Dermal Absorption	**Organics**							
				TCDD TE	1.48E-04	mg/kg	1.4E-11	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	2.0E-06
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	8.9E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	1.4E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.0E-07
				1,3-Dinitrobenzene	2.13E+02	mg/kg	6.5E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	8.1E-03	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	5.5E-03
				2,6-Dinitrotoluene	4.17E+03	mg/kg	1.3E-03	mg/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	8.6E-04
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	4.0E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	5.6E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	4.3E-09	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	8.3E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	1.4E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	6.9E-04	mg/kg-day	1.7E-02	$(mg/kg\text{-}day)^{-1}$	1.2E-05
				2-Nitrotoluene	1.31E+04	mg/kg	1.2E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	4.2E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	2.7E-03	mg/kg-day	1.6E-02	$(mg/kg\text{-}day)^{-1}$	4.4E-05
				PETN	5.16E+00	mg/kg	1.6E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	4.1E-03	mg/kg-day	3.0E-02	$(mg/kg\text{-}day)^{-1}$	1.2E-04

Table E.1-50
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Child Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Total Soil	Total Soil	SWMU 51	**Dermal Absorption**	**Inorganics**							
				Aluminum	1.98E+04	mg/kg	6.1E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	1.2E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	1.0E-06	mg/kg-day	1.5E+00	$(mg/kg-day)^{-1}$	1.5E-06
				Chromium III	4.48E+02	mg/kg	1.4E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	1.4E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Copper	1.77E+02	mg/kg	5.4E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Iron	1.03E+05	mg/kg	3.2E-03	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Lead	3.57E+03	mg/kg	1.1E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	3.3E-05	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	5.1E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	1.5E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								6.6E-03
		Exposure Point Total									3.1E-02
	Exposure Media Total										3.1E-02
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	5.9E-16	mg/kg-day	1.5E+05	$(mg/kg-day)^{-1}$	8.9E-11
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	6.1E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	1.8E-13	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	8.5E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	1.0E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,6-Dinitrotoluene	4.17E+03	mg/kg	1.7E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	8.6E-11	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Hexanone	1.84E-02	mg/kg	7.4E-14	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	1.1E-11	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2-Nitroaniline	4.50E+01	mg/kg	1.8E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Nitroglycerin	2.26E+03	mg/kg	9.0E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				3-Nitrotoluene	1.38E+03	mg/kg	5.5E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Nitrotoluene	8.87E+03	mg/kg	3.5E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				PETN	5.16E+00	mg/kg	2.1E-11	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	1.7E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Inorganics							
				Aluminum	1.98E+04	mg/kg	7.9E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Antimony	3.89E+00	mg/kg	1.6E-11	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Arsenic	1.04E+01	mg/kg	4.2E-11	mg/kg-day	1.5E+01	$(mg/kg-day)^{-1}$	6.3E-10
				Chromium III	4.48E+02	mg/kg	1.8E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Cobalt	4.44E+01	mg/kg	1.8E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Copper	1.77E+02	mg/kg	7.1E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Iron	1.03E+05	mg/kg	4.1E-07	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Lead	3.57E+03	mg/kg	1.4E-08	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Manganese	1.08E+03	mg/kg	4.3E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Thallium	1.67E+00	mg/kg	6.7E-12	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				Vanadium	4.76E+01	mg/kg	1.9E-10	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								7.2E-10
		Exposure Point Total									7.2E-10
	Exposure Media Total										7.2E-10
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics**							
				2-Nitrotoluene	1.31E+04	mg/kg	1.0E-03	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	6.5E-09	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Total Soil Total											3.1E-02

Table E.1-50
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Child Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Groundwater	Groundwater	SWMU 51	**Ingestion**	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	5.1E-06	mg/kg-day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	2.8E-06
				TCDD TE	3.30E-05	µg/L	1.8E-10	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	2.7E-05
				Inorganics							
				Chromium III	1.19E+01	µg/L	6.5E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								3.0E-05
			Dermal Absorption	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	2.0E-06	mg/kg-day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	1.1E-06
				TCDD TE	3.30E-05	µg/L	2.3E-09	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	3.5E-04
				Inorganics							
				Chromium III	1.19E+01	µg/L	4.3E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								3.5E-04
		Exposure Point Total									3.8E-04
	Exposure Media Total										3.8E-04
	Air	SWMU 51	**Inhalation** (Indoor Air)	**Organics** Tetrachloroethene	2.65E-05	mg/m^3	3.5E-06	mg/kg-day	2.0E-02	$(mg/kg\text{-}day)^{-1}$	7.0E-08
			Exp. Route Total								7.0E-08
		Exposure Point Total									7.0E-08
	Exposure Media Total										7.0E-08
	Home Grown Produce	SWMU 51	**Ingestion**	**Inorganics** No COPCs							
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Groundwater Total											3.8E-04
										Total of Receptor Risks Across All Media	3.1E-02

N/A = Not Applicable.

Table E.1-51
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Child Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Units	Value	Units	Value	Units	
Total Soil	Total Soil	SWMU 51	**Ingestion**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	1.9E-09	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.9E-03	mg/kg-day	3.0E-02	mg/kg-day	6.5E-02
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	5.7E-07	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	2.7E-03	mg/kg-day	1.0E-04	mg/kg-day	2.7E+01
				2,4-Dinitrotoluene	2.59E+04	mg/kg	3.3E-01	mg/kg-day	2.0E-03	mg/kg-day	1.7E+02
				2,6-Dinitrotoluene	4.17E+03	mg/kg	5.3E-02	mg/kg-day	1.0E-03	mg/kg-day	5.3E+01
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	2.7E-04	mg/kg-day	2.0E-03	mg/kg-day	1.4E-01
				2-Hexanone	1.84E-02	mg/kg	2.4E-07	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	6.0E-07	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	3.5E-05	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	5.8E-04	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	2.9E-02	mg/kg-day	1.0E-04	mg/kg-day	2.9E+02
				2-Nitrotoluene	1.31E+04	mg/kg	1.7E-01	mg/kg-day	1.0E-02	mg/kg-day	1.7E+01
				3-Nitrotoluene	1.38E+03	mg/kg	1.8E-02	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	1.1E-01	mg/kg-day	4.0E-03	mg/kg-day	2.8E+01
				PETN	5.16E+00	mg/kg	6.6E-05	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	5.4E-01	mg/kg-day	5.0E-04	mg/kg-day	1.1E+03
				Inorganics							
				Aluminum	1.98E+04	mg/kg	2.5E-01	mg/kg-day	1.0E+00	mg/kg-day	2.5E-01
				Antimony	3.89E+00	mg/kg	5.0E-05	mg/kg-day	4.0E-04	mg/kg-day	1.2E-01
				Arsenic	1.04E+01	mg/kg	1.3E-04	mg/kg-day	3.0E-04	mg/kg-day	4.4E-01
				Chromium III	4.48E+02	mg/kg	5.7E-03	mg/kg-day	1.5E+00	mg/kg-day	3.8E-03
				Cobalt	4.44E+01	mg/kg	5.7E-04	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	2.3E-03	mg/kg-day	4.0E-02	mg/kg-day	5.7E-02
				Iron	1.03E+05	mg/kg	1.3E+00	mg/kg-day	7.0E-01	mg/kg-day	1.9E+00
				Lead	3.57E+03	mg/kg	4.6E-02	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	1.4E-02	mg/kg-day	2.0E-02	mg/kg-day	6.9E-01
				Thallium	1.67E+00	mg/kg	2.1E-05	mg/kg-day	7.0E-05	mg/kg-day	3.1E-01
				Vanadium	4.76E+01	mg/kg	6.1E-04	mg/kg-day	1.0E-03	mg/kg-day	6.1E-01
			Exp. Route Total								1.7E+03
			Dermal Absorption	**Organics**							
				TCDD TE	1.48E-04	mg/kg	1.6E-10	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	1.0E-04	mg/kg-day	3.0E-02	mg/kg-day	3.4E-03
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	1.6E-07	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	7.6E-04	mg/kg-day	1.0E-04	mg/kg-day	7.6E+00
				2,4-Dinitrotoluene	2.59E+04	mg/kg	9.5E-02	mg/kg-day	2.0E-03	mg/kg-day	4.7E+01
				2,6-Dinitrotoluene	4.17E+03	mg/kg	1.5E-02	mg/kg-day	1.0E-03	mg/kg-day	1.5E+01
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	4.6E-06	mg/kg-day	2.0E-03	mg/kg-day	2.3E-03
				2-Hexanone	1.84E-02	mg/kg	6.6E-08	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	5.1E-08	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	9.7E-06	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	1.6E-04	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	8.1E-03	mg/kg-day	1.0E-04	mg/kg-day	8.1E+01
				2-Nitrotoluene	1.31E+04	mg/kg	1.4E-02	mg/kg-day	1.0E-02	mg/kg-day	1.4E+00
				3-Nitrotoluene	1.38E+03	mg/kg	4.9E-03	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	3.2E-02	mg/kg-day	4.0E-03	mg/kg-day	7.9E+00
				PETN	5.16E+00	mg/kg	1.8E-05	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	4.8E-02	mg/kg-day	5.0E-04	mg/kg-day	9.6E+01

Table E.1-51
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Child Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Units	Value	Units	Value	Units	
Total Soil	Total Soil	SWMU 51	**Dermal Absorption**	**Inorganics**							
				Aluminum	1.98E+04	mg/kg	7.1E-03	mg/kg-day	1.0E+00	mg/kg-day	7.1E-03
				Antimony	3.89E+00	mg/kg	1.4E-06	mg/kg-day	6.0E-05	mg/kg-day	2.3E-02
				Arsenic	1.04E+01	mg/kg	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	4.0E-02
				Chromium III	4.48E+02	mg/kg	1.6E-04	mg/kg-day	2.0E-02	mg/kg-day	8.2E-03
				Cobalt	4.44E+01	mg/kg	1.6E-05	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	6.3E-05	mg/kg-day	4.0E-02	mg/kg-day	1.6E-03
				Iron	1.03E+05	mg/kg	3.7E-02	mg/kg-day	7.0E-01	mg/kg-day	5.3E-02
				Lead	3.57E+03	mg/kg	1.3E-03	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	3.9E-04	mg/kg-day	8.0E-04	mg/kg-day	4.8E-01
				Thallium	1.67E+00	mg/kg	6.0E-07	mg/kg-day	7.0E-05	mg/kg-day	8.5E-03
				Vanadium	4.76E+01	mg/kg	1.7E-05	mg/kg-day	2.6E-05	mg/kg-day	6.6E-01
			Exp. Route Total								2.6E+02
		Exposure Point Total									1.9E+03
	Exposure Media Total										1.9E+03
	Air (Particulates)	SWMU 51	**Inhalation**	**Organics**							
				TCDD TE	1.48E-04	mg/kg	6.9E-15	mg/kg-day	N/A	mg/kg-day	---
				1,3,5-Trinitrobenzene	1.52E+02	mg/kg	7.1E-09	mg/kg-day	N/A	mg/kg-day	---
				Dibenz(a,h)anthracene	4.45E-02	mg/kg	2.1E-12	mg/kg-day	N/A	mg/kg-day	---
				1,3-Dinitrobenzene	2.13E+02	mg/kg	9.9E-09	mg/kg-day	N/A	mg/kg-day	---
				2,4-Dinitrotoluene	2.59E+04	mg/kg	1.2E-06	mg/kg-day	N/A	mg/kg-day	---
				2,6-Dinitrotoluene	4.17E+03	mg/kg	1.9E-07	mg/kg-day	N/A	mg/kg-day	---
				2-Amino-4,6-Dinitrotoluene	2.15E+01	mg/kg	1.0E-09	mg/kg-day	N/A	mg/kg-day	---
				2-Hexanone	1.84E-02	mg/kg	8.6E-13	mg/kg-day	N/A	mg/kg-day	---
				4,6-Dinitro-o-cresol	2.70E+00	mg/kg	1.3E-10	mg/kg-day	N/A	mg/kg-day	---
				2-Nitroaniline	4.50E+01	mg/kg	2.1E-09	mg/kg-day	N/A	mg/kg-day	---
				Nitroglycerin	2.26E+03	mg/kg	1.1E-07	mg/kg-day	N/A	mg/kg-day	---
				3-Nitrotoluene	1.38E+03	mg/kg	6.4E-08	mg/kg-day	N/A	mg/kg-day	---
				4-Nitrotoluene	8.87E+03	mg/kg	4.1E-07	mg/kg-day	N/A	mg/kg-day	---
				PETN	5.16E+00	mg/kg	2.4E-10	mg/kg-day	N/A	mg/kg-day	---
				2,4,6-Trinitrotoluene	4.21E+04	mg/kg	2.0E-06	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Aluminum	1.98E+04	mg/kg	9.2E-07	mg/kg-day	1.0E-03	mg/kg-day	9.2E-04
				Antimony	3.89E+00	mg/kg	1.8E-10	mg/kg-day	N/A	mg/kg-day	---
				Arsenic	1.04E+01	mg/kg	4.9E-10	mg/kg-day	N/A	mg/kg-day	---
				Chromium III	4.48E+02	mg/kg	2.1E-08	mg/kg-day	N/A	mg/kg-day	---
				Cobalt	4.44E+01	mg/kg	2.1E-09	mg/kg-day	N/A	mg/kg-day	---
				Copper	1.77E+02	mg/kg	8.3E-09	mg/kg-day	N/A	mg/kg-day	---
				Iron	1.03E+05	mg/kg	4.8E-06	mg/kg-day	N/A	mg/kg-day	---
				Lead	3.57E+03	mg/kg	1.7E-07	mg/kg-day	N/A	mg/kg-day	---
				Manganese	1.08E+03	mg/kg	5.0E-08	mg/kg-day	1.4E-05	mg/kg-day	3.5E-03
				Thallium	1.67E+00	mg/kg	7.8E-11	mg/kg-day	N/A	mg/kg-day	---
				Vanadium	4.76E+01	mg/kg	2.2E-09	mg/kg-day	N/A	mg/kg-day	---
			Exp. Route Total								4.4E-03
		Exposure Point Total									4.4E-03
	Exposure Media Total										4.4E-03
	Air (Volatiles)	SWMU 51	**Inhalation**	**Organics**							
				2-Nitrotoluene	1.31E+04	mg/kg	1.2E-02	mg/kg-day	N/A	mg/kg-day	---
				4-Methyl-2-pentanone	4.71E-02	mg/kg	7.6E-08	mg/kg-day	8.6E-01	mg/kg-day	8.9E-08
			Exp. Route Total								8.9E-08
		Exposure Point Total									8.9E-08
	Exposure Media Total										8.9E-08
Total Soil Total											1.9E+03

Table E.1-51
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Child Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Units	Value	Units	Value	Units	
Groundwater	Groundwater	SWMU 51	**Ingestion**	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	5.9E-05	mg/kg-day	1.0E-02	mg/kg-day	5.9E-03
				TCDD TE	3.30E-05	µg/L	2.1E-09	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Chromium III	1.19E+01	µg/L	7.6E-04	mg/kg-day	1.5E+00	mg/kg-day	5.1E-04
			Exp. Route Total								6.5E-03
			Dermal	**Organics**							
			Absorption	Tetrachloroethene	9.30E-01	µg/L	2.4E-05	mg/kg-day	1.0E-02	mg/kg-day	2.4E-03
				TCDD TE	3.30E-05	µg/L	2.7E-08	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Chromium III	1.19E+01	µg/L	5.0E-06	mg/kg-day	2.0E-02	mg/kg-day	2.6E-04
			Exp. Route Total								2.6E-03
		Exposure Point Total									9.1E-03
	Exposure Media Total										9.1E-03
	Air	SWMU 51	**Inhalation**	**Organics**							
			(Indoor Air)	Tetrachloroethene	2.65E-05	mg/m^3	4.1E-05	mg/kg-day	8.0E-02	mg/kg-day	5.1E-04
			Exp. Route Total								5.1E-04
		Exposure Point Total									5.1E-04
	Exposure Media Total										5.1E-04
	Home Grown Produce	SWMU 51	**Ingestion**	**Inorganics**							
				No COPCs							
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Groundwater Total											9.6E-03
										Total of Receptor Hazards Across All Media	1.9E+03

N/A = Not Applicable.

Table E.1-52
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Off-site Lifetime Resident

Scenario Timeframe: Future
Receptor Population: Off-site Lifetime Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Groundwater	Groundwater	SWMU 51	**Ingestion**	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	1.6E-05	mg/kg-day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	8.6E-06
				TCDD TE	3.30E-05	µg/L	5.7E-10	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	8.5E-05
				Inorganics							
				Chromium III	1.19E+01	µg/L	2.0E-04	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								9.4E-05
			Dermal Absorption	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	8.0E-06	mg/kg-day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	4.3E-06
				TCDD TE	3.30E-05	µg/L	9.1E-09	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.4E-03
				Inorganics							
				Chromium III	1.19E+01	µg/L	1.7E-06	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								1.4E-03
		Exposure Point Total									1.5E-03
	Exposure Media Total										1.5E-03
	Air	SWMU 51	**Inhalation** (Indoor Air)	**Organics** Tetrachloroethene	2.65E-05	mg/m^3	6.6E-06	mg/kg-day	2.0E-02	$(mg/kg\text{-}day)^{-1}$	1.3E-07
			Exp. Route Total								1.3E-07
			Inhalation (Shower Room)	**Organics** Tetrachloroethene	1.30E-03	mg/m^3	6.3E-06	mg/kg-day	2.0E-02	$(mg/kg\text{-}day)^{-1}$	1.3E-07
			Exp. Route Total								1.3E-07
		Exposure Point Total									2.6E-07
	Exposure Media Total										2.6E-07
	Home Grown Produce	SWMU 51	**Ingestion**	**Inorganics** No COPCs							
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Groundwater Total											1.5E-03
										Total of Receptor Risks Across All Media	1.5E-03

N/A = Not Applicable.

Table E.1-53
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Off-site Adult Resident

Scenario Timeframe: Future
Receptor Population: Off-site Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Units	Value	Units	Value	Units	
Groundwater	Groundwater	SWMU 51	**Ingestion**	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	2.5E-05	mg/kg-day	1.0E-02	mg/kg-day	2.5E-03
				TCDD TE	3.30E-05	µg/L	9.0E-10	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Chromium III	1.19E+01	µg/L	3.3E-04	mg/kg-day	1.5E+00	mg/kg-day	2.2E-04
			Exp. Route Total								2.8E-03
			Dermal Absorption	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	1.4E-05	mg/kg-day	1.0E-02	mg/kg-day	1.4E-03
				TCDD TE	3.30E-05	µg/L	1.6E-08	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Chromium III	1.19E+01	µg/L	2.9E-06	mg/kg-day	2.0E-02	mg/kg-day	1.5E-04
			Exp. Route Total								1.4E-03
		Exposure Point Total									4.2E-03
	Exposure Media Total										4.2E-03
	Air	SWMU 51	**Inhalation** (Indoor Air)	**Organics** Tetrachloroethene	2.65E-05	mg/m³	7.2E-06	mg/kg-day	8.0E-02	mg/kg-day	9.0E-05
			Exp. Route Total								9.0E-05
			Inhalation (Shower Room)	**Organics** Tetrachloroethene	1.30E-03	mg/m³	1.5E-05	mg/kg-day	8.0E-02	mg/kg-day	1.8E-04
			Exp. Route Total								1.8E-04
		Exposure Point Total									2.8E-04
	Exposure Media Total										2.8E-04
	Home Grown Produce	SWMU 51	**Ingestion**	**Inorganics** No COPCs							
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Groundwater Total											4.4E-03
										Total of Receptor Hazards Across All Media	4.4E-03

N/A = Not Applicable.

Table E.1-54
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Off-site Adult Resident

Scenario Timeframe: Future
Receptor Population: Off-site Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Groundwater	Groundwater	SWMU 51	**Ingestion**	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	1.1E-05	mg/kg-day	5.4E-01	$(mg/kg-day)^{-1}$	5.9E-06
				TCDD TE	3.30E-05	µg/L	3.9E-10	mg/kg-day	1.5E+05	$(mg/kg-day)^{-1}$	5.8E-05
				Inorganics							
				Chromium III	1.19E+01	µg/L	1.4E-04	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								6.4E-05
			Dermal Absorption	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	5.9E-06	mg/kg-day	5.4E-01	$(mg/kg-day)^{-1}$	3.2E-06
				TCDD TE	3.30E-05	µg/L	6.8E-09	mg/kg-day	1.5E+05	$(mg/kg-day)^{-1}$	1.0E-03
				Inorganics							
				Chromium III	1.19E+01	µg/L	1.3E-06	mg/kg-day	N/A	$(mg/kg-day)^{-1}$	---
			Exp. Route Total								1.0E-03
		Exposure Point Total									1.1E-03
	Exposure Media Total										1.1E-03
	Air	SWMU 51	**Inhalation** (Indoor Air)	**Organics** Tetrachloroethene	2.65E-05	mg/m^3	3.1E-06	mg/kg-day	2.0E-02	$(mg/kg-day)^{-1}$	6.2E-08
			Exp. Route Total								6.2E-08
			Inhalation (Shower Room)	**Organics** Tetrachloroethene	1.30E-03	mg/m^3	6.3E-06	mg/kg-day	2.0E-02	mg/kg-day	1.3E-07
			Exp. Route Total								1.3E-07
		Exposure Point Total									1.9E-07
	Exposure Media Total										1.9E-07
	Home Grown Produce	SWMU 51	**Ingestion**	**Inorganics** No COPCs							
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Groundwater Total											1.1E-03
										Total of Receptor Risks AARoss All Media	1.1E-03

N/A = Not Applicable.

Table E.1-55
Calculation of Cancer Risks
Reasonable Maximum Exposure
Future - Off-site Child Resident

Scenario Timeframe: Future
Receptor Population: Off-site Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		
					Value	Units	Value	Units	Value	Units	Cancer Risk
Groundwater	Groundwater	SWMU 51	**Ingestion**	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	5.1E-06	mg/kg-day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	2.8E-06
				TCDD TE	3.30E-05	µg/L	1.8E-10	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	2.7E-05
				Inorganics							
				Chromium III	1.19E+01	µg/L	6.5E-05	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								3.0E-05
			Dermal Absorption	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	2.0E-06	mg/kg-day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	1.1E-06
				TCDD TE	3.30E-05	µg/L	2.3E-09	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	3.5E-04
				Inorganics							
				Chromium III	1.19E+01	µg/L	4.3E-07	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	---
			Exp. Route Total								3.5E-04
		Exposure Point Total									3.8E-04
	Exposure Media Total										3.8E-04
	Air	SWMU 51	**Inhalation** (Indoor Air)	**Organics**							
				Tetrachloroethene	2.65E-05	mg/m^3	3.5E-06	mg/kg-day	2.0E-02	$(mg/kg\text{-}day)^{-1}$	7.0E-08
			Exp. Route Total								7.0E-08
		Exposure Point Total									7.0E-08
	Exposure Media Total										7.0E-08
	Home Grown Produce	SWMU 51	**Ingestion**	**Inorganics**							
				No COPCs							
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Groundwater Total											3.8E-04
										Total of Receptor Risks Across All Media	3.8E-04

N/A = Not Applicable.

Table E.1-56
Calculation of Non-cancer Hazards
Reasonable Maximum Exposure
Future - Off-site Child Resident

Scenario Timeframe: Future
Receptor Population: Off-site Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Units	Value	Units	Value	Units	
Groundwater	Groundwater	SWMU 51	**Ingestion**	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	5.9E-05	mg/kg-day	1.0E-02	mg/kg-day	5.9E-03
				TCDD TE	3.30E-05	µg/L	2.1E-09	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Chromium III	1.19E+01	µg/L	7.6E-04	mg/kg-day	1.5E+00	mg/kg-day	5.1E-04
			Exp. Route Total								6.5E-03
			Dermal Absorption	**Organics**							
				Tetrachloroethene	9.30E-01	µg/L	2.4E-05	mg/kg-day	1.0E-02	mg/kg-day	2.4E-03
				TCDD TE	3.30E-05	µg/L	2.7E-08	mg/kg-day	N/A	mg/kg-day	---
				Inorganics							
				Chromium III	1.19E+01	µg/L	5.0E-06	mg/kg-day	2.0E-02	mg/kg-day	2.6E-04
			Exp. Route Total								2.6E-03
		Exposure Point Total									9.1E-03
	Exposure Media Total										9.1E-03
	Air	SWMU 51	**Inhalation** (Indoor Air)	**Organics**							
				Tetrachloroethene	2.65E-05	mg/m^3	4.1E-05	mg/kg-day	8.0E-02	mg/kg-day	5.1E-04
			Exp. Route Total								5.1E-04
		Exposure Point Total									5.1E-04
	Exposure Media Total										5.1E-04
	Home Grown Produce	SWMU 51	**Ingestion**	**Inorganics**							
				No COPCs							
			Exp. Route Total								0.0E+00
		Exposure Point Total									0.0E+00
	Exposure Media Total										0.0E+00
Groundwater Total											9.6E-03
										Total of Receptor Hazards Across All Media	9.6E-03

N/A = Not Applicable.

Table E.1-57
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Current - Maintenance Worker

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	SWMU 51										
			2,4-Dinitrotoluene	9.5E-08		6.4E-08	1.6E-07	CNS, Blood, Liver	1.9E-04		1.3E-04	3.3E-04
			2,6-Dinitrotoluene	4.1E-08		2.7E-08	6.8E-08	CNS, Blood, Liver	1.7E-04		1.1E-04	2.8E-04
			Dibenz(a,h)anthracene	5.9E-09		5.1E-09	1.1E-08	N/A	---		---	---
			2-Nitrotoluene	---		---	---	Erythrocyte (Blood)	1.2E-03		2.4E-04	1.5E-03
			3-Nitrotoluene	---		---	---	N/A	---		---	---
			4-Nitrotoluene	3.8E-08		2.5E-08	6.4E-08	N/A	1.7E-03		1.1E-03	2.8E-03
			Aluminum	---		---	---	Developmental nervous system	4.5E-03		2.9E-04	4.8E-03
			Arsenic	4.6E-07		9.2E-08	5.5E-07	Skin, Vascular Effects	2.9E-03		5.7E-04	3.4E-03
			Chromium III[a]	---		---	---	NOAEL	3.7E-06		1.9E-05	2.2E-05
			Cobalt	---		---	---	N/A	---		---	---
			Iron	---		---	---	Blood, Liver, GI Irritation	7.7E-03		5.1E-04	8.2E-03
			Manganese	---		---	---	CNS	5.2E-03		8.6E-03	1.4E-02
			Thallium	---		---	---	Blood, Liver, Hair	3.1E-03		2.0E-04	3.3E-03
			Vanadium	---		---	---	Kidney	1.1E-02		2.8E-02	3.9E-02
			Chemical Total	6.4E-07		2.1E-07	8.5E-07		0.038		0.040	0.077
		Exposure Point Total					8.5E-07					0.077
	Exposure Media Total						8.5E-07					0.077
	Air (Particulates and Volatiles)	SWMU 51										
			2,4-Dinitrotoluene		---		---	N/A		---		---
			2,6-Dinitrotoluene		---		---	N/A		---		---
			Dibenz(a,h)anthracene		---		---	N/A		---		---
			2-Nitrotoluene		---		---	N/A		---		---
			3-Nitrotoluene		---		---	N/A		---		---
			4-Nitrotoluene		---		---	N/A		---		---
			Aluminum		---		---	N/A		1.1E-03		1.1E-03
			Arsenic		1.2E-09		1.2E-09	N/A		---		---
			Chromium		---		---	N/A		---		---
			Cobalt		---		---	N/A		---		
			Iron		---		---	N/A		---		---
			Manganese		---		---	CNS		1.9E-03		1.9E-03
			Thallium		---		---	N/A		---		---
			Vanadium		---		---	N/A		---		---
			Chemical Total		1.2E-09		1.2E-09			0.0030		0.0030
		Exposure Point Total					1.2E-09					0.0030
	Exposure Media Total						1.2E-09					0.0030
Surface Soil Total							8.6E-07					0.080

Table E.1-57
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Current - Maintenance Worker

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air (Ambient Air)	SWMU 51	Tetrachloroethene		9.8E-14		9.8E-14	CNS		1.7E-10		1.7E-10
			Chemical Total		9.8E-14		9.8E-14			1.7E-10		1.7E-10
		Exposure Point Total					9.8E-14					1.7E-10
	Exposure Media Total						9.8E-14					1.7E-10
Groundwater Total							9.8E-14					
Receptor Total							8.6E-07					0.080

8.6E-07	Total Hazard Across All Media = 0.080

(a) Chromium RfD is based on NOAEL; no target organ is identified.

CNS = Central Nervous System.
GI = Gastrointestinal
NOAEL = No Observable Adverse Effects Level.
N/A = Not Available.

Total CNS HI Across All Media =	0.021
Total Blood HI Across All Media =	0.014
Total Liver HI Across All Media =	0.012
Total Kidney HI Across All Media =	0.039
Total Skin HI Across All Media =	0.0034
Total Vascular Effects HI Across All Media =	0.0034
Total NOAEL HI Across All Media =	0.000022
Total GI Irritation HI Across All Media =	0.0082
Total Hair HI Across All Media =	0.0033

Table E.1-58
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	SWMU 51										
			2,4-Dinitrotoluene	9.5E-08		6.4E-08	1.6E-07	CNS, Blood, Liver	1.9E-04		1.3E-04	3.3E-04
			2,6-Dinitrotoluene	4.1E-08		2.7E-08	6.8E-08	CNS, Blood, Liver	1.7E-04		1.1E-04	2.8E-04
			Dibenz(a,h)anthracene	5.9E-09		5.1E-09	1.1E-08	N/A	---		---	---
			2-Nitrotoluene	---		---	---	Erythrocyte (Blood)	1.2E-03		2.4E-04	1.5E-03
			3-Nitrotoluene	---		---	---	N/A	---		---	---
			4-Nitrotoluene	3.8E-08		2.5E-08	6.4E-08	N/A	1.7E-03		1.1E-03	2.8E-03
			Aluminum	---		---	---	Developmental Nervous System	4.5E-03		2.9E-04	4.8E-03
			Arsenic	4.6E-07		9.2E-08	5.5E-07	Skin, Vascular Effects	2.9E-03		5.7E-04	3.4E-03
			Chromium III[a]	---		---	---	NOAEL	3.7E-06		1.9E-05	2.2E-05
			Cobalt	---		---	---	N/A	---		---	---
			Iron	---		---	---	Blood, Liver, GI Irritation	7.7E-03		5.1E-04	8.2E-03
			Manganese	---		---	---	CNS	5.2E-03		8.6E-03	1.4E-02
			Thallium	---		---	---	Blood, Liver, Hair	3.1E-03		2.0E-04	3.3E-03
			Vanadium	---		---	---	Kidney	1.1E-02		2.8E-02	3.9E-02
			Chemical Total	6.4E-07		2.1E-07	8.5E-07		0.038		0.040	0.077
		Exposure Point Total					8.5E-07					0.077
	Exposure Media Total						8.5E-07					0.077
	Air (Particulates and Volatiles)	SWMU 51										
			2,4-Dinitrotoluene		---		---	N/A		---		---
			2,6-Dinitrotoluene		---		---	N/A		---		---
			Dibenz(a,h)anthracene		---		---	N/A		---		---
			2-Nitrotoluene		---		---	N/A		---		---
			3-Nitrotoluene		---		---	N/A		---		---
			4-Nitrotoluene		---		---	N/A		---		---
			Aluminum		---		---	N/A		1.1E-03		1.1E-03
			Arsenic		1.2E-09		1.2E-09	N/A		---		---
			Chromium III		---		---	N/A		---		---
			Cobalt		---		---	N/A		---		
			Iron		---		---	N/A		---		---
			Manganese		---		---	CNS		1.9E-03		1.9E-03
			Thallium		---		---	N/A		---		---
			Vanadium		---		---	N/A		---		---
			Chemical Total		1.2E-09		1.2E-09			0.0030		0.0030
		Exposure Point Total					1.2E-09					0.0030
	Exposure Media Total						1.2E-09					0.0030
Surface Soil Total							8.6E-07					0.080

Table E.1-58
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	SWMU 51										
			TCDD TE	1.6E-06		3.1E-07	1.9E-06	N/A	---		---	---
			1,3,5-Trinitrobenzene	---		---	---	Blood, Spleen	9.9E-04		1.2E-04	1.1E-03
			Dibenz(a,h)anthracene	2.3E-08		1.9E-08	4.2E-08	N/A	---		---	---
			1,3-Dinitrobenzene	---		---	---	Spleen	4.2E-01		2.8E-01	6.9E-01
			2,4-Dinitrotoluene	1.2E-03		8.3E-04	2.1E-03	CNS, Blood, Liver	2.5E+00		1.7E+00	4.2E+00
			2,6-Dinitrotoluene	2.0E-04		1.3E-04	3.3E-04	CNS, Blood, Liver	8.2E-01		5.3E-01	1.3E+00
			2-Amino-4,6-Dinitrotoluene	---		---		N/A	2.1E-03		8.3E-05	2.2E-03
			2-Hexanone	---		---	---	N/A	---		---	---
			4-Methyl-2-pentanone	---		---	---	N/A	---		---	---
			4,6-Dinitro-o-cresol	---		---		N/A	---		---	---
			2-Nitroaniline	---		---	---	N/A	---		---	---
			Nitroglycerin	2.7E-06		1.8E-06	4.5E-06	N/A	4.4E+00		2.9E+00	7.3E+00
			2-Nitrotoluene	---		---	---	Erythrocyte (Blood)	2.6E-01		5.1E-02	3.1E-01
			3-Nitrotoluene	---		---	---	N/A	---		---	---
			4-Nitrotoluene	9.9E-06		6.5E-06	1.6E-05	N/A	4.3E-01		2.9E-01	7.2E-01
			PETN	---		---	---	N/A	---		---	---
			2,4,6-Trinitrotoluene	8.8E-05		1.9E-05	1.1E-04	Liver	1.6E+01		3.5E+00	2.0E+01
			Aluminum	---		---	---	Developmental nervous system	3.9E-03		2.6E-04	4.1E-03
			Antimony	---		---	---	Blood Chemistry	1.9E-03		8.4E-04	2.7E-03
			Arsenic	1.1E-06		2.2E-07	1.3E-06	Skin, Vascular Effects	6.8E-03		1.3E-03	8.1E-03
			Chromium III[a]	---		---	---	NOAEL	5.8E-05		3.0E-04	3.6E-04
			Cobalt	---		---	---	N/A	---		---	---
			Copper	---		---	---	GI Tract	8.7E-04		5.7E-05	9.2E-04
			Iron	---		---	---	Blood, Liver, GI Irritation	2.9E-02		1.9E-03	3.1E-02
			Lead	---		---	---	N/A	---		---	---
			Manganese	---		---	---	CNS	1.1E-02		1.7E-02	2.8E-02
			Thallium	---		---	---	Blood, Liver, Hair	4.7E-03		3.1E-04	5.0E-03
			Vanadium	---		---	---	Kidney	9.3E-03		2.4E-02	3.3E-02
			Chemical Total	1.5E-03		9.9E-04	2.5E-03		25.4		9.3	35
		Exposure Point Total					2.5E-03					35
	Exposure Media Total						2.5E-03					35

Table E.1-58
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
	Air (Particulates and Volatiles)	SWMU 51	TCDD TE		4.0E-10		4.0E-10	N/A		---		---
			1,3,5-Trinitrobenzene		---		---	N/A		---		---
			Dibenz(a,h)anthracene		---		---	N/A		---		---
			1,3-Dinitrobenzene		---		---	N/A		---		---
			2,4-Dinitrotoluene		---		---	N/A		---		---
			2,6-Dinitrotoluene		---		---	N/A		---		---
			2-Amino-4,6-Dinitrotoluene		---			N/A		---		---
			2-Hexanone		---		---	N/A		---		---
			4-Methyl-2-pentanone		---		---	Body Weight		1.1E-07		1.1E-07
			4,6-Dinitro-o-cresol		---			N/A		---		---
			2-Nitroaniline		---		---	N/A		---		---
			Nitroglycerin		---		---	N/A		---		---
			2-Nitrotoluene		---		---	N/A		---		---
			3-Nitrotoluene		---		---	N/A		---		---
			4-Nitrotoluene		---		---	N/A		---		---
			PETN		---		---	N/A		---		---
			2,4,6-Trinitrotoluene		---		---	N/A		---		---
			Aluminum		---		---	N/A		9.9E-04		9.9E-04
			Antimony		---		---	N/A		---		---
			Arsenic		2.8E-09		2.8E-09	N/A		---		---
			Chromium III		---		---	N/A		---		---
			Cobalt		---		---	N/A		---		---
			Copper		---		---	N/A		---		---
			Iron		---		---	N/A		---		---
			Lead		---		---	N/A		---		---
			Manganese		---		---	CNS		3.8E-03		3.8E-03
			Thallium		---		---	N/A		---		---
			Vanadium		---		---	N/A		---		---
			Chemical Total		3.2E-09		3.2E-09			0.0048		0.0048
		Exposure Point Total					3.2E-09					0.0048
	Exposure Media Total						3.2E-09					0.0048
Total Soil Total							2.5E-03					35
Groundwater	Air (Ambient Air)	SWMU 51	Tetrachloroethene		9.8E-14		9.8E-14	CNS		1.7E-10		1.7E-10
			Chemical Total		9.8E-14		9.8E-14			1.7E-10		1.7E-10
		Exposure Point Total					9.8E-14					1.7E-10
	Exposure Media Total						9.8E-14					1.7E-10
Groundwater Total							9.8E-14					1.7E-10
Receptor Total[b]							2.5E-03					35

Total Risk Across All Media[b] = 2.5E-03

Total Hazard Across All Media[b] = 35

(a) Chromium RfD is based on NOAEL; no target organ is identified.
(b) Since total soil represents the more highly contaminated portion of soil, total risk and hazard estimates are conservatively based on this soil data grouping.

CNS = Central nervous system.
GI = Gastrointestinal.
NOAEL = No Observable Adverse Effects Level.
N/A = Not Available.

Total Blood HI Across All Media =	5.9
Total Spleen HI Across All Media =	0.69
Total CNS HI Across All Media =	5.6
Total Liver HI Across All Media =	25.6
Total Kidney HI Across All Media =	0.033
Total Skin HI Across All Media =	0.0081
Total Vascular Effects HI Across All Media =	0.0081
Total NOAEL HI Across All Media =	0.00036
Total GI Tract HI Across All Media =	0.032
Total Hair HI Across All Media =	0.0050
Total Body Weight HI Across All Media =	1.1E-07

Table E.1-59
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	SWMU 51										
			2,4-Dinitrotoluene	4.3E-07		2.9E-07	7.1E-07	CNS, Blood, Liver	8.8E-04		5.9E-04	1.5E-03
			2,6-Dinitrotoluene	1.8E-07		1.2E-07	3.1E-07	CNS, Blood, Liver	7.6E-04		5.0E-04	1.3E-03
			Dibenz(a,h)anthracene	2.7E-08		2.3E-08	4.9E-08	N/A	---		---	---
			2-Nitrotoluene	---		---	---	Erythrocyte (Blood)	5.5E-03		3.6E-03	9.2E-03
			3-Nitrotoluene	---		---	---	N/A	---		---	---
			4-Nitrotoluene	1.7E-07		1.1E-07	2.9E-07	N/A	7.6E-03		5.0E-03	1.3E-02
			Aluminum	---		---	---	Developmental nervous system	2.0E-02		1.3E-03	2.1E-02
			Arsenic	2.1E-06		4.1E-07	2.5E-06	Skin, Vascular Effects	1.3E-02		2.6E-03	1.6E-02
			Chromium III[a]	---		---	---	NOAEL	1.7E-05		8.4E-05	1.0E-04
			Cobalt	---		---	---	N/A	---		---	---
			Iron	---		---	---	Blood, Liver, GI Irritation	3.4E-02		2.3E-03	3.7E-02
			Manganese	---		---	---	CNS	2.3E-02		3.9E-02	6.2E-02
			Thallium	---		---	---	Blood, Liver, Hair	1.4E-02		9.1E-04	1.5E-02
			Vanadium	---		---	---	Kidney	5.0E-02		1.3E-01	1.8E-01
			Chemical Total	2.9E-06		9.6E-07	3.8E-06		0.17		0.18	0.35
		Exposure Point Total					3.8E-06					0.35
	Exposure Media Total						3.8E-06					0.35
	Air (Particulates and Volatiles)	SWMU 51										
			2,4-Dinitrotoluene		---		---	N/A		---		---
			2,6-Dinitrotoluene		---		---	N/A		---		---
			Dibenz(a,h)anthracene		---		---	N/A		---		---
			2-Nitrotoluene		---		---	N/A		---		---
			3-Nitrotoluene		---		---	N/A		---		---
			4-Nitrotoluene		---		---	N/A		---		---
			Aluminum		---		---	N/A		5.1E-03		5.1E-03
			Arsenic		5.4E-09		5.4E-09	N/A		---		---
			Chromium		---		---	N/A		---		---
			Cobalt		---		---	N/A		---		
			Iron		---		---	N/A		---		---
			Manganese		---		---	CNS		8.4E-03		8.4E-03
			Thallium		---		---	N/A		---		---
			Vanadium		---		---	N/A		---		---
			Chemical Total		5.4E-09		5.4E-09			0.013		0.013
		Exposure Point Total					5.4E-09					0.013
	Exposure Media Total						5.4E-09					0.013
Surface Soil Total							3.9E-06					0.36

Table E.1-59
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	SWMU 51										
			TCDD TE	7.0E-06		1.4E-06	8.4E-06	N/A	---		---	---
			1,3,5-Trinitrobenzene	---		---	---	Blood, Spleen	4.5E-03		5.6E-04	5.0E-03
			Dibenz(a,h)anthracene	1.0E-07		8.8E-08	1.9E-07	N/A	---		---	---
			1,3-Dinitrobenzene	---		---	---	Spleen	1.9E+00		1.2E+00	3.1E+00
			2,4-Dinitrotoluene	5.5E-03		3.7E-03	9.3E-03	CNS, Blood, Liver	1.1E+01		7.7E+00	1.9E+01
			2,6-Dinitrotoluene	8.9E-04		5.8E-04	1.5E-03	CNS, Blood, Liver	3.7E+00		2.4E+00	6.1E+00
			2-Amino-4,6-Dinitrotoluene	---		---		Liver, Erythrocyte (Blood)	9.5E-03		3.7E-04	9.8E-03
			2-Hexanone	---		---	---	N/A	---		---	---
			4-Methyl-2-pentanone	---		---	---	N/A	---		---	---
			4,6-Dinitro-o-cresol	---		---		N/A	---		---	---
			2-Nitroaniline	---		---	---	N/A	---		---	---
			Nitroglycerin	1.2E-05		8.0E-06	2.0E-05	N/A	2.0E+01		1.3E+01	3.3E+01
			2-Nitrotoluene	---		---	---	Erythrocyte (Blood)	1.2E+00		2.3E-01	1.4E+00
			3-Nitrotoluene	---		---	---	N/A	---		---	---
			4-Nitrotoluene	4.5E-05		2.9E-05	7.4E-05	N/A	2.0E+00		1.3E+00	3.2E+00
			PETN	---		---	---	N/A	---		---	---
			2,4,6-Trinitrotoluene	4.0E-04		8.4E-05	4.8E-04	Liver	7.4E+01		1.6E+01	9.0E+01
			Aluminum	---		---	---	Developmental nervous system	1.7E-02		1.2E-03	1.9E-02
			Antimony	---		---	---	Blood Chemistry	8.6E-03		3.8E-03	1.2E-02
			Arsenic	4.9E-06		9.7E-07	5.9E-06	Skin, Vascular Effects	3.1E-02		6.0E-03	3.7E-02
			Chromium III[a]	---		---	---	NOAEL	2.6E-04		1.3E-03	1.6E-03
			Cobalt	---		---	---	N/A	---		---	---
			Copper	---		---	---	GI Tract	3.9E-03		2.6E-04	4.2E-03
			Iron	---		---	---	Blood, Liver, GI Irritation	1.3E-01		8.6E-03	1.4E-01
			Lead	---		---	---	N/A	---		---	---
			Manganese	---		---	---	CNS	4.8E-02		7.8E-02	1.3E-01
			Thallium	---		---	---	Blood, Liver, Hair	2.1E-02		1.4E-03	2.2E-02
			Vanadium	---		---	---	Kidney	4.2E-02		1.1E-01	1.5E-01
			Chemical Total	6.9E-03		4.4E-03	1.1E-02		114		42	156
		Exposure Point Total					1.1E-02					156
	Exposure Media Total						1.1E-02					156

Table E.1-59
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
	Air (Particulates and Volatiles)	SWMU 51	TCDD TE		1.8E-09		1.8E-09	N/A		---		---
			1,3,5-Trinitrobenzene		---		---	N/A		---		---
			Dibenz(a,h)anthracene		---		---	N/A		---		---
			1,3-Dinitrobenzene		---		---	N/A		---		---
			2,4-Dinitrotoluene		---		---	N/A		---		---
			2,6-Dinitrotoluene		---		---	N/A		---		---
			2-Amino-4,6-Dinitrotoluene		---		---	N/A		---		
			2-Hexanone		---		---	N/A		---		---
			4-Methyl-2-pentanone		---		---	Body Weight		4.9E-07		4.9E-07
			4,6-Dinitro-o-cresol		---		---	N/A		---		
			2-Nitroaniline		---		---	N/A		---		---
			Nitroglycerin		---		---	N/A		---		---
			2-Nitrotoluene		---		---	N/A		---		---
			3-Nitrotoluene		---		---	N/A		---		---
			4-Nitrotoluene		---		---	N/A		---		---
			PETN		---		---	N/A		---		---
			2,4,6-Trinitrotoluene		---		---	N/A		---		---
			Aluminum		---		---	N/A		4.5E-03		4.5E-03
			Antimony		---		---	N/A		---		---
			Arsenic		1.3E-08		1.3E-08	N/A		---		---
			Chromium III		---		---	N/A		---		---
			Cobalt		---		---	N/A		---		---
			Copper		---		---	N/A		---		---
			Iron		---		---	N/A		---		---
			Lead		---		---	N/A		---		---
			Manganese		---		---	CNS		1.7E-02		1.7E-02
			Thallium		---		---	N/A		---		---
			Vanadium		---		---	N/A		---		---
			Chemical Total		1.4E-08		1.4E-08			0.021		0.021
		Exposure Point Total					1.4E-08					0.021
	Exposure Media Total						1.4E-08					0.021
Total Soil Total							1.1E-02					156

Table E.1-59
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	SWMU 51	Tetrachloroethene	1.6E-06			1.6E-06	Liver	8.2E-04			8.2E-04
			TCDD TE	1.6E-05			1.6E-05	N/A	---			---
			Chromium III	---			---	NOAEL	7.0E-14			7.0E-14
			Chemical Total	1.7E-05			1.7E-05		0.00082			0.00082
		Exposure Point Total					1.7E-05					0.00082
	Exposure Media Total						1.7E-05					0.00082
	Air (Ambient Air)	SWMU 51	Tetrachloroethene		4.4E-13		4.4E-13	CNS		7.7E-10		7.7.E-10
			Chemical Total		4.4E-13		4.4E-13			7.7E-10		7.7.E-10
		Exposure Point Total					4.4E-13					7.7.E-10
	Air (Indoor Air)	SWMU 51	Tetrachloroethene		3.3E-08		3.3E-08	CNS		5.8E-05		5.8.E-05
			Chemical Total		3.3E-08		3.3E-08			5.8E-05		5.8.E-05
		Exposure Point Total					3.3E-08					5.8.E-05
	Exposure Media Total						3.3E-08					5.8.E-05
Groundwater Total							1.7E-05					8.8E-04
Receptor Total[b]							1.1E-02					156

Total Risk Across All Media[b] = 1.1E-02

Total Hazard Across All Media[b] = 156

(a) Chromium RfD is based on NOAEL; no target organ is identified.
(b) Since total soil represents the more highly contaminated portion of soil, total risk and hazard estimates are conservatively based on this soil data grouping.
Since indoor air represents the more highly contaminated portion of groundwater, total risk and hazard estimates are conservatively based on this data grouping.

CNS = Central nervous system.
GI = Gastrointestinal.
NOAEL = No Observable Adverse Effects Level.
N/A = Not Available.

Total Blood HI Across All Media =	26.7
Total Spleen HI Across All Media =	3.1
Total CNS HI Across All Media =	25
Total Liver HI Across All Media =	115
Total Kidney HI Across All Media =	0.15
Total Skin HI Across All Media =	0.037
Total Vascular Effects HI Across All Media =	0.037
Total NOAEL HI Across All Media =	0.0016
Total GI Tract HI Across All Media =	0.14
Total Hair HI Across All Media =	0.022
Total Body Weight HI Across All Media =	4.9E-07

Table E.1-60
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Excavation Worker

Scenario Timeframe: Future
Receptor Population: Excavation Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	SWMU 51										
			TCDD TE	1.0E-06		9.2E-08	1.1E-06	N/A	---		---	---
			1,3,5-Trinitrobenzene	---		---	---	Blood, Spleen	1.6E-02		9.3E-04	1.7E-02
			Dibenz(a,h)anthracene	1.5E-08		5.8E-09	2.1E-08	N/A	---		---	---
			1,3-Dinitrobenzene	---		---	---	Spleen	6.9E+00		2.1E+00	8.9E+00
			2,4-Dinitrotoluene	8.1E-04		2.5E-04	1.1E-03	CNS, Blood, Liver	4.2E+01		1.3E+01	5.5E+01
			2,6-Dinitrotoluene	1.3E-04		3.9E-05	1.7E-04	CNS, Blood, Liver	1.3E+01		4.0E+00	1.7E+01
			2-Amino-4,6-Dinitrotoluene	---		---		Liver, Erythrocyte (Blood)	3.5E-02		6.2E-04	3.5E-02
			2-Hexanone	---		---	---	N/A	---		---	---
			4-Methyl-2-pentanone	---		---	---	N/A	---		---	---
			4,6-Dinitro-o-cresol	---		---		N/A	---		---	---
			2-Nitroaniline	---		---	---	N/A	---		---	---
			Nitroglycerin	1.8E-06		5.3E-07	2.3E-06	N/A	7.3E+01		2.2E+01	9.5E+01
			2-Nitrotoluene	---		---	---	Erythrocyte (Blood)	4.2E+00		3.8E-01	4.6E+00
			3-Nitrotoluene	---		---	---	N/A	---		---	---
			4-Nitrotoluene	6.5E-06		2.0E-06	8.5E-06	N/A	7.2E+00		2.1E+00	9.3E+00
			PETN	---		---	---	N/A	---		---	---
			2,4,6-Trinitrotoluene	5.8E-05		5.6E-06	6.4E-05	Liver	2.7E+02		2.6E+01	3.0E+02
			Aluminum	---		---	---	Developmental nervous system	6.4E-02		1.9E-03	6.6E-02
			Antimony	---		---	---	Blood Chemistry	3.1E-02		6.3E-03	3.8E-02
			Arsenic	7.2E-07		6.5E-08	7.8E-07	Skin, Vascular Effects	1.1E-01		1.0E-02	1.2E-01
			Chromium III[a]	---		---	---	NOAEL	9.6E-04		2.2E-04	1.2E-03
			Cobalt	---		---	---	N/A	---		---	---
			Copper	---		---	---	GI Tract	1.4E-02		4.3E-04	1.5E-02
			Iron	---		---	---	Blood, Liver, GI Irritation	4.8E-01		1.4E-02	4.9E-01
			Lead	---		---	---	N/A	---		---	---
			Manganese	---		---	---	CNS	1.7E-01		1.3E-01	3.1E-01
			Thallium	---		---	---	Blood, Liver, Hair	7.7E-02		2.3E-03	7.9E-02
			Vanadium	---		---	---	Kidney	1.5E-01		1.8E-01	3.3E-01
			Chemical Total	1.0E-03		3.0E-04	1.3E-03		420		70	489
		Exposure Point Total					1.3E-03					489
	Exposure Media Total						1.3E-03					489

Table E.1-60
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Excavation Worker

Scenario Timeframe: Future
Receptor Population: Excavation Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Air (Particulates and Volatiles)	SWMU 51	TCDD TE		3.2E-08		3.2E-08	N/A		---		---
			1,3,5-Trinitrobenzene		---		---	N/A		---		---
			Dibenz(a,h)anthracene		---		---	N/A		---		---
			1,3-Dinitrobenzene		---		---	N/A		---		---
			2,4-Dinitrotoluene		---		---	N/A		---		---
			2,6-Dinitrotoluene		---		---	N/A		---		---
			2-Amino-4,6-Dinitrotoluene		---		---	N/A		---		---
			2-Hexanone		---		---	N/A		---		---
			4-Methyl-2-pentanone		---		---	Body Weight		5.4E-07		5.4E-07
			4,6-Dinitro-o-cresol		---		---	N/A		---		---
			2-Nitroaniline		---		---	N/A		---		---
			Nitroglycerin		---		---	N/A		---		---
			2-Nitrotoluene		---		---	N/A		---		---
			3-Nitrotoluene		---		---	N/A		---		---
			4-Nitrotoluene		---		---	N/A		---		---
			PETN		---		---	N/A		---		---
			2,4,6-Trinitrotoluene		---		---	N/A		---		---
			Aluminum		---		---	N/A		2.0E+00		2.0E+00
			Antimony		---		---	N/A		---		---
			Arsenic		2.3E-07		2.3E-07	N/A		---		---
			Chromium III		---		---	N/A		---		---
			Cobalt		---		---	N/A		---		---
			Copper		---		---	N/A		---		---
			Iron		---		---	N/A		---		---
			Lead		---		---	N/A		---		---
			Manganese		---		---	CNS		7.6E+00		7.6E+00
			Thallium		---		---	N/A		---		---
			Vanadium		---		---	N/A		---		---
			Chemical Total		2.6E-07		2.6E-07			9.6		9.6
		Exposure Point Total					2.6E-07					9.6
	Exposure Media Total						2.6E-07					9.6
Total Soil Total							1.3E-03					499
Groundwater	Air (Trench Air)	SWMU 51	Tetrachloroethene		5.3E-10		5.3E-10	CNS		2.3E-05		2.3.E-05
			Chemical Total		5.3E-10		5.3E-10			2.3E-05		2.3.E-05
		Exposure Point Total					5.3E-10					2.3.E-05
	Exposure Media Total						5.3E-10					2.3.E-05
Groundwater Total							5.3E-10					2.3E-05
Receptor Total							1.3E-03					499

	1.3E-03
Total Hazard Across All Media =	499

(a) Chromium RfD is based on NOAEL; no target organ is identified.

CNS = Central nervous system.
GI = Gastrointestinal.
NOAEL = No Observable Adverse Effects Level.
N/A = Not Available.

Total Spleen HI Across All Media =	9.0
Total CNS HI Across All Media =	80
Total Blood HI Across All Media =	77
Total Liver HI Across All Media =	371
Total Kidney HI Across All Media =	0.33
Total Skin HI Across All Media =	0.12
Total Vascular Effects HI Across All Media =	0.12
Total NOAEL HI Across All Media =	0.0012
Total GI Tract HI Across All Media =	0.50
Total Hair HI Across All Media =	0.079
Total Body Weight HI Across All Media =	5.42E-07

Table E.1-61
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Adult/ Lifetime Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/ Lifetime

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	SWMU 51										
			TCDD TE	3.5E-05		3.3E-06	3.8E-05	N/A	---		---	---
			1,3,5-Trinitrobenzene	---		---	---	Blood, Spleen	6.9E-03		5.3E-04	7.5E-03
			Dibenz(a,h)anthracene	5.1E-07		2.1E-07	7.2E-07	N/A	---		---	---
			1,3-Dinitrobenzene	---		---	---	Spleen	2.9E+00		1.2E+00	4.1E+00
			2,4-Dinitrotoluene	2.8E-02		8.9E-03	3.6E-02	CNS, Blood, Liver	1.8E+01		7.2E+00	2.5E+01
			2,6-Dinitrotoluene	4.4E-03		1.4E-03	5.8E-03	CNS, Blood, Liver	5.7E+00		2.3E+00	8.0E+00
			2-Amino-4,6-Dinitrotoluene					Liver, Erythrocyte (Blood)	1.5E-02		3.5E-04	1.5E-02
			2-Hexanone	---		---	---	N/A	---		---	---
			4-Methyl-2-pentanone	---		---	---	N/A	---		---	---
			4,6-Dinitro-o-cresol					N/A	---		---	---
			2-Nitroaniline	---		---	---	N/A	---		---	---
			Nitroglycerin	6.0E-05		1.9E-05	7.9E-05	N/A	3.1E+01		1.2E+01	4.3E+01
			2-Nitrotoluene	---		---	---	Erythrocyte (Blood)	1.8E+00		2.1E-01	2.0E+00
			3-Nitrotoluene	---		---	---	N/A	---		---	---
			4-Nitrotoluene	2.2E-04		7.0E-05	2.9E-04	N/A	3.0E+00		1.2E+00	4.2E+00
			PETN	---		---	---	N/A	---		---	---
			2,4,6-Trinitrotoluene	2.0E-03		2.0E-04	2.2E-03	Liver	1.2E+02		1.5E+01	1.3E+02
			Aluminum	---		---	---	Developmental nervous system	2.7E-02		1.1E-03	2.8E-02
			Antimony	---		---	---	Blood Chemistry	1.3E-02		3.5E-03	1.7E-02
			Arsenic	2.4E-05		2.3E-06	2.7E-05	Skin, Vascular Effects	4.7E-02		5.7E-03	5.3E-02
			Chromium III[a]	---		---	---	NOAEL	4.1E-04		1.3E-03	1.7E-03
			Cobalt	---		---	---	N/A	---		---	---
			Copper	---		---	---	GI Tract	6.1E-03		2.4E-04	6.3E-03
			Iron	---		---	---	Blood, Liver, GI Irritation	2.0E-01		8.0E-03	2.1E-01
			Lead	---		---	---	N/A	---		---	---
			Manganese	---		---	---	CNS	7.4E-02		7.4E-02	1.5E-01
			Thallium	---		---	---	Blood, Liver, Hair	3.3E-02		1.3E-03	3.4E-02
			Vanadium	---		---	---	Kidney	6.5E-02		1.0E-01	1.7E-01
			Chemical Total	3.4E-02		1.1E-02	4.5E-02		178		39	217
		Exposure Point Total					4.5E-02					217
	Exposure Media Total						4.5E-02					217

Table E.1-61
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Adult/ Lifetime Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/ Lifetime

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Air (Particulates and Volatiles)	SWMU 51										
			TCDD TE		2.7E-10		2.7E-10	N/A		---		---
			1,3,5-Trinitrobenzene		---		---	N/A		---		---
			Dibenz(a,h)anthracene		---		---	N/A		---		---
			1,3-Dinitrobenzene		---		---	N/A		---		---
			2,4-Dinitrotoluene		---		---	N/A		---		---
			2,6-Dinitrotoluene		---		---	N/A		---		---
			2-Amino-4,6-Dinitrotoluene		---		---	N/A		---		---
			2-Hexanone		---		---	N/A		---		---
			4-Methyl-2-pentanone		---		---	Body Weight		3.1E-08		3.1E-08
			4,6-Dinitro-o-cresol		---		---	N/A		---		---
			2-Nitroaniline		---		---	N/A		---		---
			Nitroglycerin		---		---	N/A		---		---
			2-Nitrotoluene		---		---	N/A		---		---
			3-Nitrotoluene		---		---	N/A		---		---
			4-Nitrotoluene		---		---	N/A		---		---
			PETN		---		---	N/A		---		---
			2,4,6-Trinitrotoluene		---		---	N/A		---		---
			Aluminum		---		---	N/A		2.9E-04		2.9E-04
			Antimony		---		---	N/A		---		---
			Arsenic		1.9E-09		1.9E-09	N/A		---		---
			Chromium III		---		---	N/A		---		---
			Cobalt		---		---	N/A		---		---
			Copper		---		---	N/A		---		---
			Iron		---		---	N/A		---		---
			Lead		---		---	N/A		---		---
			Manganese		---		---	CNS		1.1E-03		1.1E-03
			Thallium		---		---	N/A		---		---
			Vanadium		---		---	N/A		---		---
			Chemical Total		2.2E-09		2.2E-09			0.0014		0.0014
		Exposure Point Total					2.2E-09					0.0014
	Exposure Media Total						2.2E-09					0.0014
Total Soil Total							4.5E-02					217

Table E.1-61
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Adult/ Lifetime Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/ Lifetime

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	SWMU 51	Tetrachloroethene	7.5E-06		3.7E-06	1.1E-05	Liver	2.5E-03		1.4E-03	3.9E-03
			TCDD TE	7.4E-05		1.2E-03	1.2E-03	N/A	---		---	
			Chromium III	---		---		NOAEL	2.2E-04		1.5E-04	3.7E-04
			Chemical Total	8.1E-05		1.2E-03	1.2E-03		0.0028		0.0015	0.0043
		Exposure Point Total					1.2E-03					4.3.E-03
	Exposure Media Total						1.2E-03					4.3.E-03
	Air (Indoor Air)	SWMU 51	Tetrachloroethene		1.2E-07		1.2E-07	CNS		9.0E-05		9.0.E-05
			Chemical Total		1.2E-07		1.2E-07			9.0E-05		9.0.E-05
		Exposure Point Total					1.2E-07					9.0.E-05
	Exposure Media Total						1.2E-07					9.0.E-05
	Air (Shower Room)	SWMU 51	Tetrachloroethene		1.0E-07		1.0E-07	CNS		1.8E-04		1.8.E-04
			Chemical Total		1.0E-07		1.0E-07			1.8E-04		1.8.E-04
		Exposure Point Total					1.0E-07					1.8.E-04
	Exposure Media Total						1.0E-07					1.8.E-04
Groundwater Total							1.2E-03					4.6E-03
Receptor Total							4.6E-02					2.2E+02

	4.6E-02
Total Hazard Across All Media =	2.2E+02

(a) Chromium RfD is based on NOAEL; no target organ is identified.

CNS = Central nervous system.
GI = Gastrointestinal.
NOAEL = No Observable Adverse Effects Level.
N/A = Not Available.

Total Blood HI Across All Media =	35
Total Spleen HI Across All Media =	4.1
Total CNS HI Across All Media =	33
Total Liver HI Across All Media =	163
Total Kidney HI Across All Media =	0.17
Total Skin HI Across All Media =	0.053
Total Vascular Effects HI Across All Media =	0.053
Total NOAEL HI Across All Media =	0.0020
Total GI Tract HI Across All Media =	0.22
Total Hair HI Across All Media =	0.034
Total Body Weight HI Across All Media =	3.1E-08

Table E.1-62
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Off-site Adult/ Lifetime Resident

Scenario Timeframe: Future
Receptor Population: Off-site Resident
Receptor Age: Adult/ Lifetime

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	SWMU 51	Tetrachloroethene	7.5E-06		3.7E-06	1.1E-05	Liver	2.5E-03		1.4E-03	3.9E-03
			TCDD TE	7.4E-05		1.2E-03	1.2E-03	N/A	---		---	
			Chromium III	---		---	---	NOAEL	2.2E-04		1.5E-04	3.7E-04
			Chemical Total	8.1E-05		1.2E-03	1.2E-03		0.0028		0.0015	0.0043
		Exposure Point Total					1.2E-03					0.0043
	Exposure Media Total						1.2E-03					0.0043
	Air (Indoor Air)	SWMU 51	Tetrachloroethene		1.2E-07		1.2E-07	CNS		9.0E-05		9.0.E-05
			Chemical Total		1.2E-07		1.2E-07			9.0E-05		9.0.E-05
		Exposure Point Total					1.2E-07					9.0.E-05
	Exposure Media Total						1.2E-07					9.0.E-05
	Air (Shower Room)	SWMU 51	Tetrachloroethene		1.0E-07		1.0E-07	CNS		1.8E-04		1.8.E-04
			Chemical Total		1.0E-07		1.0E-07			1.8E-04		1.8.E-04
		Exposure Point Total					1.0E-07					1.8.E-04
	Exposure Media Total						1.0E-07					1.8.E-04
Groundwater Total							1.2E-03					4.6E-03
Receptor Total							1.2E-03					0.0046

1.2E-03

Total Hazard Across All Media = 0.0046

CNS = Central nervous system.
N/A = Not Available.

Total Liver HI Across All Media = 0.0039
Total NOAEL HI Across All Media = 0.00037
Total CNS HI Across All Media = 0.00028

Table E.1-63
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Child Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	SWMU 51										
			TCDD TE	2.4E-05		2.0E-06	2.6E-05	N/A	---		---	---
			1,3,5-Trinitrobenzene	---		---	---	Blood, Spleen	6.5E-02		3.4E-03	6.8E-02
			Dibenz(a,h)anthracene	3.6E-07		1.3E-07	4.9E-07	N/A	---		---	---
			1,3-Dinitrobenzene	---		---	---	Spleen	2.7E+01		7.6E+00	3.5E+01
			2,4-Dinitrotoluene	1.9E-02		5.5E-03	2.5E-02	CNS, Blood, Liver	1.7E+02		4.7E+01	2.1E+02
			2,6-Dinitrotoluene	3.1E-03		8.6E-04	4.0E-03	CNS, Blood, Liver	5.3E+01		1.5E+01	6.8E+01
			2-Amino-4,6-Dinitrotoluene	---		---	---	Liver, Erythrocyte (Blood)	1.4E-01		2.3E-03	1.4E-01
			2-Hexanone	---		---	---	N/A	---		---	---
			4-Methyl-2-pentanone	---		---	---	N/A	---		---	---
			4,6-Dinitro-o-cresol	---		---	---	N/A	---		---	---
			2-Nitroaniline	---		---	---	N/A	---		---	---
			Nitroglycerin	4.2E-05		1.2E-05	5.4E-05	N/A	2.9E+02		8.1E+01	3.7E+02
			2-Nitrotoluene	---		---	---	Erythrocyte (Blood)	1.7E+01		1.4E+00	1.8E+01
			3-Nitrotoluene	---		---	---	N/A	---		---	---
			4-Nitrotoluene	1.6E-04		4.4E-05	2.0E-04	N/A	2.8E+01		7.9E+00	3.6E+01
			PETN	---		---	---	N/A	---		---	---
			2,4,6-Trinitrotoluene	1.4E-03		1.2E-04	1.5E-03	Liver	1.1E+03		9.6E+01	1.2E+03
			Aluminum	---		---	---	Developmental nervous system	2.5E-01		7.1E-03	2.6E-01
			Antimony	---		---	---	Blood Chemistry	1.2E-01		2.3E-02	1.5E-01
			Arsenic	1.7E-05		1.4E-06	1.9E-05	Skin, Vascular Effects	4.4E-01		3.7E-02	4.8E-01
			Chromium III[a]	---		---	---	NOAEL	3.8E-03		8.2E-03	1.2E-02
			Cobalt	---		---	---	N/A	---		---	---
			Copper	---		---	---	GI Tract	5.7E-02		1.6E-03	5.8E-02
			Iron	---		---	---	Blood, Liver, GI Irritation	1.9E+00		5.3E-02	1.9E+00
			Lead	---		---	---	N/A	---		---	---
			Manganese	---		---	---	CNS	6.9E-01		4.8E-01	1.2E+00
			Thallium	---		---	---	Blood, Liver, Hair	3.1E-01		8.5E-03	3.1E-01
			Vanadium	---		---	---	Kidney	6.1E-01		6.6E-01	1.3E+00
			Chemical Total	2.4E-02		6.6E-03	3.1E-02		1661		258	1919
		Exposure Point Total					3.1E-02					1919
	Exposure Media Total						3.1E-02					1919

Table E.1-63
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Child Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Air (Particulates and Volatiles)	SWMU 51	TCDD TE		1.6E-10		1.6E-10	N/A		---		---
			1,3,5-Trinitrobenzene		---		---	N/A		---		---
			Dibenz(a,h)anthracene		---		---	N/A		---		---
			1,3-Dinitrobenzene		---		---	N/A		---		---
			2,4-Dinitrotoluene		---		---	N/A		---		---
			2,6-Dinitrotoluene		---		---	N/A		---		---
			2-Amino-4,6-Dinitrotoluene		---		---	N/A		---		---
			2-Hexanone		---		---	N/A		---		---
			4-Methyl-2-pentanone		---		---	Body Weight		1.8E-07		1.8E-07
			4,6-Dinitro-o-cresol		---		---	N/A		---		---
			2-Nitroaniline		---		---	N/A		---		---
			Nitroglycerin		---		---	N/A		---		---
			2-Nitrotoluene		---		---	N/A		---		---
			3-Nitrotoluene		---		---	N/A		---		---
			4-Nitrotoluene		---		---	N/A		---		---
			PETN		---		---	N/A		---		---
			2,4,6-Trinitrotoluene		---		---	N/A		---		---
			Aluminum		---		---	N/A		1.6E-03		1.6E-03
			Antimony		---		---	N/A		---		---
			Arsenic		1.1E-09		1.1E-09	N/A		---		---
			Chromium III		---		---	N/A		---		---
			Cobalt		---		---	N/A		---		---
			Copper		---		---	N/A		---		---
			Iron		---		---	N/A		---		---
			Lead		---		---	N/A		---		---
			Manganese		---		---	CNS		6.2E-03		6.2E-03
			Thallium		---		---	N/A		---		---
			Vanadium		---		---	N/A		---		---
			Chemical Total		1.3E-09		1.3E-09			0.0078		0.0078
		Exposure Point Total					1.3E-09					0.0078
	Exposure Media Total						1.3E-09					0.0078
Total Soil Total							3.1E-02					1919

Table E.1-63
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Child Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	SWMU 51	Tetrachloroethene	2.8E-06		1.1E-06	3.8E-06	Liver	5.9E-03		2.4E-03	8.3E-03
			TCDD TE	2.7E-05		3.5E-04	3.7E-04	N/A	---		---	---
			Chromium III	---		---		NOAEL	5.1E-04		2.6E-04	7.6E-04
			Chemical Total	3.0E-05		3.5E-04	3.8E-04		0.0065		2.6E-03	9.1E-03
		Exposure Point Total					3.8E-04					9.1.E-03
	Exposure Media Total						3.8E-04					9.1.E-03
	Air (Indoor Air)	SWMU 51	Tetrachloroethene		7.0E-08		7.0E-08	CNS		5.1E-04		5.1.E-04
			Chemical Total		7.0E-08		7.0E-08			5.1E-04		5.1.E-04
		Exposure Point Total					7.0E-08					5.1.E-04
	Exposure Media Total						7.0E-08					5.1.E-04
Groundwater Total							3.8E-04					9.6E-03
Receptor Total							3.1E-02					1919

3.1E-02

Total Hazard Across All Media = 1919

(a) Chromium RfD is based on NOAEL; no target organ is identified.

Total Blood HI Across All Media =	302
Total Spleen HI Across All Media =	35
Total CNS HI Across All Media =	282
Total Liver HI Across All Media =	1,456
Total Kidney HI Across All Media =	1.3
Total Skin HI Across All Media =	0.48
Total Vascular Effects HI Across All Media =	0.48
Total NOAEL HI Across All Media =	0.013
Total GI Tract HI Across All Media =	2.0
Total Hair HI Across All Media =	0.31
Total Body Weight HI Across All Media =	1.8E-07

CNS = Central nervous system.
GI = Gastrointestinal.
NOAEL = No Observable Adverse Effects Level.
N/A = Not Available.

Table E.1-64
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future - Off-site Child Resident

Scenario Timeframe: Future
Receptor Population: Off-site Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	SWMU 51										
			Tetrachloroethene	2.8E-06		1.1E-06	3.8E-06	Liver	5.9E-03		2.4E-03	8.3E-03
			TCDD TE	2.7E-05		3.5E-04	3.7E-04	N/A	---		---	
			Cromium III	---		---	---	NOAEL	5.1E-04		2.6E-04	7.6E-04
			Chemical Total	3.0E-05		3.5E-04	3.8E-04		0.0065		0.0026	0.0091
		Exposure Point Total					3.8E-04					0.0091
	Exposure Media Total						3.8E-04					0.0091
	Air (Indoor Air)	SWMU 51										
			Tetrachloroethene		7.0E-08		7.0E-08	CNS		5.1E-04		5.1.E-04
			Chemical Total		7.0E-08		7.0E-08			5.1E-04		5.1.E-04
		Exposure Point Total					7.0E-08					5.1.E-04
	Exposure Media Total						7.0E-08					5.1.E-04
Groundwater Total							3.8E-04					9.6E-03
Receptor Total							3.8E-04					0.0096

3.8E-04

Total Hazard Across All Media = 0.0096

CNS = Central nervous system.
N/A = Not Available.

Total Liver HI Across All Media = 0.0083
Total NOAEL HI Across All Media = 0.00076
Total CNS HI Across All Media = 0.00051

Table E.1-65
Risk Assessment Summary
Reasonable Maximum Exposure
Current - Maintenance Worker

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	SWMU 51											
			Chemical Total					<1.0E-06					<1
		Exposure Point Total						<1.0E-06					<1
	Exposure Media Total							<1.0E-06					<1
	Air (Particulates and Volatiles)	SWMU 51											
			Chemical Total					<1.0E-06					<1
		Exposure Point Total						<1.0E-06					<1
	Exposure Media Total							<1.0E-06					<1
Soil Total								<1.0E-06					<1
Groundwater	Air (Ambient Air)	SWMU 51											
			Chemical Total					<1.0E-06					<1
		Exposure Point Total						<1.0E-06					<1
	Exposure Media Total							<1.0E-06					<1
Groundwater Total													
Receptor Total								<1.0E-06					<1

Total Risk Across All Media = <1.0E-06

Total Hazard Across All Media = <1

Table E.1-66
Risk Assessment Summary
Reasonable Maximum Exposure
Future - Maintenance Worker

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
	Air (Particulates and Volatiles)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Surface Soil Total							<1.0E-06					<1
Total Soil	Total Soil	SWMU 51										
			TCDD TE	1.6E-06		3.1E-07	1.9E-06					
			2,4-Dinitrotoluene	1.2E-03		8.3E-04	2.1E-03	CNS, Blood, Liver	2.5E+00		1.7E+00	4.2E+00
			2,6-Dinitrotoluene	2.0E-04		1.3E-04	3.3E-04	CNS, Blood, Liver	8.2E-01		5.3E-01	1.3E+00
			Nitroglycerin	2.7E-06		1.8E-06	4.5E-06	N/A	4.4E+00		2.9E+00	7.3E+00
			4-Nitrotoluene	9.9E-06		6.5E-06	1.6E-05					
			2,4,6-Trinitrotoluene	8.8E-05		1.9E-05	1.1E-04	Liver	1.6E+01		3.5E+00	2.0E+01
			Arsenic	1.1E-06		2.2E-07	1.3E-06					
			Chemical Total	1.5E-03		9.9E-04	2.5E-03		24.3		8.6	32.9
		Exposure Point Total					2.5E-03					32.9
	Exposure Media Total						2.5E-03					32.9
	Air (Particulates and Volatiles)	SWMU 51										
			Chemical Total				<1.0E-06					<1
			Radionuclide Total									
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Total Soil Total							2.5E-03					32.9
Groundwater	Air (Ambient Air)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Groundwater Total												
Receptor Total[a]							2.5E-03					32.9

2.5E-03

Total Hazard Across All Media[a] = 32.9

(a) Since total soil represents the more highly contaminated portion of soil, total risk and hazard estimates are conservatively based on this soil data grouping.

CNS = Central Nervous System

Total CNS HI Across All Media = 5.6
Total Blood HI Across All Media = 5.6
Total Liver HI Across All Media = 25.5

Table E.1-67
Risk Assessment Summary
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	SWMU 51	Arsenic	2.1E-06		4.1E-07	2.5E-06					
			Chemical Total	2.1E-06		4.1E-07	2.5E-06					<1
		Exposure Point Total					2.5E-06					<1
	Exposure Media Total						2.5E-06					<1
	Air (Particulates and Volatiles)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Surface Soil Total							2.5E-06					<1
Total Soil	Total Soil	SWMU 51	TCDD TE	7.0E-06		1.4E-06	8.4E-06					
			1,3-Dinitrobenzene					Spleen	1.9E+00		1.2E+00	3.1E+00
			2,4-Dinitrotoluene	5.5E-03		3.7E-03	9.3E-03	CNS, Blood, Liver	1.1E+01		7.7E+00	1.9E+01
			2,6-Dinitrotoluene	8.9E-04		5.8E-04	1.5E-03	CNS, Blood, Liver	3.7E+00		2.4E+00	6.1E+00
			Nitroglycerin	1.2E-05		8.0E-06	2.0E-05	N/A	2.0E+01		1.3E+01	3.3E+01
			2-Nitrotoluene					N/A	1.2E+00		2.3E-01	1.4E+00
			4-Nitrotoluene	4.5E-05		2.9E-05	7.4E-05	N/A	2.0E+00		1.3E+00	3.2E+00
			2,4,6-Trinitrotoluene	4.0E-04		8.4E-05	4.8E-04	Liver	7.4E+01		1.6E+01	9.0E+01
			Arsenic	4.9E-06		9.7E-07	5.9E-06					
			Chemical Total	6.9E-03		4.4E-03	1.1E-02		114		42	156
		Exposure Point Total					1.1E-02					156
	Exposure Media Total						1.1E-02					156
	Air (Particulates and Volatiles)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Total Soil Total							1.1E-02					156

Table E.1-67
Risk Assessment Summary
Reasonable Maximum Exposure
Future - Industrial Worker

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	SWMU 51										
			Tetrachloroethene	1.6E-06			1.6E-06					
			TCDD TE	1.6E-05			1.6E-05					
			Chemical Total	1.7E-05			1.7E-05					
		Exposure Point Total					1.7E-05					<1
	Exposure Media Total						1.7E-05					<1
	Air (Ambient Air)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Air (Indoor Air)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Groundwater Total							1.7E-05					<1
Receptor Total[a]							1.1E-02					156

1.1E-02

Total Hazard Across All Media[a] = 156

(a) Since total soil represents the more highly contaminated portion of soil, total risk and hazard estimates are conservatively based on this soil data grouping.

CNS = Central Nervous System

Total Spleen HI Across All Media = 3.1
Total CNS HI Across All Media = 25
Total Blood HI Across All Media = 25
Total Liver HI Across All Media = 115

Table E.1-68
Risk Assessment Summary
Reasonable Maximum Exposure
Future - Excavation Worker

Scenario Timeframe: Future
Receptor Population: Excavation Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	SWMU 51										
			TCDD TE	1.0E-06		9.2E-08	1.1E-06					
			1,3-Dinitrobenzene					Spleen	6.9E+00		2.1E+00	8.9E+00
			2,4-Dinitrotoluene	8.1E-04		2.5E-04	1.1E-03	CNS, Blood, Liver	4.2E+01		1.3E+01	5.5E+01
			2,6-Dinitrotoluene	1.3E-04		3.9E-05	1.7E-04	CNS, Blood, Liver	1.3E+01		4.0E+00	1.7E+01
			Nitroglycerin	1.8E-06		5.3E-07	2.3E-06	N/A	7.3E+01		2.2E+01	9.5E+01
			2-Nitrotoluene					Erythrocyte (Blood)	4.2E+00		3.8E-01	4.6E+00
			4-Nitrotoluene	6.5E-06		2.0E-06	8.5E-06	N/A	7.2E+00		2.1E+00	9.3E+00
			2,4,6-Trinitrotoluene	5.8E-05		5.6E-06	6.4E-05	Liver	2.7E+02		2.6E+01	3.0E+02
			Chemical Total	1.0E-03		3.0E-04	1.3E-03		418		69	488
		Exposure Point Total					1.3E-03					488
	Exposure Media Total						1.3E-03					488
	Air (Particulates and Volatiles)	SWMU 51										
			Aluminum					N/A		2.0E+00		2.0E+00
			Manganese					CNS		7.6E+00		7.6E+00
			Chemical Total				<1.0E-06			9.6		9.6
		Exposure Point Total					<1.0E-06					9.6
	Exposure Media Total						<1.0E-06					9.6
Total Soil Total							1.3E-03					497
Groundwater	Air (Trench Air)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Groundwater Total												
Receptor Total							1.3E-03					497

1.3E-03

Total Hazard Across All Media = 497

CNS = Central Nervous System
GI - Gastrointestinal

Total Spleen HI Across All Media = 8.9
Total CNS HI Across All Media = 80
Total Blood HI Across All Media = 77
Total Liver HI Across All Media = 370

Table E.1-69
Risk Assessment Summary
Reasonable Maximum Exposure
Future - Adult/ Lifetime Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/ Lifetime

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	SWMU 51										
			TCDD TE	3.5E-05		3.3E-06	3.8E-05					
			1,3-Dinitrobenzene					Spleen	2.9E+00		1.2E+00	4.1E+00
			2,4-Dinitrotoluene	2.8E-02		8.9E-03	3.6E-02	CNS, Blood, Liver	1.8E+01		7.2E+00	2.5E+01
			2,6-Dinitrotoluene	4.4E-03		1.4E-03	5.8E-03	CNS, Blood, Liver	5.7E+00		2.3E+00	8.0E+00
			Nitroglycerin	6.0E-05		1.9E-05	7.9E-05	N/A	3.1E+01		1.2E+01	4.3E+01
			2-Nitrotoluene					Erythrocyte (Blood)	1.8E+00		2.1E-01	2.0E+00
			4-Nitrotoluene	2.2E-04		7.0E-05	2.9E-04	N/A	3.0E+00		1.2E+00	1.2E+00
			2,4,6-Trinitrotoluene	2.0E-03		2.0E-04	2.2E-03	Liver	1.2E+02		1.5E+01	1.3E+02
			Arsenic	2.4E-05		2.3E-06	2.7E-05					
			Chemical Total	3.4E-02		1.1E-02	4.5E-02		178		39	214
		Exposure Point Total					4.5E-02					214
	Exposure Media Total						4.5E-02					214
	Air (Particulates and Volatiles)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Total Soil Total							4.5E-02					214
Groundwater	Groundwater	SWMU 51										
			Tetrachloroethene	7.5E-06		3.7E-06	1.1E-05					
			TCDD TE	7.4E-05		1.2E-03	1.2E-03					
			Chemical Total	8.1E-05		1.2E-03	1.2E-03					<1
		Exposure Point Total					1.2E-03					<1
	Exposure Media Total						1.2E-03					<1
	Air (Indoor Air)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
	Air (Shower Room)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Groundwater Total							1.2E-03					<1
Receptor Total							4.6E-02					214

4.6E-02

Total Hazard Across All Media = 214

CNS = Central Nervous System

Total Spleen HI Across All Media = 4
Total CNS HI Across All Media = 33
Total Blood HI Across All Media = 35
Total Liver HI Across All Media = 163

Table E.1-70
Risk Assessment Summary
Reasonable Maximum Exposure
Future - Child Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	SWMU 51										
			TCDD TE	2.4E-05		2.0E-06	2.6E-05					
			1,3-Dinitrobenzene					Spleen	2.7E+01		7.6E+00	3.5E+01
			2,4-Dinitrotoluene	1.9E-02		5.5E-03	2.5E-02	CNS, Blood, Liver	1.7E+02		4.7E+01	2.1E+02
			2,6-Dinitrotoluene	3.1E-03		8.6E-04	4.0E-03	CNS, Blood, Liver	5.3E+01		1.5E+01	6.8E+01
			Nitroglycerin	4.2E-05		1.2E-05	5.4E-05	N/A	2.9E+02		8.1E+01	3.7E+02
			2-Nitrotoluene					Erythrocyte (Blood)	1.7E+01		1.4E+00	1.8E+01
			4-Nitrotoluene	1.6E-04		4.4E-05	2.0E-04	N/A	2.8E+01		7.9E+00	3.6E+01
			2,4,6-Trinitrotoluene	1.4E-03		1.2E-04	1.5E-03	Liver	1.1E+03		9.6E+01	1.2E+03
			Arsenic	1.7E-05		1.4E-06	1.9E-05					
			Iron					Blood, Liver, GI Irritation	1.9E+00		5.3E-02	1.9E+00
			Manganese					CNS	6.9E-01		4.8E-01	1.2E+00
			Vanadium					Kidney	6.1E-01		6.6E-01	1.3E+00
			Chemical Total	2.4E-02		6.6E-03	3.1E-02		1660		258	1917
		Exposure Point Total					3.1E-02					1917
	Exposure Media Total						3.1E-02					1917
	Air (Particulates and Volatiles)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Total Soil Total							3.1E-02					1917
Groundwater	Groundwater	SWMU 51										
			Tetrachloroethene	2.8E-06		1.1E-06	3.8E-06					
			TCDD TE	2.7E-05		3.5E-04	3.7E-04					
			Chemical Total	3.0E-05		3.5E-04	3.8E-04					<1
		Exposure Point Total					3.8E-04					<1
	Exposure Media Total						3.8E-04					<1
	Air (Indoor Air)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Groundwater Total							3.8E-04					<1
Receptor Total							3.1E-02					1917

	3.1E-02
Total Hazard Across All Media =	1917

CNS = Central Nervous System
GI = Gastrointestinal

Total Spleen HI Across All Media =	35
Total CNS HI Across All Media =	282
Total Blood HI Across All Media =	#REF!
Total Liver HI Across All Media =	#REF!
Total Kidney HI Across All Media =	1.3
Total GI Irritation HI Across All Media =	1.9

Table E.1-71
Risk Assessment Summary
Reasonable Maximum Exposure
Future - Off-site Adult/ Lifetime Resident

Scenario Timeframe: Future
Receptor Population: Off-site Resident
Receptor Age: Adult/ Lifetime

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	SWMU 51										
			Tetrachloroethene	7.5E-06		3.7E-06	1.1E-05					
			TCDD TE	7.4E-05		1.2E-03	1.2E-03					
			Chemical Total	8.1E-05		1.2E-03	1.2E-03					<1
		Exposure Point Total					1.2E-03					<1
	Exposure Media Total						1.2E-03					<1
	Air (Indoor Air)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
	Air (Shower Room)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Groundwater Total							1.2E-03					<1
Receptor Total							1.2E-03					<1

1.2E-03

Total Hazard Across All Media = <1

Table E.1-72
Risk Assessment Summary
Reasonable Maximum Exposure
Future - Off-site Child Resident

Scenario Timeframe: Future
Receptor Population: Off-site Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	SWMU 51										
			Tetrachloroethene	2.8E-06		1.1E-06	3.8E-06					
			TCDD TE	2.7E-05		3.5E-04	3.7E-04					
			Chemical Total	3.0E-05		3.5E-04	3.8E-04					<1
		Exposure Point Total					3.8E-04					<1
	Exposure Media Total						3.8E-04					<1
	Air (Indoor Air)	SWMU 51										
			Chemical Total				<1.0E-06					<1
		Exposure Point Total					<1.0E-06					<1
	Exposure Media Total						<1.0E-06					<1
Groundwater Total							3.8E-04					<1
Receptor Total							3.8E-04					<1

3.8E-04

Total Hazard Across All Media = <1

Appendix E-2

Calculations for 2,3,7,8-TCDD Equivalents

Dioxin/Furan 2,3,7,8-TCDD Equivalent Calculations - Groundwater
SWMU 51 - Radford Army Ammunition Plant

SAMPNUMB	PARAMETER	Value	DVQUAL	Units		final	TEF	ND = U	TCDD-TE_GW (ng/L)			
48MW07	1,2,3,4,6,7,8-HpCDD	0.00801	U	ng/L		0.00801	0.01	U	0.00E+00			
48MW07	1,2,3,4,6,7,8-HpCDF	0.00494	U	ng/L		0.00494	0.01	U	0.00E+00			
48MW07	1,2,3,4,7,8,9-HpCDF	0.00594	U	ng/L		0.00594	0.01	U	0.00E+00			
48MW07	1,2,3,4,7,8-HxCDD	0.00494	U	ng/L		0.00494	0.1	U	0.00E+00			
48MW07	1,2,3,4,7,8-HxCDF	0.00494	U	ng/L		0.00494	0.1	U	0.00E+00			
48MW07	1,2,3,6,7,8-HxCDD	0.00494	U	ng/L		0.00494	0.1	U	0.00E+00			
48MW07	1,2,3,6,7,8-HxCDF	0.00494	U	ng/L		0.00494	0.1	U	0.00E+00			
48MW07	1,2,3,7,8,9-HxCDD	0.00494	U	ng/L		0.00494	0.1	U	0.00E+00			
48MW07	1,2,3,7,8,9-HxCDF	0.00494	U	ng/L		0.00494	0.1	U	0.00E+00			
48MW07	1,2,3,7,8-PeCDD	0.00494	U	ng/L		0.00494	1	U	0.00E+00			
48MW07	1,2,3,7,8-PeCDF	0.00494	U	ng/L		0.00494	0.03	U	0.00E+00			
48MW07	2,3,4,6,7,8-HxCDF	0.00494	U	ng/L		0.00494	0.1	U	0.00E+00			
48MW07	2,3,4,7,8-PeCDF	0.00494	U	ng/L		0.00494	0.3	U	0.00E+00			
48MW07	2,3,7,8-TCDD	0.00369	U	ng/L		0.00369	1	U	0.00E+00			
48MW07	2,3,7,8-TCDF	0.00253	U	ng/L		0.00253	0.1	U	0.00E+00			
48MW07	OCDD	0.0146	J	ng/L		0.0146	0.0003	J	4.38E-06	48MW07	TCDD-TE_GW (ng/L)	4.38E-06
48MW07	OCDF	0.0127	U	ng/L		0.0127	0.0003	U	0.00E+00			
51MW1	1,2,3,4,6,7,8-HpCDD	0.00875	U	ng/L		0.00875	0.01	U	0.00E+00			
51MW1	1,2,3,4,6,7,8-HpCDF	0.00541	U	ng/L		0.00541	0.01	U	0.00E+00			
51MW1	1,2,3,4,7,8,9-HpCDF	0.00701	U	ng/L		0.00701	0.01	U	0.00E+00			
51MW1	1,2,3,4,7,8-HxCDD	0.0089	U	ng/L		0.0089	0.1	U	0.00E+00			
51MW1	1,2,3,4,7,8-HxCDF	0.00529	U	ng/L		0.00529	0.1	U	0.00E+00			
51MW1	1,2,3,6,7,8-HxCDD	0.00821	U	ng/L		0.00821	0.1	U	0.00E+00			
51MW1	1,2,3,6,7,8-HxCDF	0.00466	U	ng/L		0.00466	0.1	U	0.00E+00			
51MW1	1,2,3,7,8,9-HxCDD	0.00901	U	ng/L		0.00901	0.1	U	0.00E+00			
51MW1	1,2,3,7,8,9-HxCDF	0.00631	U	ng/L		0.00631	0.1	U	0.00E+00			
51MW1	1,2,3,7,8-PeCDD	0.0061	U	ng/L		0.0061	1	U	0.00E+00			
51MW1	1,2,3,7,8-PeCDF	0.0034	U	ng/L		0.0034	0.03	U	0.00E+00			
51MW1	2,3,4,6,7,8-HxCDF	0.00528	U	ng/L		0.00528	0.1	U	0.00E+00			
51MW1	2,3,4,7,8-PeCDF	0.00332	U	ng/L		0.00332	0.3	U	0.00E+00			
51MW1	2,3,7,8-TCDD	0.00332	U	ng/L		0.00332	1	U	0.00E+00			
51MW1	2,3,7,8-TCDF	0.00329	U	ng/L		0.00329	0.1	U	0.00E+00			
51MW1	OCDD	0.0376	J	ng/L		0.0376	0.0003	J	1.13E-05	51MW1	TCDD-TE_GW (ng/L)	1.13E-05
51MW1	OCDF	0.0167	U	ng/L		0.0167	0.0003	U	0.00E+00			
51MW2	1,2,3,4,6,7,8-HpCDD	0.0103	U	ng/L		0.0103	0.01	U	0.00E+00			
51MW2	1,2,3,4,6,7,8-HpCDF	0.00613	U	ng/L		0.00613	0.01	U	0.00E+00			
51MW2	1,2,3,4,7,8,9-HpCDF	0.00794	U	ng/L		0.00794	0.01	U	0.00E+00			
51MW2	1,2,3,4,7,8-HxCDD	0.0131	U	ng/L		0.0131	0.1	U	0.00E+00			
51MW2	1,2,3,4,7,8-HxCDF	0.00683	U	ng/L		0.00683	0.1	U	0.00E+00			
51MW2	1,2,3,6,7,8-HxCDD	0.0121	U	ng/L		0.0121	0.1	U	0.00E+00			
51MW2	1,2,3,6,7,8-HxCDF	0.00602	U	ng/L		0.00602	0.1	U	0.00E+00			
51MW2	1,2,3,7,8,9-HxCDD	0.0132	U	ng/L		0.0132	0.1	U	0.00E+00			
51MW2	1,2,3,7,8,9-HxCDF	0.00814	U	ng/L		0.00814	0.1	U	0.00E+00			
51MW2	1,2,3,7,8-PeCDD	0.00651	U	ng/L		0.00651	1	U	0.00E+00			
51MW2	1,2,3,7,8-PeCDF	0.0036	U	ng/L		0.0036	0.03	U	0.00E+00			
51MW2	2,3,4,6,7,8-HxCDF	0.00681	U	ng/L		0.00681	0.1	U	0.00E+00			
51MW2	2,3,4,7,8-PeCDF	0.00352	U	ng/L		0.00352	0.3	U	0.00E+00			
51MW2	2,3,7,8-TCDD	0.00368	U	ng/L		0.00368	1	U	0.00E+00			
51MW2	2,3,7,8-TCDF	0.00358	U	ng/L		0.00358	0.1	U	0.00E+00			
51MW2	OCDD	0.0208	U	ng/L		0.0208	0.0003	U	0.00E+00	51MW2	TCDD-TE_GW (ng/L)	0.00E+00
51MW2	OCDF	0.0166	U	ng/L		0.0166	0.0003	U	0.00E+00			
59MW01	1,2,3,4,6,7,8-HpCDD			ng/L	0.012	0.012	0.01	J	1.20E-04			
59MW01	1,2,3,4,6,7,8-HpCDF	0.00309	J	ng/L	0.0113	0.007195	0.01	J	7.20E-05			
59MW01	1,2,3,4,7,8,9-HpCDF			ng/L	0.0104	0.0104	0.01	J	1.04E-04			
59MW01	1,2,3,4,7,8-HxCDD			ng/L	0.0137	0.0137	0.1	J	1.37E-03			
59MW01	1,2,3,4,7,8-HxCDF	0.00307	J	ng/L	0.0144	0.008735	0.1	J	8.74E-04			
59MW01	1,2,3,6,7,8-HxCDD			ng/L	0.0125	0.0125	0.1	J	1.25E-03			
59MW01	1,2,3,6,7,8-HxCDF	0.00271	J	ng/L	0.0141	0.008405	0.1	J	8.41E-04			
59MW01	1,2,3,7,8,9-HxCDD			ng/L	0.013	0.013	0.1	J	1.30E-03			
59MW01	1,2,3,7,8,9-HxCDF	0.00253	J	ng/L	0.0137	0.008115	0.1	J	8.12E-04			
59MW01	1,2,3,7,8-PeCDD	0.00302	J	ng/L	0.0169	0.00996	1	J	9.96E-03			
59MW01	1,2,3,7,8-PeCDF	0.0037	J	ng/L	0.0178	0.01075	0.03	J	3.23E-04			
59MW01	2,3,4,6,7,8-HxCDF	0.0019	J	ng/L	0.011	0.00645	0.1	J	6.45E-04			
59MW01	2,3,4,7,8-PeCDF	0.00298	J	ng/L	0.0135	0.00824	0.3	J	2.47E-03			
59MW01	2,3,7,8-TCDD			ng/L	0.00595	0.00595	1	J	5.95E-03			
59MW01	2,3,7,8-TCDF			ng/L	0.00355	0.00355	0.1	J	3.55E-04			
59MW01	OCDD	0.00703	J	ng/L	0.0189	0.012965	0.0003	J	3.89E-06	59MW01	TCDD-TE_GW (ng/L)	2.65E-02
59MW01	OCDF			ng/L	0.0178	0.0178	0.0003	J	5.34E-06			

Highlighted Text: detected field duplicates are averaged with sample (all field dups were J-qualified)

Dioxin/Furan 2,3,7,8-TCDD Equivalents Calculations - Soil
SWMU 51 - Radford Army Ammunition Plant

SAMPNUMB	PARAMETER	VALUE	Units	LABQUAL	DVQUAL	DETECT_LIM	VALIDVALUE	AMATRIX	TE Needed?	TEF	ND = U	TCDD-TE			
51SB2A	1,2,3,4,6,7,8-HpCDD	33	ng/kg			0.76	33	SS	Y	0.01		0.33			
51SB2A	1,2,3,4,6,7,8-HpCDF	0.94	ng/kg	U	U	0.28	0.94	SS	Y	0.01	U	0			
51SB2A	1,2,3,4,7,8,9-HpCDF	0.94	ng/kg	U	U	0.36	0.94	SS	Y	0.01	U	0			
51SB2A	1,2,3,4,7,8-HxCDD	0.94	ng/kg	U	U	0.24	0.94	SS	Y	0.1	U	0			
51SB2A	1,2,3,4,7,8-HxCDF	0.94	ng/kg	U	UJ	0.19	0.94	SS	Y	0.1	U	0			
51SB2A	1,2,3,6,7,8-HxCDD	0.94	ng/kg	U	U	0.25	0.94	SS	Y	0.1	U	0			
51SB2A	1,2,3,6,7,8-HxCDF	0.94	ng/kg	U	U	0.21	0.94	SS	Y	0.1	U	0			
51SB2A	1,2,3,7,8,9-HxCDD	0.94	ng/kg	U	U	0.24	0.94	SS	Y	0.1	U	0			
51SB2A	1,2,3,7,8,9-HxCDF	0.94	ng/kg	U	U	0.16	0.94	SS	Y	0.1	U	0			
51SB2A	1,2,3,7,8-PeCDD	0.94	ng/kg	U	U	0.16	0.94	SS	Y	1	U	0			
51SB2A	1,2,3,7,8-PeCDF	0.94	ng/kg	U	U	0.15	0.94	SS	Y	0.03	U	0			
51SB2A	2,3,4,6,7,8-HxCDF	0.94	ng/kg	U	U	0.18	0.94	SS	Y	0.1	U	0			
51SB2A	2,3,4,7,8-PeCDF	0.94	ng/kg	U	U	0.24	0.94	SS	Y	0.3	U	0			
51SB2A	2,3,7,8-TCDD	0.24	ng/kg	A		0.24	0.24	SS	Y	1		0.24			
51SB2A	2,3,7,8-TCDF	0.19	ng/kg	U	U	0.15	0.19	SS	Y	0.1	U	0			
51SB2A	OCDD	3200	ng/kg			0.59	3200	SS	Y	0.0003		0.96	51SB2A	TCDD-TE	1.53
51SB2A	OCDF	1.9	ng/kg	U	U	0.45	1.9	SS	Y	0.0003	U	0			
51SB2B	1,2,3,4,6,7,8-HpCDD	1300	ng/kg			6.2	1300	SB	Y	0.01		13			
51SB2B	1,2,3,4,6,7,8-HpCDF	310	ng/kg			4	310	SB	Y	0.01		3.1			
51SB2B	1,2,3,4,7,8,9-HpCDF	31	ng/kg	J	J	6.9	31	SB	Y	0.01	J	0.31			
51SB2B	1,2,3,4,7,8-HxCDD	10	ng/kg	I	J	2.8	10	SB	Y	0.1	J	1			
51SB2B	1,2,3,4,7,8-HxCDF	74	ng/kg			2.3	74	SB	Y	0.1		7.4			
51SB2B	1,2,3,6,7,8-HxCDD	51	ng/kg			3	51	SB	Y	0.1		5.1			
51SB2B	1,2,3,6,7,8-HxCDF	22	ng/kg	J	J	1.7	22	SB	Y	0.1	J	2.2			
51SB2B	1,2,3,7,8,9-HxCDD	24	ng/kg	J	J	3.7	24	SB	Y	0.1	J	2.4			
51SB2B	1,2,3,7,8,9-HxCDF	14	ng/kg	J	J	3.4	14	SB	Y	0.1	J	1.4			
51SB2B	1,2,3,7,8-PeCDD	9.7	ng/kg	U	U	4.9	9.7	SB	Y	1	U	0			
51SB2B	1,2,3,7,8-PeCDF	31	ng/kg	J	J	1.5	31	SB	Y	0.03	J	0.93			
51SB2B	2,3,4,6,7,8-HxCDF	28	ng/kg	J	J	1.3	28	SB	Y	0.1	J	2.8			
51SB2B	2,3,4,7,8-PeCDF	72	ng/kg			1.5	72	SB	Y	0.3		21.6			
51SB2B	2,3,7,8-TCDD	4.5	ng/kg	A		4.5	4.5	SB	Y	1		4.5			
51SB2B	2,3,7,8-TCDF	120	ng/kg	A		2.1	120	SB	Y	0.1		12			
51SB2B	OCDD	15000	ng/kg			7	15000	SB	Y	0.0003		4.5	51SB2B	TCDD-TE	82.519
51SB2B	OCDF	930	ng/kg			4	930	SB	Y	0.0003		0.279			
51SB2C	1,2,3,4,6,7,8-HpCDD	91	ng/kg			2.1	91	SB	Y	0.01		0.91			
51SB2C	1,2,3,4,6,7,8-HpCDF	20	ng/kg	J	J	2	20	SB	Y	0.01	J	0.2			
51SB2C	1,2,3,4,7,8,9-HpCDF	9.3	ng/kg	U	U	3.1	9.3	SB	Y	0.01	U	0			
51SB2C	1,2,3,4,7,8-HxCDD	9.3	ng/kg	U	U	3	9.3	SB	Y	0.1	U	0			
51SB2C	1,2,3,4,7,8-HxCDF	9.3	ng/kg	U	U	1.5	9.3	SB	Y	0.1	U	0			
51SB2C	1,2,3,6,7,8-HxCDD	9.3	ng/kg	U	U	3.1	9.3	SB	Y	0.1	U	0			
51SB2C	1,2,3,6,7,8-HxCDF	9.3	ng/kg	U	U	1.4	9.3	SB	Y	0.1	U	0			
51SB2C	1,2,3,7,8,9-HxCDD	9.3	ng/kg	U	U	3.1	9.3	SB	Y	0.1	U	0			
51SB2C	1,2,3,7,8,9-HxCDF	9.3	ng/kg	U	U	1.8	9.3	SB	Y	0.1	U	0			
51SB2C	1,2,3,7,8-PeCDD	9.3	ng/kg	U	U	2.5	9.3	SB	Y	1	U	0			
51SB2C	1,2,3,7,8-PeCDF	9.3	ng/kg	U	U	0.85	9.3	SB	Y	0.03	U	0			
51SB2C	2,3,4,6,7,8-HxCDF	9.3	ng/kg	U	U	1.9	9.3	SB	Y	0.1	U	0			
51SB2C	2,3,4,7,8-PeCDF	9.3	ng/kg	U	U	0.96	9.3	SB	Y	0.3	U	0			
51SB2C	2,3,7,8-TCDD	1.9	ng/kg	U	U	1.9	1.9	SB	Y	1	U	0			
51SB2C	2,3,7,8-TCDF	8.2	ng/kg	AJ	J	2	8.2	SB	Y	0.1	J	0.82			
51SB2C	OCDD	1300	ng/kg			5.5	1300	SB	Y	0.0003		0.39	51SB2C	TCDD-TE	2.3401
51SB2C	OCDF	67	ng/kg	J	J	4.5	67	SB	Y	0.0003	J	0.0201			
51SB2D	1,2,3,4,6,7,8-HpCDD	0.98	ng/kg	U	U	0.11	0.98	SB	Y	0.01	U	0			
51SB2D	1,2,3,4,6,7,8-HpCDF	0.98	ng/kg	U	U	0.11	0.98	SB	Y	0.01	U	0			
51SB2D	1,2,3,4,7,8,9-HpCDF	0.98	ng/kg	U	U	0.16	0.98	SB	Y	0.01	U	0			
51SB2D	1,2,3,4,7,8-HxCDD	0.98	ng/kg	U	U	0.077	0.98	SB	Y	0.1	U	0			
51SB2D	1,2,3,4,7,8-HxCDF	0.98	ng/kg	U	U	0.045	0.98	SB	Y	0.1	U	0			
51SB2D	1,2,3,6,7,8-HxCDD	0.98	ng/kg	U	U	0.073	0.98	SB	Y	0.1	U	0			
51SB2D	1,2,3,6,7,8-HxCDF	0.98	ng/kg	U	U	0.058	0.98	SB	Y	0.1	U	0			
51SB2D	1,2,3,7,8,9-HxCDD	0.98	ng/kg	U	U	0.086	0.98	SB	Y	0.1	U	0			
51SB2D	1,2,3,7,8,9-HxCDF	0.98	ng/kg	U	U	0.064	0.98	SB	Y	0.1	U	0			
51SB2D	1,2,3,7,8-PeCDD	0.98	ng/kg	U	U	0.17	0.98	SB	Y	1	U	0			
51SB2D	1,2,3,7,8-PeCDF	0.98	ng/kg	U	U	0.053	0.98	SB	Y	0.03	U	0			
51SB2D	2,3,4,6,7,8-HxCDF	0.98	ng/kg	U	U	0.056	0.98	SB	Y	0.1	U	0			
51SB2D	2,3,4,7,8-PeCDF	0.98	ng/kg	U	U	0.061	0.98	SB	Y	0.3	U	0			
51SB2D	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.11	0.2	SB	Y	1	U	0			
51SB2D	2,3,7,8-TCDF	0.2	ng/kg	U	U	0.053	0.2	SB	Y	0.1	U	0			
51SB2D	OCDD	2	ng/kg	U	U	0.12	2	SB	Y	0.0003	U	0	51SB2D	TCDD-TE	0
51SB2D	OCDF	2	ng/kg	U	U	0.13	2	SB	Y	0.0003	U	0			

Dioxin/Furan 2,3,7,8-TCDD Equivalents Calculations - Soil
SWMU 51 - Radford Army Ammunition Plant

SAMPNUMB	PARAMETER	VALUE	Units	LABQUAL	DVQUAL	DETECT_LIM	VALIDVALUE	AMATRIX	TE Needed?	TEF	ND = U	TCDD-TE			
51SB3A	1,2,3,4,6,7,8-HpCDD	30	ng/kg			0.35	30	SS	Y	0.01		0.3			
51SB3A	1,2,3,4,6,7,8-HpCDF	1.2	ng/kg	J	J	0.082	1.2	SS	Y	0.01	J	0.012			
51SB3A	1,2,3,4,7,8,9-HpCDF	0.99	ng/kg	U	U	0.068	0.99	SS	Y	0.01	U	0			
51SB3A	1,2,3,4,7,8-HxCDD	0.99	ng/kg	U	U	0.099	0.99	SS	Y	0.1	U	0			
51SB3A	1,2,3,4,7,8-HxCDF	0.99	ng/kg	U	U	0.057	0.99	SS	Y	0.1	U	0			
51SB3A	1,2,3,6,7,8-HxCDD	0.99	ng/kg	U	U	0.083	0.99	SS	Y	0.1	U	0			
51SB3A	1,2,3,6,7,8-HxCDF	0.99	ng/kg	U	U	0.06	0.99	SS	Y	0.1	U	0			
51SB3A	1,2,3,7,8,9-HxCDD	0.99	ng/kg	U	U	0.11	0.99	SS	Y	0.1	U	0			
51SB3A	1,2,3,7,8,9-HxCDF	0.99	ng/kg	U	U	0.066	0.99	SS	Y	0.1	U	0			
51SB3A	1,2,3,7,8-PeCDD	0.99	ng/kg	U	U	0.11	0.99	SS	Y	1	U	0			
51SB3A	1,2,3,7,8-PeCDF	0.99	ng/kg	U	U	0.051	0.99	SS	Y	0.03	U	0			
51SB3A	2,3,4,6,7,8-HxCDF	0.99	ng/kg	U	U	0.054	0.99	SS	Y	0.1	U	0			
51SB3A	2,3,4,7,8-PeCDF	0.99	ng/kg	U	U	0.058	0.99	SS	Y	0.3	U	0			
51SB3A	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.11	0.2	SS	Y	1	U	0			
51SB3A	2,3,7,8-TCDF	0.2	ng/kg	U	U	0.07	0.2	SS	Y	0.1	U	0			
51SB3A	OCDD	4900	ng/kg			0.11	4900	SS	Y	0.0003		1.47	51SB3A	TCDD-TE	1.78263
51SB3A	OCDF	2.1	ng/kg	J	J	0.096	2.1	SS	Y	0.0003	J	0.00063			
51SB3B	1,2,3,4,6,7,8-HpCDD	1600	ng/kg	A		1.1	1600	SB	Y	0.01		16			
51SB3B	1,2,3,4,6,7,8-HpCDF	370	ng/kg			0.36	370	SB	Y	0.01		3.7			
51SB3B	1,2,3,4,7,8,9-HpCDF	42	ng/kg			0.21	42	SB	Y	0.01		0.42			
51SB3B	1,2,3,4,7,8-HxCDD	12	ng/kg			0.91	12	SB	Y	0.1		1.2			
51SB3B	1,2,3,4,7,8-HxCDF	91	ng/kg		J	0.6	91	SB	Y	0.1	J	9.1			
51SB3B	1,2,3,6,7,8-HxCDD	63	ng/kg		J	0.94	63	SB	Y	0.1	J	6.3			
51SB3B	1,2,3,6,7,8-HxCDF	31	ng/kg		J	0.83	31	SB	Y	0.1	J	3.1			
51SB3B	1,2,3,7,8,9-HxCDD	78	ng/kg			0.51	78	SB	Y	0.1		7.8			
51SB3B	1,2,3,7,8,9-HxCDF	15	ng/kg			0.38	15	SB	Y	0.1		1.5			
51SB3B	1,2,3,7,8-PeCDD	5.5	ng/kg			0.18	5.5	SB	Y	1		5.5			
51SB3B	1,2,3,7,8-PeCDF	37	ng/kg			0.29	37	SB	Y	0.03		1.11			
51SB3B	2,3,4,6,7,8-HxCDF	26	ng/kg			0.29	26	SB	Y	0.1		2.6			
51SB3B	2,3,4,7,8-PeCDF	90	ng/kg			0.51	90	SB	Y	0.3		27			
51SB3B	2,3,7,8-TCDD	0.74	ng/kg	J	J	0.18	0.74	SB	Y	1	J	0.74			
51SB3B	2,3,7,8-TCDF	160	ng/kg	A		0.22	160	SB	Y	0.1		16			
51SB3B	OCDD	15000	ng/kg			0.14	15000	SB	Y	0.0003		4.5	51SB3B	TCDD-TE	106.849
51SB3B	OCDF	930	ng/kg			0.15	930	SB	Y	0.0003		0.279			
51SB3C	1,2,3,4,6,7,8-HpCDD	22	ng/kg			0.1	22	SB	Y	0.01		0.22			
51SB3C	1,2,3,4,6,7,8-HpCDF	3.5	ng/kg	J	J	0.084	3.5	SB	Y	0.01	J	0.035			
51SB3C	1,2,3,4,7,8,9-HpCDF	0.94	ng/kg	U	U	0.084	0.94	SB	Y	0.01	U	0			
51SB3C	1,2,3,4,7,8-HxCDD	0.94	ng/kg	U	U	0.075	0.94	SB	Y	0.1	U	0			
51SB3C	1,2,3,4,7,8-HxCDF	0.94	ng/kg	U	U	0.075	0.94	SB	Y	0.1	U	0			
51SB3C	1,2,3,6,7,8-HxCDD	0.94	ng/kg	U	U	0.069	0.94	SB	Y	0.1	U	0			
51SB3C	1,2,3,6,7,8-HxCDF	0.94	ng/kg	U	U	0.081	0.94	SB	Y	0.1	U	0			
51SB3C	1,2,3,7,8,9-HxCDD	0.94	ng/kg	U	U	0.083	0.94	SB	Y	0.1	U	0			
51SB3C	1,2,3,7,8,9-HxCDF	0.94	ng/kg	U	U	0.055	0.94	SB	Y	0.1	U	0			
51SB3C	1,2,3,7,8-PeCDD	0.94	ng/kg	U	U	0.14	0.94	SB	Y	1	U	0			
51SB3C	1,2,3,7,8-PeCDF	0.94	ng/kg	U	U	0.08	0.94	SB	Y	0.03	U	0			
51SB3C	2,3,4,6,7,8-HxCDF	0.94	ng/kg	U	U	0.057	0.94	SB	Y	0.1	U	0			
51SB3C	2,3,4,7,8-PeCDF	0.94	ng/kg	U	U	0.091	0.94	SB	Y	0.3	U	0			
51SB3C	2,3,7,8-TCDD	0.19	ng/kg	U	U	0.17	0.19	SB	Y	1	U	0			
51SB3C	2,3,7,8-TCDF	1.4	ng/kg			0.1	1.4	SB	Y	0.1		0.14			
51SB3C	OCDD	690	ng/kg			0.22	690	SB	Y	0.0003		0.207	51SB3C	TCDD-TE	0.6053
51SB3C	OCDF	11	ng/kg			0.1	11	SB	Y	0.0003		0.0033			
51SB3D	1,2,3,4,6,7,8-HpCDD	0.98	ng/kg	U	U	0.058	0.98	SB	Y	0.01	U	0			
51SB3D	1,2,3,4,6,7,8-HpCDF	0.98	ng/kg	U	U	0.027	0.98	SB	Y	0.01	U	0			
51SB3D	1,2,3,4,7,8,9-HpCDF	0.98	ng/kg	U	U	0.047	0.98	SB	Y	0.01	U	0			
51SB3D	1,2,3,4,7,8-HxCDD	0.98	ng/kg	U	U	0.043	0.98	SB	Y	0.1	U	0			
51SB3D	1,2,3,4,7,8-HxCDF	0.98	ng/kg	U	U	0.044	0.98	SB	Y	0.1	U	0			
51SB3D	1,2,3,6,7,8-HxCDD	0.98	ng/kg	U	U	0.045	0.98	SB	Y	0.1	U	0			
51SB3D	1,2,3,6,7,8-HxCDF	0.98	ng/kg	U	U	0.042	0.98	SB	Y	0.1	U	0			
51SB3D	1,2,3,7,8,9-HxCDD	0.98	ng/kg	U	U	0.056	0.98	SB	Y	0.1	U	0			
51SB3D	1,2,3,7,8,9-HxCDF	0.98	ng/kg	U	U	0.049	0.98	SB	Y	0.1	U	0			
51SB3D	1,2,3,7,8-PeCDD	0.98	ng/kg	U	U	0.12	0.98	SB	Y	1	U	0			
51SB3D	1,2,3,7,8-PeCDF	0.98	ng/kg	U	U	0.069	0.98	SB	Y	0.03	U	0			
51SB3D	2,3,4,6,7,8-HxCDF	0.98	ng/kg	U	U	0.043	0.98	SB	Y	0.1	U	0			
51SB3D	2,3,4,7,8-PeCDF	0.98	ng/kg	U	U	0.065	0.98	SB	Y	0.3	U	0			
51SB3D	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.11	0.2	SB	Y	1	U	0			
51SB3D	2,3,7,8-TCDF	0.2	ng/kg	U	U	0.091	0.2	SB	Y	0.1	U	0	51SB3D	TCDD-TE	0
51SB3D	OCDF	2	ng/kg	U	UJ	0.057	2	SB	Y	0.0003	U	0			

Dioxin/Furan 2,3,7,8-TCDD Equivalents Calculations - Soil
SWMU 51 - Radford Army Ammunition Plant

SAMPNUMB	PARAMETER	VALUE	Units	LABQUAL	DVQUAL	DETECT_LIM	VALIDVALUE	AMATRIX	TE Needed?	TEF	ND = U	TCDD-TE			
51SB4A	1,2,3,4,6,7,8-HpCDD	20	ng/kg			0.27	20	SS	Y	0.01		0.2			
51SB4A	1,2,3,4,6,7,8-HpCDF	0.99	ng/kg	U	U	0.17	0.99	SS	Y	0.01	U	0			
51SB4A	1,2,3,4,7,8,9-HpCDF	0.99	ng/kg	U	U	0.31	0.99	SS	Y	0.01	U	0			
51SB4A	1,2,3,4,7,8-HxCDD	0.99	ng/kg	U	U	0.1	0.99	SS	Y	0.1	U	0			
51SB4A	1,2,3,4,7,8-HxCDF	0.99	ng/kg	U	U	0.096	0.99	SS	Y	0.1	U	0			
51SB4A	1,2,3,6,7,8-HxCDD	0.99	ng/kg	U	U	0.15	0.99	SS	Y	0.1	U	0			
51SB4A	1,2,3,6,7,8-HxCDF	0.99	ng/kg	U	U	0.11	0.99	SS	Y	0.1	U	0			
51SB4A	1,2,3,7,8,9-HxCDD	0.99	ng/kg	U	U	0.12	0.99	SS	Y	0.1	U	0			
51SB4A	1,2,3,7,8,9-HxCDF	0.99	ng/kg	U	U	0.11	0.99	SS	Y	0.1	U	0			
51SB4A	1,2,3,7,8-PeCDD	0.99	ng/kg	U	U	0.082	0.99	SS	Y	1	U	0			
51SB4A	1,2,3,7,8-PeCDF	0.99	ng/kg	U	U	0.1	0.99	SS	Y	0.03	U	0			
51SB4A	2,3,4,6,7,8-HxCDF	0.99	ng/kg	U	U	0.069	0.99	SS	Y	0.1	U	0			
51SB4A	2,3,4,7,8-PeCDF	0.99	ng/kg	U	U	0.069	0.99	SS	Y	0.3	U	0			
51SB4A	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.16	0.2	SS	Y	1	U	0			
51SB4A	2,3,7,8-TCDF	0.2	ng/kg	U	U	0.086	0.2	SS	Y	0.1	U	0			
51SB4A	OCDD	1900	ng/kg			0.15	1900	SS	Y	0.0003		0.57	51SB4A	TCDD-TE	0.77
51SB4A	OCDF	2	ng/kg	U	U	0.11	2	SS	Y	0.0003	U	0			
51SB4B	1,2,3,4,6,7,8-HpCDD	1900	ng/kg	A		3.4	1900	SB	Y	0.01		19			
51SB4B	1,2,3,4,6,7,8-HpCDF	400	ng/kg	A		1.7	400	SB	Y	0.01		4			
51SB4B	1,2,3,4,7,8,9-HpCDF	47	ng/kg	A		2.3	47	SB	Y	0.01		0.47			
51SB4B	1,2,3,4,7,8-HxCDD	16	ng/kg			0.83	16	SB	Y	0.1		1.6			
51SB4B	1,2,3,4,7,8-HxCDF	82	ng/kg			0.25	82	SB	Y	0.1		8.2			
51SB4B	1,2,3,6,7,8-HxCDD	63	ng/kg			0.73	63	SB	Y	0.1		6.3			
51SB4B	1,2,3,6,7,8-HxCDF	34	ng/kg			0.47	34	SB	Y	0.1		3.4			
51SB4B	1,2,3,7,8,9-HxCDD	31	ng/kg			0.72	31	SB	Y	0.1		3.1			
51SB4B	1,2,3,7,8,9-HxCDF	17	ng/kg			0.87	17	SB	Y	0.1		1.7			
51SB4B	1,2,3,7,8-PeCDD	6	ng/kg			0.55	6	SB	Y	1		6			
51SB4B	1,2,3,7,8-PeCDF	43	ng/kg			0.22	43	SB	Y	0.03		1.29			
51SB4B	2,3,4,6,7,8-HxCDF	32	ng/kg			0.66	32	SB	Y	0.1		3.2			
51SB4B	2,3,4,7,8-PeCDF	88	ng/kg			0.19	88	SB	Y	0.3		26.4			
51SB4B	2,3,7,8-TCDD	1.1	ng/kg	IA	J	0.53	1.1	SB	Y	1	J	1.1			
51SB4B	2,3,7,8-TCDF	130	ng/kg	A		0.54	130	SB	Y	0.1		13			
51SB4B	OCDD	17000	ng/kg			1.1	17000	SB	Y	0.0003		5.1	51SB4B	TCDD-TE	104.19
51SB4B	OCDF	1100	ng/kg			1.1	1100	SB	Y	0.0003		0.33			
51SB4C	1,2,3,4,6,7,8-HpCDD	6.6	ng/kg			0.52	6.6	SB	Y	0.01		0.066			
51SB4C	1,2,3,4,6,7,8-HpCDF	0.98	ng/kg	U	U	0.33	0.98	SB	Y	0.01	U	0			
51SB4C	1,2,3,4,7,8,9-HpCDF	0.98	ng/kg	U	U	0.64	0.98	SB	Y	0.01	U	0			
51SB4C	1,2,3,4,7,8-HxCDD	0.98	ng/kg	U	U	0.34	0.98	SB	Y	0.1	U	0			
51SB4C	1,2,3,4,7,8-HxCDF	0.98	ng/kg	U	U	0.17	0.98	SB	Y	0.1	U	0			
51SB4C	1,2,3,6,7,8-HxCDD	0.98	ng/kg	U	U	0.27	0.98	SB	Y	0.1	U	0			
51SB4C	1,2,3,6,7,8-HxCDF	0.98	ng/kg	U	U	0.15	0.98	SB	Y	0.1	U	0			
51SB4C	1,2,3,7,8,9-HxCDD	0.98	ng/kg	U	U	0.25	0.98	SB	Y	0.1	U	0			
51SB4C	1,2,3,7,8,9-HxCDF	0.98	ng/kg	U	U	0.21	0.98	SB	Y	0.1	U	0			
51SB4C	1,2,3,7,8-PeCDD	0.98	ng/kg	U	U	0.22	0.98	SB	Y	1	U	0			
51SB4C	1,2,3,7,8-PeCDF	0.98	ng/kg	U	U	0.29	0.98	SB	Y	0.03	U	0			
51SB4C	2,3,4,6,7,8-HxCDF	0.98	ng/kg	U	U	0.14	0.98	SB	Y	0.1	U	0			
51SB4C	2,3,4,7,8-PeCDF	0.98	ng/kg	U	U	0.28	0.98	SB	Y	0.3	U	0			
51SB4C	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.31	0.2	SB	Y	1	U	0			
51SB4C	2,3,7,8-TCDF	0.47	ng/kg	J	J	0.18	0.47	SB	Y	0.1	J	0.047			
51SB4C	OCDD	130	ng/kg			0.74	130	SB	Y	0.0003		0.039	51SB4C	TCDD-TE	0.15296
51SB4C	OCDF	3.2	ng/kg	J	J	0.4	3.2	SB	Y	0.0003	J	0.00096			
51SB4D	1,2,3,4,6,7,8-HpCDF	0.99	ng/kg	U	U	0.08	0.99	SB	Y	0.01	U	0			
51SB4D	1,2,3,4,7,8,9-HpCDF	0.99	ng/kg	U	U	0.11	0.99	SB	Y	0.01	U	0			
51SB4D	1,2,3,4,7,8-HxCDD	0.99	ng/kg	U	U	0.13	0.99	SB	Y	0.1	U	0			
51SB4D	1,2,3,4,7,8-HxCDF	0.99	ng/kg	U	U	0.059	0.99	SB	Y	0.1	U	0			
51SB4D	1,2,3,6,7,8-HxCDD	0.99	ng/kg	U	U	0.12	0.99	SB	Y	0.1	U	0			
51SB4D	1,2,3,6,7,8-HxCDF	0.99	ng/kg	U	U	0.073	0.99	SB	Y	0.1	U	0			
51SB4D	1,2,3,7,8,9-HxCDD	0.99	ng/kg	U	U	0.15	0.99	SB	Y	0.1	U	0			
51SB4D	1,2,3,7,8,9-HxCDF	0.99	ng/kg	U	U	0.12	0.99	SB	Y	0.1	U	0			
51SB4D	1,2,3,7,8-PeCDD	0.99	ng/kg	U	U	0.11	0.99	SB	Y	1	U	0			
51SB4D	1,2,3,7,8-PeCDF	0.99	ng/kg	U	U	0.048	0.99	SB	Y	0.03	U	0			
51SB4D	2,3,4,6,7,8-HxCDF	0.99	ng/kg	U	U	0.093	0.99	SB	Y	0.1	U	0			
51SB4D	2,3,4,7,8-PeCDF	0.99	ng/kg	U	U	0.05	0.99	SB	Y	0.3	U	0			
51SB4D	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.14	0.2	SB	Y	1	U	0			
51SB4D	2,3,7,8-TCDF	0.2	ng/kg	U	U	0.082	0.2	SB	Y	0.1	U	0	51SB4D	TCDD-TE	0
51SB4D	OCDF	2	ng/kg	U	U	0.14	2	SB	Y	0.0003	U	0			

Dioxin/Furan 2,3,7,8-TCDD Equivalents Calculations - Soil
SWMU 51 - Radford Army Ammunition Plant

SAMPNUMB	PARAMETER	VALUE	Units	LABQUAL	DVQUAL	DETECT_LIM	VALIDVALUE	AMATRIX	TE Needed?	TEF	ND = U	TCDD-TE			
51SB5A	1,2,3,4,6,7,8-HpCDD	38	ng/kg			0.25	38	SS	Y	0.01		0.38			
51SB5A	1,2,3,4,6,7,8-HpCDF	0.99	ng/kg	U	U	0.063	0.99	SS	Y	0.01	U	0			
51SB5A	1,2,3,4,7,8,9-HpCDF	0.99	ng/kg	U	U	0.075	0.99	SS	Y	0.01	U	0			
51SB5A	1,2,3,4,7,8-HxCDD	0.99	ng/kg	U	U	0.076	0.99	SS	Y	0.1	U	0			
51SB5A	1,2,3,4,7,8-HxCDF	0.99	ng/kg	U	U	0.048	0.99	SS	Y	0.1	U	0			
51SB5A	1,2,3,6,7,8-HxCDD	0.99	ng/kg	U	U	0.1	0.99	SS	Y	0.1	U	0			
51SB5A	1,2,3,6,7,8-HxCDF	0.99	ng/kg	U	U	0.049	0.99	SS	Y	0.1	U	0			
51SB5A	1,2,3,7,8,9-HxCDD	0.99	ng/kg	U	U	0.09	0.99	SS	Y	0.1	U	0			
51SB5A	1,2,3,7,8,9-HxCDF	0.99	ng/kg	U	U	0.045	0.99	SS	Y	0.1	U	0			
51SB5A	1,2,3,7,8-PeCDD	0.99	ng/kg	U	U	0.093	0.99	SS	Y	1	U	0			
51SB5A	1,2,3,7,8-PeCDF	0.99	ng/kg	U	U	0.034	0.99	SS	Y	0.03	U	0			
51SB5A	2,3,4,6,7,8-HxCDF	0.99	ng/kg	U	U	0.041	0.99	SS	Y	0.1	U	0			
51SB5A	2,3,4,7,8-PeCDF	0.99	ng/kg	U	U	0.04	0.99	SS	Y	0.3	U	0			
51SB5A	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.075	0.2	SS	Y	1	U	0			
51SB5A	2,3,7,8-TCDF	0.2	ng/kg	U	U	0.054	0.2	SS	Y	0.1	U	0			
51SB5A	OCDD	5900	ng/kg			0.16	5900	SS	Y	0.0003		1.77	51SB5A	TCDD-TE	2.15
51SB5A	OCDF	2	ng/kg	U	U	0.12	2	SS	Y	0.0003	U	0			
51SB5B	1,2,3,4,6,7,8-HpCDD	1600	ng/kg			0.31	1600	SB	Y	0.01		16			
51SB5B	1,2,3,4,6,7,8-HpCDF	360	ng/kg			0.93	360	SB	Y	0.01		3.6			
51SB5B	1,2,3,4,7,8,9-HpCDF	42	ng/kg			0.9	42	SB	Y	0.01		0.42			
51SB5B	1,2,3,4,7,8-HxCDD	14	ng/kg			0.53	14	SB	Y	0.1		1.4			
51SB5B	1,2,3,4,7,8-HxCDF	78	ng/kg			0.56	78	SB	Y	0.1		7.8			
51SB5B	1,2,3,6,7,8-HxCDD	57	ng/kg			0.46	57	SB	Y	0.1		5.7			
51SB5B	1,2,3,6,7,8-HxCDF	31	ng/kg			0.33	31	SB	Y	0.1		3.1			
51SB5B	1,2,3,7,8,9-HxCDD	28	ng/kg			0.44	28	SB	Y	0.1		2.8			
51SB5B	1,2,3,7,8,9-HxCDF	12	ng/kg			0.5	12	SB	Y	0.1		1.2			
51SB5B	1,2,3,7,8-PeCDD	4.6	ng/kg	J	J	0.75	4.6	SB	Y	1	J	4.6			
51SB5B	1,2,3,7,8-PeCDF	40	ng/kg			0.31	40	SB	Y	0.03		1.2			
51SB5B	2,3,4,6,7,8-HxCDF	34	ng/kg			0.74	34	SB	Y	0.1		3.4			
51SB5B	2,3,4,7,8-PeCDF	85	ng/kg			0.38	85	SB	Y	0.3		25.5			
51SB5B	2,3,7,8-TCDD	0.48	ng/kg	I	J	0.2	0.48	SB	Y	1	J	0.48			
51SB5B	2,3,7,8-TCDF	160	ng/kg			0.17	160	SB	Y	0.1		16			
51SB5B	OCDD	16000	ng/kg			0.34	16000	SB	Y	0.0003		4.8	51SB5B	TCDD-TE	98.282
51SB5B	OCDF	940	ng/kg			0.36	940	SB	Y	0.0003		0.282			
51SB5C	1,2,3,4,6,7,8-HpCDD	6.3	ng/kg			0.3	6.3	SB	Y	0.01		0.063			
51SB5C	1,2,3,4,6,7,8-HpCDF	1	ng/kg	J	J	0.2	1	SB	Y	0.01	J	0.01			
51SB5C	1,2,3,4,7,8,9-HpCDF	0.98	ng/kg	U	U	0.2	0.98	SB	Y	0.01	U	0			
51SB5C	1,2,3,4,7,8-HxCDD	0.98	ng/kg	U	U	0.12	0.98	SB	Y	0.1	U	0			
51SB5C	1,2,3,4,7,8-HxCDF	0.98	ng/kg	U	U	0.067	0.98	SB	Y	0.1	U	0			
51SB5C	1,2,3,6,7,8-HxCDD	0.98	ng/kg	U	U	0.13	0.98	SB	Y	0.1	U	0			
51SB5C	1,2,3,6,7,8-HxCDF	0.98	ng/kg	U	U	0.065	0.98	SB	Y	0.1	U	0			
51SB5C	1,2,3,7,8,9-HxCDD	0.98	ng/kg	U	U	0.12	0.98	SB	Y	0.1	U	0			
51SB5C	1,2,3,7,8,9-HxCDF	0.98	ng/kg	U	U	0.15	0.98	SB	Y	0.1	U	0			
51SB5C	1,2,3,7,8-PeCDD	0.98	ng/kg	U	U	0.14	0.98	SB	Y	1	U	0			
51SB5C	1,2,3,7,8-PeCDF	0.98	ng/kg	U	U	0.086	0.98	SB	Y	0.03	U	0			
51SB5C	2,3,4,6,7,8-HxCDF	0.98	ng/kg	U	U	0.062	0.98	SB	Y	0.1	U	0			
51SB5C	2,3,4,7,8-PeCDF	0.98	ng/kg	U	U	0.082	0.98	SB	Y	0.3	U	0			
51SB5C	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.11	0.2	SB	Y	1	U	0			
51SB5C	2,3,7,8-TCDF	0.37	ng/kg	J	J	0.088	0.37	SB	Y	0.1	J	0.037			
51SB5C	OCDD	110	ng/kg			0.3	110	SB	Y	0.0003		0.033	51SB5C	TCDD-TE	0.14396
51SB5C	OCDF	3.2	ng/kg	J	J	0.16	3.2	SB	Y	0.0003	J	0.00096			
51SB5D	1,2,3,4,6,7,8-HpCDD	0.99	ng/kg	U	U	0.12	0.99	SB	Y	0.01	U	0			
51SB5D	1,2,3,4,6,7,8-HpCDF	0.99	ng/kg	U	U	0.062	0.99	SB	Y	0.01	U	0			
51SB5D	1,2,3,4,7,8,9-HpCDF	0.99	ng/kg	U	U	0.083	0.99	SB	Y	0.01	U	0			
51SB5D	1,2,3,4,7,8-HxCDD	0.99	ng/kg	U	U	0.15	0.99	SB	Y	0.1	U	0			
51SB5D	1,2,3,4,7,8-HxCDF	0.99	ng/kg	U	U	0.13	0.99	SB	Y	0.1	U	0			
51SB5D	1,2,3,6,7,8-HxCDD	0.99	ng/kg	U	U	0.05	0.99	SB	Y	0.1	U	0			
51SB5D	1,2,3,6,7,8-HxCDF	0.99	ng/kg	U	U	0.13	0.99	SB	Y	0.1	U	0			
51SB5D	1,2,3,7,8,9-HxCDD	0.99	ng/kg	U	U	0.064	0.99	SB	Y	0.1	U	0			
51SB5D	1,2,3,7,8,9-HxCDF	0.99	ng/kg	U	U	0.17	0.99	SB	Y	0.1	U	0			
51SB5D	1,2,3,7,8-PeCDD	0.99	ng/kg	U	U	0.078	0.99	SB	Y	1	U	0			
51SB5D	1,2,3,7,8-PeCDF	0.99	ng/kg	U	U	0.077	0.99	SB	Y	0.03	U	0			
51SB5D	2,3,4,6,7,8-HxCDF	0.99	ng/kg	U	U	0.11	0.99	SB	Y	0.1	U	0			
51SB5D	2,3,4,7,8-PeCDF	0.99	ng/kg	U	U	0.063	0.99	SB	Y	0.3	U	0			
51SB5D	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.11	0.2	SB	Y	1	U	0			
51SB5D	2,3,7,8-TCDF	0.2	ng/kg	U	U	0.065	0.2	SB	Y	0.1	U	0	51SB5D	TCDD-TE	0
51SB5D	OCDF	2	ng/kg	U	U	0.089	2	SB	Y	0.0003	U	0			

Dioxin/Furan 2,3,7,8-TCDD Equivalents Calculations - Soil
SWMU 51 - Radford Army Ammunition Plant

SAMPNUMB	PARAMETER	VALUE	Units	LABQUAL	DVQUAL	DETECT_LIM	VALIDVALUE	AMATRIX	TE Needed?	TEF	ND = U	TCDD-TE			
51SB6A	1,2,3,4,6,7,8-HpCDD	30	ng/kg			0.33	30	SS	Y	0.01		0.3			
51SB6A	1,2,3,4,6,7,8-HpCDF	0.97	ng/kg	U	U	0.079	0.97	SS	Y	0.01	U	0			
51SB6A	1,2,3,4,7,8,9-HpCDF	0.97	ng/kg	U	U	0.092	0.97	SS	Y	0.01	U	0			
51SB6A	1,2,3,4,7,8-HxCDD	0.97	ng/kg	U	U	0.11	0.97	SS	Y	0.1	U	0			
51SB6A	1,2,3,4,7,8-HxCDF	0.97	ng/kg	U	U	0.052	0.97	SS	Y	0.1	U	0			
51SB6A	1,2,3,6,7,8-HxCDD	0.97	ng/kg	U	U	0.094	0.97	SS	Y	0.1	U	0			
51SB6A	1,2,3,6,7,8-HxCDF	0.97	ng/kg	U	U	0.055	0.97	SS	Y	0.1	U	0			
51SB6A	1,2,3,7,8,9-HxCDD	0.97	ng/kg	U	U	0.077	0.97	SS	Y	0.1	U	0			
51SB6A	1,2,3,7,8,9-HxCDF	0.97	ng/kg	U	U	0.051	0.97	SS	Y	0.1	U	0			
51SB6A	1,2,3,7,8-PeCDD	0.97	ng/kg	U	U	0.07	0.97	SS	Y	1	U	0			
51SB6A	1,2,3,7,8-PeCDF	0.97	ng/kg	U	U	0.092	0.97	SS	Y	0.03	U	0			
51SB6A	2,3,4,6,7,8-HxCDF	0.97	ng/kg	U	U	0.045	0.97	SS	Y	0.1	U	0			
51SB6A	2,3,4,7,8-PeCDF	0.97	ng/kg	U	U	0.064	0.97	SS	Y	0.3	U	0			
51SB6A	2,3,7,8-TCDD	0.19	ng/kg	U	U	0.082	0.19	SS	Y	1	U	0			
51SB6A	2,3,7,8-TCDF	0.19	ng/kg	U	U	0.061	0.19	SS	Y	0.1	U	0			
51SB6A	OCDD	4400	ng/kg			0.11	4400	SS	Y	0.0003		1.32	51SB6A	TCDD-TE	1.62069
51SB6A	OCDF	2.3	ng/kg	J	J	0.11	2.3	SS	Y	0.0003	J	0.00069			
51SB6B	1,2,3,4,6,7,8-HpCDD	2800	ng/kg			0.58	2800	SB	Y	0.01		28			
51SB6B	1,2,3,4,6,7,8-HpCDF	970	ng/kg			0.44	970	SB	Y	0.01		9.7			
51SB6B	1,2,3,4,7,8,9-HpCDF	55	ng/kg	A		1.3	55	SB	Y	0.01		0.55			
51SB6B	1,2,3,4,7,8-HxCDD	46	ng/kg			0.88	46	SB	Y	0.1		4.6			
51SB6B	1,2,3,4,7,8-HxCDF	130	ng/kg	E	J	0.87	130	SB	Y	0.1	J	13			
51SB6B	1,2,3,6,7,8-HxCDD	120	ng/kg			0.5	120	SB	Y	0.1		12			
51SB6B	1,2,3,6,7,8-HxCDF	41	ng/kg			0.39	41	SB	Y	0.1		4.1			
51SB6B	1,2,3,7,8,9-HxCDD	86	ng/kg			0.48	86	SB	Y	0.1		8.6			
51SB6B	1,2,3,7,8,9-HxCDF	10	ng/kg			0.43	10	SB	Y	0.1		1			
51SB6B	1,2,3,7,8-PeCDD	27	ng/kg			0.52	27	SB	Y	1		27			
51SB6B	1,2,3,7,8-PeCDF	22	ng/kg	E	J	0.36	22	SB	Y	0.03	J	0.66			
51SB6B	2,3,4,6,7,8-HxCDF	52	ng/kg			0.58	52	SB	Y	0.1		5.2			
51SB6B	2,3,4,7,8-PeCDF	49	ng/kg	E	J	0.44	49	SB	Y	0.3	J	14.7			
51SB6B	2,3,7,8-TCDD	3.3	ng/kg	IA	J	0.28	3.3	SB	Y	1	J	3.3			
51SB6B	2,3,7,8-TCDF	82	ng/kg	A		0.39	82	SB	Y	0.1		8.2			
51SB6B	OCDD	23000	ng/kg			0.66	23000	SB	Y	0.0003		6.9	51SB6B	TCDD-TE	148.23
51SB6B	OCDF	2400	ng/kg			0.82	2400	SB	Y	0.0003		0.72			
51SB6C	1,2,3,4,6,7,8-HpCDF	0.99	ng/kg	U	U	0.076	0.99	SB	Y	0.01	U	0			
51SB6C	1,2,3,4,7,8,9-HpCDF	0.99	ng/kg	U	U	0.11	0.99	SB	Y	0.01	U	0			
51SB6C	1,2,3,4,7,8-HxCDD	0.99	ng/kg	U	U	0.11	0.99	SB	Y	0.1	U	0			
51SB6C	1,2,3,4,7,8-HxCDF	0.99	ng/kg	U	U	0.066	0.99	SB	Y	0.1	U	0			
51SB6C	1,2,3,6,7,8-HxCDD	0.99	ng/kg	U	U	0.093	0.99	SB	Y	0.1	U	0			
51SB6C	1,2,3,6,7,8-HxCDF	0.99	ng/kg	U	U	0.071	0.99	SB	Y	0.1	U	0			
51SB6C	1,2,3,7,8,9-HxCDD	0.99	ng/kg	U	U	0.12	0.99	SB	Y	0.1	U	0			
51SB6C	1,2,3,7,8,9-HxCDF	0.99	ng/kg	U	U	0.13	0.99	SB	Y	0.1	U	0			
51SB6C	1,2,3,7,8-PeCDD	0.99	ng/kg	U	U	0.13	0.99	SB	Y	1	U	0			
51SB6C	1,2,3,7,8-PeCDF	0.99	ng/kg	U	U	0.068	0.99	SB	Y	0.03	U	0			
51SB6C	2,3,4,6,7,8-HxCDF	0.99	ng/kg	U	U	0.11	0.99	SB	Y	0.1	U	0			
51SB6C	2,3,4,7,8-PeCDF	0.99	ng/kg	U	U	0.064	0.99	SB	Y	0.3	U	0			
51SB6C	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.082	0.2	SB	Y	1	U	0			
51SB6C	2,3,7,8-TCDF	0.2	ng/kg	U	U	0.053	0.2	SB	Y	0.1	U	0			
51SB6C	OCDD	390	ng/kg	U	U	0.55	390	SB	Y	0.0003	U	0	51SB6C	TCDD-TE	0
51SB6C	OCDF	2	ng/kg	U	U	0.16	2	SB	Y	0.0003	U	0			
51SB6D	1,2,3,4,6,7,8-HpCDD	9.9	ng/kg	UA	U	9.9	9.9	SB	Y	0.01	U	0			
51SB6D	1,2,3,4,6,7,8-HpCDF	7.5	ng/kg	UA	U	7.5	7.5	SB	Y	0.01	U	0			
51SB6D	1,2,3,4,7,8,9-HpCDF	9.1	ng/kg	UA	U	9.1	9.1	SB	Y	0.01	U	0			
51SB6D	1,2,3,4,7,8-HxCDD	12	ng/kg	UA	U	12	12	SB	Y	0.1	U	0			
51SB6D	1,2,3,4,7,8-HxCDF	9.1	ng/kg	UA	U	9.1	9.1	SB	Y	0.1	U	0			
51SB6D	1,2,3,6,7,8-HxCDD	10	ng/kg	UA	U	10	10	SB	Y	0.1	U	0			
51SB6D	1,2,3,6,7,8-HxCDF	8.6	ng/kg	UA	U	8.6	8.6	SB	Y	0.1	U	0			
51SB6D	1,2,3,7,8,9-HxCDD	12	ng/kg	UA	U	12	12	SB	Y	0.1	U	0			
51SB6D	1,2,3,7,8,9-HxCDF	12	ng/kg	UA	U	12	12	SB	Y	0.1	U	0			
51SB6D	1,2,3,7,8-PeCDD	9.4	ng/kg	UA	U	9.4	9.4	SB	Y	1	U	0			
51SB6D	1,2,3,7,8-PeCDF	11	ng/kg	UA	U	11	11	SB	Y	0.03	U	0			
51SB6D	2,3,4,6,7,8-HxCDF	8.6	ng/kg	UA	U	8.6	8.6	SB	Y	0.1	U	0			
51SB6D	2,3,4,7,8-PeCDF	9.7	ng/kg	UA	U	9.7	9.7	SB	Y	0.3	U	0			
51SB6D	2,3,7,8-TCDD	22	ng/kg	UA	U	22	22	SB	Y	1	U	0			
51SB6D	2,3,7,8-TCDF	20	ng/kg	UA	U	20	20	SB	Y	0.1	U	0	51SB6D	TCDD-TE	0
51SB6D	OCDF	22	ng/kg	UA	U	22	22	SB	Y	0.0003	U	0			

Dioxin/Furan 2,3,7,8-TCDD Equivalents Calculations - Soil
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SAMPNUMB	PARAMETER	VALUE	Units	LABQUAL	DVQUAL	DETECT_LIM	VALIDVALUE	AMATRIX	TE Needed?	TEF	ND = U	TCDD-TE			
TMSB1A	1,2,3,4,6,7,8-HpCDD	70	ng/kg			0.33	70	SS	Y	0.01		0.7			
TMSB1A	1,2,3,4,6,7,8-HpCDF	4.5	ng/kg	J	J	0.21	4.5	SS	Y	0.01	J	0.045			
TMSB1A	1,2,3,4,7,8,9-HpCDF	1	ng/kg	U	U	0.24	1	SS	Y	0.01	U	0			
TMSB1A	1,2,3,4,7,8-HxCDD	1	ng/kg	U	U	0.14	1	SS	Y	0.1	U	0			
TMSB1A	1,2,3,4,7,8-HxCDF	1	ng/kg	U	U	0.1	1	SS	Y	0.1	U	0			
TMSB1A	1,2,3,6,7,8-HxCDD	1.2	ng/kg	J	J	0.14	1.2	SS	Y	0.1	J	0.12			
TMSB1A	1,2,3,6,7,8-HxCDF	1	ng/kg	U	U	0.18	1	SS	Y	0.1	U	0			
TMSB1A	1,2,3,7,8,9-HxCDD	2.2	ng/kg	J	J	0.16	2.2	SS	Y	0.1	J	0.22			
TMSB1A	1,2,3,7,8,9-HxCDF	1	ng/kg	U	U	0.17	1	SS	Y	0.1	U	0			
TMSB1A	1,2,3,7,8-PeCDD	1	ng/kg	U	U	0.17	1	SS	Y	1	U	0			
TMSB1A	1,2,3,7,8-PeCDF	1	ng/kg	U	U	0.13	1	SS	Y	0.03	U	0			
TMSB1A	2,3,4,6,7,8-HxCDF	1	ng/kg	U	U	0.18	1	SS	Y	0.1	U	0			
TMSB1A	2,3,4,7,8-PeCDF	1	ng/kg	U	U	0.1	1	SS	Y	0.3	U	0			
TMSB1A	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.14	0.2	SS	Y	1	U	0			
TMSB1A	2,3,7,8-TCDF	0.2	ng/kg	U	U	0.14	0.2	SS	Y	0.1	U	0			
TMSB1A	OCDD	7400	ng/kg			0.34	7400	SS	Y	0.0003		2.22	TMSB1A	TCDD-TE	3.30662
TMSB1A	OCDF	5.4	ng/kg	J	J	0.23	5.4	SS	Y	0.0003	J	0.00162			
TMSB5D	1,2,3,4,6,7,8-HpCDF	0.98	ng/kg	U	U	0.12	0.98	SB	Y	0.01	U	0			
TMSB5D	1,2,3,4,7,8,9-HpCDF	0.98	ng/kg	U	U	0.12	0.98	SB	Y	0.01	U	0			
TMSB5D	1,2,3,4,7,8-HxCDD	0.98	ng/kg	U	U	0.15	0.98	SB	Y	0.1	U	0			
TMSB5D	1,2,3,4,7,8-HxCDF	0.98	ng/kg	U	U	0.098	0.98	SB	Y	0.1	U	0			
TMSB5D	1,2,3,6,7,8-HxCDD	0.98	ng/kg	U	U	0.15	0.98	SB	Y	0.1	U	0			
TMSB5D	1,2,3,6,7,8-HxCDF	0.98	ng/kg	U	U	0.087	0.98	SB	Y	0.1	U	0			
TMSB5D	1,2,3,7,8,9-HxCDD	0.98	ng/kg	U	U	0.15	0.98	SB	Y	0.1	U	0			
TMSB5D	1,2,3,7,8,9-HxCDF	0.98	ng/kg	U	U	0.11	0.98	SB	Y	0.1	U	0			
TMSB5D	1,2,3,7,8-PeCDD	0.98	ng/kg	U	U	0.088	0.98	SB	Y	1	U	0			
TMSB5D	1,2,3,7,8-PeCDF	0.98	ng/kg	U	U	0.079	0.98	SB	Y	0.03	U	0			
TMSB5D	2,3,4,6,7,8-HxCDF	0.98	ng/kg	U	U	0.093	0.98	SB	Y	0.1	U	0			
TMSB5D	2,3,4,7,8-PeCDF	0.98	ng/kg	U	U	0.063	0.98	SB	Y	0.3	U	0			
TMSB5D	2,3,7,8-TCDD	0.2	ng/kg	U	U	0.073	0.2	SB	Y	1	U	0			
TMSB5D	2,3,7,8-TCDF	0.2	ng/kg	U	U	0.084	0.2	SB	Y	0.1	U	0	TMSB5D	TCDD-TE	0
TMSB5D	OCDF	2	ng/kg	U	U	0.14	2	SB	Y	0.0003	U	0			

Appendix E-3

Exposure Point Concentrations – ProUCL 4.0 Output

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\ProUCL\SWMU-51_ProUCL_Input_SS.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,3-Dinitrobenzene

General Statistics

Number of Valid Samples	11	Number of Detected Data	4
Number of Unique Samples	4	Number of Non-Detect Data	7
		Percent Non-Detects	63.64%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.08	Minimum Detected	-2.526
Maximum Detected	0.77	Maximum Detected	-0.261
Mean of Detected	0.308	Mean of Detected	-1.528
SD of Detected	0.313	SD of Detected	0.938
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.777	Shapiro Wilk Test Statistic	0.938
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.144	Mean	-2.462
SD	0.215	SD	0.901
95% DL/2 (t) UCL	0.261	95% H-Stat (DL/2) UCL	0.157

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-2.318
		SD in Log Scale	0.944
		Mean in Original Scale	0.158
		SD in Original Scale	0.211
		95% Percentile Bootstrap UCL	0.275
		95% BCA Bootstrap UCL	0.35

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	0.562	**Data appear Normal at 5% Significance Level**
Theta Star	0.547	
nu star	4.494	

A-D Test Statistic	0.416	**Nonparametric Statistics**	
5% A-D Critical Value	0.662	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.662	Mean	0.163
5% K-S Critical Value	0.399	SD	0.197
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0685
		95% KM (t) UCL	0.287
Assuming Gamma Distribution		95% KM (z) UCL	0.275
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.271
Minimum	0.08	95% KM (bootstrap t) UCL	0.452
Maximum	0.77	95% KM (BCA) UCL	0.77
Mean	0.314	95% KM (Percentile Bootstrap) UCL	0.343
Median	0.309	95% KM (Chebyshev) UCL	0.461
SD	0.172	97.5% KM (Chebyshev) UCL	0.59
k star	3.029	99% KM (Chebyshev) UCL	0.844
Theta star	0.104		
Nu star	66.63	**Potential UCLs to Use**	
AppChi2	48.85	95% KM (t) UCL	0.287
95% Gamma Approximate UCL	0.429	95% KM (Percentile Bootstrap) UCL	0.343
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

2,4,6-Trinitrotoluene

General Statistics

Number of Valid Samples	11	Number of Detected Data	10
Number of Unique Samples	9	Number of Non-Detect Data	1
		Percent Non-Detects	9.09%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.04	Minimum Detected	-3.219
Maximum Detected	1.3	Maximum Detected	0.262
Mean of Detected	0.276	Mean of Detected	-1.907
SD of Detected	0.386	SD of Detected	1.114
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.648	Shapiro Wilk Test Statistic	0.944
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.255	Mean	-2.006
SD	0.372	SD	1.106
95% DL/2 (t) UCL	0.459	95% H-Stat (DL/2) UCL	0.74
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0805	Mean in Log Scale	-2
SD	0.529	SD in Log Scale	1.1

95% MLE (t) UCL	0.369	Mean in Original Scale	0.256
95% MLE (Tiku) UCL	0.422	SD in Original Scale	0.372
		95% Percentile Bootstrap UCL	0.461
		95% BCA Bootstrap UCL	0.57

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.723
Theta Star	0.382
nu star	14.47
A-D Test Statistic	0.533
5% A-D Critical Value	0.75
K-S Test Statistic	0.75
5% K-S Critical Value	0.274
Data appear Gamma Distributed at 5% Significance Level	

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00928
Maximum	1.3
Mean	0.252
Median	0.12
SD	0.374
k star	0.617
Theta star	0.408
Nu star	13.58
AppChi2	6.284
95% Gamma Approximate UCL	0.544
95% Adjusted Gamma UCL	0.622

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.256
SD	0.354
SE of Mean	0.113
95% KM (t) UCL	0.46
95% KM (z) UCL	0.441
95% KM (jackknife) UCL	0.459
95% KM (bootstrap t) UCL	1.015
95% KM (BCA) UCL	0.452
95% KM (Percentile Bootstrap) UCL	0.454
95% KM (Chebyshev) UCL	0.747
97.5% KM (Chebyshev) UCL	0.96
99% KM (Chebyshev) UCL	1.377
Potential UCLs to Use	
95% KM (Chebyshev) UCL	0.747

2,4-Dinitrotoluene

General Statistics

Number of Valid Samples	11	Number of Detected Data	9
Number of Unique Samples	8	Number of Non-Detect Data	2
		Percent Non-Detects	18.18%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.09	Minimum Detected	-2.408
Maximum Detected	2.5	Maximum Detected	0.916
Mean of Detected	0.806	Mean of Detected	-0.619
SD of Detected	0.703	SD of Detected	1.091
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.755	Shapiro Wilk Test Statistic	0.802
5% Shapiro Wilk Critical Value	0.829	5% Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.668	Mean	-1.051
SD	0.699	SD	1.37
95% DL/2 (t) UCL	1.05	95% H-Stat (DL/2) UCL	4.572
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.446	Mean in Log Scale	-0.879
SD	0.943	SD in Log Scale	1.142
95% MLE (t) UCL	0.962	Mean in Original Scale	0.684
95% MLE (Tiku) UCL	1.015	SD in Original Scale	0.685
		95% Percentile Bootstrap UCL	1.037
		95% BCA Bootstrap UCL	1.136

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.997	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	0.808		
nu star	17.94		
A-D Test Statistic	0.804	**Nonparametric Statistics**	
5% A-D Critical Value	0.736	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.736	Mean	0.675
5% K-S Critical Value	0.285	SD	0.66
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.211
		95% KM (t) UCL	1.058
Assuming Gamma Distribution		95% KM (z) UCL	1.023
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.054
Minimum	0.09	95% KM (bootstrap t) UCL	1.268
Maximum	2.5	95% KM (BCA) UCL	1.108
Mean	0.714	95% KM (Percentile Bootstrap) UCL	1.058
Median	0.68	95% KM (Chebyshev) UCL	1.596
SD	0.663	97.5% KM (Chebyshev) UCL	1.994
k star	1.062	99% KM (Chebyshev) UCL	2.776
Theta star	0.672		
Nu star	23.37	**Potential UCLs to Use**	
AppChi2	13.37	97.5% KM (Chebyshev) UCL	1.994
95% Gamma Approximate UCL	1.248		
95% Adjusted Gamma UCL	1.373		

Note: DL/2 is not a recommended method.

2,6-Dinitrotoluene

General Statistics

Number of Valid Samples	7	Number of Detected Data	5
Number of Unique Samples	5	Number of Non-Detect Data	2
		Percent Non-Detects	28.57%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.055	Minimum Detected	-2.9
Maximum Detected	1.7	Maximum Detected	0.531
Mean of Detected	0.547	Mean of Detected	-1.326

SD of Detected	0.676	SD of Detected	1.441
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.794	Shapiro Wilk Test Statistic	0.923
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.405	Mean	-1.803
SD	0.603	SD	1.431
95% DL/2 (t) UCL	0.848	95% H-Stat (DL/2) UCL	1.249
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-1.731
		SD in Log Scale	1.392
		Mean in Original Scale	0.411
		SD in Original Scale	0.599
		95% Percentile Bootstrap UCL	0.809
		95% BCA Bootstrap UCL	1
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.461	**Data appear Normal at 5% Significance Level**	
Theta Star	1.187		
nu star	4.607		
A-D Test Statistic	0.314	**Nonparametric Statistics**	
5% A-D Critical Value	0.696	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.696	Mean	0.409
5% K-S Critical Value	0.366	SD	0.556
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.235
		95% KM (t) UCL	0.865
Assuming Gamma Distribution		95% KM (z) UCL	0.795
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.85
Minimum	0.055	95% KM (bootstrap t) UCL	1.375
Maximum	1.7	95% KM (BCA) UCL	0.83
Mean	0.47	95% KM (Percentile Bootstrap) UCL	0.813
Median	0.38	95% KM (Chebyshev) UCL	1.432
SD	0.577	97.5% KM (Chebyshev) UCL	1.875
k star	0.618	99% KM (Chebyshev) UCL	2.746
Theta star	0.76		
Nu star	8.653	**Potential UCLs to Use**	
AppChi2	3.119	95% KM (t) UCL	0.865
95% Gamma Approximate UCL	1.304	95% KM (Percentile Bootstrap) UCL	0.813
95% Adjusted Gamma UCL	1.844		

Note: DL/2 is not a recommended method.

Aluminum

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		**Log-transformed Statistics**	
Minimum	10600	Minimum of Log Data	9.269
Maximum	28100	Maximum of Log Data	10.24
Mean	19323	Mean of log Data	9.815
Median	20800	SD of log Data	0.354
SD	6329		
Coefficient of Variation	0.328		
Skewness	-0.113		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.924	Shapiro Wilk Test Statistic	0.907
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22781	95% H-UCL	24411
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	28503
95% Adjusted-CLT UCL	22392	97.5% Chebyshev (MVUE) UCL	32452
95% Modified-t UCL	22770	99% Chebyshev (MVUE) UCL	40211

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.898	**Data appear Normal at 5% Significance Level**	
Theta Star	2801		
nu star	151.7		
Approximate Chi Square Value (.05)	124.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	22461
Adjusted Chi Square Value	120.2	95% Jackknife UCL	22781
		95% Standard Bootstrap UCL	22290
Anderson-Darling Test Statistic	0.428	95% Bootstrap-t UCL	22604
Anderson-Darling 5% Critical Value	0.73	95% Hall's Bootstrap UCL	22054
Kolmogorov-Smirnov Test Statistic	0.185	95% Percentile Bootstrap UCL	22200
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	22295
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	27640
		97.5% Chebyshev(Mean, Sd) UCL	31239
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	38309
95% Approximate Gamma UCL	23595		
95% Adjusted Gamma UCL	24390		

Potential UCL to Use		Use 95% Student's-t UCL	22781

Antimony

General Statistics

Number of Valid Samples	11	Number of Detected Data	2
Number of Unique Samples	2	Number of Non-Detect Data	9
		Percent Non-Detects	81.82%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.25	Minimum Detected	-1.386
Maximum Detected	0.64	Maximum Detected	-0.446
Mean of Detected	0.445	Mean of Detected	-0.916
SD of Detected	0.276	SD of Detected	0.665
Minimum Non-Detect	0.44	Minimum Non-Detect	-0.821
Maximum Non-Detect	0.82	Maximum Non-Detect	-0.198

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	11
Number treated as Detected	0
Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	1	Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.32	Mean	-1.19
SD	0.12	SD	0.308
95% DL/2 (t) UCL	0.385	95% H-Stat (DL/2) UCL	0.351

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	N/A	
nu star	N/A	

		Nonparametric Statistics	
A-D Test Statistic	0.359		
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.299
5% K-S Critical Value	N/A	SD	0.129
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0645
		95% KM (t) UCL	0.416
Assuming Gamma Distribution		95% KM (z) UCL	0.405
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.565
Minimum	N/A	95% KM (bootstrap t) UCL	1.8E+308
Maximum	N/A	95% KM (BCA) UCL	0.64
Mean	N/A	95% KM (Percentile Bootstrap) UCL	0.64
Median	N/A	95% KM (Chebyshev) UCL	0.58
SD	N/A	97.5% KM (Chebyshev) UCL	0.701
k star	N/A	99% KM (Chebyshev) UCL	0.94
Theta star	N/A		

Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	0.416
95% Gamma Approximate UCL	N/A	95% KM (% Bootstrap) UCL	0.64
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

Arsenic

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.8	Minimum of Log Data	1.03
Maximum	5.7	Maximum of Log Data	1.74
Mean	3.891	Mean of log Data	1.334
Median	3.7	SD of log Data	0.23
SD	0.943		
Coefficient of Variation	0.242		
Skewness	0.933		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.904	Shapiro Wilk Test Statistic	0.942
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	4.406	95% H-UCL	4.469
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	5.066
95% Adjusted-CLT UCL	4.444	97.5% Chebyshev (MVUE) UCL	5.576
95% Modified-t UCL	4.419	99% Chebyshev (MVUE) UCL	6.578

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	14.85	**Data appear Normal at 5% Significance Level**	
Theta Star	0.262		
nu star	326.6		
Approximate Chi Square Value (.05)	285.7	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	4.358
Adjusted Chi Square Value	279.5	95% Jackknife UCL	4.406
		95% Standard Bootstrap UCL	4.343
Anderson-Darling Test Statistic	0.361	95% Bootstrap-t UCL	4.592
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	4.556
Kolmogorov-Smirnov Test Statistic	0.149	95% Percentile Bootstrap UCL	4.373
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	4.445
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	5.13
		97.5% Chebyshev(Mean, Sd) UCL	5.666
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	6.719
95% Approximate Gamma UCL	4.447		
95% Adjusted Gamma UCL	4.547		

Potential UCL to Use		Use 95% Student's-t UCL	4.406

Barium

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		**Log-transformed Statistics**	
Minimum	49.6	Minimum of Log Data	3.904
Maximum	120	Maximum of Log Data	4.787
Mean	80.05	Mean of log Data	4.356
Median	81.5	SD of log Data	0.244
SD	19.14		
Coefficient of Variation	0.239		
Skewness	0.433		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.966	Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	90.51	95% H-UCL	92.99
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	105.9
95% Adjusted-CLT UCL	90.35	97.5% Chebyshev (MVUE) UCL	117.1
95% Modified-t UCL	90.64	99% Chebyshev (MVUE) UCL	139

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	13.91	**Data appear Normal at 5% Significance Level**	
Theta Star	5.754		
nu star	306.1		
Approximate Chi Square Value (.05)	266.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	89.55
Adjusted Chi Square Value	260.5	95% Jackknife UCL	90.51
		95% Standard Bootstrap UCL	89.19
Anderson-Darling Test Statistic	0.222	95% Bootstrap-t UCL	91.24
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	92.97
Kolmogorov-Smirnov Test Statistic	0.127	95% Percentile Bootstrap UCL	89.36
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	89.39
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	105.2
		97.5% Chebyshev(Mean, Sd) UCL	116.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	137.5
95% Approximate Gamma UCL	91.93		
95% Adjusted Gamma UCL	94.05		

Potential UCL to Use		Use 95% Student's-t UCL	90.51

Beryllium

General Statistics

Number of Valid Samples	11	Number of Unique Samples	10

Raw Statistics		Log-transformed Statistics	
Minimum	0.41	Minimum of Log Data	-0.892
Maximum	0.8	Maximum of Log Data	-0.223
Mean	0.599	Mean of log Data	-0.527
Median	0.57	SD of log Data	0.179
SD	0.105		
Coefficient of Variation	0.176		
Skewness	0.238		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.977	Shapiro Wilk Test Statistic	0.972
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.656	95% H-UCL	0.665
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.74
95% Adjusted-CLT UCL	0.653	97.5% Chebyshev (MVUE) UCL	0.801
95% Modified-t UCL	0.656	99% Chebyshev (MVUE) UCL	0.921

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	25.66	**Data appear Normal at 5% Significance Level**	
Theta Star	0.0233		
nu star	564.6		
Approximate Chi Square Value (.05)	510.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	0.651
Adjusted Chi Square Value	502.1	95% Jackknife UCL	0.656
		95% Standard Bootstrap UCL	0.648
Anderson-Darling Test Statistic	0.217	95% Bootstrap-t UCL	0.657
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	0.66
Kolmogorov-Smirnov Test Statistic	0.148	95% Percentile Bootstrap UCL	0.648
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	0.653
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.737
		97.5% Chebyshev(Mean, Sd) UCL	0.797
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.914
95% Approximate Gamma UCL	0.662		
95% Adjusted Gamma UCL	0.673		

Potential UCL to Use		Use 95% Student's-t UCL	0.656

Cadmium

General Statistics

Number of Valid Samples	6	Number of Detected Data	3
Number of Unique Samples	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.13	Minimum Detected	-2.04
Maximum Detected	0.36	Maximum Detected	-1.022
Mean of Detected	0.227	Mean of Detected	-1.574

SD of Detected	0.119	SD of Detected	0.515
Minimum Non-Detect	0.0395	Minimum Non-Detect	-3.231
Maximum Non-Detect	0.041	Maximum Non-Detect	-3.194

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	3
Number treated as Detected	3
Single DL Non-Detect Percentage	50.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.929	Shapiro Wilk Test Statistic	0.979
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.123	Mean	-2.737
SD	0.136	SD	1.315
95% DL/2 (t) UCL	0.235	95% H-Stat (DL/2) UCL	0.177
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.231	Mean in Log Scale	-2.439
SD	0.0974	SD in Log Scale	1.024
95% MLE (t) UCL	0.311	Mean in Original Scale	0.132
95% MLE (Tiku) UCL	0.343	SD in Original Scale	0.128
		95% Percentile Bootstrap UCL	0.221
		95% BCA Bootstrap UCL	0.24

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	**Data appear Normal at 5% Significance Level**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	0.295	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.178
5% K-S Critical Value	N/A	SD	0.0841
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0421
		95% KM (t) UCL	0.263
Assuming Gamma Distribution		95% KM (z) UCL	0.248
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.257
Minimum	N/A	95% KM (bootstrap t) UCL	0.271
Maximum	N/A	95% KM (BCA) UCL	0.36
Mean	N/A	95% KM (Percentile Bootstrap) UCL	0.36
Median	N/A	95% KM (Chebyshev) UCL	0.362
SD	N/A	97.5% KM (Chebyshev) UCL	0.441
k star	N/A	99% KM (Chebyshev) UCL	0.597
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	0.263
95% Gamma Approximate UCL	N/A	95% KM (Percentile Bootstrap) UCL	0.36
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

Calcium

General Statistics

Number of Valid Samples	8	Number of Unique Samples	8

Raw Statistics		**Log-transformed Statistics**	
Minimum	228	Minimum of Log Data	5.429
Maximum	483	Maximum of Log Data	6.18
Mean	320.1	Mean of log Data	5.742
Median	300.3	SD of log Data	0.243
SD	83.59		
Coefficient of Variation	0.261		
Skewness	1.241		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.87	Shapiro Wilk Test Statistic	0.921
Shapiro Wilk Critical Value	0.818	Shapiro Wilk Critical Value	0.818
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	376.1	95% H-UCL	385.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	439.5
95% Adjusted-CLT UCL	382.5	97.5% Chebyshev (MVUE) UCL	491.4
95% Modified-t UCL	378.2	99% Chebyshev (MVUE) UCL	593.2

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	11.77	**Data appear Normal at 5% Significance Level**	
Theta Star	27.2		
nu star	188.3		
Approximate Chi Square Value (.05)	157.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0195	95% CLT UCL	368.7
Adjusted Chi Square Value	150.4	95% Jackknife UCL	376.1
		95% Standard Bootstrap UCL	367.6
Anderson-Darling Test Statistic	0.467	95% Bootstrap-t UCL	444.3
Anderson-Darling 5% Critical Value	0.716	95% Hall's Bootstrap UCL	756.4
Kolmogorov-Smirnov Test Statistic	0.296	95% Percentile Bootstrap UCL	371.1
Kolmogorov-Smirnov 5% Critical Value	0.294	95% BCA Bootstrap UCL	377.3
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	448.9
		97.5% Chebyshev(Mean, Sd) UCL	504.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	614.1
95% Approximate Gamma UCL	382.5		
95% Adjusted Gamma UCL	400.6		

Potential UCL to Use		Use 95% Student's-t UCL	376.1

Chromium

General Statistics

Number of Valid Samples	11	Number of Unique Samples	10

Raw Statistics		**Log-transformed Statistics**	
Minimum	17.2	Minimum of Log Data	2.845
Maximum	34.6	Maximum of Log Data	3.544
Mean	25.54	Mean of log Data	3.222
Median	26.4	SD of log Data	0.204
SD	4.938		
Coefficient of Variation	0.193		
Skewness	-0.184		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.949	Shapiro Wilk Test Statistic	0.924
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	28.24	95% H-UCL	28.88
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	32.44
95% Adjusted-CLT UCL	27.9	97.5% Chebyshev (MVUE) UCL	35.41
95% Modified-t UCL	28.23	99% Chebyshev (MVUE) UCL	41.26

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	20.19	**Data appear Normal at 5% Significance Level**	
Theta Star	1.265		
nu star	444.2		
Approximate Chi Square Value (.05)	396.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	27.99
Adjusted Chi Square Value	388.9	95% Jackknife UCL	28.24
		95% Standard Bootstrap UCL	27.91
Anderson-Darling Test Statistic	0.419	95% Bootstrap-t UCL	28.09
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	28.13
Kolmogorov-Smirnov Test Statistic	0.158	95% Percentile Bootstrap UCL	27.85
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	27.71
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	32.03
		97.5% Chebyshev(Mean, Sd) UCL	34.84
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	40.36
95% Approximate Gamma UCL	28.63		
95% Adjusted Gamma UCL	29.17		

Potential UCL to Use		Use 95% Student's-t UCL	28.24

Cobalt

General Statistics

Number of Valid Samples	11	Number of Unique Samples	10

Raw Statistics		Log-transformed Statistics	
Minimum	3.3	Minimum of Log Data	1.194
Maximum	13.9	Maximum of Log Data	2.632
Mean	7.505	Mean of log Data	1.936
Median	7.2	SD of log Data	0.428
SD	3.05		
Coefficient of Variation	0.406		
Skewness	0.614		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.959	Shapiro Wilk Test Statistic	0.967
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	9.171	95% H-UCL	10.08
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	11.83
95% Adjusted-CLT UCL	9.199	97.5% Chebyshev (MVUE) UCL	13.69
95% Modified-t UCL	9.2	99% Chebyshev (MVUE) UCL	17.34

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	4.774	**Data appear Normal at 5% Significance Level**	
Theta Star	1.572		
nu star	105		
Approximate Chi Square Value (.05)	82.38	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	9.017
Adjusted Chi Square Value	79.11	95% Jackknife UCL	9.171
		95% Standard Bootstrap UCL	8.932
Anderson-Darling Test Statistic	0.203	95% Bootstrap-t UCL	9.35
Anderson-Darling 5% Critical Value	0.731	95% Hall's Bootstrap UCL	9.564
Kolmogorov-Smirnov Test Statistic	0.147	95% Percentile Bootstrap UCL	9.014
Kolmogorov-Smirnov 5% Critical Value	0.256	95% BCA Bootstrap UCL	9.118
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	11.51
		97.5% Chebyshev(Mean, Sd) UCL	13.25
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	16.66
95% Approximate Gamma UCL	9.568		
95% Adjusted Gamma UCL	9.963		

Potential UCL to Use		Use 95% Student's-t UCL	9.171

Copper

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		Log-transformed Statistics	
Minimum	4.7	Minimum of Log Data	1.548
Maximum	17.4	Maximum of Log Data	2.856
Mean	10.01	Mean of log Data	2.222
Median	10.7	SD of log Data	0.436
SD	4.047		

Coefficient of Variation	0.404
Skewness	0.259

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.951	Shapiro Wilk Test Statistic	0.935
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	12.23	95% H-UCL	13.55
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	15.91
95% Adjusted-CLT UCL	12.12	97.5% Chebyshev (MVUE) UCL	18.44
95% Modified-t UCL	12.24	99% Chebyshev (MVUE) UCL	23.41

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.639	**Data appear Normal at 5% Significance Level**	
Theta Star	2.159		
nu star	102.1		
Approximate Chi Square Value (.05)	79.74	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	12.02
Adjusted Chi Square Value	76.53	95% Jackknife UCL	12.23
		95% Standard Bootstrap UCL	11.93
Anderson-Darling Test Statistic	0.329	95% Bootstrap-t UCL	12.4
Anderson-Darling 5% Critical Value	0.731	95% Hall's Bootstrap UCL	12.2
Kolmogorov-Smirnov Test Statistic	0.164	95% Percentile Bootstrap UCL	11.97
Kolmogorov-Smirnov 5% Critical Value	0.256	95% BCA Bootstrap UCL	12
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	15.33
		97.5% Chebyshev(Mean, Sd) UCL	17.63
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	22.15
95% Approximate Gamma UCL	12.81		
95% Adjusted Gamma UCL	13.35		

Potential UCL to Use		Use 95% Student's-t UCL	12.23

Fluoranthene

General Statistics

Number of Valid Samples	11	Number of Detected Data	4
Number of Unique Samples	4	Number of Non-Detect Data	7
		Percent Non-Detects	63.64%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.011	Minimum Detected	-4.51
Maximum Detected	0.027	Maximum Detected	-3.612
Mean of Detected	0.0174	Mean of Detected	-4.109
SD of Detected	0.00694	SD of Detected	0.382
Minimum Non-Detect	0.0077	Minimum Non-Detect	-4.867
Maximum Non-Detect	0.0081	Maximum Non-Detect	-4.816

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	7
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	4

Observations < Largest ND are treated as NDs

Single DL Non-Detect Percentage 63.64%

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.927
5% Shapiro Wilk Critical Value	0.748

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.98
5% Shapiro Wilk Critical Value	0.748

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	0.00882
SD	0.00777
95% DL/2 (t) UCL	0.0131

Maximum Likelihood Estimate(MLE) Method

Mean	0.004
SD	0.0127
95% MLE (t) UCL	0.0109
95% MLE (Tiku) UCL	0.0144

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	-5.018
SD	0.751
95% H-Stat (DL/2) UCL	0.0151

Log ROS Method

Mean in Log Scale	-5.009
SD in Log Scale	0.767
Mean in Original Scale	0.00892
SD in Original Scale	0.00774
95% Percentile Bootstrap UCL	0.0126
95% BCA Bootstrap UCL	0.0138

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	2.428
Theta Star	0.00715
nu star	19.43
A-D Test Statistic	0.251
5% A-D Critical Value	0.657
K-S Test Statistic	0.657
5% K-S Critical Value	0.395

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	0.011
Maximum	0.027
Mean	0.017
Median	0.0166
SD	0.0041
k star	15.17
Theta star	0.00112
Nu star	333.7
AppChi2	292.4
95% Gamma Approximate UCL	0.0194
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.0133
SD	0.00475
SE of Mean	0.00165
95% KM (t) UCL	0.0163
95% KM (z) UCL	0.016
95% KM (jackknife) UCL	0.0161
95% KM (bootstrap t) UCL	0.0168
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	0.0192
95% KM (Chebyshev) UCL	0.0205
97.5% KM (Chebyshev) UCL	0.0236
99% KM (Chebyshev) UCL	0.0298

Potential UCLs to Use

95% KM (t) UCL	0.0163
95% KM (Percentile Bootstrap) UCL	0.0192

Iron

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		**Log-transformed Statistics**	
Minimum	11500	Minimum of Log Data	9.35
Maximum	31600	Maximum of Log Data	10.36
Mean	23436	Mean of log Data	10.01
Median	26300	SD of log Data	0.351
SD	7213		
Coefficient of Variation	0.308		
Skewness	-0.542		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.889	Shapiro Wilk Test Statistic	0.866
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	27378	95% H-UCL	29591
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	34537
95% Adjusted-CLT UCL	26633	97.5% Chebyshev (MVUE) UCL	39294
95% Modified-t UCL	27319	99% Chebyshev (MVUE) UCL	48639

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	7.262	**Data appear Normal at 5% Significance Level**	
Theta Star	3227		
nu star	159.8		
Approximate Chi Square Value (.05)	131.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	27013
Adjusted Chi Square Value	127.4	95% Jackknife UCL	27378
		95% Standard Bootstrap UCL	26836
Anderson-Darling Test Statistic	0.661	95% Bootstrap-t UCL	26937
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	26405
Kolmogorov-Smirnov Test Statistic	0.228	95% Percentile Bootstrap UCL	26627
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	26527
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	32915
		97.5% Chebyshev(Mean, Sd) UCL	37017
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	45074
95% Approximate Gamma UCL	28465		
95% Adjusted Gamma UCL	29397		

Potential UCL to Use		Use 95% Student's-t UCL	27378

Lead

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		Log-transformed Statistics	
Minimum	11	Minimum of Log Data	2.398
Maximum	34.1	Maximum of Log Data	3.529
Mean	16.58	Mean of log Data	2.76
Median	14.7	SD of log Data	0.303
SD	6.325		
Coefficient of Variation	0.381		
Skewness	2.468		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.705	Shapiro Wilk Test Statistic	0.838
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	20.04	95% H-UCL	19.95
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.08
95% Adjusted-CLT UCL	21.24	97.5% Chebyshev (MVUE) UCL	25.94
95% Modified-t UCL	20.28	99% Chebyshev (MVUE) UCL	31.56

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	7.709	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	2.151		
nu star	169.6		
Approximate Chi Square Value (.05)	140.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	19.72
Adjusted Chi Square Value	136.2	95% Jackknife UCL	20.04
		95% Standard Bootstrap UCL	19.5
Anderson-Darling Test Statistic	0.902	95% Bootstrap-t UCL	25.76
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	34.42
Kolmogorov-Smirnov Test Statistic	0.256	95% Percentile Bootstrap UCL	20.01
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	20.99
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	24.9
		97.5% Chebyshev(Mean, Sd) UCL	28.49
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	35.56
95% Approximate Gamma UCL	20.02		
95% Adjusted Gamma UCL	20.65		

Potential UCL to Use		
	Use 95% Student's-t UCL	20.04
	or 95% Modified-t UCL	20.28

Magnesium

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		Log-transformed Statistics	
Minimum	483	Minimum of Log Data	6.18
Maximum	1930	Maximum of Log Data	7.565
Mean	929.6	Mean of log Data	6.752
Median	890	SD of log Data	0.421

SD	417.9
Coefficient of Variation	0.45
Skewness	1.361

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.878	Shapiro Wilk Test Statistic	0.951
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1158	95% H-UCL	1234
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1448
95% Adjusted-CLT UCL	1192	97.5% Chebyshev (MVUE) UCL	1673
95% Modified-t UCL	1167	99% Chebyshev (MVUE) UCL	2116
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.571	**Data appear Normal at 5% Significance Level**	
Theta Star	203.4		
nu star	100.6		
Approximate Chi Square Value (.05)	78.42	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	1137
Adjusted Chi Square Value	75.24	95% Jackknife UCL	1158
		95% Standard Bootstrap UCL	1125
Anderson-Darling Test Statistic	0.302	95% Bootstrap-t UCL	1253
Anderson-Darling 5% Critical Value	0.731	95% Hall's Bootstrap UCL	1976
Kolmogorov-Smirnov Test Statistic	0.156	95% Percentile Bootstrap UCL	1134
Kolmogorov-Smirnov 5% Critical Value	0.256	95% BCA Bootstrap UCL	1160
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1479
		97.5% Chebyshev(Mean, Sd) UCL	1716
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2183
95% Approximate Gamma UCL	1192		
95% Adjusted Gamma UCL	1242		
Potential UCL to Use		Use 95% Student's-t UCL	1158

Manganese

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		**Log-transformed Statistics**	
Minimum	251	Minimum of Log Data	5.525
Maximum	707	Maximum of Log Data	6.561
Mean	443.4	Mean of log Data	6.036
Median	395	SD of log Data	0.358
SD	159.1		
Coefficient of Variation	0.359		
Skewness	0.565		

Relevant UCL Statistics

Normal Distribution Test	**Lognormal Distribution Test**

Shapiro Wilk Test Statistic	0.904	Shapiro Wilk Test Statistic	0.933
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	530.3	95% H-UCL	559.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	653.9
95% Adjusted-CLT UCL	531	97.5% Chebyshev (MVUE) UCL	745.1
95% Modified-t UCL	531.7	99% Chebyshev (MVUE) UCL	924.1

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.447	**Data appear Normal at 5% Significance Level**	
Theta Star	68.77		
nu star	141.8		
Approximate Chi Square Value (.05)	115.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	522.3
Adjusted Chi Square Value	111.4	95% Jackknife UCL	530.3
		95% Standard Bootstrap UCL	518.3
Anderson-Darling Test Statistic	0.372	95% Bootstrap-t UCL	544.9
Anderson-Darling 5% Critical Value	0.73	95% Hall's Bootstrap UCL	522.4
Kolmogorov-Smirnov Test Statistic	0.158	95% Percentile Bootstrap UCL	520.8
Kolmogorov-Smirnov 5% Critical Value	0.256	95% BCA Bootstrap UCL	528.1
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	652.4
		97.5% Chebyshev(Mean, Sd) UCL	742.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	920.6
95% Approximate Gamma UCL	545.3		
95% Adjusted Gamma UCL	564.4		

Potential UCL to Use		Use 95% Student's-t UCL	530.3

Mercury

General Statistics

Number of Valid Samples	8	Number of Detected Data	7
Number of Unique Samples	6	Number of Non-Detect Data	1
		Percent Non-Detects	12.50%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.024	Minimum Detected	-3.73
Maximum Detected	0.1	Maximum Detected	-2.303
Mean of Detected	0.0565	Mean of Detected	-3.013
SD of Detected	0.0312	SD of Detected	0.582
Minimum Non-Detect	0.016	Minimum Non-Detect	-4.135
Maximum Non-Detect	0.016	Maximum Non-Detect	-4.135

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.869	Shapiro Wilk Test Statistic	0.897
5% Shapiro Wilk Critical Value	0.803	5% Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0504	Mean	-3.24
SD	0.0336	SD	0.838
95% DL/2 (t) UCL	0.073	95% H-Stat (DL/2) UCL	0.13
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0492	Mean in Log Scale	-3.191
SD	0.0336	SD in Log Scale	0.738
95% MLE (t) UCL	0.0717	Mean in Original Scale	0.0509
95% MLE (Tiku) UCL	0.0717	SD in Original Scale	0.033
		95% Percentile Bootstrap UCL	0.0693
		95% BCA Bootstrap UCL	0.0707

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	2.236	**Data appear Normal at 5% Significance Level**	
Theta Star	0.0253		
nu star	31.3		
A-D Test Statistic	0.378	**Nonparametric Statistics**	
5% A-D Critical Value	0.71	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.71	Mean	0.0524
5% K-S Critical Value	0.313	SD	0.0291
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0111
		95% KM (t) UCL	0.0735
Assuming Gamma Distribution		95% KM (z) UCL	0.0707
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.0733
Minimum	0.00788	95% KM (bootstrap t) UCL	0.0851
Maximum	0.1	95% KM (BCA) UCL	0.0707
Mean	0.0504	95% KM (Percentile Bootstrap) UCL	0.0711
Median	0.0473	95% KM (Chebyshev) UCL	0.101
SD	0.0336	97.5% KM (Chebyshev) UCL	0.122
k star	1.407	99% KM (Chebyshev) UCL	0.163
Theta star	0.0358		
Nu star	22.51	**Potential UCLs to Use**	
AppChi2	12.72	95% KM (t) UCL	0.0735
95% Gamma Approximate UCL	0.0892	95% KM (Percentile Bootstrap) UCL	0.0711
95% Adjusted Gamma UCL	0.104		

Note: DL/2 is not a recommended method.

m-Nitrotoluene

General Statistics			
Number of Valid Samples	11	Number of Detected Data	8
Number of Unique Samples	8	Number of Non-Detect Data	3
		Percent Non-Detects	27.27%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.105	Minimum Detected	-2.254
Maximum Detected	9.2	Maximum Detected	2.219
Mean of Detected	2.171	Mean of Detected	0.0363
SD of Detected	2.963	SD of Detected	1.388

Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.2	Maximum Non-Detect	-1.609

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.682	Shapiro Wilk Test Statistic	0.973
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.606	Mean	-0.602
SD	2.661	SD	1.594
95% DL/2 (t) UCL	3.06	95% H-Stat (DL/2) UCL	3.651
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.696	Mean in Log Scale	-0.64
SD	3.477	SD in Log Scale	1.669
95% MLE (t) UCL	2.596	Mean in Original Scale	1.606
95% MLE (Tiku) UCL	2.769	SD in Original Scale	2.661
		95% Percentile Bootstrap UCL	2.987
		95% BCA Bootstrap UCL	3.845
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.585	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	3.709		
nu star	9.363		
A-D Test Statistic	0.296	**Nonparametric Statistics**	
5% A-D Critical Value	0.743	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.743	Mean	1.607
5% K-S Critical Value	0.304	SD	2.536
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.817
		95% KM (t) UCL	3.089
Assuming Gamma Distribution		95% KM (z) UCL	2.952
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	3.023
Minimum	0	95% KM (bootstrap t) UCL	5.483
Maximum	9.2	95% KM (BCA) UCL	3.335
Mean	1.651	95% KM (Percentile Bootstrap) UCL	3.057
Median	0.744	95% KM (Chebyshev) UCL	5.17
SD	2.64	97.5% KM (Chebyshev) UCL	6.712
k star	0.253	99% KM (Chebyshev) UCL	9.741
Theta star	6.53		
Nu star	5.561	**Potential UCLs to Use**	
AppChi2	1.42	95% KM (Chebyshev) UCL	5.17
95% Gamma Approximate UCL	6.465		
95% Adjusted Gamma UCL	8.276		

Note: DL/2 is not a recommended method.

Nickel

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		**Log-transformed Statistics**	
Minimum	4.4	Minimum of Log Data	1.482
Maximum	13.2	Maximum of Log Data	2.58
Mean	8.105	Mean of log Data	2.032
Median	8.4	SD of log Data	0.37
SD	2.908		
Coefficient of Variation	0.359		
Skewness	0.353		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.946	Shapiro Wilk Test Statistic	0.948
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	9.694	95% H-UCL	10.35
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	12.11
95% Adjusted-CLT UCL	9.647	97.5% Chebyshev (MVUE) UCL	13.84
95% Modified-t UCL	9.709	99% Chebyshev (MVUE) UCL	17.23

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.164	**Data appear Normal at 5% Significance Level**	
Theta Star	1.315		
nu star	135.6		
Approximate Chi Square Value (.05)	109.7	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	9.547
Adjusted Chi Square Value	105.9	95% Jackknife UCL	9.694
		95% Standard Bootstrap UCL	9.494
Anderson-Darling Test Statistic	0.276	95% Bootstrap-t UCL	9.849
Anderson-Darling 5% Critical Value	0.73	95% Hall's Bootstrap UCL	9.606
Kolmogorov-Smirnov Test Statistic	0.174	95% Percentile Bootstrap UCL	9.559
Kolmogorov-Smirnov 5% Critical Value	0.256	95% BCA Bootstrap UCL	9.614
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	11.93
		97.5% Chebyshev(Mean, Sd) UCL	13.58
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	16.83
95% Approximate Gamma UCL	10.02		
95% Adjusted Gamma UCL	10.38		

Potential UCL to Use		Use 95% Student's-t UCL	9.694

Nitrobenzene

General Statistics

Number of Valid Samples	11	Number of Detected Data	4
Number of Unique Samples	4	Number of Non-Detect Data	7
		Percent Non-Detects	63.64%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.045	Minimum Detected	-3.101
Maximum Detected	0.125	Maximum Detected	-2.079
Mean of Detected	0.0875	Mean of Detected	-2.502
SD of Detected	0.0338	SD of Detected	0.439
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.993	Shapiro Wilk Test Statistic	0.946
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0636	Mean	-2.816
SD	0.0265	SD	0.346
95% DL/2 (t) UCL	0.0781	95% H-Stat (DL/2) UCL	0.0791

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.73
		SD in Log Scale	0.369
		Mean in Original Scale	0.0694
		SD in Original Scale	0.0264
		95% Percentile Bootstrap UCL	0.0826
		95% BCA Bootstrap UCL	0.0837

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.099	**Data appear Normal at 5% Significance Level**	
Theta Star	0.0417		
nu star	16.79		
A-D Test Statistic	0.25	**Nonparametric Statistics**	
5% A-D Critical Value	0.658	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.658	Mean	0.0716
5% K-S Critical Value	0.395	SD	0.0255
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0136
		95% KM (t) UCL	0.0963
Assuming Gamma Distribution		95% KM (z) UCL	0.094
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.108
Minimum	0.045	95% KM (bootstrap t) UCL	0.0938
Maximum	0.125	95% KM (BCA) UCL	0.105
Mean	0.0824	95% KM (Percentile Bootstrap) UCL	0.105
Median	0.08	95% KM (Chebyshev) UCL	0.131
SD	0.0218	97.5% KM (Chebyshev) UCL	0.157
k star	11.11	99% KM (Chebyshev) UCL	0.207
Theta star	0.00742		
Nu star	244.4	**Potential UCLs to Use**	
AppChi2	209.2	95% KM (t) UCL	0.0963
95% Gamma Approximate UCL	0.0963	95% KM (Percentile Bootstrap) UCL	0.105

95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

o-Nitrotoluene

General Statistics

Number of Valid Samples	11	Number of Detected Data	9
Number of Unique Samples	9	Number of Non-Detect Data	2
		Percent Non-Detects	18.18%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.14	Minimum Detected	-1.966
Maximum Detected	110	Maximum Detected	4.7
Mean of Detected	23.69	Mean of Detected	1.91
SD of Detected	34.79	SD of Detected	2.107
Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.2	Maximum Non-Detect	-1.609

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.703	Shapiro Wilk Test Statistic	0.952
5% Shapiro Wilk Critical Value	0.829	5% Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	19.4	Mean	1.144
SD	32.55	SD	2.541
95% DL/2 (t) UCL	37.18	95% H-Stat (DL/2) UCL	11456
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	12.01	Mean in Log Scale	1.23
SD	38.97	SD in Log Scale	2.431
95% MLE (t) UCL	33.31	Mean in Original Scale	19.41
95% MLE (Tiku) UCL	33.9	SD in Original Scale	32.54
		95% Percentile Bootstrap UCL	37.03
		95% BCA Bootstrap UCL	46.45

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	0.411	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	57.63	
nu star	7.397	
A-D Test Statistic	0.154	**Nonparametric Statistics**
5% A-D Critical Value	0.77	Kaplan-Meier (KM) Method
K-S Test Statistic	0.77	Mean 19.4
5% K-S Critical Value	0.294	SD 31.03
Data appear Gamma Distributed at 5% Significance Level		SE of Mean 9.924
		95% KM (t) UCL 37.39
Assuming Gamma Distribution		95% KM (z) UCL 35.73
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL 37.13

Minimum	0	95% KM (bootstrap t) UCL	64.22
Maximum	110	95% KM (BCA) UCL	37.87
Mean	19.38	95% KM (Percentile Bootstrap) UCL	37.43
Median	4.4	95% KM (Chebyshev) UCL	62.66
SD	32.56	97.5% KM (Chebyshev) UCL	81.38
k star	0.169	99% KM (Chebyshev) UCL	118.1
Theta star	114.8		
Nu star	3.715	**Potential UCLs to Use**	
AppChi2	0.612	95% KM (Chebyshev) UCL	62.66
95% Gamma Approximate UCL	117.6		
95% Adjusted Gamma UCL	162.4		

Note: DL/2 is not a recommended method.

Phenanthrene

General Statistics

Number of Valid Samples	11	Number of Detected Data	9
Number of Unique Samples	8	Number of Non-Detect Data	2
		Percent Non-Detects	18.18%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.00995	Minimum Detected	-4.61
Maximum Detected	0.03	Maximum Detected	-3.507
Mean of Detected	0.0156	Mean of Detected	-4.222
SD of Detected	0.00623	SD of Detected	0.344
Minimum Non-Detect	0.0079	Minimum Non-Detect	-4.841
Maximum Non-Detect	0.0079	Maximum Non-Detect	-4.841

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.814	Shapiro Wilk Test Statistic	0.914
5% Shapiro Wilk Critical Value	0.829	5% Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0134	Mean	-4.46
SD	0.00729	SD	0.614
95% DL/2 (t) UCL	0.0174	95% H-Stat (DL/2) UCL	0.0179
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0134	Mean in Log Scale	-4.373
SD	0.00713	SD in Log Scale	0.458
95% MLE (t) UCL	0.0173	Mean in Original Scale	0.0139
95% MLE (Tiku) UCL	0.0174	SD in Original Scale	0.00669
		95% Percentile Bootstrap UCL	0.0171
		95% BCA Bootstrap UCL	0.0176

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	5.934	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	0.00262	

nu star	106.8		
A-D Test Statistic	0.456	**Nonparametric Statistics**	
5% A-D Critical Value	0.722	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.722	Mean	0.0145
5% K-S Critical Value	0.279	SD	0.00574
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.00183
		95% KM (t) UCL	0.0179
Assuming Gamma Distribution		95% KM (z) UCL	0.0175
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.0177
Minimum	0.00686	95% KM (bootstrap t) UCL	0.0208
Maximum	0.03	95% KM (BCA) UCL	0.018
Mean	0.0142	95% KM (Percentile Bootstrap) UCL	0.0178
Median	0.013	95% KM (Chebyshev) UCL	0.0225
SD	0.00634	97.5% KM (Chebyshev) UCL	0.026
k star	4.966	99% KM (Chebyshev) UCL	0.0328
Theta star	0.00286		
Nu star	109.3	**Potential UCLs to Use**	
AppChi2	86.13	95% KM (BCA) UCL	0.018
95% Gamma Approximate UCL	0.018		
95% Adjusted Gamma UCL	0.0188		

Note: DL/2 is not a recommended method.

p-Nitrotoluene

General Statistics

Number of Valid Samples	11	Number of Detected Data	8
Number of Unique Samples	8	Number of Non-Detect Data	3
		Percent Non-Detects	27.27%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.445	Minimum Detected	-0.81
Maximum Detected	62	Maximum Detected	4.127
Mean of Detected	14.01	Mean of Detected	1.777
SD of Detected	20.1	SD of Detected	1.551
Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.2	Maximum Non-Detect	-1.609

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.661	Shapiro Wilk Test Statistic	0.961
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	10.21	Mean	0.664
SD	18.03	SD	2.306
95% DL/2 (t) UCL	20.07	95% H-Stat (DL/2) UCL	251.1

Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	6.098	Mean in Log Scale	0.732
SD	21.51	SD in Log Scale	2.241
95% MLE (t) UCL	17.85	Mean in Original Scale	10.23
95% MLE (Tiku) UCL	18.16	SD in Original Scale	18.02
		95% Percentile Bootstrap UCL	20.11
		95% BCA Bootstrap UCL	25.54

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.521	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	26.88		
nu star	8.337		
A-D Test Statistic	0.312	**Nonparametric Statistics**	
5% A-D Critical Value	0.749	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.749	Mean	10.31
5% K-S Critical Value	0.305	SD	17.13
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	5.523
		95% KM (t) UCL	20.32
Assuming Gamma Distribution		95% KM (z) UCL	19.39
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	19.96
Minimum	0	95% KM (bootstrap t) UCL	36.5
Maximum	62	95% KM (BCA) UCL	21.75
Mean	10.19	95% KM (Percentile Bootstrap) UCL	20.36
Median	2.5	95% KM (Chebyshev) UCL	34.38
SD	18.05	97.5% KM (Chebyshev) UCL	44.8
k star	0.147	99% KM (Chebyshev) UCL	65.26
Theta star	69.27		
Nu star	3.235	**Potential UCLs to Use**	
AppChi2	0.445	95% KM (Chebyshev) UCL	34.38
95% Gamma Approximate UCL	73.99		
95% Adjusted Gamma UCL	104.6		

Note: DL/2 is not a recommended method.

Potassium

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		**Log-transformed Statistics**	
Minimum	360	Minimum of Log Data	5.886
Maximum	1610	Maximum of Log Data	7.384
Mean	825.5	Mean of log Data	6.609
Median	843	SD of log Data	0.495
SD	388.8		
Coefficient of Variation	0.471		
Skewness	0.587		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.934	Shapiro Wilk Test Statistic	0.94
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85

Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1038	95% H-UCL	1179
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1379
95% Adjusted-CLT UCL	1041	97.5% Chebyshev (MVUE) UCL	1617
95% Modified-t UCL	1041	99% Chebyshev (MVUE) UCL	2085
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.584	**Data appear Normal at 5% Significance Level**	
Theta Star	230.3		
nu star	78.86		
Approximate Chi Square Value (.05)	59.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	1018
Adjusted Chi Square Value	56.65	95% Jackknife UCL	1038
		95% Standard Bootstrap UCL	1005
Anderson-Darling Test Statistic	0.311	95% Bootstrap-t UCL	1059
Anderson-Darling 5% Critical Value	0.732	95% Hall's Bootstrap UCL	1053
Kolmogorov-Smirnov Test Statistic	0.16	95% Percentile Bootstrap UCL	1021
Kolmogorov-Smirnov 5% Critical Value	0.256	95% BCA Bootstrap UCL	1025
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1337
		97.5% Chebyshev(Mean, Sd) UCL	1558
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1992
95% Approximate Gamma UCL	1096		
95% Adjusted Gamma UCL	1149		
Potential UCL to Use		Use 95% Student's-t UCL	1038

Pyrene

General Statistics			
Number of Valid Samples	11	Number of Detected Data	4
Number of Unique Samples	4	Number of Non-Detect Data	7
		Percent Non-Detects	63.64%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.0079	Minimum Detected	-4.841
Maximum Detected	0.0135	Maximum Detected	-4.305
Mean of Detected	0.0106	Mean of Detected	-4.568
SD of Detected	0.00233	SD of Detected	0.223
Minimum Non-Detect	0.0077	Minimum Non-Detect	-4.867
Maximum Non-Detect	0.0081	Maximum Non-Detect	-4.816
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	8
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	3
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	72.73%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.995	Shapiro Wilk Test Statistic	0.998
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00635	Mean	-5.185
SD	0.00359	SD	0.505
95% DL/2 (t) UCL	0.00831	95% H-Stat (DL/2) UCL	0.00854
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.00542	Mean in Log Scale	-5.025
SD	0.00476	SD in Log Scale	0.396
95% MLE (t) UCL	0.00802	Mean in Original Scale	0.00709
95% MLE (Tiku) UCL	0.0102	SD in Original Scale	0.00309
		95% Percentile Bootstrap UCL	0.00869
		95% BCA Bootstrap UCL	0.00898

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	6.966	**Data appear Normal at 5% Significance Level**	
Theta Star	0.00152		
nu star	55.73		
A-D Test Statistic	0.197	**Nonparametric Statistics**	
5% A-D Critical Value	0.657	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.657	Mean	0.00887
5% K-S Critical Value	0.394	SD	0.00177
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0006171
		95% KM (t) UCL	0.00999
Assuming Gamma Distribution		95% KM (z) UCL	0.00989
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.0103
Minimum	0.0079	95% KM (bootstrap t) UCL	0.00977
Maximum	0.0135	95% KM (BCA) UCL	0.0117
Mean	0.0105	95% KM (Percentile Bootstrap) UCL	0.0115
Median	0.0103	95% KM (Chebyshev) UCL	0.0116
SD	0.0013	97.5% KM (Chebyshev) UCL	0.0127
k star	52.67	99% KM (Chebyshev) UCL	0.015
Theta star	0.0001992		
Nu star	1159	**Potential UCLs to Use**	
AppChi2	1081	95% KM (t) UCL	0.00999
95% Gamma Approximate UCL	0.0112	95% KM (Percentile Bootstrap) UCL	0.0115
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

Thallium

General Statistics

Number of Valid Samples	7	Number of Detected Data	2
Number of Unique Samples	2	Number of Non-Detect Data	5
		Percent Non-Detects	71.43%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.65	Minimum Detected	-0.431
Maximum Detected	1.1	Maximum Detected	0.0953
Mean of Detected	0.875	Mean of Detected	-0.168

SD of Detected	0.318	SD of Detected	0.372
Minimum Non-Detect	0.355	Minimum Non-Detect	-1.036
Maximum Non-Detect	0.56	Maximum Non-Detect	-0.58

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	5
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	2
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	71.43%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	1	Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.43	Mean	-1.041
SD	0.332	SD	0.635
95% DL/2 (t) UCL	0.674	95% H-Stat (DL/2) UCL	0.484

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	N/A	
nu star	N/A	

A-D Test Statistic	0.359	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.714
5% K-S Critical Value	N/A	SD	0.157
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0842
		95% KM (t) UCL	0.878
Assuming Gamma Distribution		95% KM (z) UCL	0.853
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.05
Minimum	N/A	95% KM (bootstrap t) UCL	0.714
Maximum	N/A	95% KM (BCA) UCL	1.1
Mean	N/A	95% KM (Percentile Bootstrap) UCL	1.1
Median	N/A	95% KM (Chebyshev) UCL	1.081
SD	N/A	97.5% KM (Chebyshev) UCL	1.24
k star	N/A	99% KM (Chebyshev) UCL	1.552
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	0.878
95% Gamma Approximate UCL	N/A	95% KM (% Bootstrap) UCL	1.1
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

Vanadium

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		**Log-transformed Statistics**	
Minimum	27.5	Minimum of Log Data	3.314
Maximum	64.1	Maximum of Log Data	4.16
Mean	49.42	Mean of log Data	3.866
Median	53.7	SD of log Data	0.286
SD	12.63		
Coefficient of Variation	0.256		
Skewness	-0.639		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.895	Shapiro Wilk Test Statistic	0.868
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	56.32	95% H-UCL	59.29
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	68.34
95% Adjusted-CLT UCL	54.9	97.5% Chebyshev (MVUE) UCL	76.47
95% Modified-t UCL	56.2	99% Chebyshev (MVUE) UCL	92.44

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	10.71	**Data appear Normal at 5% Significance Level**	
Theta Star	4.613		
nu star	235.7		
Approximate Chi Square Value (.05)	201.1	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	55.68
Adjusted Chi Square Value	195.9	95% Jackknife UCL	56.32
		95% Standard Bootstrap UCL	55.23
Anderson-Darling Test Statistic	0.659	95% Bootstrap-t UCL	55.43
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	54.57
Kolmogorov-Smirnov Test Statistic	0.242	95% Percentile Bootstrap UCL	55.1
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	54.71
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	66.02
		97.5% Chebyshev(Mean, Sd) UCL	73.2
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	87.32
95% Approximate Gamma UCL	57.9		
95% Adjusted Gamma UCL	59.44		

Potential UCL to Use		Use 95% Student's-t UCL	56.32

Zinc

General Statistics

Number of Valid Samples	11	Number of Unique Samples	11

Raw Statistics		**Log-transformed Statistics**	
Minimum	19.5	Minimum of Log Data	2.97
Maximum	37.6	Maximum of Log Data	3.627
Mean	29.81	Mean of log Data	3.374
Median	31.9	SD of log Data	0.216
SD	6.063		
Coefficient of Variation	0.203		
Skewness	-0.38		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.931	Shapiro Wilk Test Statistic	0.917
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	33.12	95% H-UCL	33.98
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	38.33
95% Adjusted-CLT UCL	32.59	97.5% Chebyshev (MVUE) UCL	42.01
95% Modified-t UCL	33.09	99% Chebyshev (MVUE) UCL	49.23

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	18.07	**Data appear Normal at 5% Significance Level**	
Theta Star	1.65		
nu star	397.5		
Approximate Chi Square Value (.05)	352.2	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	32.82
Adjusted Chi Square Value	345.3	95% Jackknife UCL	33.12
		95% Standard Bootstrap UCL	32.67
Anderson-Darling Test Statistic	0.427	95% Bootstrap-t UCL	32.87
Anderson-Darling 5% Critical Value	0.729	95% Hall's Bootstrap UCL	32.41
Kolmogorov-Smirnov Test Statistic	0.204	95% Percentile Bootstrap UCL	32.72
Kolmogorov-Smirnov 5% Critical Value	0.255	95% BCA Bootstrap UCL	32.45
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	37.78
		97.5% Chebyshev(Mean, Sd) UCL	41.23
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	48
95% Approximate Gamma UCL	33.64		
95% Adjusted Gamma UCL	34.31		

Potential UCL to Use		Use 95% Student's-t UCL	33.12

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,3,5-Trinitrobenzene

General Statistics

Number of Valid Samples	25	Number of Detected Data	11
Number of Unique Samples	11	Number of Non-Detect Data	14
		Percent Non-Detects	56.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.07	Minimum Detected	-2.659
Maximum Detected	850	Maximum Detected	6.745
Mean of Detected	176.5	Mean of Detected	2.112
SD of Detected	293.4	SD of Detected	3.632
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	100	Maximum Non-Detect	4.605

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	22
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	3
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	88.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.675	Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.85	5% Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	79.69	Mean	-0.472
SD	208.9	SD	3.579
95% DL/2 (t) UCL	151.2	95% H-Stat (DL/2) UCL	31445
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-0.95
		SD in Log Scale	4.056
		Mean in Original Scale	77.76
		SD in Original Scale	209.4
		95% Percentile Bootstrap UCL	153
		95% BCA Bootstrap UCL	177

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.231
Theta Star	763.7
nu star	5.085
A-D Test Statistic	0.507
5% A-D Critical Value	0.846
K-S Test Statistic	0.846
5% K-S Critical Value	0.28
Data appear Gamma Distributed at 5% Significance Level	

Data Distribution Test with Detected Values Only
Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	0.07
Maximum	2021
Mean	363
Median	81.88
SD	512.8
k star	0.339
Theta star	1069
Nu star	16.97
AppChi2	8.652
95% Gamma Approximate UCL	712
95% Adjusted Gamma UCL	746.9

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	77.94
SD	205.1
SE of Mean	43.03
95% KM (t) UCL	151.6
95% KM (z) UCL	148.7
95% KM (jackknife) UCL	149.6
95% KM (bootstrap t) UCL	214.2
95% KM (BCA) UCL	157.5
95% KM (Percentile Bootstrap) UCL	150.9
95% KM (Chebyshev) UCL	265.5
97.5% KM (Chebyshev) UCL	346.7
99% KM (Chebyshev) UCL	506.1
Potential UCLs to Use	
95% KM (t) UCL	151.6

Note: DL/2 is not a recommended method.

1,3-Dinitrobenzene

General Statistics

Number of Valid Samples	25	Number of Detected Data	12
Number of Unique Samples	11	Number of Non-Detect Data	13
		Percent Non-Detects	52.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.08	Minimum Detected	-2.526
Maximum Detected	460	Maximum Detected	6.131
Mean of Detected	50.79	Mean of Detected	0.456
SD of Detected	131.6	SD of Detected	3.004
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	10	Maximum Non-Detect	2.303

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	21
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	4
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	84.00%

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.452
5% Shapiro Wilk Critical Value	0.859

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	24.6
SD	92.7
95% DL/2 (t) UCL	56.32
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.843
5% Shapiro Wilk Critical Value	0.859

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-1.155
SD	2.729
95% H-Stat (DL/2) UCL	45.03
Log ROS Method	
Mean in Log Scale	-2.552
SD in Log Scale	3.911
Mean in Original Scale	24.39
SD in Original Scale	92.76
95% Percentile Bootstrap UCL	58.83
95% BCA Bootstrap UCL	80.34

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.213
Theta Star	238.1
nu star	5.119
A-D Test Statistic	1.296
5% A-D Critical Value	0.861
K-S Test Statistic	0.861
5% K-S Critical Value	0.27

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0
Maximum	530.6
Mean	83.62
Median	0.62
SD	151.5
k star	0.118
Theta star	709.8
Nu star	5.891
AppChi2	1.584
95% Gamma Approximate UCL	310.9
95% Adjusted Gamma UCL	342.6

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	24.42
SD	90.87
SE of Mean	18.98
95% KM (t) UCL	56.9
95% KM (z) UCL	55.65
95% KM (jackknife) UCL	56.15
95% KM (bootstrap t) UCL	299.2
95% KM (BCA) UCL	60.64
95% KM (Percentile Bootstrap) UCL	58.59
95% KM (Chebyshev) UCL	107.2
97.5% KM (Chebyshev) UCL	143
99% KM (Chebyshev) UCL	213.3

Potential UCLs to Use

99% KM (Chebyshev) UCL	213.3

2,4,6-Trinitrotoluene

General Statistics

Number of Valid Samples	25	Number of Detected Data	23
Number of Unique Samples	21	Number of Non-Detect Data	2
		Percent Non-Detects	8.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.04	Minimum Detected	-3.219
Maximum Detected	61000	Maximum Detected	11.02
Mean of Detected	7902	Mean of Detected	1.864
SD of Detected	18097	SD of Detected	5.178
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.502	Shapiro Wilk Test Statistic	0.808
5% Shapiro Wilk Critical Value	0.914	5% Shapiro Wilk Critical Value	0.914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	7270	Mean	1.475
SD	17465	SD	5.137
95% DL/2 (t) UCL	13246	95% H-Stat (DL/2) UCL	4.327E+10
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	2794	Mean in Log Scale	1.358
SD	21257	SD in Log Scale	5.267
95% MLE (t) UCL	10068	Mean in Original Scale	7270
95% MLE (Tiku) UCL	10252	SD in Original Scale	17465
		95% Percentile Bootstrap UCL	13440
		95% BCA Bootstrap UCL	15292

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.127	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	62319		
nu star	5.833		
A-D Test Statistic	2.745	**Nonparametric Statistics**	
5% A-D Critical Value	0.929	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.929	Mean	7270

5% K-S Critical Value	0.204	SD	17112
Data not Gamma Distributed at 5% Significance Level		SE of Mean	3499
		95% KM (t) UCL	13257
Assuming Gamma Distribution		95% KM (z) UCL	13026
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	13246
Minimum	0	95% KM (bootstrap t) UCL	18495
Maximum	61000	95% KM (BCA) UCL	13223
Mean	7270	95% KM (Percentile Bootstrap) UCL	13490
Median	0.39	95% KM (Chebyshev) UCL	22523
SD	17465	97.5% KM (Chebyshev) UCL	29123
k star	0.108	99% KM (Chebyshev) UCL	42087
Theta star	67118		
Nu star	5.416	**Potential UCLs to Use**	
AppChi2	1.349	99% KM (Chebyshev) UCL	42087
95% Gamma Approximate UCL	29187		
95% Adjusted Gamma UCL	32349		

Note: DL/2 is not a recommended method.

2,4-Dinitrotoluene

General Statistics

Number of Valid Samples	25	Number of Detected Data	22
Number of Unique Samples	21	Number of Non-Detect Data	3
		Percent Non-Detects	12.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.04	Minimum Detected	-3.219
Maximum Detected	44000	Maximum Detected	10.69
Mean of Detected	4805	Mean of Detected	2.496
SD of Detected	11494	SD of Detected	4.557
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.494	Shapiro Wilk Test Statistic	0.85
5% Shapiro Wilk Critical Value	0.911	5% Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	4228	Mean	1.837
SD	10869	SD	4.635
95% DL/2 (t) UCL	7947	95% H-Stat (DL/2) UCL	749900000

Maximum Likelihood Estimate(MLE) Method	
Mean	1955
SD	12723
95% MLE (t) UCL	6308
95% MLE (Tiku) UCL	6301

Log ROS Method	
Mean in Log Scale	1.665
SD in Log Scale	4.865
Mean in Original Scale	4228
SD in Original Scale	10869
95% Percentile Bootstrap UCL	7972
95% BCA Bootstrap UCL	9100

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.143
Theta Star	33495
nu star	6.311
A-D Test Statistic	2.368
5% A-D Critical Value	0.92
K-S Test Statistic	0.92
5% K-S Critical Value	0.208

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0
Maximum	44000
Mean	4228
Median	0.93
SD	10869
k star	0.11
Theta star	38453
Nu star	5.498
AppChi2	1.389
95% Gamma Approximate UCL	16737
95% Adjusted Gamma UCL	18530

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	4228
SD	10649
SE of Mean	2180
95% KM (t) UCL	7958
95% KM (z) UCL	7814
95% KM (jackknife) UCL	7947
95% KM (bootstrap t) UCL	12347
95% KM (BCA) UCL	8251
95% KM (Percentile Bootstrap) UCL	7973
95% KM (Chebyshev) UCL	13731
97.5% KM (Chebyshev) UCL	17842
99% KM (Chebyshev) UCL	25919

Potential UCLs to Use

99% KM (Chebyshev) UCL	25919

2,6-Dinitrotoluene

General Statistics

Number of Valid Samples	18
Number of Unique Samples	14

Number of Detected Data	14
Number of Non-Detect Data	4
Percent Non-Detects	22.22%

Raw Statistics

Minimum Detected	0.055
Maximum Detected	11000

Log-transformed Statistics

Minimum Detected	-2.9
Maximum Detected	9.306

Mean of Detected	1538	Mean of Detected	2.889
SD of Detected	3189	SD of Detected	4.279
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.572	Shapiro Wilk Test Statistic	0.918
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1196	Mean	1.581
SD	2865	SD	4.51
95% DL/2 (t) UCL	2371	95% H-Stat (DL/2) UCL	124000000
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	256	Mean in Log Scale	1.346
SD	3649	SD in Log Scale	4.85
95% MLE (t) UCL	1752	Mean in Original Scale	1196
95% MLE (Tiku) UCL	1850	SD in Original Scale	2865
		95% Percentile Bootstrap UCL	2395
		95% BCA Bootstrap UCL	2902

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.181	**Data Follow Appr. Gamma Distribution at 5% Significance Level**	
Theta Star	8501		
nu star	5.065		
A-D Test Statistic	0.778	**Nonparametric Statistics**	
5% A-D Critical Value	0.884	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.884	Mean	1196
5% K-S Critical Value	0.254	SD	2784
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	681.1
		95% KM (t) UCL	2381
Assuming Gamma Distribution		95% KM (z) UCL	2316
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2371
Minimum	0	95% KM (bootstrap t) UCL	5466
Maximum	11000	95% KM (BCA) UCL	2417
Mean	1196	95% KM (Percentile Bootstrap) UCL	2447
Median	1.225	95% KM (Chebyshev) UCL	4165
SD	2865	97.5% KM (Chebyshev) UCL	5449
k star	0.11	99% KM (Chebyshev) UCL	7973
Theta star	10886		

Nu star	3.956	**Potential UCLs to Use**	
AppChi2	0.704	95% KM (Chebyshev) UCL	4165
95% Gamma Approximate UCL	6719		
95% Adjusted Gamma UCL	8049		

Note: DL/2 is not a recommended method.

2-Amino-4,6-Dinitrotoluene

General Statistics

Number of Valid Samples	25	Number of Detected Data	2
Number of Unique Samples	2	Number of Non-Detect Data	23
		Percent Non-Detects	92.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.05	Minimum Detected	-2.996
Maximum Detected	32	Maximum Detected	3.466
Mean of Detected	16.03	Mean of Detected	0.235
SD of Detected	22.59	SD of Detected	4.569
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	100	Maximum Non-Detect	4.605

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	25
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	1	Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	7.718	Mean	-1.54
SD	17.18	SD	2.695
95% DL/2 (t) UCL	13.6	95% H-Stat (DL/2) UCL	104.5
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.363
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A
Data not Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	1.502
SD	6.655
SE of Mean	2.007
95% KM (t) UCL	4.935
95% KM (z) UCL	4.803
95% KM (jackknife) UCL	22.45
95% KM (bootstrap t) UCL	1.8E+308
95% KM (BCA) UCL	32
95% KM (Percentile Bootstrap) UCL	32
95% KM (Chebyshev) UCL	10.25
97.5% KM (Chebyshev) UCL	14.03
99% KM (Chebyshev) UCL	21.47
Potential UCLs to Use	
99% KM (Chebyshev) UCL	21.47

2-Hexanone

General Statistics

Number of Valid Samples	25	Number of Detected Data	4
Number of Unique Samples	4	Number of Non-Detect Data	21
		Percent Non-Detects	84.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0062	Minimum Detected	-5.083
Maximum Detected	0.021	Maximum Detected	-3.863
Mean of Detected	0.0133	Mean of Detected	-4.448
SD of Detected	0.0073	SD of Detected	0.599
Minimum Non-Detect	0.0092	Minimum Non-Detect	-4.689
Maximum Non-Detect	0.058	Maximum Non-Detect	-2.847

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	25
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.878
5% Shapiro Wilk Critical Value	0.748

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00853
SD	0.00694
95% DL/2 (t) UCL	0.0109
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.883
5% Shapiro Wilk Critical Value	0.748

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-4.975
SD	0.591
95% H-Stat (DL/2) UCL	0.00968
Log ROS Method	
Mean in Log Scale	-4.852
SD in Log Scale	0.339
Mean in Original Scale	0.00833
SD in Original Scale	0.00368
95% Percentile Bootstrap UCL	0.0096
95% BCA Bootstrap UCL	0.01

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.183
Theta Star	0.0112
nu star	9.462
A-D Test Statistic	0.418
5% A-D Critical Value	0.659
K-S Test Statistic	0.659
5% K-S Critical Value	0.396

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.0062
Maximum	0.021
Mean	0.0133
Median	0.0133
SD	0.00273
k star	19.56
Theta star	0.0006816
Nu star	977.9
AppChi2	906.3
95% Gamma Approximate UCL	0.0144
95% Adjusted Gamma UCL	N/A

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00823
SD	0.00369
SE of Mean	0.00111
95% KM (t) UCL	0.0101
95% KM (z) UCL	0.0101
95% KM (jackknife) UCL	0.0106
95% KM (bootstrap t) UCL	0.0099
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	0.0184
95% KM (Chebyshev) UCL	0.0131
97.5% KM (Chebyshev) UCL	0.0152
99% KM (Chebyshev) UCL	0.0193

Potential UCLs to Use

95% KM (t) UCL	0.0101
95% KM (Percentile Bootstrap) UCL	0.0184

Note: DL/2 is not a recommended method.

4,6-dinitro-2-methyl phenol

General Statistics

Number of Valid Samples	25	Number of Detected Data	2
Number of Unique Samples	2	Number of Non-Detect Data	23
		Percent Non-Detects	92.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	2.1	Minimum Detected	0.742
Maximum Detected	2.7	Maximum Detected	0.993
Mean of Detected	2.4	Mean of Detected	0.868
SD of Detected	0.424	SD of Detected	0.178
Minimum Non-Detect	0.75	Minimum Non-Detect	-0.288
Maximum Non-Detect	1800	Maximum Non-Detect	7.496

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	25
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	1	Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	49.08	Mean	0.471
SD	179.8	SD	2.374
95% DL/2 (t) UCL	110.6	95% H-Stat (DL/2) UCL	332.6
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	0.359	**Nonparametric Statistics**	

5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	2.132
5% K-S Critical Value	N/A	SD	0.134
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0435
		95% KM (t) UCL	2.206
Assuming Gamma Distribution		95% KM (z) UCL	2.203
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.523
Minimum	N/A	95% KM (bootstrap t) UCL	1.8E+308
Maximum	N/A	95% KM (BCA) UCL	2.7
Mean	N/A	95% KM (Percentile Bootstrap) UCL	2.7
Median	N/A	95% KM (Chebyshev) UCL	2.321
SD	N/A	97.5% KM (Chebyshev) UCL	2.403
k star	N/A	99% KM (Chebyshev) UCL	2.564
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	2.206
95% Gamma Approximate UCL	N/A	95% KM (% Bootstrap) UCL	2.7
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

4-Methyl-2-Pentanone

General Statistics

Number of Valid Samples	25	Number of Detected Data	6
Number of Unique Samples	6	Number of Non-Detect Data	19
		Percent Non-Detects	76.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.0069	Minimum Detected	-4.976
Maximum Detected	0.16	Maximum Detected	-1.833
Mean of Detected	0.0613	Mean of Detected	-3.299
SD of Detected	0.0594	SD of Detected	1.198
Minimum Non-Detect	0.0092	Minimum Non-Detect	-4.689
Maximum Non-Detect	0.058	Maximum Non-Detect	-2.847

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	22
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	3
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	88.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.891	Shapiro Wilk Test Statistic	0.966
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0202
SD	0.0364
95% DL/2 (t) UCL	0.0326
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-4.681
SD	1.059
95% H-Stat (DL/2) UCL	0.0212
Log ROS Method	
Mean in Log Scale	-4.853
SD in Log Scale	1.155
Mean in Original Scale	0.0189
SD in Original Scale	0.0365
95% Percentile Bootstrap UCL	0.0315
95% BCA Bootstrap UCL	0.037

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.672
Theta Star	0.0912
nu star	8.065
A-D Test Statistic	0.214
5% A-D Critical Value	0.713
K-S Test Statistic	0.713
5% K-S Critical Value	0.34

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0
Maximum	0.16
Mean	0.0147
Median	0
SD	0.0381
k star	0.0872
Theta star	0.169
Nu star	4.362
AppChi2	0.87
95% Gamma Approximate UCL	0.0738
95% Adjusted Gamma UCL	0.0832

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0201
SD	0.0353
SE of Mean	0.00774
95% KM (t) UCL	0.0333
95% KM (z) UCL	0.0328
95% KM (jackknife) UCL	0.0307
95% KM (bootstrap t) UCL	0.0372
95% KM (BCA) UCL	0.0729
95% KM (Percentile Bootstrap) UCL	0.0471
95% KM (Chebyshev) UCL	0.0538
97.5% KM (Chebyshev) UCL	0.0684
99% KM (Chebyshev) UCL	0.097

Potential UCLs to Use

95% KM (t) UCL	0.0333
95% KM (Percentile Bootstrap) UCL	0.0471

Aluminum

General Statistics

Number of Valid Samples 25

Number of Unique Samples 22

Raw Statistics

Minimum	8620
Maximum	29700
Mean	17711
Median	15800
SD	6052
Coefficient of Variation	0.342
Skewness	0.586

Log-transformed Statistics

Minimum of Log Data	9.062
Maximum of Log Data	10.3
Mean of log Data	9.727
SD of log Data	0.34

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.926
Shapiro Wilk Critical Value	0.918

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	19782

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	19854
95% Modified-t UCL	19805

Gamma Distribution Test

k star (bias corrected)	8.131
Theta Star	2178
nu star	406.6
Approximate Chi Square Value (.05)	360.8
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	357.9
Anderson-Darling Test Statistic	0.462
Anderson-Darling 5% Critical Value	0.745
Kolmogorov-Smirnov Test Statistic	0.138
Kolmogorov-Smirnov 5% Critical Value	0.175

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	19956
95% Adjusted Gamma UCL	20119

Potential UCL to Use

Use 95% Student's-t UCL 19782

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.961
Shapiro Wilk Critical Value	0.918

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	20175
95% Chebyshev (MVUE) UCL	23061
97.5% Chebyshev (MVUE) UCL	25376
99% Chebyshev (MVUE) UCL	29923

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	19702
95% Jackknife UCL	19782
95% Standard Bootstrap UCL	19695
95% Bootstrap-t UCL	20075
95% Hall's Bootstrap UCL	19931
95% Percentile Bootstrap UCL	19822
95% BCA Bootstrap UCL	19848
95% Chebyshev(Mean, Sd) UCL	22987
97.5% Chebyshev(Mean, Sd) UCL	25270
99% Chebyshev(Mean, Sd) UCL	29755

Antimony

General Statistics

Number of Valid Samples	18	Number of Detected Data	4
Number of Unique Samples	4	Number of Non-Detect Data	14
		Percent Non-Detects	77.78%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.25	Minimum Detected	-1.386
Maximum Detected	5.4	Maximum Detected	1.686
Mean of Detected	2.498	Mean of Detected	0.291
SD of Detected	2.475	SD of Detected	1.454
Minimum Non-Detect	0.3	Minimum Non-Detect	-1.204
Maximum Non-Detect	0.82	Maximum Non-Detect	-0.198

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	16
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	2
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	88.89%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.894	Shapiro Wilk Test Statistic	0.913
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.76	Mean	-0.996
SD	1.413	SD	0.96
95% DL/2 (t) UCL	1.339	95% H-Stat (DL/2) UCL	0.68
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-1.175
		SD in Log Scale	1.048
		Mean in Original Scale	0.72
		SD in Original Scale	1.428
		95% Percentile Bootstrap UCL	1.303
		95% BCA Bootstrap UCL	1.562

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.4	**Data appear Normal at 5% Significance Level**	
Theta Star	6.25		
nu star	3.197		
A-D Test Statistic	0.353	**Nonparametric Statistics**	

5% A-D Critical Value	0.668
K-S Test Statistic	0.668
5% K-S Critical Value	0.403

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0
Maximum	5.4
Mean	0.555
Median	0
SD	1.491
k star	0.0837
Theta star	6.631
Nu star	3.013
AppChi2	0.376
95% Gamma Approximate UCL	4.444
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Kaplan-Meier (KM) Method	
Mean	0.754
SD	1.375
SE of Mean	0.374
95% KM (t) UCL	1.406
95% KM (z) UCL	1.37
95% KM (jackknife) UCL	1.269
95% KM (bootstrap t) UCL	1.269
95% KM (BCA) UCL	5.4
95% KM (Percentile Bootstrap) UCL	3.889
95% KM (Chebyshev) UCL	2.387
97.5% KM (Chebyshev) UCL	3.093
99% KM (Chebyshev) UCL	4.48

Potential UCLs to Use

95% KM (t) UCL	1.406
95% KM (Percentile Bootstrap) UCL	3.889

Arsenic

General Statistics

Number of Valid Samples	21
Number of Unique Samples	18

Raw Statistics

Minimum	1.5
Maximum	15.3
Mean	5.824
Median	3.7
SD	4.794
Coefficient of Variation	0.823
Skewness	1.267

Log-transformed Statistics

Minimum of Log Data	0.405
Maximum of Log Data	2.728
Mean of log Data	1.486
SD of log Data	0.734

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.746
Shapiro Wilk Critical Value	0.908

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	7.628

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	7.854
95% Modified-t UCL	7.676

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.9
Shapiro Wilk Critical Value	0.908

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	8.343
95% Chebyshev (MVUE) UCL	9.971
97.5% Chebyshev (MVUE) UCL	11.82
99% Chebyshev (MVUE) UCL	15.45

Gamma Distribution Test

k star (bias corrected)	1.716
Theta Star	3.393
nu star	72.09
Approximate Chi Square Value (.05)	53.54
Adjusted Level of Significance	0.0383
Adjusted Chi Square Value	52.31
Anderson-Darling Test Statistic	1.331
Anderson-Darling 5% Critical Value	0.754
Kolmogorov-Smirnov Test Statistic	0.217
Kolmogorov-Smirnov 5% Critical Value	0.192

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	7.842
95% Adjusted Gamma UCL	8.026

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	7.545
95% Jackknife UCL	7.628
95% Standard Bootstrap UCL	7.503
95% Bootstrap-t UCL	7.965
95% Hall's Bootstrap UCL	7.403
95% Percentile Bootstrap UCL	7.538
95% BCA Bootstrap UCL	7.931
95% Chebyshev(Mean, Sd) UCL	10.38
97.5% Chebyshev(Mean, Sd) UCL	12.36
99% Chebyshev(Mean, Sd) UCL	16.23

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 10.38

Chromium

General Statistics

Number of Valid Samples	25
Number of Unique Samples	24

Raw Statistics

Minimum	12.95
Maximum	533
Mean	103.7
Median	25.15
SD	172.9
Coefficient of Variation	1.668
Skewness	1.845

Log-transformed Statistics

Minimum of Log Data	2.561
Maximum of Log Data	6.279
Mean of log Data	3.67
SD of log Data	1.232

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.544
Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	162.8

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	174.2

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.702
Shapiro Wilk Critical Value	0.918

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	170.4
95% Chebyshev (MVUE) UCL	181.2
97.5% Chebyshev (MVUE) UCL	225.1

95% Modified-t UCL	165	99% Chebyshev (MVUE) UCL	311.3

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.582	Data do not follow a Discernable Distribution (0.05)	
Theta Star	178.1		
nu star	29.11		
Approximate Chi Square Value (.05)	17.79	Nonparametric Statistics	
Adjusted Level of Significance	0.0395	95% CLT UCL	160.5
Adjusted Chi Square Value	17.19	95% Jackknife UCL	162.8
		95% Standard Bootstrap UCL	161.2
Anderson-Darling Test Statistic	4.43	95% Bootstrap-t UCL	192.2
Anderson-Darling 5% Critical Value	0.795	95% Hall's Bootstrap UCL	151.3
Kolmogorov-Smirnov Test Statistic	0.415	95% Percentile Bootstrap UCL	160.9
Kolmogorov-Smirnov 5% Critical Value	0.183	95% BCA Bootstrap UCL	173.1
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	254.4
		97.5% Chebyshev(Mean, Sd) UCL	319.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	447.7
95% Approximate Gamma UCL	169.6		
95% Adjusted Gamma UCL	175.5		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	447.7

Cobalt

General Statistics

Number of Valid Samples	25	Number of Unique Samples	23

Raw Statistics		Log-transformed Statistics	
Minimum	3.2	Minimum of Log Data	1.163
Maximum	179	Maximum of Log Data	5.187
Mean	14.4	Mean of log Data	2.054
Median	7.2	SD of log Data	0.79
SD	34.46		
Coefficient of Variation	2.392		
Skewness	4.923		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.285	Shapiro Wilk Test Statistic	0.752
Shapiro Wilk Critical Value	0.918	Shapiro Wilk Critical Value	0.918
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	26.19	95% H-UCL	15.32
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	18.38

95% Adjusted-CLT UCL	32.99
95% Modified-t UCL	27.32
97.5% Chebyshev (MVUE) UCL	21.79
99% Chebyshev (MVUE) UCL	28.5

Gamma Distribution Test

k star (bias corrected)	0.86
Theta Star	16.75
nu star	42.99
Approximate Chi Square Value (.05)	28.96
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	28.17
Anderson-Darling Test Statistic	3.933
Anderson-Darling 5% Critical Value	0.775
Kolmogorov-Smirnov Test Statistic	0.325
Kolmogorov-Smirnov 5% Critical Value	0.18

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	21.38
95% Adjusted Gamma UCL	21.98

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	25.74
95% Jackknife UCL	26.19
95% Standard Bootstrap UCL	25.49
95% Bootstrap-t UCL	106.6
95% Hall's Bootstrap UCL	72.4
95% Percentile Bootstrap UCL	28.08
95% BCA Bootstrap UCL	35.61
95% Chebyshev(Mean, Sd) UCL	44.44
97.5% Chebyshev(Mean, Sd) UCL	57.44
99% Chebyshev(Mean, Sd) UCL	82.97

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 44.44

Copper

General Statistics

Number of Valid Samples	25
Number of Unique Samples	24

Raw Statistics

Minimum	4.6
Maximum	360
Mean	33.02
Median	10.7
SD	72.17
Coefficient of Variation	2.186
Skewness	4.205

Log-transformed Statistics

Minimum of Log Data	1.526
Maximum of Log Data	5.886
Mean of log Data	2.587
SD of log Data	1.142

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.416
Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.813
Shapiro Wilk Critical Value	0.918

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 57.71

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL 69.73

95% Modified-t UCL 59.74

Assuming Lognormal Distribution

95% H-UCL 47.82

95% Chebyshev (MVUE) UCL 52.94

97.5% Chebyshev (MVUE) UCL 65.24

99% Chebyshev (MVUE) UCL 89.42

Gamma Distribution Test

k star (bias corrected) 0.615

Theta Star 53.72

nu star 30.73

Approximate Chi Square Value (.05) 19.07

Adjusted Level of Significance 0.0395

Adjusted Chi Square Value 18.44

Anderson-Darling Test Statistic 2.973

Anderson-Darling 5% Critical Value 0.791

Kolmogorov-Smirnov Test Statistic 0.323

Kolmogorov-Smirnov 5% Critical Value 0.182

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL 53.21

95% Adjusted Gamma UCL 55.02

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL 56.76

95% Jackknife UCL 57.71

95% Standard Bootstrap UCL 56.74

95% Bootstrap-t UCL 107.8

95% Hall's Bootstrap UCL 131.6

95% Percentile Bootstrap UCL 59.4

95% BCA Bootstrap UCL 74.54

95% Chebyshev(Mean, Sd) UCL 95.93

97.5% Chebyshev(Mean, Sd) UCL 123.2

99% Chebyshev(Mean, Sd) UCL 176.6

Potential UCL to Use

Use 99% Chebyshev (Mean, Sd) UCL 176.6

Iron

General Statistics

Number of Valid Samples 25

Number of Unique Samples 24

Raw Statistics

Minimum 11500

Maximum 191000

Mean 50804

Median 23700

SD 59867

Coefficient of Variation 1.178

Skewness 1.598

Log-transformed Statistics

Minimum of Log Data 9.35

Maximum of Log Data 12.16

Mean of log Data 10.36

SD of log Data 0.894

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic 0.605

Shapiro Wilk Critical Value 0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic 0.773

Shapiro Wilk Critical Value 0.918

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 71289

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL 74588

95% Modified-t UCL 71927

Assuming Lognormal Distribution

95% H-UCL 72491

95% Chebyshev (MVUE) UCL 85937

97.5% Chebyshev (MVUE) UCL 103216

99% Chebyshev (MVUE) UCL 137157

Gamma Distribution Test

k star (bias corrected) 1.071

Theta Star 47426

nu star 53.56

Approximate Chi Square Value (.05) 37.75

Adjusted Level of Significance 0.0395

Adjusted Chi Square Value 36.84

Anderson-Darling Test Statistic 3.394

Anderson-Darling 5% Critical Value 0.769

Kolmogorov-Smirnov Test Statistic 0.347

Kolmogorov-Smirnov 5% Critical Value 0.179

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL 72088

95% Adjusted Gamma UCL 73859

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL 70499

95% Jackknife UCL 71289

95% Standard Bootstrap UCL 70626

95% Bootstrap-t UCL 78248

95% Hall's Bootstrap UCL 68663

95% Percentile Bootstrap UCL 70820

95% BCA Bootstrap UCL 74224

95% Chebyshev(Mean, Sd) UCL 102995

97.5% Chebyshev(Mean, Sd) UCL 125578

99% Chebyshev(Mean, Sd) UCL 169938

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 102995

Lead

General Statistics

Number of Valid Samples 25

Number of Unique Samples 25

Raw Statistics

Minimum 4.2

Maximum 4180

Mean 698.3

Median 14.7

SD 1443

Coefficient of Variation 2.066

Skewness 1.809

Log-transformed Statistics

Minimum of Log Data 1.435

Maximum of Log Data 8.338

Mean of log Data 3.683

SD of log Data 2.33

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic 0.52

Shapiro Wilk Critical Value 0.918

Lognormal Distribution Test

Shapiro Wilk Test Statistic 0.712

Shapiro Wilk Critical Value 0.918

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1192

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	1284
95% Modified-t UCL	1209

Gamma Distribution Test

k star (bias corrected)	0.245
Theta Star	2849
nu star	12.25
Approximate Chi Square Value (.05)	5.394
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	5.086
Anderson-Darling Test Statistic	4.554
Anderson-Darling 5% Critical Value	0.874
Kolmogorov-Smirnov Test Statistic	0.392
Kolmogorov-Smirnov 5% Critical Value	0.191

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	1586
95% Adjusted Gamma UCL	1682

Potential UCL to Use

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	5235
95% Chebyshev (MVUE) UCL	1595
97.5% Chebyshev (MVUE) UCL	2096
99% Chebyshev (MVUE) UCL	3081

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	1173
95% Jackknife UCL	1192
95% Standard Bootstrap UCL	1165
95% Bootstrap-t UCL	1472
95% Hall's Bootstrap UCL	1101
95% Percentile Bootstrap UCL	1185
95% BCA Bootstrap UCL	1276
95% Chebyshev(Mean, Sd) UCL	1956
97.5% Chebyshev(Mean, Sd) UCL	2500
99% Chebyshev(Mean, Sd) UCL	3569

Use 99% Chebyshev (Mean, Sd) UCL 3569

Manganese

General Statistics

Number of Valid Samples	25
Number of Unique Samples	25

Raw Statistics

Minimum	140
Maximum	3590
Mean	506.4
Median	370
SD	657.1
Coefficient of Variation	1.297
Skewness	4.653

Log-transformed Statistics

Minimum of Log Data	4.942
Maximum of Log Data	8.186
Mean of log Data	5.962
SD of log Data	0.591

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.387

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.816

Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	731.3

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	853.3
95% Modified-t UCL	751.7

Gamma Distribution Test

k star (bias corrected)	1.816
Theta Star	278.9
nu star	90.8
Approximate Chi Square Value (.05)	69.83
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	68.58
Anderson-Darling Test Statistic	2.586
Anderson-Darling 5% Critical Value	0.756
Kolmogorov-Smirnov Test Statistic	0.26
Kolmogorov-Smirnov 5% Critical Value	0.177

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	658.5
95% Adjusted Gamma UCL	670.6

Potential UCL to Use

Shapiro Wilk Critical Value	0.918

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	591.7
95% Chebyshev (MVUE) UCL	708
97.5% Chebyshev (MVUE) UCL	816
99% Chebyshev (MVUE) UCL	1028

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	722.6
95% Jackknife UCL	731.3
95% Standard Bootstrap UCL	719.1
95% Bootstrap-t UCL	1364
95% Hall's Bootstrap UCL	1562
95% Percentile Bootstrap UCL	756.2
95% BCA Bootstrap UCL	904.4
95% Chebyshev(Mean, Sd) UCL	1079
97.5% Chebyshev(Mean, Sd) UCL	1327
99% Chebyshev(Mean, Sd) UCL	1814

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 1079

m-Nitrotoluene

General Statistics

Number of Valid Samples	25	Number of Detected Data	19
Number of Unique Samples	19	Number of Non-Detect Data	6
		Percent Non-Detects	24.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.105	Minimum Detected	-2.254
Maximum Detected	2100	Maximum Detected	7.65
Mean of Detected	324.4	Mean of Detected	2.421
SD of Detected	632.1	SD of Detected	3.124
Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.2	Maximum Non-Detect	-1.609

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.592
5% Shapiro Wilk Critical Value	0.901

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	246.6
SD	565.3
95% DL/2 (t) UCL	440
Maximum Likelihood Estimate(MLE) Method	
Mean	102.5
SD	689.5
95% MLE (t) UCL	338.4
95% MLE (Tiku) UCL	344.5

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.217
Theta Star	1494
nu star	8.254
A-D Test Statistic	1.587
5% A-D Critical Value	0.88
K-S Test Statistic	0.88
5% K-S Critical Value	0.219

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0
Maximum	2100
Mean	246.5
Median	1.9
SD	565.4
k star	0.11
Theta star	2243
Nu star	5.497
AppChi2	1.388
95% Gamma Approximate UCL	976.1
95% Adjusted Gamma UCL	1081

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.91
5% Shapiro Wilk Critical Value	0.901

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	1.287
SD	3.4
95% H-Stat (DL/2) UCL	8670
Log ROS Method	
Mean in Log Scale	0.894
SD in Log Scale	3.945
Mean in Original Scale	246.6
SD in Original Scale	565.3
95% Percentile Bootstrap UCL	447.5
95% BCA Bootstrap UCL	496

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	246.6
SD	553.9
SE of Mean	113.8
95% KM (t) UCL	441.3
95% KM (z) UCL	433.8
95% KM (jackknife) UCL	440
95% KM (bootstrap t) UCL	601.7
95% KM (BCA) UCL	454.8
95% KM (Percentile Bootstrap) UCL	447.1
95% KM (Chebyshev) UCL	742.7
97.5% KM (Chebyshev) UCL	957.4
99% KM (Chebyshev) UCL	1379

Potential UCLs to Use

99% KM (Chebyshev) UCL	1379

o-Nitrotoluene

General Statistics

Number of Valid Samples	25	Number of Detected Data	21
Number of Unique Samples	21	Number of Non-Detect Data	4
		Percent Non-Detects	16.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.14	Minimum Detected	-1.966
Maximum Detected	25000	Maximum Detected	10.13
Mean of Detected	2331	Mean of Detected	3.885
SD of Detected	6050	SD of Detected	3.355
Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.2	Maximum Non-Detect	-1.609

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.452	Shapiro Wilk Test Statistic	0.969
5% Shapiro Wilk Critical Value	0.908	5% Shapiro Wilk Critical Value	0.908
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1958	Mean	2.895
SD	5592	SD	3.84
95% DL/2 (t) UCL	3872	95% H-Stat (DL/2) UCL	6489711
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	1022	Mean in Log Scale	2.791
SD	6310	SD in Log Scale	4.022
95% MLE (t) UCL	3181	Mean in Original Scale	1958
95% MLE (Tiku) UCL	3124	SD in Original Scale	5592
		95% Percentile Bootstrap UCL	3905
		95% BCA Bootstrap UCL	4880

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.196	**Data appear Lognormal at 5% Significance Level**	
Theta Star	11901		
nu star	8.227		
A-D Test Statistic	1.56	**Nonparametric Statistics**	
5% A-D Critical Value	0.894	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.894	Mean	1958
5% K-S Critical Value	0.21	SD	5479

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0
Maximum	25000
Mean	1958
Median	24
SD	5592
k star	0.12
Theta star	16366
Nu star	5.983
AppChi2	1.631
95% Gamma Approximate UCL	7183
95% Adjusted Gamma UCL	7906

SE of Mean	1123
95% KM (t) UCL	3879
95% KM (z) UCL	3805
95% KM (jackknife) UCL	3872
95% KM (bootstrap t) UCL	6066
95% KM (BCA) UCL	3916
95% KM (Percentile Bootstrap) UCL	3912
95% KM (Chebyshev) UCL	6852
97.5% KM (Chebyshev) UCL	8970
99% KM (Chebyshev) UCL	13130

Potential UCLs to Use

99% KM (Chebyshev) UCL	13130

Note: DL/2 is not a recommended method.

p-Nitrotoluene

General Statistics

Number of Valid Samples	25	Number of Detected Data	20
Number of Unique Samples	19	Number of Non-Detect Data	5
		Percent Non-Detects	20.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.19	Minimum Detected	-1.661
Maximum Detected	16000	Maximum Detected	9.68
Mean of Detected	1677	Mean of Detected	3.621
SD of Detected	4160	SD of Detected	3.14
Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.2	Maximum Non-Detect	-1.609

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.471	Shapiro Wilk Test Statistic	0.95
5% Shapiro Wilk Critical Value	0.905	5% Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1342	Mean	2.436
SD	3764	SD	3.695
95% DL/2 (t) UCL	2630	95% H-Stat (DL/2) UCL	425294

Maximum Likelihood Estimate(MLE) Method	
Mean	546.2
SD	4393
95% MLE (t) UCL	2049
95% MLE (Tiku) UCL	2046

Log ROS Method	
Mean in Log Scale	2.338
SD in Log Scale	3.877
Mean in Original Scale	1342
SD in Original Scale	3764
95% Percentile Bootstrap UCL	2625
95% BCA Bootstrap UCL	3266

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.199
Theta Star	8447
nu star	7.941
A-D Test Statistic	1.927
5% A-D Critical Value	0.89
K-S Test Statistic	0.89
5% K-S Critical Value	0.215

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0
Maximum	16000
Mean	1342
Median	13
SD	3764
k star	0.112
Theta star	12019
Nu star	5.581
AppChi2	1.43
95% Gamma Approximate UCL	5237
95% Adjusted Gamma UCL	5792

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	1342
SD	3688
SE of Mean	756.8
95% KM (t) UCL	2636
95% KM (z) UCL	2586
95% KM (jackknife) UCL	2630
95% KM (bootstrap t) UCL	3689
95% KM (BCA) UCL	2893
95% KM (Percentile Bootstrap) UCL	2620
95% KM (Chebyshev) UCL	4640
97.5% KM (Chebyshev) UCL	6068
99% KM (Chebyshev) UCL	8871

Potential UCLs to Use

99% KM (Chebyshev) UCL	8871

Thallium

General Statistics

Number of Valid Samples	17	Number of Detected Data	5
Number of Unique Samples	5	Number of Non-Detect Data	12
		Percent Non-Detects	70.59%

Raw Statistics

Minimum Detected	0.65
Maximum Detected	5.9
Mean of Detected	1.902

Log-transformed Statistics

Minimum Detected	-0.431
Maximum Detected	1.775
Mean of Detected	0.258

SD of Detected	2.241	SD of Detected	0.87
Minimum Non-Detect	0.355	Minimum Non-Detect	-1.036
Maximum Non-Detect	2.8	Maximum Non-Detect	1.03
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	16
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	94.12%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.625	Shapiro Wilk Test Statistic	0.763
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.806	Mean	-0.8
SD	1.365	SD	0.934
95% DL/2 (t) UCL	1.384	95% H-Stat (DL/2) UCL	0.787
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-1.575
		SD in Log Scale	1.366
		Mean in Original Scale	0.636
		SD in Original Scale	1.403
		95% Percentile Bootstrap UCL	1.256
		95% BCA Bootstrap UCL	1.698
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.711	**Data appear Lognormal at 5% Significance Level**	
Theta Star	2.675		
nu star	7.109		
A-D Test Statistic	0.882	**Nonparametric Statistics**	
5% A-D Critical Value	0.687	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.687	Mean	1.022
5% K-S Critical Value	0.362	SD	1.227
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.333
		95% KM (t) UCL	1.603
Assuming Gamma Distribution		95% KM (z) UCL	1.57
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.485
Minimum	0	95% KM (bootstrap t) UCL	4.333
Maximum	5.963	95% KM (BCA) UCL	1.927
Mean	2.26	95% KM (Percentile Bootstrap) UCL	1.665
Median	1.832	95% KM (Chebyshev) UCL	2.473
SD	2.048	97.5% KM (Chebyshev) UCL	3.101

k star	0.198
Theta star	11.43
Nu star	6.725
AppChi2	2.021
95% Gamma Approximate UCL	7.522
95% Adjusted Gamma UCL	8.626

99% KM (Chebyshev) UCL	4.334

Potential UCLs to Use

95% KM (t) UCL	1.603
95% KM (% Bootstrap) UCL	1.665

Note: DL/2 is not a recommended method.

Vanadium

General Statistics

Number of Valid Samples	25
Number of Unique Samples	25

Raw Statistics

Minimum	21.2
Maximum	66.1
Mean	42.72
Median	38.8
SD	14.32
Coefficient of Variation	0.335
Skewness	0.112

Log-transformed Statistics

Minimum of Log Data	3.054
Maximum of Log Data	4.191
Mean of log Data	3.696
SD of log Data	0.357

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.933
Shapiro Wilk Critical Value	0.918

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.932
Shapiro Wilk Critical Value	0.918

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	47.62

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	47.5
95% Modified-t UCL	47.63

Assuming Lognormal Distribution

95% H-UCL	49.16
95% Chebyshev (MVUE) UCL	56.45
97.5% Chebyshev (MVUE) UCL	62.34
99% Chebyshev (MVUE) UCL	73.91

Gamma Distribution Test

k star (bias corrected)	7.715
Theta Star	5.537
nu star	385.8
Approximate Chi Square Value (.05)	341.2
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	338.4
Anderson-Darling Test Statistic	0.496
Anderson-Darling 5% Critical Value	0.745
Kolmogorov-Smirnov Test Statistic	0.123

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	47.43
95% Jackknife UCL	47.62
95% Standard Bootstrap UCL	47.39
95% Bootstrap-t UCL	47.46
95% Hall's Bootstrap UCL	47.26
95% Percentile Bootstrap UCL	47.39

Kolmogorov-Smirnov 5% Critical Value	0.175
Data appear Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL	48.3
95% Adjusted Gamma UCL	48.7
Potential UCL to Use	

95% BCA Bootstrap UCL	47.55
95% Chebyshev(Mean, Sd) UCL	55.2
97.5% Chebyshev(Mean, Sd) UCL	60.6
99% Chebyshev(Mean, Sd) UCL	71.21
Use 95% Student's-t UCL	47.62

Appendix E-4

Johnson & Ettinger Model – Input and Output

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	1.55E+02	2.00E+02	5.9E-06	6.0E-01

END

Appendix E-5

Chromium Concentration Plots

Table 5-1
Geotechnical Laboratory Data Summary

Sample ID	Depth (ft)	Soil Moisture Content	Atterberg Limits			USCS Symbol (1)	TOC	pH		Soil Porosity	Bulk Density		Calculated Soil Porosities			Hydraulic Conductivity	Silt/Clay	% Fine Sand	% Medium Sand	% Coarse Sand	Gravel
		Water Content (%)	Liquid Limit	Plastic Limit	Plastic Index		Organic Content (burnoff) (%)	Distilled Water	0.01 M CaCl Solution	Soil Particle Density (-)	Soil Bulk Density (pcf)	Dry Density (pcf)	Total (-)	Air Filled (-)	Water Filled (-)	Permeability (cm/sec)					
51SB3A	0-1										90.9										
	0.25	19.2	33	16	17	SC	3.9	5.0	4.2	2.702	122.7	102.9	0.39	0.05	0.34	1.4E-05	0	67	21	4.1	4.1
	0.5	17.7																			
51SB3B	13-14										83.2										
	13.2	155.3																			
	13.75	175.3																			
	14	145.4	78	64	14	OH	30.4	7.8	7.2	2.806	84.4	34.4	0.80	0.00	0.80	5.0E-08	0	80	10	2	0
51SB3C	15-16										113.9										
	15.6	8.7																			
	15.85	15.8	np	np	np	SP-SM	1.5	5.9	5.7	2.659	117.5	101.4	0.39	0.09	0.30	2.2E-05	0	59	30	5.2	4.6
51SB3D	37-38										92.4										
	37.5	37.4																			
	37.75	65.2	44	38	6	SM	1.7	5.9	5.1	2.734	97.0	58.7	0.66	0.02	0.64	1.4E-05	0	42	25	22	0

Notes: (1) USCS symbol based on visual observation and Atterberg Limits reported.

Sample ID	Depth - T	Depth - B	Analyte	Cr Result	Lab Q	Val Q	Units	pH	TOC
51SB3A	0.0	0.5	Chromium	27.4	N	K	mg/kg	5.0	39000
51SB3B	13.0	15.0	Chromium	469	N		mg/kg	7.8	304000
51SB3C	15.0	18.0	Chromium	16.6	N		mg/kg	5.9	15000
51SB3D	36.0	38.0	Chromium	39.1	N		mg/kg	5.9	17000

Appendix E-6

Risk and Hazard Evaluation for Cover Soil and Deep Soil

Table E.6-13

Background Comparison for Cover Soil at SWMU 51

Soil COPEC	Wilcoxon Mann Whitney Test [a] Site > Background?	Considered to be Background?
Aluminum	No	Yes
Arsenic	No	Yes
Manganese	No	Yes
Vanadium	No [b]	Yes

[a] Wilcoxin Mann Whitney Test, unless otherwise noted.
[b] Both Site and Background data sets had normal distribution, thus t-test used.

Table E.6-14

Background Comparison for Deep Soil at SWMU 51

Soil COPEC	Wilcoxon Mann Whitney Test Site > Background?	Considered to be Background?
Aluminum	No	Yes
Arsenic	No	Yes
Manganese	No	Yes

Table E.6-1
Occurrence, Distribution and Selection of Chemicals of Potential Concern
Future - Cover Soil - SWMU 51

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Cover Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	N/A	2,3,7,8 TCDD TE	N/A	3.31E-06	mg/kg	51SB1A	6/6	N/A	3.31E-06	N/A	4.3E-06 C	N/A	N/A	No	BSL
	99-35-4	1,3,5-Trinitrobenzene	7.00E-02 L	2.80E-01	mg/kg	51SB7B	4/17	1.00E-01 - 1.00E-01	2.80E-01	N/A	2.3E+02 N	N/A	N/A	No	BSL
	99-65-0	1,3-Dinitrobenzene	8.00E-02 J	7.70E-01 J	mg/kg	51SB2A	5/17	1.00E-01 - 1.00E-01	7.70E-01	N/A	7.8E-01 N	N/A	N/A	No	BSL
	118-96-7	2,4,6-Trinitrotoluene	4.00E-02 J	1.30E+00	mg/kg	51SB7A	15/17	1.00E-01 - 1.00E-01	1.30E+00	N/A	3.9E+00 N	N/A	N/A	No	BSL
	121-14-2	2,4-Dinitrotoluene	4.00E-02 J	2.50E+00	mg/kg	51SB4A	14/17	1.00E-01 - 1.00E-01	2.50E+00	N/A	9.4E-01 C	N/A	N/A	Yes	ASL
	606-20-2	2,6-Dinitrotoluene	5.50E-02 J	7.90E+00	mg/kg	51SB1B	7/11	1.00E-01 - 1.00E-01	7.90E+00	N/A	9.4E-01 C	N/A	N/A	Yes	ASL
	35572-78-2	2-amino-4,6-Dinitrotoluene	5.00E-02 J	5.00E-02 J	mg/kg	51SB7B	1/17	1.00E-01 - 1.00E-01	5.00E-02	N/A	N/A	N/A	N/A	Yes	NTX
	91-57-6	2-Methylnaphthalene	2.00E-02	2.00E-02	mg/kg	51SB10A	1/17	7.50E-03 - 8.30E-03	2.00E-02	N/A	3.1E+01 N	N/A	N/A	No	BSL
	88-72-2	2-Nitrotoluene	1.40E-01 J	1.10E+02	mg/kg	51SB4A	13/17	2.00E-01 - 2.00E-01	1.10E+02	N/A	7.8E+01 N	N/A	N/A	Yes	ASL
	99-08-1	3-Nitrotoluene	1.05E-01 J	9.20E+00 J	mg/kg	51SB4A	11/17	2.00E-01 - 2.00E-01	9.20E+00	N/A	N/A	N/A	N/A	Yes	NTX
	99-99-0	4-Nitrotoluene	1.90E-01 J	6.20E+01	mg/kg	51SB4A	12/17	2.00E-01 - 2.00E-01	6.20E+01	N/A	3.1E+01 N	N/A	N/A	Yes	ASL
	7429-90-5	Aluminum	1.06E+04	2.81E+04	mg/kg	51SB4A	17/17	N/A	2.81E+04	N/A	7.8E+03 N	N/A	N/A	Yes	ASL
	7440-36-0	Antimony	2.50E-01 J	6.40E-01 L	mg/kg	51SB6A	2/14	3.00E-01 - 8.20E-01	6.40E-01	N/A	3.1E+00 N	N/A	N/A	No	BSL
	7440-38-2	Arsenic	1.50E+00 J	5.70E+00	mg/kg	51SB5A	15/15	N/A	5.70E+00	N/A	4.3E-01 C	N/A	N/A	Yes	ASL
	7440-39-3	Barium	3.36E+01	1.20E+02	mg/kg	51SB9A	17/17	N/A	1.20E+02	N/A	1.6E+03 N	N/A	N/A	No	BSL
	56-55-3	Benzo(a)anthracene	2.00E-02 J	2.00E-02 J	mg/kg	51SB8A	1/17	7.50E-03 - 8.30E-03	2.00E-02	N/A	2.2E-01 C	N/A	N/A	No	BSL
	50-32-8	Benzo(a)pyrene	8.48E-03 J	8.48E-03 J	mg/kg	51SB8A	1/17	7.50E-03 - 8.30E-03	8.48E-03	N/A	2.2E-02 C	N/A	N/A	No	BSL
	205-99-2	Benzo(b)fluoranthene	2.90E-02 J	2.90E-02 J	mg/kg	51SB8A	1/17	7.50E-03 - 8.30E-03	2.90E-02	N/A	2.2E-01 C	N/A	N/A	No	BSL
	191-24-2	Benzo(g,h,i)perylene	2.60E-02 J	2.60E-02 J	mg/kg	51SB8A	1/17	7.50E-03 - 8.30E-03	2.60E-02	N/A	2.3E+02 N	N/A	N/A	No	BSL
	207-08-9	Benzo(k)fluoranthene	3.70E-02 J	3.70E-02 J	mg/kg	51SB8A	1/17	7.50E-03 - 8.30E-03	3.70E-02	N/A	2.2E+00 C	N/A	N/A	No	BSL
	7440-41-7	Beryllium	4.00E-01	8.00E-01	mg/kg	51SB9A	17/17	N/A	8.00E-01	N/A	1.6E+01 N	N/A	N/A	No	BSL
	7440-43-9	Cadmium	1.30E-01 J	3.60E-01 J	mg/kg	51SB3A	4/10	3.90E-02 - 4.30E-02	3.60E-01	N/A	7.8E+00 N	N/A	N/A	No	BSL
	7440-70-2	Calcium	1.67E+02	4.83E+02	mg/kg	51SB7A	9/9	N/A	4.83E+02	N/A	N/A	1.00E+06	RDA	No	BSL
	7440-47-3	Chromium VI	1.30E+01	3.46E+01	mg/kg	51SB5A	17/17	N/A	3.46E+01	N/A	2.3E+01 N	N/A	N/A	Yes	ASL
	218-01-9	Chrysene	3.95E-02 J	3.95E-02 J	mg/kg	51SB8A	1/17	7.50E-03 - 8.30E-03	3.95E-02	N/A	2.2E+01 C	N/A	N/A	No	BSL
	7440-48-4	Cobalt	3.30E+00	1.79E+02	mg/kg	51SB7B	17/17	N/A	1.79E+02	N/A	N/A	N/A	N/A	Yes	NTX
	7440-50-8	Copper	4.60E+00	1.74E+01	mg/kg	51SB5A	17/17	N/A	1.74E+01	N/A	3.1E+02 N	N/A	N/A	No	BSL
	121-82-4	Cyclonite	1.20E+00 J	1.20E+00 J	mg/kg	51SB1B	1/17	2.00E-01 - 2.00E-01	1.20E+00	N/A	5.8E+00 C	N/A	N/A	No	BSL
	53-70-3	Dibenz(a,h)anthracene	4.45E-02 J	4.45E-02 J	mg/kg	51SB8A	1/17	7.50E-03 - 8.30E-03	4.45E-02	N/A	2.2E-02 C	N/A	N/A	Yes	ASL
	84-66-2	Diethyl phthalate	1.20E+00	1.20E+00	mg/kg	51SB7A	1/17	3.70E-01 - 4.10E-01	1.20E+00	N/A	6.3E+03 N	N/A	N/A	No	BSL
	206-44-0	Fluoranthene	1.10E-02 J	2.70E-02	mg/kg	51SB9A	4/17	7.50E-03 - 8.30E-03	2.70E-02	N/A	3.1E+02 N	N/A	N/A	No	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	3.15E-02 J	3.15E-02 J	mg/kg	51SB8A	1/17	7.50E-03 - 8.30E-03	3.15E-02	N/A	2.2E-01 C	N/A	N/A	No	BSL
	7439-89-6	Iron	1.15E+04	3.31E+04	mg/kg	51SB7B	17/17	N/A	3.31E+04	N/A	5.5E+03 N	N/A	N/A	Yes	ASL
	7439-92-1	Lead	4.20E+00	6.67E+01	mg/kg	51SB7B	17/17	N/A	6.67E+01	N/A	N/A	4.00E+02	N/A	No	BSL
	7439-95-4	Magnesium	4.83E+02	1.93E+03	mg/kg	51SB5A	17/17	N/A	1.93E+03	N/A	N/A	1.00E+06	RDA	No	BSL
	7439-96-5	Manganese	2.51E+02	3.59E+03	mg/kg	51SB7B	17/17	N/A	3.59E+03	N/A	1.6E+02 N	N/A	N/A	Yes	ASL
	7439-97-6	Mercury (Inorganic)	2.30E-02 J	1.00E-01	mg/kg	51SB3A	8/13	1.50E-02 - 1.60E-02	1.00E-01	N/A	2.3E+00 N	N/A	N/A	No	BSL
	7440-02-0	Nickel	4.40E+00	1.32E+01	mg/kg	51SB5A	17/17	N/A	1.32E+01	N/A	1.6E+02 N	N/A	N/A	No	BSL
	98-95-3	Nitrobenzene	4.50E-02 J	2.00E-01	mg/kg	51SB9B	7/17	1.00E-01 - 1.00E-01	2.00E-01	N/A	3.9E+00 N	N/A	N/A	No	BSL
	86-30-6	n-Nitrosodiphenylamine	4.50E-02 J	4.50E-02 J	mg/kg	51SB7B	1/17	3.70E-01 - 4.10E-01	4.50E-02	N/A	1.3E+02 C	N/A	N/A	No	BSL
	85-01-8	Phenanthrene	8.40E-03 J	3.00E-02	mg/kg	51SB10A	13/17	7.60E-03 - 8.30E-03	3.00E-02	N/A	2.3E+02 N	N/A	N/A	No	BSL

Table E.6-1
Occurrence, Distribution and Selection of Chemicals of Potential Concern
Future - Cover Soil - SWMU 51

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Cover Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	7440-09-7	Potassium	3.60E+02	1.61E+03	mg/kg	51SB5A	17/17	N/A	1.61E+03	N/A	N/A	1.00E+06	N/A	No	BSL
	129-00-0	Pyrene	7.90E-03 J	1.35E-02 J	mg/kg	51SB8A	4/17	7.50E-03 - 8.30E-03	1.35E-02	N/A	2.3E+02 N	N/A	N/A	No	BSL
	7782-49-2	Selenium	6.05E-01 J	6.05E-01 J	mg/kg	51SB1A	1/16	1.50E-01 - 8.30E-01	6.05E-01	N/A	3.9E+01 N	N/A	N/A	No	BSL
	7440-28-0	Thallium	6.50E-01 J	1.10E+00 J	mg/kg	51SB3A	3/13	3.55E-01 - 2.80E+00	1.10E+00	N/A	5.5E-01 N	N/A	N/A	Yes	ASL
	57-12-5	Total Cyanide	2.10E-01	2.10E-01	mg/kg	51SB11B	1/17	1.50E-01 - 1.80E-01	2.10E-01	N/A	1.6E+02 N	N/A	N/A	No	BSL
	7440-62-2	Vanadium	2.12E+01	6.61E+01	mg/kg	51SB7B	17/17	N/A	6.61E+01	N/A	7.8E+00 N	N/A	N/A	Yes	ASL
	7440-66-6	Zinc	1.95E+01	4.19E+01	mg/kg	51SB7B	17/17	N/A	4.19E+01	N/A	2.3E+03 N	N/A	N/A	No	BSL

(1) Maximum concentration used for screening.

(2) N/A - Refer to supporting information for background discussion.
Background values derived from site-specific statistical analysis. See text for supporting information.

(3) Screening toxicity values from USEPA Region 3 RBC Table (October 2007). See text for derivation of Nutrient RDAs.

(4) Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Break Down Product (BDP)
No Toxicity Information (NTX)

Deletion Reason: Infrequent Detection (<= 5%, IFD)
Below Screening and/or ARAR/TBC Level (BSL)

Definitions:
N/A = Not Applicable or Not Available
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
J, K, L = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic
RDA = Recommended Daily Allowance

Table E.6-7
Occurrence, Distribution and Selection of Chemicals of Potential Concern
Future - Deep Soil - SWMU 51

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Deep Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Deep Soil	N/A	TCDD TE	N/A	1.44E-07	mg/kg	51SB5C	1/7	N/A	1.44E-07	N/A	4.30E-06	N/A	N/A	No	BSL
	67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.00E-06 J	1.00E-06 J	mg/kg	51SB5C	1/7	9.80E-07 - 7.50E-06	1.00E-06	N/A	N/A	N/A	N/A	No	TEQ
	35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	6.30E-06	6.30E-06	mg/kg	51SB5C	1/5	9.80E-07 - 9.90E-06	6.30E-06	N/A	N/A	N/A	N/A	No	TEQ
	51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	3.70E-07 J	3.70E-07 J	mg/kg	51SB5C	1/7	2.00E-07 - 2.00E-05	3.70E-07	N/A	N/A	N/A	N/A	No	TEQ
	3268-87-9	Octachlorodibenzodioxin	1.10E-04	1.10E-04	mg/kg	51SB5C	1/3	2.00E-06 - 3.90E-04	1.10E-04	N/A	N/A	N/A	N/A	No	TEQ
	39001-02-0	Octachlorodibenzofuran	3.20E-06 J	3.20E-06 J	mg/kg	51SB5C	1/7	2.00E-06 - 2.20E-05	3.20E-06	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Heptachlorodibenzofuran	1.00E-06 J	1.00E-06 J	mg/kg	51SB5C	1/7	9.80E-07 - 4.80E-06	1.00E-06	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Heptachlorodibenzo-p-dioxin	6.30E-06	6.30E-06	mg/kg	51SB5C	1/5	9.80E-07 - 4.80E-06	6.30E-06	N/A	N/A	N/A	N/A	No	TEQ
	N/A	Total Tetrachlorodibenzofuran	6.20E-07 J	6.20E-07 J	mg/kg	51SB5C	1/7	2.00E-07 - 9.60E-07	6.20E-07	N/A	N/A	N/A	N/A	No	TEQ
	99-35-4	1,3,5-Trinitrobenzene	4.00E-02 L	1.80E+01	mg/kg	51SB6D	11/13	1.00E-01 - 1.00E-01	1.80E+01	N/A	2.3E+02 N	N/A	N/A	No	BSL
	99-65-0	1,3-Dinitrobenzene	9.00E-02 J	3.20E-01 J	mg/kg	51SB2D	6/13	1.00E-01 - 1.00E-01	3.20E-01	N/A	7.8E-01 N	N/A	N/A	No	BSL
	118-96-7	2,4,6-Trinitrotoluene	3.00E-01 L	2.20E+01 L	mg/kg	51SB6D	13/13	N/A	2.20E+01	N/A	3.9E+01 N	N/A	N/A	Yes	ASL
	121-14-2	2,4-Dinitrotoluene	3.00E-02 J	4.20E+01	mg/kg	51SB3D	11/13	1.00E-01 - 1.00E-01	4.20E+01	N/A	9.4E-01 C	N/A	N/A	Yes	ASL
	606-20-2	2,6-Dinitrotoluene	1.50E+00 J	1.10E+01 J	mg/kg	51SB3D	8/11	1.00E-01 - 1.00E-01	1.10E+01	N/A	9.4E-01 C	N/A	N/A	Yes	ASL
	88-74-4	2-Nitroaniline	7.70E-02 J	7.70E-02 J	mg/kg	51SB6D	1/13	3.60E-01 - 4.50E-01	7.70E-02	N/A	N/A	N/A	N/A	Yes	NTX
	88-72-2	2-Nitrotoluene	1.70E-01 J	9.30E+01	mg/kg	51SB10C	11/13	2.00E-01 - 2.00E-01	9.30E+01	N/A	7.8E+01 N	N/A	N/A	Yes	ASL
	99-08-1	3-Nitrotoluene	2.20E-01 J	8.20E+00 J	mg/kg	51SB10C	9/13	2.00E-01 - 2.00E-01	8.20E+00	N/A	N/A	N/A	N/A	No	BSL
	99-99-0	4-Nitrotoluene	2.40E-01 J	4.50E+01	mg/kg	51SB10C	10/13	2.00E-01 - 2.00E-01	4.50E+01	N/A	3.1E+01 N	N/A	N/A	Yes	ASL
	534-52-1	4,6-Dinitro-o-cresol	1.50E-01 J	3.30E-01 J	mg/kg	51SB3D	4/13	7.70E-01 - 9.00E-01	3.30E-01	N/A	N/A	N/A	N/A	Yes	NTX
	108-10-1	4-Methyl-2-pentanone	4.40E-03 J	4.40E-03 J	mg/kg	51SB5C	1/13	9.80E-03 - 1.20E-02	4.40E-03	N/A	N/A	N/A	N/A	Yes	NTX
	117-81-7	bis(2-Ethylhexyl) phthalate	4.80E-02 J	8.20E-02 J	mg/kg	51SB7C	4/13	3.80E-01 - 4.50E-01	8.20E-02	N/A	4.6E+01 C	N/A	N/A	No	BSL
	74-87-3	Chloromethane	2.80E-03 J	2.80E-03 J	mg/kg	51SB6D	1/13	9.80E-03 - 1.20E-02	2.80E-03	N/A	N/A	N/A	N/A	Yes	NTX
	121-82-4	Cyclonite (RDX)	3.00E-01 J	7.20E+00 J	mg/kg	51SB3D	9/13	2.00E-01 - 2.00E-01	7.20E+00	N/A	5.8E+00 C	N/A	N/A	Yes	ASL
	84-66-2	Diethyl phthalate	1.60E+00	1.60E+00	mg/kg	51SB6D	1/13	3.60E-01 - 4.50E-01	1.60E+00	N/A	6.3E+03 N	N/A	N/A	No	BSL
	206-44-0	Fluoranthene	1.20E-02	1.20E-02	mg/kg	51SB6D	1/13	7.20E-03 - 9.00E-03	1.20E-02	N/A	3.1E+02 N	N/A	N/A	No	BSL
	98-95-3	Nitrobenzene	7.00E-02 J	1.60E-01	mg/kg	51SB1C	4/13	1.00E-01 - 1.00E-01	1.60E-01	N/A	3.9E+00 N	N/A	N/A	No	BSL
	55-63-0	Nitroglycerin	6.70E+00	6.70E+00	mg/kg	51SB8C	1/13	5.40E+00 - 6.70E+00	6.70E+00	N/A	7.8E-01 N	N/A	N/A	Yes	ASL
	85-01-8	Phenanthrene	9.10E-03 J	1.80E-02	mg/kg	51SB10C	10/13	7.70E-03 - 9.00E-03	1.80E-02	N/A	2.3E+02 N	N/A	N/A	No	BSL
	129-00-0	Pyrene	1.00E-02	1.00E-02	mg/kg	51SB6D	1/13	7.20E-03 - 9.00E-03	1.00E-02	N/A	2.3E+02 N	N/A	N/A	No	BSL
	7429-90-5	Aluminum	8.65E+03	2.77E+04	mg/kg	51SB1C	13/13	N/A	2.77E+04	N/A	7.8E+03 N	N/A	N/A	Yes	ASL
	7440-36-0	Antimony	5.00E-01 J	5.00E-01 J	mg/kg	51SB6C	1/8	3.00E-01 - 8.70E-01	5.00E-01	N/A	3.1E+00 N	N/A	N/A	No	BSL
	7440-38-2	Arsenic	9.60E-01 J	6.00E+00	mg/kg	51SB8C	10/10	N/A	6.00E+00	N/A	4.3E-01 C	N/A	N/A	Yes	ASL
	7440-39-3	Barium	2.63E+01	1.67E+02	mg/kg	51SB4D	13/13	N/A	1.67E+02	N/A	1.6E+03 N	N/A	N/A	No	BSL
	7440-41-7	Beryllium	4.30E-01	2.50E+00	mg/kg	51SB11C	13/13	N/A	2.50E+00	N/A	1.6E+01 N	N/A	N/A	No	BSL
	7440-43-9	Cadmium	1.90E-01 J	8.00E-01 J	mg/kg	51SB8C	7/12	3.70E-02 - 4.10E-02	8.00E-01	N/A	7.8E+00 N	N/A	N/A	No	BSL
	7440-70-2	Calcium	3.10E+02	1.75E+03	mg/kg	51SB4D	12/12	N/A	1.75E+03	N/A	N/A	1.00E+06	RDA	No	BSL
	7440-47-3	Chromium	1.08E+01	4.77E+01	mg/kg	51SB1C	13/13	N/A	4.77E+01	N/A	2.3E+01 N	N/A	N/A	Yes	ASL
	7440-48-4	Cobalt	4.60E+00	9.51E+01	mg/kg	51SB3D	13/13	N/A	9.51E+01	N/A	N/A	N/A	N/A	Yes	NTX
	7440-50-8	Copper	4.10E+00	9.29E+01	mg/kg	51SB3D	9/9	N/A	9.29E+01	N/A	3.1E+02 N	N/A	N/A	No	BSL
	7439-89-6	Iron	1.25E+04	5.11E+04	mg/kg	51SB8C	13/13	N/A	5.11E+04	N/A	5.5E+03 N	N/A	N/A	Yes	ASL
	7439-92-1	Lead	7.50E-01 J	1.80E+01	mg/kg	51SB6D	11/11	N/A	1.80E+01	N/A	N/A	4.00E+02	USEPA	No	BSL
	7439-95-4	Magnesium	5.48E+02	2.22E+04	mg/kg	51SB1C	13/13	N/A	2.22E+04	N/A	N/A	1.00E+06	RDA	No	BSL
	7439-96-5	Manganese	2.21E+02	1.33E+03	mg/kg	51SB8C	13/13	N/A	1.33E+03	N/A	1.6E+02 N	N/A	N/A	Yes	ASL

Table E.6-7
Occurrence, Distribution and Selection of Chemicals of Potential Concern
Future - Deep Soil - SWMU 51

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Deep Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	7440-02-0	Nickel	4.20E+00	1.09E+02	mg/kg	51SB3D	13/13	N/A	1.09E+02	N/A	1.6E+02 N	N/A	N/A	No	BSL
	7440-09-7	Potassium	5.28E+02	3.09E+03	mg/kg	51SB3D	13/13	N/A	3.09E+03	N/A	N/A	1.00E+06	RDA	No	BSL
	7440-23-5	Sodium	5.78E+02	6.86E+02	mg/kg	51SB2D	2/13	7.24E+01 - 7.77E+02	6.86E+02	N/A	N/A	1.00E+06	RDA	No	BSL
	7440-28-0	Thallium	1.40E+00 J	1.40E+00 J	mg/kg	51SB11C	1/7	3.60E-01 - 5.40E-01	1.40E+00	N/A	5.5E-01 N	N/A	N/A	Yes	ASL
	57-12-5	Total Cyanide	6.50E-01	6.50E-01	mg/kg	51SB5C	1/13	1.50E-01 - 1.90E-01	6.50E-01	N/A	1.6E+02 N	N/A	N/A	No	BSL
	7440-62-2	Vanadium	8.80E+00	4.12E+01	mg/kg	51SB6C	13/13	N/A	4.12E+01	N/A	7.8E+00 N	N/A	N/A	Yes	ASL
	7440-66-6	Zinc	1.43E+01	2.56E+01	mg/kg	51SB6C	10/10	N/A	2.56E+01	N/A	2.3E+03 N	N/A	N/A	No	BSL

(1) Maximum concentration used for screening.

(2) N/A - Refer to supporting information for background discussion.
Background values derived from site-specific statistical analysis. See text for supporting information.

(3) Screening toxicity values from USEPA Region 3 RBC Table (October 2007). See text for derivation of Nutrient RDAs.

(4) Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Break Down Product (BDP)
No Toxicity Information (NTX)

Deletion Reason: Infrequent Detection (<= 5%, IFD)
Below Background Levels (BKG)
Below Screening and/or ARAR/TBC Level (BSL)

Definitions:
N/A = Not Applicable or Not Available
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
J, K, L = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic
RDA = Recommended Daily Allowance

Table E.6-6
Calculated Risks and Hazards
Cover Soil - SWMU 51
Child Resident

Chemical	Total Soil EPC	Total Soil Ingestion Risk	Total Soil Dermal Risk	Total Soil Inhalation Risk	Total Soil Risk	Total Soil Ingestion HI	Total Soil Dermal HI	Total Soil Inhalation HI	Total Soil HI	Cover Soil EPC	Cover Soil Risk[a]	Cover Soil HI[b]
Organics												
2,3,7,8-TCDD TE	1.48E-04	2.4E-05	2.0E-06	1.6E-10	2.6E-05					2.55E-06	4.5E-07	
Dibenz[a,h]anthracene	4.45E-02	3.6E-07	1.3E-07		4.9E-07					8.71E-03	9.5E-08	
2,4-Dinitrotoluene	2.59E+04	1.9E-02	5.5E-03		2.5E-02	1.7E+02	4.7E+01		2.1E+02	1.01E+00	9.7E-07	8.3E-03
2,6-Dinitrotoluene	4.17E+03	3.1E-03	8.6E-04		4.0E-03	5.3E+01	1.5E+01		6.8E+01	2.52E+00	2.4E-06	4.1E-02
2-Amino-4,6-Dinitrotoluene	2.15E+01					1.4E-01	2.3E-03		1.4E-01	6.16E-02		4.0E-04
2-Nitrotoluene	1.31E+04					1.7E+01	1.4E+00		1.8E+01	4.76E+01		6.6E-02
3-Nitrotoluene	1.38E+03									2.76E+00		
4-Nitrotoluene	8.87E+03	1.6E-04	4.4E-05		2.0E-04	2.8E+01	7.9E+00		3.6E+01	2.63E+01	5.9E-07	1.1E-01
Inorganics												
Aluminum	1.98E+04					2.5E-01	7.1E-03	1.6E-03	2.6E-01	2.10E+04		2.8E-01
Arsenic	1.04E+01	1.7E-05	1.4E-06	1.1E-09	1.9E-05	4.4E-01	3.7E-02		4.8E-01	3.92E+00	7.0E-06	1.8E-01
Chromium	4.48E+02					3.8E-03	8.2E-03		1.2E-02	2.52E+01		6.8E-04
Cobalt	4.44E+01									6.22E+01		
Iron	1.03E+05					1.9E+00	5.3E-02		1.9E+00	2.53E+04		4.7E-01
Manganese	1.08E+03					6.9E-01	4.8E-01	6.2E-03	1.2E+00	1.42E+03		1.6E+00
Thallium	1.67E+00					3.1E-01	8.5E-03		3.1E-01	1.10E+00		2.1E-01
Vanadium	4.76E+01					6.1E-01	6.6E-01		1.3E+00	5.15E+01		1.4E+00
Total											1.1E-05	4.3E+00

EPC = Exposure Point Concentration
HI = Hazard Index

[a] Risks associated with exposures to COPCs in cover soil only were calculated relative to risks for the total soil: (Cover Soil EPC/Total Soil EPC) x Total Soil Risk = Cover Soil Risk.

[b] HIs associated with exposures to COPCs in cover soil only were calculated relative to HIs for the total soil: (Cover Soil EPC/Total Soil EPC) x Total Soil HI = Cover Soil HI.

Table E.6-12
Calculated Risks and Hazards
Deep Soil - SWMU 51
Child Resident

Chemical	Total Soil EPC	Total Soil Ingestion Risk	Total Soil Dermal Risk	Total Soil Inhalation Risk	Total Soil Risk	Total Soil Ingestion HI	Total Soil Dermal HI	Total Soil Inhalation HI	Total Soil HI	Deep Soil EPC	Deep Soil Risk[a]	Deep Soil HI[b]
Organics												
Chloromethane[c]	2.80E-03							5.7E-06	5.7E-06	2.80E-03		5.7E-06
2,4-Dinitrotoluene	2.59E+04	1.9E-02	5.5E-03		2.5E-02	1.7E+02	4.7E+01		2.1E+02	2.57E+01	2.5E-05	2.1E-01
2,6-Dinitrotoluene	4.17E+03	3.1E-03	8.6E-04		4.0E-03	5.3E+01	1.5E+01		6.8E+01	5.78E+00	5.5E-06	9.4E-02
4-Methyl-2-Pentanone	4.71E-02							1.8E-07	1.8E-07	4.40E-03		1.7E-08
4,6-Dinitro-o-cresol	2.70E+00									2.86E-01		
2-Nitroaniline	4.50E+01									7.70E-02		
Nitroglycerin	2.26E+03	4.2E-05	1.2E-05		5.4E-05	2.9E+02	8.1E+01		3.7E+02	4.18E+00	1.0E-07	6.8E-01
2-Nitrotoluene	1.31E+04					1.7E+01	1.4E+00		1.8E+01	6.12E+01		8.5E-02
3-Nitrotoluene	1.38E+03									3.30E+00		
4-Nitrotoluene	8.87E+03	1.6E-04	4.4E-05		2.0E-04	2.8E+01	7.9E+00		3.6E+01	1.89E+01	4.2E-07	7.7E-02
RDX[c]	4.23E+00	5.1E-07	2.1E-08		5.3E-07	1.8E-02	7.6E-04		1.9E-02	4.23E+00	5.3E-07	1.9E-02
2,4,6-Trinitrotoluene	4.21E+04	1.4E-03	1.2E-04		1.5E-03	1.1E+03	9.6E+01		1.2E+03	1.24E+01	4.4E-07	3.5E-01
Inorganics												
Aluminum	1.98E+04					2.5E-01	7.1E-03	1.6E-03	2.6E-01	2.00E+04		2.6E-01
Arsenic	1.04E+01	1.7E-05	1.4E-06	1.1E-09	1.9E-05	4.4E-01	3.7E-02		4.8E-01	3.85E+00	6.9E-06	1.8E-01
Chromium	4.48E+02					3.8E-03	8.2E-03		1.2E-02	3.39E+01		9.1E-04
Cobalt	4.44E+01									4.02E+01		
Iron	1.03E+05					1.9E+00	5.3E-02		1.9E+00	3.57E+04		6.7E-01
Manganese	1.08E+03					6.9E-01	4.8E-01	6.2E-03	1.2E+00	6.26E+02		6.8E-01
Thallium	1.67E+00					3.1E-01	8.5E-03		3.1E-01	5.89E-01		1.1E-01
Vanadium	4.76E+01					6.1E-01	6.6E-01		1.3E+00	2.54E+01		6.7E-01
Total											3.8E-05	4.1E+00

EPC = Exposure Point Concentration
HI = Hazard Index

[a] Risks associated with exposures to COPCs in deep soil only were calculated relative to risks for the total soil: (Deep Soil EPC/Total Soil EPC) x Total Soil Risk = Deep Soil Risk.

[b] HIs associated with exposures to COPCs in deep soil only were calculated relative to HIs for the total soil: (Deep Soil EPC/Total Soil EPC) x Total Soil HI = Deep Soil HI.

[c] Chemical was a COPC in deep soil only. Deep soil risk and HI are calculated for inclusion in the cumulative deep soil risk and HI

Appendix E-7

Background Comparisons – ProUCL 4.0 Output

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd SS.wst
Full Precision	OFF
Confidence Coefficient	0.95

Aluminum

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Aluminum Data	28	0	28	28	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	28	3620	20100	8300	6705	4279

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	4.541	4.078	1828	8.91	0.477	0.0535

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.871	0.924	Data Not Normal
Lilliefors (Full: no NDs)	0.208	0.167	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.741	0.749	
Kolmogorov-Smirnov (Full: no NDs)	0.171	0.166	Data appear Approximate Gamma Distribution

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.948	0.924	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.142	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Antimony

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Antimony Data	14	0	14	0	14	100.00%

Insufficient detected observations for valid results

Arsenic

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Arsenic Data	28	0	28	28	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	28	1.5	10.2	3.732	2.75	2.33

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	3.494	3.143	1.068	1.167	0.532	0.456

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.803	0.924	Data Not Normal
Lilliefors (Full: no NDs)	0.203	0.167	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	1.02	0.752	
Kolmogorov-Smirnov (Full: no NDs)	0.165	0.166	Data appear Approximate Gamma Distribution

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.932	0.924	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.138	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Barium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Barium Data	28	0	28	24	4	14.29%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	4	0.36	1	0.683	0.685	0.367
Statistics (Detects Only)	24	23.4	174	75.55	61.85	43.2
Statistics (All: NDs treated as DL value)	28	0.36	174	64.85	58.65	47.97
Statistics (All: NDs treated as DL/2 value)	28	0.18	174	64.8	58.65	48.04
Statistics (Normal ROS Estimated Data)	28	-33.62	174	61.51	58.65	53.13
Statistics (Gamma ROS Estimated Data)	28	0	174	66.05	58.65	46.43
Statistics (Lognormal ROS Estimated Data)	28	14.2	174	67.13	58.65	45.07

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	3.215	2.894	23.5	4.161	0.597	0.144
Statistics (NDs = DL)	0.867	0.798	74.79	3.495	1.762	0.504
Statistics (NDs = DL/2)	0.769	0.711	84.25	3.396	1.997	0.588
Statistics (Gamma ROS Estimates)	0.566	0.529	116.7	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	3.967	0.734	0.185

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.917	0.916	Data Appear Normal
Lilliefors (Detects Only)	0.192	0.181	Data Not Normal
Shapiro-Wilks (NDs = DL)	0.941	0.924	Data Appear Normal
Lilliefors (NDs = DL)	0.153	0.167	Data Appear Normal
Shapiro-Wilks (NDs = DL/2)	0.941	0.924	Data Appear Normal

Lilliefors (NDs = DL/2)	0.153	0.167	Data Appear Normal
Shapiro-Wilks (Normal ROS Estimates)	0.971	0.924	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.127	0.167	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.354	0.751	
Kolmogorov-Smirnov (Detects Only)	0.127	0.179	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	1.516	0.78	
Kolmogorov-Smirnov (NDs = DL)	0.191	0.171	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	1.873	0.784	
Kolmogorov-Smirnov (NDs = DL/2)	0.217	0.172	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	3.326	0.804	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.279	0.174	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.959	0.916	Data Appear Lognormal
Lilliefors (Detects Only)	0.104	0.181	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.725	0.924	Data Not Lognormal
Lilliefors (NDs = DL)	0.28	0.167	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.691	0.924	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.309	0.167	Data Not Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.955	0.924	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.11	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Beryllium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Beryllium Data	28	0	28	15	13	46.43%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.022	0.03	0.0278	0.03	0.0033
Statistics (Detects Only)	15	0.61	1.5	0.887	0.87	0.246
Statistics (All: NDs treated as DL value)	28	0.022	1.5	0.488	0.615	0.471
Statistics (All: NDs treated as DL/2 value)	28	0.011	1.5	0.481	0.615	0.477
Statistics (Normal ROS Estimated Data)	28	-0.178	1.5	0.577	0.615	0.402
Statistics (Gamma ROS Estimated Data)	28	0.498	1.5	0.87	0.879	0.206
Statistics (Lognormal ROS Estimated Data)	28	0.276	1.5	0.674	0.615	0.297

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	15.44	13.81	0.0574	-0.153	0.26	-1.698
Statistics (NDs = DL)	0.6	0.559	0.814	-1.748	1.757	-1.005
Statistics (NDs = DL/2)	0.478	0.45	1.008	-2.07	2.107	-1.018
Statistics (Gamma ROS Estimates)	19.32	17.28	0.045	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	-0.483	0.427	-0.884

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.908	0.881	Data Appear Normal
Lilliefors (Detects Only)	0.151	0.229	Data Appear Normal
Shapiro-Wilks (NDs = DL)	0.826	0.924	Data Not Normal
Lilliefors (NDs = DL)	0.299	0.167	Data Not Normal
Shapiro-Wilks (NDs = DL/2)	0.823	0.924	Data Not Normal
Lilliefors (NDs = DL/2)	0.3	0.167	Data Not Normal
Shapiro-Wilks (Normal ROS Estimates)	0.984	0.924	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.0906	0.167	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.307	0.736	
Kolmogorov-Smirnov (Detects Only)	0.159	0.221	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	3.179	0.8	
Kolmogorov-Smirnov (NDs = DL)	0.312	0.174	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	3.391	0.815	
Kolmogorov-Smirnov (NDs = DL/2)	0.314	0.175	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	0.229	0.745	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.102	0.165	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.953	0.881	Data Appear Lognormal
Lilliefors (Detects Only)	0.15	0.229	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.731	0.924	Data Not Lognormal
Lilliefors (NDs = DL)	0.306	0.167	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.715	0.924	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.308	0.167	Data Not Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.981	0.924	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0909	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Cadmium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Cadmium Data	28	0	28	2	26	92.86%

Insufficient detected observations for valid results

Calcium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Calcium Data	28	0	28	23	5	17.86%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	5	4.6	6.6	5.12	4.8	0.844
Statistics (Detects Only)	23	116	7340	1197	885	1440
Statistics (All: NDs treated as DL value)	28	4.6	7340	983.9	761.5	1380

Statistics (All: NDs treated as DL/2 value)	28	2.3	7340	983.5	761.5	1380
Statistics (Normal ROS Estimated Data)	28	-1605	7340	751.5	761.5	1625
Statistics (Gamma ROS Estimated Data)	28	0	7340	984.5	761.5	1380
Statistics (Lognormal ROS Estimated Data)	28	104.3	7340	1007	761.5	1364

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	1.506	1.368	794.6	6.72	0.84	0.125
Statistics (NDs = DL)	0.575	0.537	1712	5.81	2.128	0.366
Statistics (NDs = DL/2)	0.523	0.491	1879	5.686	2.383	0.419
Statistics (Gamma ROS Estimates)	0.178	0.183	5519	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	6.391	1.047	0.164

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.553	0.914	Data Not Normal
Lilliefors (Detects Only)	0.275	0.185	Data Not Normal
Shapiro-Wilks (NDs = DL)	0.587	0.924	Data Not Normal
Lilliefors (NDs = DL)	0.244	0.167	Data Not Normal
Shapiro-Wilks (NDs = DL/2)	0.587	0.924	Data Not Normal
Lilliefors (NDs = DL/2)	0.244	0.167	Data Not Normal
Shapiro-Wilks (Normal ROS Estimates)	0.761	0.924	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.207	0.167	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.694	0.76	
Kolmogorov-Smirnov (Detects Only)	0.152	0.185	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	1.232	0.803	
Kolmogorov-Smirnov (NDs = DL)	0.192	0.174	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	1.47	0.808	
Kolmogorov-Smirnov (NDs = DL/2)	0.211	0.175	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	6.572	0.907	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.417	0.184	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.967	0.914	Data Appear Lognormal
Lilliefors (Detects Only)	0.0979	0.185	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.779	0.924	Data Not Lognormal
Lilliefors (NDs = DL)	0.279	0.167	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.75	0.924	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.296	0.167	Data Not Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.949	0.924	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.114	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Chromium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs

Chromium Data	28	0	28	28	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	28	6.3	53.3	21.09	22.4	10.5

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	4.111	3.695	5.13	2.922	0.529	0.181

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.92	0.924	Data Not Normal
Lilliefors (Full: no NDs)	0.11	0.167	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.612	0.75	
Kolmogorov-Smirnov (Full: no NDs)	0.145	0.166	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.946	0.924	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.17	0.167	Data Not Lognormal

Note: DL/2 is not a recommended method.

Cobalt

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Cobalt Data	28	0	28	20	8	28.57%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	8	0.11	0.75	0.501	0.72	0.319
Statistics (Detects Only)	20	5.9	45.4	15.95	12.1	10.07
Statistics (All: NDs treated as DL value)	28	0.11	45.4	11.53	10.15	11.04
Statistics (All: NDs treated as DL/2 value)	28	0.055	45.4	11.46	10.15	11.11
Statistics (Normal ROS Estimated Data)	28	-10.02	45.4	9.494	10.15	13.45
Statistics (Gamma ROS Estimated Data)	28	3.774	45.4	13.39	10.15	9.473
Statistics (Lognormal ROS Estimated Data)	28	3.134	45.4	12.48	10.15	10.13

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	3.439	3.095	4.636	2.617	0.545	0.208
Statistics (NDs = DL)	0.701	0.65	16.45	1.583	1.793	1.132
Statistics (NDs = DL/2)	0.588	0.549	19.49	1.385	2.092	1.51
Statistics (Gamma ROS Estimates)	2.851	2.569	4.697	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	2.25	0.749	0.333

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.819	0.905	Data Not Normal

Lilliefors (Detects Only)	0.236	0.198	Data Not Normal
Shapiro-Wilks (NDs = DL)	0.867	0.924	Data Not Normal
Lilliefors (NDs = DL)	0.158	0.167	Data Appear Normal
Shapiro-Wilks (NDs = DL/2)	0.867	0.924	Data Not Normal
Lilliefors (NDs = DL/2)	0.156	0.167	Data Appear Normal
Shapiro-Wilks (Normal ROS Estimates)	0.936	0.924	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.128	0.167	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.596	0.747	
Kolmogorov-Smirnov (Detects Only)	0.167	0.195	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	1.122	0.79	
Kolmogorov-Smirnov (NDs = DL)	0.195	0.172	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	1.507	0.801	
Kolmogorov-Smirnov (NDs = DL/2)	0.221	0.174	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	0.785	0.754	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.155	0.167	Data appear Approximate Gamma Distribution

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.96	0.905	Data Appear Lognormal
Lilliefors (Detects Only)	0.132	0.198	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.831	0.924	Data Not Lognormal
Lilliefors (NDs = DL)	0.257	0.167	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.802	0.924	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.288	0.167	Data Not Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.954	0.924	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.126	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Copper

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Copper Data	28	0	28	26	2	7.14%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	2	0.17	0.17	0.17	0.17	N/A
Statistics (Detects Only)	26	2.2	13.6	6.919	5.35	3.696
Statistics (All: NDs treated as DL value)	28	0.17	13.6	6.437	5.2	3.973
Statistics (All: NDs treated as DL/2 value)	28	0.085	13.6	6.431	5.2	3.983
Statistics (Normal ROS Estimated Data)	28	-2.356	13.6	6.306	5.2	4.214
Statistics (Gamma ROS Estimated Data)	28	0	13.6	6.44	5.2	3.969
Statistics (Lognormal ROS Estimated Data)	28	1.502	13.6	6.545	5.2	3.814

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	3.738	3.361	1.851	1.795	0.544	0.303
Statistics (NDs = DL)	1.699	1.541	3.788	1.54	1.072	0.696
Statistics (NDs = DL/2)	1.493	1.357	4.307	1.49	1.234	0.828
Statistics (Gamma ROS Estimates)	0.633	0.589	10.17	--	--	--

Statistics (Lognormal ROS Estimates)	--	--	--	1.703	0.623	0.366

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.88	0.92	Data Not Normal
Lilliefors (Detects Only)	0.206	0.174	Data Not Normal
Shapiro-Wilks (NDs = DL)	0.919	0.924	Data Not Normal
Lilliefors (NDs = DL)	0.181	0.167	Data Not Normal
Shapiro-Wilks (NDs = DL/2)	0.92	0.924	Data Not Normal
Lilliefors (NDs = DL/2)	0.18	0.167	Data Not Normal
Shapiro-Wilks (Normal ROS Estimates)	0.939	0.924	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.164	0.167	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.717	0.749	
Kolmogorov-Smirnov (Detects Only)	0.151	0.172	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	0.918	0.761	
Kolmogorov-Smirnov (NDs = DL)	0.152	0.168	Data appear Approximate Gamma Distribution
Anderson-Darling (NDs = DL/2)	1.191	0.763	
Kolmogorov-Smirnov (NDs = DL/2)	0.177	0.168	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	3.942	0.797	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.345	0.173	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.939	0.92	Data Appear Lognormal
Lilliefors (Detects Only)	0.135	0.174	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.748	0.924	Data Not Lognormal
Lilliefors (NDs = DL)	0.222	0.167	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.69	0.924	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.258	0.167	Data Not Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.952	0.924	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.118	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Iron

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Iron Data	28	0	28	28	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	28	7250	63000	20108	19750	11869

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	3.411	3.069	5895	9.755	0.57	0.0584

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.846	0.924	Data Not Normal
Lilliefors (Full: no NDs)	0.139	0.167	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.612	0.752	
Kolmogorov-Smirnov (Full: no NDs)	0.151	0.166	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.932	0.924	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.153	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Lead

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Lead Data	28	0	28	28	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	28	8.9	225	26.96	15.15	41.34

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	1.456	1.324	18.52	2.913	0.702	0.241

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.416	0.924	Data Not Normal
Lilliefors (Full: no NDs)	0.375	0.167	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	3.163	0.764	
Kolmogorov-Smirnov (Full: no NDs)	0.253	0.169	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.798	0.924	Data Not Lognormal
Lilliefors (Full: no NDs)	0.192	0.167	Data Not Lognormal

Note: DL/2 is not a recommended method.

Magnesium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Magnesium Data	28	0	28	25	3	10.71%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	3	4.7	5	4.833	4.8	0.153
Statistics (Detects Only)	25	158	20400	2498	913	4334
Statistics (All: NDs treated as DL value)	28	4.7	20400	2231	741	4161
Statistics (All: NDs treated as DL/2 value)	28	2.35	20400	2230	741	4161
Statistics (Normal ROS Estimated Data)	28	-5148	20400	1678	741	4743
Statistics (Gamma ROS Estimated Data)	28	0	20400	2230	741	4161
Statistics (Lognormal ROS Estimated Data)	28	56.13	20400	2236	741	4158

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	0.694	0.643	3600	6.951	1.272	0.183
Statistics (NDs = DL)	0.479	0.451	4657	6.375	2.075	0.325
Statistics (NDs = DL/2)	0.457	0.432	4879	6.301	2.257	0.358
Statistics (Gamma ROS Estimates)	0.198	0.201	11267	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	6.638	1.512	0.228

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.558	0.918	Data Not Normal
Lilliefors (Detects Only)	0.303	0.177	Data Not Normal
Shapiro-Wilks (NDs = DL)	0.546	0.924	Data Not Normal
Lilliefors (NDs = DL)	0.299	0.167	Data Not Normal
Shapiro-Wilks (NDs = DL/2)	0.546	0.924	Data Not Normal
Lilliefors (NDs = DL/2)	0.299	0.167	Data Not Normal
Shapiro-Wilks (Normal ROS Estimates)	0.729	0.924	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.267	0.167	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	1.247	0.789	
Kolmogorov-Smirnov (Detects Only)	0.183	0.182	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	0.674	0.815	
Kolmogorov-Smirnov (NDs = DL)	0.131	0.175	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL/2)	0.681	0.82	
Kolmogorov-Smirnov (NDs = DL/2)	0.141	0.176	Data Appear Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	3.847	0.898	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.366	0.183	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.95	0.918	Data Appear Lognormal
Lilliefors (Detects Only)	0.107	0.177	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.889	0.924	Data Not Lognormal
Lilliefors (NDs = DL)	0.195	0.167	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.856	0.924	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.22	0.167	Data Not Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.973	0.924	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0849	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Manganese

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Manganese Data	28	0	28	28	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	28	43	2040	695.9	490	591.5

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	1.442	1.311	482.6	6.16	0.971	0.158

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.84	0.924	Data Not Normal
Lilliefors (Full: no NDs)	0.197	0.167	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.306	0.764	
Kolmogorov-Smirnov (Full: no NDs)	0.102	0.169	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.962	0.924	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.106	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Mercury

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Mercury Data	28	0	28	3	25	89.29%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	25	0.019	0.06	0.0466	0.05	0.017
Statistics (Detects Only)	3	0.07	1.2	0.467	0.13	0.636
Statistics (All: NDs treated as DL value)	28	0.019	1.2	0.0916	0.06	0.218
Statistics (All: NDs treated as DL/2 value)	28	0.0095	1.2	0.0708	0.03	0.223
Statistics (Normal ROS Estimated Data)	28	-6.561	1.2	-3.164	-3.255	1.837
Statistics (Gamma ROS Estimated Data)	28	0	1.2	0.05	0	0.227
Statistics (Lognormal ROS Estimated Data)	28	0	1.2	0.0503	2.3931E-5	0.227

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	0.798	0.737	0.585	-1.506	1.494	-0.992
Statistics (NDs = DL)	0.982	0.901	0.0933	-2.979	0.795	-0.267
Statistics (NDs = DL/2)	0.644	0.598	0.11	-3.598	0.952	-0.265
Statistics (Gamma ROS Estimates)	0.0553	0.0732	0.904	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	-10.44	4.519	-0.433

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.79	0.767	Data Appear Normal
Lilliefors (Detects Only)	0.368	0.512	Data Appear Normal
Shapiro-Wilks (NDs = DL)	0.268	0.924	Data Not Normal
Lilliefors (NDs = DL)	0.468	0.167	Data Not Normal
Shapiro-Wilks (NDs = DL/2)	0.253	0.924	Data Not Normal
Lilliefors (NDs = DL/2)	0.466	0.167	Data Not Normal
Shapiro-Wilks (Normal ROS Estimates)	0.974	0.924	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.0965	0.167	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.439	N/A	
Kolmogorov-Smirnov (Detects Only)	0.373	N/A	
Anderson-Darling (NDs = DL)	4.794	0.775	
Kolmogorov-Smirnov (NDs = DL)	0.41	0.17	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	5.507	0.796	
Kolmogorov-Smirnov (NDs = DL/2)	0.458	0.173	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	9.082	1.229	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.564	0.206	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.904	0.767	Data Appear Lognormal
Lilliefors (Detects Only)	0.306	0.512	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.71	0.924	Data Not Lognormal
Lilliefors (NDs = DL)	0.31	0.167	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.708	0.924	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.355	0.167	Data Not Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.974	0.924	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0964	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Nickel

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Nickel Data	28	0	28	17	11	39.29%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	11	0.21	1.3	1.005	1.3	0.504
Statistics (Detects Only)	17	4.6	18.1	9.935	9.4	4.294
Statistics (All: NDs treated as DL value)	28	0.21	18.1	6.427	5.55	5.545
Statistics (All: NDs treated as DL/2 value)	28	0.105	18.1	6.23	5.55	5.741
Statistics (Normal ROS Estimated Data)	28	-7.045	18.1	5.574	5.55	6.652
Statistics (Gamma ROS Estimated Data)	28	1.974	18.1	9.082	8.465	3.849
Statistics (Lognormal ROS Estimated Data)	28	1.602	18.1	7.218	5.55	4.794

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.

Statistics (Detects Only)	5.612	5.034	1.77	2.204	0.448	0.203
Statistics (NDs = DL)	0.953	0.874	6.748	1.251	1.353	1.082
Statistics (NDs = DL/2)	0.709	0.657	8.784	0.979	1.668	1.704
Statistics (Gamma ROS Estimates)	5.329	4.782	1.704	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	1.759	0.683	0.388

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.938	0.892	Data Appear Normal
Lilliefors (Detects Only)	0.12	0.215	Data Appear Normal
Shapiro-Wilks (NDs = DL)	0.891	0.924	Data Not Normal
Lilliefors (NDs = DL)	0.215	0.167	Data Not Normal
Shapiro-Wilks (NDs = DL/2)	0.88	0.924	Data Not Normal
Lilliefors (NDs = DL/2)	0.227	0.167	Data Not Normal
Shapiro-Wilks (Normal ROS Estimates)	0.977	0.924	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.0932	0.167	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.276	0.741	
Kolmogorov-Smirnov (Detects Only)	0.133	0.21	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	0.909	0.776	
Kolmogorov-Smirnov (NDs = DL)	0.199	0.171	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	1.342	0.789	
Kolmogorov-Smirnov (NDs = DL/2)	0.225	0.172	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	0.176	0.748	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.0785	0.166	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.949	0.892	Data Appear Lognormal
Lilliefors (Detects Only)	0.125	0.215	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.872	0.924	Data Not Lognormal
Lilliefors (NDs = DL)	0.188	0.167	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.847	0.924	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.236	0.167	Data Not Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.959	0.924	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.107	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Potassium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Potassium Data	28	0	28	22	6	21.43%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	6	201	271	220	213	25.92
Statistics (Detects Only)	22	166	2350	735.4	509.5	632.6
Statistics (All: NDs treated as DL value)	28	166	2350	625	317.5	598.1

Statistics (All: NDs treated as DL/2 value)	28	100.5	2350	601.4	317.5	616.1
Statistics (Normal ROS Estimated Data)	28	-180.2	2350	544.7	317.5	671
Statistics (Gamma ROS Estimated Data)	28	135.6	2350	613.1	326.6	607.5
Statistics (Lognormal ROS Estimated Data)	28	142.4	2350	609.6	317.5	609.5

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	1.634	1.482	450.2	6.264	0.838	0.134
Statistics (NDs = DL)	1.53	1.39	408.6	6.076	0.826	0.136
Statistics (NDs = DL/2)	1.2	1.095	501.1	5.928	0.989	0.167
Statistics (Gamma ROS Estimates)	1.347	1.226	455.3	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	5.992	0.91	0.152

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.83	0.911	Data Not Normal
Lilliefors (Detects Only)	0.222	0.189	Data Not Normal
Shapiro-Wilks (NDs = DL)	0.756	0.924	Data Not Normal
Lilliefors (NDs = DL)	0.239	0.167	Data Not Normal
Shapiro-Wilks (NDs = DL/2)	0.787	0.924	Data Not Normal
Lilliefors (NDs = DL/2)	0.22	0.167	Data Not Normal
Shapiro-Wilks (Normal ROS Estimates)	0.874	0.924	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.176	0.167	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.667	0.758	
Kolmogorov-Smirnov (Detects Only)	0.154	0.188	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	1.637	0.762	
Kolmogorov-Smirnov (NDs = DL)	0.21	0.168	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	0.858	0.769	
Kolmogorov-Smirnov (NDs = DL/2)	0.151	0.169	Data appear Approximate Gamma Distribution
Anderson-Darling (Gamma ROS Estimates)	1.093	0.766	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.171	0.169	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.939	0.911	Data Appear Lognormal
Lilliefors (Detects Only)	0.123	0.189	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.882	0.924	Data Not Lognormal
Lilliefors (NDs = DL)	0.187	0.167	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.934	0.924	Data Appear Lognormal
Lilliefors (NDs = DL/2)	0.102	0.167	Data Appear Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.9	0.924	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.138	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Selenium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Selenium Data	28	0	28	2	26	92.86%

Insufficient detected observations for valid results

Thallium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Thallium Data	28	0	28	4	24	85.71%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	24	0.13	0.41	0.195	0.14	0.102
Statistics (Detects Only)	4	1.3	2.1	1.85	2	0.37
Statistics (All: NDs treated as DL value)	28	0.13	2.1	0.431	0.14	0.61
Statistics (All: NDs treated as DL/2 value)	28	0.065	2.1	0.348	0.07	0.638
Statistics (Normal ROS Estimated Data)	28	-1.016	2.1	0.463	0.263	0.766
Statistics (Gamma ROS Estimated Data)	28	1.3	2.1	1.854	1.856	0.123
Statistics (Lognormal ROS Estimated Data)	28	0.329	2.1	0.886	0.706	0.466

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	28.68	25.63	0.0645	0.598	0.225	0.376
Statistics (NDs = DL)	1.025	0.939	0.421	-1.403	0.921	-0.657
Statistics (NDs = DL/2)	0.649	0.604	0.535	-1.997	1.149	-0.575
Statistics (Gamma ROS Estimates)	199.2	177.9	0.0093	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	-0.229	0.457	-1.992

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.737	0.748	Data Not Normal
Lilliefors (Detects Only)	0.408	0.443	Data Appear Normal
Shapiro-Wilks (NDs = DL)	0.532	0.924	Data Not Normal
Lilliefors (NDs = DL)	0.371	0.167	Data Not Normal
Shapiro-Wilks (NDs = DL/2)	0.481	0.924	Data Not Normal
Lilliefors (NDs = DL/2)	0.446	0.167	Data Not Normal
Shapiro-Wilks (Normal ROS Estimates)	0.952	0.924	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.138	0.167	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.755	0.657	
Kolmogorov-Smirnov (Detects Only)	0.436	0.394	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	4.636	0.773	
Kolmogorov-Smirnov (NDs = DL)	0.342	0.17	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	5.51	0.795	
Kolmogorov-Smirnov (NDs = DL/2)	0.351	0.173	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	6.198	0.743	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.415	0.165	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.717	0.748	Data Not Lognormal
Lilliefors (Detects Only)	0.415	0.443	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.678	0.924	Data Not Lognormal
Lilliefors (NDs = DL)	0.311	0.167	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.639	0.924	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.318	0.167	Data Not Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.951	0.924	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.138	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Vanadium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Vanadium Data	28	0	28	28	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	28	12.2	101	33.89	33.8	17.78

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	4.392	3.946	7.716	3.405	0.497	0.146

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.832	0.924	Data Not Normal
Lilliefors (Full: no NDs)	0.141	0.167	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.622	0.749	
Kolmogorov-Smirnov (Full: no NDs)	0.111	0.166	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.939	0.924	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.138	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Zinc

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Zinc Data	28	0	28	28	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	28	7.1	216	41.21	29.7	40.24

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	1.826	1.654	22.56	3.421	0.761	0.223

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.665	0.924	Data Not Normal
Lilliefors (Full: no NDs)	0.203	0.167	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.54	0.76	
Kolmogorov-Smirnov (Full: no NDs)	0.105	0.168	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.975	0.924	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.1	0.167	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

From File H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd TS.wst

Full Precision OFF

Confidence Coefficient 0.95

Aluminum

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Aluminum Data	79	0	79	79	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	79	3620	47900	14204	12100	9433

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	2.787	2.689	5097	9.371	0.618	0.0659

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.15	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.604	0.76	
Kolmogorov-Smirnov (Full: no NDs)	0.0772	0.101	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.0626	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Antimony

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Antimony Data	38	0	38	0	38	100.00%

Insufficient detected observations for valid results

Arsenic

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Arsenic Data	79	0	79	76	3	3.80%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	3	0.09	0.12	0.103	0.1	0.0153
Statistics (Detects Only)	76	1.2	35.9	4.989	3.2	5.36
Statistics (All: NDs treated as DL value)	79	0.09	35.9	4.804	3.1	5.339

Statistics (All: NDs treated as DL/2 value)	79	0.045	35.9	4.802	3.1	5.341
Statistics (Normal ROS Estimated Data)	79	-5.169	35.9	4.604	3.1	5.608
Statistics (Gamma ROS Estimated Data)	79	0	35.9	4.8	3.1	5.343
Statistics (Lognormal ROS Estimated Data)	79	0.728	35.9	4.828	3.1	5.32

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	1.819	1.759	2.742	1.308	0.692	0.529
Statistics (NDs = DL)	1.401	1.356	3.429	1.172	0.968	0.826
Statistics (NDs = DL/2)	1.323	1.281	3.631	1.146	1.067	0.932
Statistics (Gamma ROS Estimates)	0.568	0.555	8.454	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	1.246	0.748	0.6

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.282	0.102	Data Not Normal
Lilliefors (NDs = DL)	0.279	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.279	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.263	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	4.409	0.766	
Kolmogorov-Smirnov (Detects Only)	0.213	0.104	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	3.469	0.772	
Kolmogorov-Smirnov (NDs = DL)	0.182	0.102	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	3.587	0.774	
Kolmogorov-Smirnov (NDs = DL/2)	0.176	0.103	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	10.23	0.812	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.332	0.106	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.151	0.102	Data Not Lognormal
Lilliefors (NDs = DL)	0.159	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.187	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.134	0.0997	Data Not Lognormal

Note: DL/2 is not a recommended method.

Barium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Barium Data	79	0	79	63	16	20.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	16	0.36	1.1	0.821	1	0.3
Statistics (Detects Only)	63	23.4	174	68.4	56.7	40.39
Statistics (All: NDs treated as DL value)	79	0.36	174	54.71	45.5	45.21
Statistics (All: NDs treated as DL/2 value)	79	0.18	174	54.63	45.5	45.31
Statistics (Normal ROS Estimated Data)	79	-54.83	174	50.41	45.5	51.24

Statistics (Gamma ROS Estimated Data)	79	0	174	58.64	45.5	41.27
Statistics (Lognormal ROS Estimated Data)	79	10.45	174	58.03	45.5	41.56

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	3.354	3.236	20.39	4.069	0.555	0.136
Statistics (NDs = DL)	0.737	0.717	74.26	3.188	1.839	0.577
Statistics (NDs = DL/2)	0.642	0.626	85.13	3.047	2.109	0.692
Statistics (Gamma ROS Estimates)	1.061	1.029	55.28	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	3.817	0.71	0.186

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.211	0.112	Data Not Normal
Lilliefors (NDs = DL)	0.154	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.153	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.13	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	1.567	0.757	
Kolmogorov-Smirnov (Detects Only)	0.142	0.113	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	4.488	0.794	
Kolmogorov-Smirnov (NDs = DL)	0.207	0.105	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	5.552	0.804	
Kolmogorov-Smirnov (NDs = DL/2)	0.235	0.105	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	3.925	0.78	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.215	0.103	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.114	0.112	Data Not Lognormal
Lilliefors (NDs = DL)	0.29	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.317	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0679	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Beryllium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Beryllium Data	79	0	79	40	39	49.37%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	39	0.022	0.03	0.0286	0.03	0.0026
Statistics (Detects Only)	40	0.61	5.4	1.449	1.1	1.086
Statistics (All: NDs treated as DL value)	79	0.022	5.4	0.748	0.61	1.049
Statistics (All: NDs treated as DL/2 value)	79	0.011	5.4	0.74	0.61	1.054
Statistics (Normal ROS Estimated Data)	79	-3.53	5.4	0.149	0.61	1.644
Statistics (Gamma ROS Estimated Data)	79	0	5.4	1.439	1.3	0.88
Statistics (Lognormal ROS Estimated Data)	79	0.0819	5.4	0.892	0.61	0.959

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	3.116	3.006	0.465	0.202	0.533	2.643
Statistics (NDs = DL)	0.47	0.461	1.589	-1.654	1.93	-1.167
Statistics (NDs = DL/2)	0.39	0.383	1.9	-1.996	2.273	-1.138
Statistics (Gamma ROS Estimates)	1.38	1.336	1.043	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	-0.504	0.875	-1.735

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.666	0.94	Data Not Normal
Lilliefors (Detects Only)	0.256	0.14	Data Not Normal
Lilliefors (NDs = DL)	0.247	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.248	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.117	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	2.172	0.754	
Kolmogorov-Smirnov (Detects Only)	0.198	0.14	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	6.807	0.826	
Kolmogorov-Smirnov (NDs = DL)	0.32	0.107	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	7.311	0.844	
Kolmogorov-Smirnov (NDs = DL/2)	0.323	0.108	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	5.881	0.773	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.232	0.103	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.891	0.94	Data Not Lognormal
Lilliefors (Detects Only)	0.155	0.14	Data Not Lognormal
Lilliefors (NDs = DL)	0.325	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.328	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0541	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Cadmium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Cadmium Data	79	0	79	13	66	83.54%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	66	0.02	0.05	0.0256	0.02	0.0086
Statistics (Detects Only)	13	0.57	2.5	1.152	1.1	0.585
Statistics (All: NDs treated as DL value)	79	0.02	2.5	0.211	0.02	0.479
Statistics (All: NDs treated as DL/2 value)	79	0.01	2.5	0.2	0.01	0.483
Statistics (Normal ROS Estimated Data)	79	-4.148	2.5	-1.016	-1.143	1.342
Statistics (Gamma ROS Estimated Data)	79	0.197	2.987	1.943	2.175	0.717
Statistics (Lognormal ROS Estimated Data)	79	0.0167	2.5	0.338	0.174	0.444

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	5.194	5.005	0.222	0.0424	0.448	10.55
Statistics (NDs = DL)	0.424	0.416	0.498	-3.093	1.437	-0.465
Statistics (NDs = DL/2)	0.329	0.325	0.609	-3.672	1.69	-0.46
Statistics (Gamma ROS Estimates)	5.206	5.016	0.373	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	-1.649	1.046	-0.634

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.82	0.866	Data Not Normal
Lilliefors (Detects Only)	0.246	0.246	Data Not Normal
Lilliefors (NDs = DL)	0.467	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.477	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0689	0.0997	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.512	0.736	
Kolmogorov-Smirnov (Detects Only)	0.181	0.237	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	17.17	0.836	
Kolmogorov-Smirnov (NDs = DL)	0.422	0.107	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	18.08	0.858	
Kolmogorov-Smirnov (NDs = DL/2)	0.448	0.109	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	2.804	0.754	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.164	0.101	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.934	0.866	Data Appear Lognormal
Lilliefors (Detects Only)	0.158	0.246	Data Appear Lognormal
Lilliefors (NDs = DL)	0.327	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.348	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0689	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Calcium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Calcium Data	79	0	79	63	16	20.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	16	4.6	6.7	5.563	5.4	0.796
Statistics (Detects Only)	63	116	25700	1392	717	3322
Statistics (All: NDs treated as DL value)	79	4.6	25700	1111	534	3014
Statistics (All: NDs treated as DL/2 value)	79	2.3	25700	1111	534	3014
Statistics (Normal ROS Estimated Data)	79	-3726	25700	537.2	534	3423
Statistics (Gamma ROS Estimated Data)	79	0	25700	1110	534	3014
Statistics (Lognormal ROS Estimated Data)	79	60.37	25700	1129	534	3007

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	0.899	0.873	1548	6.588	0.949	0.144
Statistics (NDs = DL)	0.456	0.447	2437	5.599	2.149	0.384
Statistics (NDs = DL/2)	0.42	0.413	2643	5.459	2.409	0.441
Statistics (Gamma ROS Estimates)	0.131	0.135	8441	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	6.173	1.189	0.193

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.359	0.112	Data Not Normal
Lilliefors (NDs = DL)	0.357	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.357	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.289	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	4.055	0.785	
Kolmogorov-Smirnov (Detects Only)	0.223	0.116	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	2.78	0.829	
Kolmogorov-Smirnov (NDs = DL)	0.146	0.107	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	3.129	0.837	
Kolmogorov-Smirnov (NDs = DL/2)	0.149	0.107	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	17.18	0.972	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.418	0.114	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.108	0.112	Data Appear Lognormal
Lilliefors (NDs = DL)	0.224	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.251	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0933	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Chromium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Chromium Data	79	0	79	79	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	79	6.3	75.8	26.86	26	12.51

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	4.546	4.382	5.91	3.177	0.501	0.158

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.0734	0.0997	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.591	0.755	
Kolmogorov-Smirnov (Full: no NDs)	0.0909	0.101	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.122	0.0997	Data Not Lognormal

Note: DL/2 is not a recommended method.

Cobalt

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Cobalt Data	79	0	79	56	23	29.11%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	23	0.11	0.84	0.587	0.73	0.286
Statistics (Detects Only)	56	5.9	130	22.23	13.3	23.94
Statistics (All: NDs treated as DL value)	79	0.11	130	15.93	11.4	22.41
Statistics (All: NDs treated as DL/2 value)	79	0.055	130	15.84	11.4	22.47
Statistics (Normal ROS Estimated Data)	79	-40.83	130	8.784	11.4	29.44
Statistics (Gamma ROS Estimated Data)	79	0	130	17.57	11.9	21.54
Statistics (Lognormal ROS Estimated Data)	79	1.86	130	16.76	11.4	21.87

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	1.78	1.721	12.49	2.795	0.701	0.251
Statistics (NDs = DL)	0.61	0.595	26.11	1.758	1.787	1.017
Statistics (NDs = DL/2)	0.523	0.511	30.31	1.556	2.08	1.337
Statistics (Gamma ROS Estimates)	0.504	0.494	34.83	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	2.331	0.947	0.406

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.263	0.118	Data Not Normal
Lilliefors (NDs = DL)	0.24	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.241	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.17	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	3.203	0.765	
Kolmogorov-Smirnov (Detects Only)	0.162	0.121	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	2.127	0.807	
Kolmogorov-Smirnov (NDs = DL)	0.155	0.105	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	2.851	0.816	
Kolmogorov-Smirnov (NDs = DL/2)	0.171	0.106	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	9.036	0.818	

Kolmogorov-Smirnov (Gamma ROS Est.)	0.36	0.106	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.13	0.118	Data Not Lognormal
Lilliefors (NDs = DL)	0.213	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.251	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0915	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Copper

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Copper Data	79	0	79	77	2	2.53%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	2	0.17	0.17	0.17	0.17	N/A
Statistics (Detects Only)	77	1.6	38.7	12.25	9.1	9.397
Statistics (All: NDs treated as DL value)	79	0.17	38.7	11.95	9	9.47
Statistics (All: NDs treated as DL/2 value)	79	0.085	38.7	11.94	9	9.473
Statistics (Normal ROS Estimated Data)	79	-11.93	38.7	11.67	9	9.957
Statistics (Gamma ROS Estimated Data)	79	0	38.7	11.94	9	9.475
Statistics (Lognormal ROS Estimated Data)	79	0.988	38.7	11.97	9	9.441

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	1.754	1.696	6.985	2.194	0.828	0.378
Statistics (NDs = DL)	1.438	1.391	8.31	2.094	1.03	0.492
Statistics (NDs = DL/2)	1.381	1.337	8.649	2.076	1.101	0.53
Statistics (Gamma ROS Estimates)	0.698	0.68	17.1	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	2.141	0.882	0.412

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.152	0.101	Data Not Normal
Lilliefors (NDs = DL)	0.155	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.155	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.136	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.936	0.767	
Kolmogorov-Smirnov (Detects Only)	0.117	0.103	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	0.591	0.772	
Kolmogorov-Smirnov (NDs = DL)	0.0861	0.102	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL/2)	0.619	0.773	
Kolmogorov-Smirnov (NDs = DL/2)	0.0788	0.103	Data Appear Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	4.964	0.798	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.209	0.105	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.082	0.101	Data Appear Lognormal
Lilliefors (NDs = DL)	0.0741	0.0997	Data Appear Lognormal
Lilliefors (NDs = DL/2)	0.0933	0.0997	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0707	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Iron

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Iron Data	79	0	79	79	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	79	7250	67700	26963	25200	11990

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	4.607	4.441	5852	10.09	0.508	0.0503

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.0648	0.0997	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.831	0.755	
Kolmogorov-Smirnov (Full: no NDs)	0.082	0.101	Data appear Approximate Gamma Distribution

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.115	0.0997	Data Not Lognormal

Note: DL/2 is not a recommended method.

Lead

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Lead Data	79	0	79	79	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	79	2.1	256	22.04	12	39.85

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	1.186	1.149	18.59	2.615	0.783	0.299

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.344	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	7.671	0.777	
Kolmogorov-Smirnov (Full: no NDs)	0.245	0.103	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.147	0.0997	Data Not Lognormal

Note: DL/2 is not a recommended method.

Magnesium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Magnesium Data	79	0	79	72	7	8.86%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	7	3.8	5	4.686	4.8	0.402
Statistics (Detects Only)	72	139	58100	6394	1270	12925
Statistics (All: NDs treated as DL value)	79	3.8	58100	5828	1080	12466
Statistics (All: NDs treated as DL/2 value)	79	1.9	58100	5827	1080	12466
Statistics (Normal ROS Estimated Data)	79	-1911	58100	4438	1080	13862
Statistics (Gamma ROS Estimated Data)	79	0	58100	5827	1080	12466
Statistics (Lognormal ROS Estimated Data)	79	28.2	58100	5832	1080	12464

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	0.484	0.474	13216	7.443	1.571	0.211
Statistics (NDs = DL)	0.379	0.373	15366	6.92	2.257	0.326
Statistics (NDs = DL/2)	0.368	0.363	15828	6.859	2.409	0.351
Statistics (Gamma ROS Estimates)	0.198	0.199	29431	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	7.129	1.812	0.254

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.323	0.104	Data Not Normal
Lilliefors (NDs = DL)	0.321	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.321	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.29	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	4.255	0.821	
Kolmogorov-Smirnov (Detects Only)	0.17	0.111	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	2.668	0.847	
Kolmogorov-Smirnov (NDs = DL)	0.136	0.108	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	2.542	0.849	
Kolmogorov-Smirnov (NDs = DL/2)	0.129	0.108	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	7.068	0.912	

Kolmogorov-Smirnov (Gamma ROS Est.)	0.298	0.111	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.0868	0.104	Data Appear Lognormal
Lilliefors (NDs = DL)	0.135	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.157	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0546	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Manganese

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Manganese Data	79	0	79	79	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	79	16.7	2040	471.4	359	467.1

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	1.121	1.087	420.6	5.647	1.118	0.198

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.165	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.359	0.779	
Kolmogorov-Smirnov (Full: no NDs)	0.0515	0.103	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.093	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Mercury

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Mercury Data	79	0	79	18	61	77.22%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	61	0.019	0.06	0.0484	0.06	0.0158
Statistics (Detects Only)	18	0.038	1.2	0.187	0.125	0.259
Statistics (All: NDs treated as DL value)	79	0.019	1.2	0.0799	0.06	0.135
Statistics (All: NDs treated as DL/2 value)	79	0.0095	1.2	0.0612	0.03	0.139
Statistics (Normal ROS Estimated Data)	79	-1.214	1.2	-0.361	-0.372	0.403
Statistics (Gamma ROS Estimated Data)	79	0.038	1.2	0.173	0.156	0.138
Statistics (Lognormal ROS Estimated Data)	79	7.9520E-4	1.2	0.0541	0.0171	0.141

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	1.552	1.501	0.12	-2.035	0.727	-0.358
Statistics (NDs = DL)	1.645	1.591	0.0485	-2.861	0.681	-0.238
Statistics (NDs = DL/2)	0.962	0.934	0.0636	-3.396	0.902	-0.266
Statistics (Gamma ROS Estimates)	3.073	2.965	0.0563	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	-4.029	1.44	-0.357

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.442	0.897	Data Not Normal
Lilliefors (Detects Only)	0.384	0.209	Data Not Normal
Lilliefors (NDs = DL)	0.356	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.361	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.067	0.0997	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	1.702	0.756	
Kolmogorov-Smirnov (Detects Only)	0.274	0.207	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	6.715	0.768	
Kolmogorov-Smirnov (NDs = DL)	0.33	0.102	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	8.44	0.784	
Kolmogorov-Smirnov (NDs = DL/2)	0.377	0.104	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	0.725	0.759	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.0728	0.101	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.871	0.897	Data Not Lognormal
Lilliefors (Detects Only)	0.193	0.209	Data Appear Lognormal
Lilliefors (NDs = DL)	0.269	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.321	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.062	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Nickel

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Nickel Data	79	0	79	61	18	22.78%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	18	0.21	1.4	1.066	1.3	0.466
Statistics (Detects Only)	61	4.6	94.2	17.95	13.2	15.68
Statistics (All: NDs treated as DL value)	79	0.21	94.2	14.1	9.4	15.49
Statistics (All: NDs treated as DL/2 value)	79	0.105	94.2	13.98	9.4	15.59
Statistics (Normal ROS Estimated Data)	79	-32.3	94.2	10.45	9.4	19.82
Statistics (Gamma ROS Estimated Data)	79	0	94.2	14.69	9.8	15.1
Statistics (Lognormal ROS Estimated Data)	79	1.082	94.2	14.48	9.4	15.18

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	1.974	1.908	9.092	2.614	0.722	0.276
Statistics (NDs = DL)	0.89	0.865	15.85	1.989	1.367	0.687
Statistics (NDs = DL/2)	0.743	0.723	18.82	1.831	1.622	0.886
Statistics (Gamma ROS Estimates)	0.377	0.371	38.92	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	2.235	0.959	0.429

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.197	0.113	Data Not Normal
Lilliefors (NDs = DL)	0.185	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.187	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.156	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.996	0.763	
Kolmogorov-Smirnov (Detects Only)	0.096	0.115	Data appear Approximate Gamma Distribution
Anderson-Darling (NDs = DL)	0.633	0.787	
Kolmogorov-Smirnov (NDs = DL)	0.112	0.104	Data appear Approximate Gamma Distribution
Anderson-Darling (NDs = DL/2)	1.261	0.794	
Kolmogorov-Smirnov (NDs = DL/2)	0.135	0.104	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	11.39	0.847	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.343	0.108	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.087	0.113	Data Appear Lognormal
Lilliefors (NDs = DL)	0.14	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.198	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0586	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Potassium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Potassium Data	79	0	79	67	12	15.19%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	12	201	271	223.1	217	20.78
Statistics (Detects Only)	67	123	10900	1690	694	2232
Statistics (All: NDs treated as DL value)	79	123	10900	1467	618	2120
Statistics (All: NDs treated as DL/2 value)	79	100.5	10900	1450	618	2131
Statistics (Normal ROS Estimated Data)	79	-1878	10900	1235	618	2322
Statistics (Gamma ROS Estimated Data)	79	0	10900	1433	618	2142
Statistics (Lognormal ROS Estimated Data)	79	104.7	10900	1456	618	2127

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.

Statistics (Detects Only)	0.92	0.893	1837	6.798	1.115	0.164
Statistics (NDs = DL)	0.837	0.814	1752	6.586	1.143	0.174
Statistics (NDs = DL/2)	0.75	0.73	1933	6.481	1.273	0.196
Statistics (Gamma ROS Estimates)	0.163	0.165	8778	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	6.525	1.216	0.186

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.247	0.108	Data Not Normal
Lilliefors (NDs = DL)	0.263	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.263	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.21	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	1.945	0.784	
Kolmogorov-Smirnov (Detects Only)	0.153	0.112	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	3.288	0.789	
Kolmogorov-Smirnov (NDs = DL)	0.171	0.104	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	2.192	0.793	
Kolmogorov-Smirnov (NDs = DL/2)	0.147	0.104	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	14.88	0.944	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.392	0.113	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.0982	0.108	Data Appear Lognormal
Lilliefors (NDs = DL)	0.106	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.0732	0.0997	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0941	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Selenium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Selenium Data	79	0	79	2	77	97.47%

Insufficient detected observations for valid results

Silver

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Silver Data	79	0	79	1	78	98.73%

Insufficient detected observations for valid results

Sodium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Sodium Data	79	0	79	6	73	92.41%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	73	10.8	25.9	15.02	12	4.717
Statistics (Detects Only)	6	114	151	131.7	127	14.76
Statistics (All: NDs treated as DL value)	79	10.8	151	23.88	12.1	31.65
Statistics (All: NDs treated as DL/2 value)	79	5.4	151	16.94	6.05	33.39
Statistics (Normal ROS Estimated Data)	79	-8.416	151	43.69	36.98	33.18
Statistics (Gamma ROS Estimated Data)	79	114	151	131.6	131.6	3.738
Statistics (Lognormal ROS Estimated Data)	79	45.83	151	70.08	64.41	20.82

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	97.1	93.42	1.356	4.875	0.111	0.0227
Statistics (NDs = DL)	1.618	1.565	14.76	2.833	0.653	0.23
Statistics (NDs = DL/2)	0.916	0.889	18.5	2.193	0.823	0.376
Statistics (Gamma ROS Estimates)	1276	1227	0.103	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	4.216	0.249	0.059

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.901	0.788	Data Appear Normal
Lilliefors (Detects Only)	0.212	0.362	Data Appear Normal
Lilliefors (NDs = DL)	0.404	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.472	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.2	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.389	0.696	
Kolmogorov-Smirnov (Detects Only)	0.22	0.332	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	13.6	0.769	
Kolmogorov-Smirnov (NDs = DL)	0.302	0.102	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	17.64	0.786	
Kolmogorov-Smirnov (NDs = DL/2)	0.386	0.104	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	22.97	0.749	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.448	0.1	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.913	0.788	Data Appear Lognormal
Lilliefors (Detects Only)	0.198	0.362	Data Appear Lognormal
Lilliefors (NDs = DL)	0.246	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.27	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.2	0.0997	Data Not Lognormal

Note: DL/2 is not a recommended method.

Thallium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Thallium Data	79	0	79	15	64	81.01%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	64	0.13	0.45	0.189	0.15	0.0931
Statistics (Detects Only)	15	1.3	5	2.527	2.2	0.932
Statistics (All: NDs treated as DL value)	79	0.13	5	0.633	0.16	1.007
Statistics (All: NDs treated as DL/2 value)	79	0.065	5	0.556	0.08	1.039
Statistics (Normal ROS Estimated Data)	79	-4.787	5	-0.573	-0.722	1.972
Statistics (Gamma ROS Estimated Data)	79	1.3	5	2.489	2.468	0.399
Statistics (Lognormal ROS Estimated Data)	79	0.155	5	0.998	0.707	0.884

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	8.698	8.377	0.29	0.868	0.352	0.405
Statistics (NDs = DL)	0.753	0.733	0.841	-1.253	1.097	-0.876
Statistics (NDs = DL/2)	0.515	0.504	1.08	-1.814	1.358	-0.748
Statistics (Gamma ROS Estimates)	44.1	42.44	0.0564	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	-0.291	0.738	-2.538

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.893	0.881	Data Appear Normal
Lilliefors (Detects Only)	0.17	0.229	Data Appear Normal
Lilliefors (NDs = DL)	0.382	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.435	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0779	0.0997	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.367	0.738	
Kolmogorov-Smirnov (Detects Only)	0.145	0.222	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	12.86	0.793	
Kolmogorov-Smirnov (NDs = DL)	0.361	0.104	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	14.62	0.817	
Kolmogorov-Smirnov (NDs = DL/2)	0.371	0.106	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	10.13	0.749	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.319	0.1	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.959	0.881	Data Appear Lognormal
Lilliefors (Detects Only)	0.134	0.229	Data Appear Lognormal
Lilliefors (NDs = DL)	0.334	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.34	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.0779	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Vanadium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Vanadium Data	79	0	79	79	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	79	12.2	114	45.84	41.4	20.38

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	4.973	4.792	9.218	3.721	0.477	0.128

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.0967	0.0997	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.228	0.754	
Kolmogorov-Smirnov (Full: no NDs)	0.054	0.101	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.0843	0.0997	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Zinc

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Zinc Data	79	0	79	79	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	79	4.7	598	54.94	30.2	87.15

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	1.083	1.05	50.74	3.478	0.93	0.267

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Full: no NDs)	0.291	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	3.363	0.78	
Kolmogorov-Smirnov (Full: no NDs)	0.145	0.103	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)

		Lilliefors (Full: no NDs)		0.0696	0.0997	Data Appear Lognormal					
Note: DL/2 is not a recommended method.											

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\ProUCL\SWMU-51_ProUCL_Input_SS.wst
Full Precision	OFF
Confidence Coefficient	0.95

Aluminum

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Aluminum Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	10600	28100	19323	20800	6329

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	9.401	6.898	2055	9.815	0.354	0.0361

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.924	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.158	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.428	0.73	
Kolmogorov-Smirnov (Full: no NDs)	0.185	0.255	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.907	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.186	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Antimony

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Antimony Data	11	0	11	2	9	81.82%

Insufficient detected observations for valid results

Arsenic

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Arsenic Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	2.8	5.7	3.891	3.7	0.943

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	20.33	14.85	0.191	1.334	0.23	0.172

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.904	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.181	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.361	0.729	
Kolmogorov-Smirnov (Full: no NDs)	0.149	0.255	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.942	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.137	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Barium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Barium Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	49.6	120	80.05	81.5	19.14

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	19.05	13.91	4.203	4.356	0.244	0.056

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.966	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.147	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.222	0.729	
Kolmogorov-Smirnov (Full: no NDs)	0.127	0.255	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.97	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.135	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Beryllium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Beryllium Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	0.41	0.8	0.599	0.57	0.105

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	35.2	25.66	0.017	-0.527	0.179	-0.339

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.977	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.153	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.217	0.729	
Kolmogorov-Smirnov (Full: no NDs)	0.148	0.255	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.972	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.165	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Cadmium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Cadmium Data	6	0	6	3	3	50.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	3	0.0395	0.041	0.0405	0.041	8.6603E-4
Statistics (Detects Only)	3	0.13	0.36	0.227	0.19	0.119
Statistics (All: NDs treated as DL value)	6	0.0395	0.36	0.134	0.0855	0.127
Statistics (All: NDs treated as DL/2 value)	6	0.0198	0.36	0.123	0.0753	0.136
Statistics (Normal ROS Estimated Data)	6	-0.246	0.36	0.0292	0.0175	0.234
Statistics (Gamma ROS Estimated Data)	6	0	0.36	0.113	0.065	0.145
Statistics (Lognormal ROS Estimated Data)	6	0.0261	0.36	0.132	0.0903	0.128

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	5.722	2.972	0.0396	-1.574	0.515	-0.327
Statistics (NDs = DL)	1.469	0.846	0.0909	-2.39	0.952	-0.398
Statistics (NDs = DL/2)	0.906	0.564	0.136	-2.737	1.315	-0.48
Statistics (Gamma ROS Estimates)	0.0915	0.157	1.238	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	-2.439	1.024	-0.42

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.929	0.767	Data Appear Normal
Lilliefors (Detects Only)	0.287	0.512	Data Appear Normal
Shapiro-Wilks (NDs = DL)	0.813	0.788	Data Appear Normal
Lilliefors (NDs = DL)	0.267	0.362	Data Appear Normal
Shapiro-Wilks (NDs = DL/2)	0.824	0.788	Data Appear Normal
Lilliefors (NDs = DL/2)	0.276	0.362	Data Appear Normal
Shapiro-Wilks (Normal ROS Estimates)	0.945	0.788	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.202	0.362	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.295	N/A	
Kolmogorov-Smirnov (Detects Only)	0.272	N/A	
Anderson-Darling (NDs = DL)	0.53	0.708	
Kolmogorov-Smirnov (NDs = DL)	0.316	0.338	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL/2)	0.572	0.717	
Kolmogorov-Smirnov (NDs = DL/2)	0.326	0.342	Data Appear Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	1.113	0.846	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.346	0.369	Data appear Approximate Gamma Distribution

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.979	0.767	Data Appear Lognormal
Lilliefors (Detects Only)	0.233	0.512	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.842	0.788	Data Appear Lognormal
Lilliefors (NDs = DL)	0.301	0.362	Data Appear Lognormal
Shapiro-Wilks (NDs = DL/2)	0.815	0.788	Data Appear Lognormal
Lilliefors (NDs = DL/2)	0.309	0.362	Data Appear Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.945	0.788	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.203	0.362	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Calcium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Calcium Data	8	0	8	8	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	8	228	483	320.1	300.3	83.59

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	18.69	11.77	17.12	5.742	0.243	0.0423

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.87	0.818	Data Appear Normal

Lilliefors (Full: no NDs)	0.317	0.313	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.467	0.716	
Kolmogorov-Smirnov (Full: no NDs)	0.296	0.294	Data appear Approximate Gamma Distribution

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.921	0.818	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.279	0.313	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Chromium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Chromium Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	17.2	34.6	25.54	26.4	4.938

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	27.68	20.19	0.923	3.222	0.204	0.0633

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.949	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.151	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.419	0.729	
Kolmogorov-Smirnov (Full: no NDs)	0.158	0.255	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.924	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.174	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Cobalt

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Cobalt Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	3.3	13.9	7.505	7.2	3.05

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	6.481	4.774	1.158	1.936	0.428	0.221

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.959	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.119	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.203	0.731	
Kolmogorov-Smirnov (Full: no NDs)	0.147	0.256	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.967	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.171	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Copper

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Copper Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	4.7	17.4	10.01	10.7	4.047

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	6.295	4.639	1.591	2.222	0.436	0.196

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.951	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.135	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.329	0.731	
Kolmogorov-Smirnov (Full: no NDs)	0.164	0.256	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.935	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.178	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Iron

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Iron Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	11500	31600	23436	26300	7213

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	9.902	7.262	2367	10.01	0.351	0.0351

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.889	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.2	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.661	0.729	
Kolmogorov-Smirnov (Full: no NDs)	0.228	0.255	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.866	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.228	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Lead

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Lead Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	11	34.1	16.58	14.7	6.325

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	10.52	7.709	1.577	2.76	0.303	0.11

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.705	0.85	Data Not Normal
Lilliefors (Full: no NDs)	0.283	0.267	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.902	0.729	

Kolmogorov-Smirnov (Full: no NDs)	0.256	0.255	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.838	0.85	Data Not Lognormal
Lilliefors (Full: no NDs)	0.236	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Magnesium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Magnesium Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	483	1930	929.6	890	417.9

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	6.201	4.571	149.9	6.752	0.421	0.0624

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.878	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.214	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.302	0.731	
Kolmogorov-Smirnov (Full: no NDs)	0.156	0.256	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.951	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.14	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Manganese

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Manganese Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	251	707	443.4	395	159.1

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	8.781	6.447	50.49	6.036	0.358	0.0592

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.904	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.188	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.372	0.73	
Kolmogorov-Smirnov (Full: no NDs)	0.158	0.256	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.933	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.144	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Mercury

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Mercury Data	8	0	8	7	1	12.50%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Detects Only)	7	0.024	0.1	0.0565	0.0515	0.0312
Statistics (All: NDs treated as DL value)	8	0.016	0.1	0.0514	0.0473	0.0323
Statistics (All: NDs treated as DL/2 value)	8	0.008	0.1	0.0504	0.0473	0.0336
Statistics (Normal ROS Estimated Data)	8	-0.0197	0.1	0.047	0.0473	0.0395
Statistics (Gamma ROS Estimated Data)	8	0.0078	0.1	0.0504	0.0473	0.0336
Statistics (Lognormal ROS Estimated Data)	8	0.0118	0.1	0.0509	0.0473	0.033

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	3.746	2.425	0.0151	-3.013	0.582	-0.193
Statistics (NDs = DL)	2.847	1.863	0.0181	-3.153	0.669	-0.212
Statistics (NDs = DL/2)	2.13	1.414	0.0237	-3.24	0.838	-0.259
Statistics (Gamma ROS Estimates)	2.118	1.407	0.0238	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	-3.191	0.738	-0.231

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.869	0.803	Data Appear Normal
Lilliefors (Detects Only)	0.221	0.335	Data Appear Normal
Shapiro-Wilks (NDs = DL)	0.878	0.818	Data Appear Normal
Lilliefors (NDs = DL)	0.194	0.313	Data Appear Normal
Shapiro-Wilks (NDs = DL/2)	0.91	0.818	Data Appear Normal
Lilliefors (NDs = DL/2)	0.184	0.313	Data Appear Normal
Shapiro-Wilks (Normal ROS Estimates)	0.944	0.818	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.16	0.313	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)

Anderson-Darling (Detects Only)	0.378	0.71	
Kolmogorov-Smirnov (Detects Only)	0.191	0.313	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	0.332	0.722	
Kolmogorov-Smirnov (NDs = DL)	0.199	0.296	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL/2)	0.266	0.724	
Kolmogorov-Smirnov (NDs = DL/2)	0.151	0.297	Data Appear Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	0.266	0.724	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.151	0.297	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.897	0.803	Data Appear Lognormal
Lilliefors (Detects Only)	0.177	0.335	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.932	0.818	Data Appear Lognormal
Lilliefors (NDs = DL)	0.181	0.313	Data Appear Lognormal
Shapiro-Wilks (NDs = DL/2)	0.922	0.818	Data Appear Lognormal
Lilliefors (NDs = DL/2)	0.169	0.313	Data Appear Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.94	0.818	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.149	0.313	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Nickel

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Nickel Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	4.4	13.2	8.105	8.4	2.908

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	8.392	6.164	0.966	2.032	0.37	0.182

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.946	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.187	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.276	0.73	
Kolmogorov-Smirnov (Full: no NDs)	0.174	0.256	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.948	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.152	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Potassium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Potassium Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	360	1610	825.5	843	388.8

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	4.845	3.584	170.4	6.609	0.495	0.0749

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.934	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.148	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.311	0.732	
Kolmogorov-Smirnov (Full: no NDs)	0.16	0.256	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.94	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.168	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Selenium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Selenium Data	11	0	11	1	10	90.91%

Insufficient detected observations for valid results

Thallium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Thallium Data	7	0	7	2	5	71.43%

Insufficient detected observations for valid results

Vanadium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Vanadium Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD

Statistics (Full: no NDs)	11	27.5	64.1	49.42	53.7	12.63

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	14.65	10.71	3.374	3.866	0.286	0.0741

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.895	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.211	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.659	0.729	
Kolmogorov-Smirnov (Full: no NDs)	0.242	0.255	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.868	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.249	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Zinc

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Zinc Data	11	0	11	11	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	11	19.5	37.6	29.81	31.9	6.063

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	24.76	18.07	1.204	3.374	0.216	0.064

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.931	0.85	Data Appear Normal
Lilliefors (Full: no NDs)	0.18	0.267	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.427	0.729	
Kolmogorov-Smirnov (Full: no NDs)	0.204	0.255	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.917	0.85	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.204	0.267	Data Appear Lognormal

Note: DL/2 is not a recommended method.											

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\ProUCL\SWMU-51_ProUCL_Input_TS.wst
Full Precision	OFF
Confidence Coefficient	0.95

Aluminum

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Aluminum Data	25	0	25	25	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	25	8620	29700	17711	15800	6052

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	9.21	8.131	1923	9.727	0.34	0.0349

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.926	0.918	Data Appear Normal
Lilliefors (Full: no NDs)	0.18	0.177	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.462	0.745	
Kolmogorov-Smirnov (Full: no NDs)	0.138	0.175	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.961	0.918	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.116	0.177	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Antimony

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Antimony Data	18	0	18	4	14	77.78%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	14	0.3	0.82	0.526	0.49	0.131
Statistics (Detects Only)	4	0.25	5.4	2.498	2.17	2.475
Statistics (All: NDs treated as DL value)	18	0.25	5.4	0.964	0.52	1.343
Statistics (All: NDs treated as DL/2 value)	18	0.15	5.4	0.76	0.263	1.413
Statistics (Normal ROS Estimated Data)	18	-1.309	5.4	0.25	-0.324	1.669
Statistics (Gamma ROS Estimated Data)	18	0	5.4	0.555	0	1.491
Statistics (Lognormal ROS Estimated Data)	18	0.112	5.4	0.72	0.213	1.428

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.

Statistics (Detects Only)	0.932	0.814	2.68	0.291	1.454	5.003
Statistics (NDs = DL)	1.331	1.146	0.725	-0.457	0.768	-1.681
Statistics (NDs = DL/2)	0.82	0.721	0.926	-0.996	0.96	-0.964
Statistics (Gamma ROS Estimates)	0.056	0.0837	9.911	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	-1.175	1.048	-0.892

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.894	0.748	Data Appear Normal
Lilliefors (Detects Only)	0.274	0.443	Data Appear Normal
Shapiro-Wilks (NDs = DL)	0.482	0.897	Data Not Normal
Lilliefors (NDs = DL)	0.432	0.209	Data Not Normal
Shapiro-Wilks (NDs = DL/2)	0.444	0.897	Data Not Normal
Lilliefors (NDs = DL/2)	0.431	0.209	Data Not Normal
Shapiro-Wilks (Normal ROS Estimates)	0.659	0.897	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.301	0.209	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.353	0.668	
Kolmogorov-Smirnov (Detects Only)	0.272	0.403	Data Appear Gamma Distributed
Anderson-Darling (NDs = DL)	2.96	0.76	
Kolmogorov-Smirnov (NDs = DL)	0.366	0.208	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	3.672	0.775	
Kolmogorov-Smirnov (NDs = DL/2)	0.381	0.211	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	4.085	1.076	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.494	0.244	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.913	0.748	Data Appear Lognormal
Lilliefors (Detects Only)	0.258	0.443	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.737	0.897	Data Not Lognormal
Lilliefors (NDs = DL)	0.296	0.209	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.662	0.897	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.312	0.209	Data Not Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.683	0.897	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.302	0.209	Data Not Lognormal

Note: DL/2 is not a recommended method.

Arsenic

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Arsenic Data	21	0	21	21	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	21	1.5	15.3	5.824	3.7	4.794

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.

Statistics (Full: no NDs)	1.965	1.716	2.963	1.486	0.734	0.494

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.746	0.908	Data Not Normal
Lilliefors (Full: no NDs)	0.272	0.193	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	1.331	0.754	
Kolmogorov-Smirnov (Full: no NDs)	0.217	0.192	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.9	0.908	Data Not Lognormal
Lilliefors (Full: no NDs)	0.173	0.193	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Chromium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Chromium Data	25	0	25	25	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	25	12.95	533	103.7	25.15	172.9

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	0.631	0.582	164.2	3.67	1.232	0.336

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.544	0.918	Data Not Normal
Lilliefors (Full: no NDs)	0.455	0.177	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	4.43	0.795	
Kolmogorov-Smirnov (Full: no NDs)	0.415	0.183	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.702	0.918	Data Not Lognormal
Lilliefors (Full: no NDs)	0.341	0.177	Data Not Lognormal

Note: DL/2 is not a recommended method.

Cobalt

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Cobalt Data	25	0	25	25	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	25	3.2	179	14.4	7.2	34.46

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	0.947	0.86	15.21	2.054	0.79	0.385

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.285	0.918	Data Not Normal
Lilliefors (Full: no NDs)	0.451	0.177	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	3.933	0.775	
Kolmogorov-Smirnov (Full: no NDs)	0.325	0.18	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.752	0.918	Data Not Lognormal
Lilliefors (Full: no NDs)	0.207	0.177	Data Not Lognormal

Note: DL/2 is not a recommended method.

Copper

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Copper Data	25	0	25	25	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	25	4.6	360	33.02	10.7	72.17

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	0.668	0.615	49.42	2.587	1.142	0.442

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.416	0.918	Data Not Normal
Lilliefors (Full: no NDs)	0.386	0.177	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	2.973	0.791	
Kolmogorov-Smirnov (Full: no NDs)	0.323	0.182	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.813	0.918	Data Not Lognormal
Lilliefors (Full: no NDs)	0.227	0.177	Data Not Lognormal

Note: DL/2 is not a recommended method.

Iron

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Iron Data	25	0	25	25	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	25	11500	191000	50804	23700	59867

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	1.187	1.071	42800	10.36	0.894	0.0863

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.605	0.918	Data Not Normal
Lilliefors (Full: no NDs)	0.416	0.177	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	3.394	0.769	
Kolmogorov-Smirnov (Full: no NDs)	0.347	0.179	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.773	0.918	Data Not Lognormal
Lilliefors (Full: no NDs)	0.278	0.177	Data Not Lognormal

Note: DL/2 is not a recommended method.

Lead

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Lead Data	25	0	25	25	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	25	4.2	4180	698.3	14.7	1443

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	0.248	0.245	2814	3.683	2.33	0.632

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.52	0.918	Data Not Normal

Lilliefors (Full: no NDs)	0.469	0.177	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	4.554	0.874	
Kolmogorov-Smirnov (Full: no NDs)	0.392	0.191	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.712	0.918	Data Not Lognormal
Lilliefors (Full: no NDs)	0.303	0.177	Data Not Lognormal

Note: DL/2 is not a recommended method.

Manganese

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Manganese Data	25	0	25	25	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	25	140	3590	506.4	370	657.1

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	2.033	1.816	249.1	5.962	0.591	0.0991

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.387	0.918	Data Not Normal
Lilliefors (Full: no NDs)	0.34	0.177	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	2.586	0.756	
Kolmogorov-Smirnov (Full: no NDs)	0.26	0.177	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.816	0.918	Data Not Lognormal
Lilliefors (Full: no NDs)	0.189	0.177	Data Not Lognormal

Note: DL/2 is not a recommended method.

Thallium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Thallium Data	17	0	17	5	12	70.59%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	12	0.355	2.8	0.698	0.54	0.666

Statistics (Detects Only)	5	0.65	5.9	1.902	0.98	2.241
Statistics (All: NDs treated as DL value)	17	0.355	5.9	1.052	0.55	1.371
Statistics (All: NDs treated as DL/2 value)	17	0.178	5.9	0.806	0.275	1.365
Statistics (Normal ROS Estimated Data)	17	-6.863	5.9	-2.611	-3.269	3.378
Statistics (Gamma ROS Estimated Data)	17	0	5.963	2.26	1.832	2.048
Statistics (Lognormal ROS Estimated Data)	17	0.0368	5.9	0.636	0.158	1.403

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	1.444	1.228	1.317	0.258	0.87	3.369
Statistics (NDs = DL)	1.528	1.297	0.689	-0.311	0.721	-2.32
Statistics (NDs = DL/2)	0.989	0.854	0.814	-0.8	0.934	-1.168
Statistics (Gamma ROS Estimates)	0.193	0.198	11.74	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	-1.575	1.366	-0.867

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.625	0.762	Data Not Normal
Lilliefors (Detects Only)	0.44	0.396	Data Not Normal
Shapiro-Wilks (NDs = DL)	0.495	0.892	Data Not Normal
Lilliefors (NDs = DL)	0.368	0.215	Data Not Normal
Shapiro-Wilks (NDs = DL/2)	0.468	0.892	Data Not Normal
Lilliefors (NDs = DL/2)	0.323	0.215	Data Not Normal
Shapiro-Wilks (Normal ROS Estimates)	0.877	0.892	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.211	0.215	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	0.882	0.687	
Kolmogorov-Smirnov (Detects Only)	0.423	0.362	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	2.519	0.755	
Kolmogorov-Smirnov (NDs = DL)	0.312	0.213	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	2.044	0.766	
Kolmogorov-Smirnov (NDs = DL/2)	0.351	0.215	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	4.069	0.885	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.441	0.232	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Detects Only)	0.763	0.762	Data Appear Lognormal
Lilliefors (Detects Only)	0.374	0.396	Data Appear Lognormal
Shapiro-Wilks (NDs = DL)	0.743	0.892	Data Not Lognormal
Lilliefors (NDs = DL)	0.292	0.215	Data Not Lognormal
Shapiro-Wilks (NDs = DL/2)	0.793	0.892	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.341	0.215	Data Not Lognormal
Shapiro-Wilks (Lognormal ROS Estimates)	0.886	0.892	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.212	0.215	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Vanadium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Vanadium Data	25	0	25	25	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	25	21.2	66.1	42.72	38.8	14.32

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	8.737	7.715	4.89	3.696	0.357	0.0965

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.933	0.918	Data Appear Normal
Lilliefors (Full: no NDs)	0.135	0.177	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.496	0.745	
Kolmogorov-Smirnov (Full: no NDs)	0.123	0.175	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.932	0.918	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.119	0.177	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd SS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Aluminum(swmu 51 ss)

Background Data: Aluminum(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Distinct Samples	11	28
Minimum	10600	3620
Maximum	28100	20100
Mean	19323	8300
Median	20800	6705
SD	6329	4279
SE of Mean	1908	808.6

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	351
WMW Test U-Stat	285
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	4.6446E-5

Conclusion with Alpha = 0.05

Reject H0, Conclude Site <> Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd SS vs SWMU 51 soil.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Antimony(swmu 51 ss)

Background Data: Antimony(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	14
Number of Missing Values	1	14
Number of Non-Detect Data	9	14
Number of Detect Data	2	0
Minimum Non-Detect	0.44	0.24
Maximum Non-Detect	0.82	0.36
Percent Non detects	81.82%	100.00%
Minimum Detected	0.25	N/A
Maximum Detected	0.64	N/A
Mean of Detected Data	0.445	N/A
Median of Detected Data	0.445	N/A
SD of Detected Data	0.276	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.82 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	143
WMW Test U-Stat	77
Lower Critical Value (0.025)	41
Upper Critical Value (0.975)	113
Approximate P-Value	1.022

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd SS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Arsenic(swmu 51 ss)

Background Data: Arsenic(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Distinct Samples	11	24
Minimum	2.8	1.5
Maximum	5.7	10.2
Mean	3.891	3.732
Median	3.7	2.75
SD	0.943	2.33
SE of Mean	0.284	0.44

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	272.5
WMW Test U-Stat	206.5
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.105

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd SS vs SWMU 51 soil.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Equal to Background Mean (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean Not Equal to Background Mean

Area of Concern Data: Barium(swmu 51 ss)

Background Data: Barium(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Distinct Samples	11	27
Minimum	49.6	0.36
Maximum	120	174
Mean	80.05	64.85
Median	81.5	58.65
SD	19.14	47.97
SE of Mean	5.77	9.066

Site vs Background Two-Sample t-Test

H0: Mu of Site = Mu of Background

Method	DF	t-Test Value	Critical - t (0.050)	P-Value
Pooled (Equal Variance)	37	1.013	2.028	0.318
Satterthwaite (Unequal Variance)	36.9	1.415	2.026	0.166

Pooled SD: 42.171

Conclusion with Alpha = 0.050

* Student t (Pooled): Do Not Reject H0, Conclude Site = Background
* Satterthwaite: Do Not Reject H0, Conclude Site = Background

Test of Equality of Variances

Numerator DF	Denominator DF	F-Test Value	P-Value
27	10	6.283	0.004

Conclusion with Alpha = 0.05

* Two variances are not equal

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd SS vs SWMU 51 soil.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Beryllium(swmu 51 ss)

Background Data: Beryllium(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Non-Detect Data	0	13
Number of Detect Data	11	15
Minimum Non-Detect	N/A	0.022
Maximum Non-Detect	N/A	0.03
Percent Non detects	0.00%	46.43%
Minimum Detected	0.41	0.61
Maximum Detected	0.8	1.5
Mean of Detected Data	0.599	0.887
Median of Detected Data	0.57	0.87
SD of Detected Data	0.105	0.246

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.03 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	225.5
WMW Test U-Stat	159.5
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.876

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd SS vs SWMU 51 soil C
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Cadmium(swmu 51 ss)

Background Data: Cadmium(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	6	28
Number of Non-Detect Data	3	26
Number of Detect Data	3	2
Minimum Non-Detect	0.0395	0.02
Maximum Non-Detect	0.041	0.05
Percent Non detects	50.00%	92.86%
Minimum Detected	0.13	0.67
Maximum Detected	0.36	0.82
Mean of Detected Data	0.227	0.745
Median of Detected Data	0.19	0.745
SD of Detected Data	0.119	0.106

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.05 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	138
WMW Test U-Stat	117
Lower Critical Value (0.025)	28
Upper Critical Value (0.975)	140
Approximate P-Value	0.142

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd SS vs SWMU 51 soil Ca
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Calcium(swmu 51 ss)

Background Data: Calcium(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	8	28
Number of Non-Detect Data	0	5
Number of Detect Data	8	23
Minimum Non-Detect	N/A	4.6
Maximum Non-Detect	N/A	6.6
Percent Non detects	0.00%	17.86%
Minimum Detected	228	116
Maximum Detected	483	7340
Mean of Detected Data	320.1	1197
Median of Detected Data	300.3	885
SD of Detected Data	83.59	1440

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 6.6 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	97
WMW Test U-Stat	61
Lower Critical Value (0.025)	42
Upper Critical Value (0.975)	182
Approximate P-Value	0.0547

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd SS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Chromium(swmu 51 ss)

Background Data: Chromium(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Distinct Samples	10	27
Minimum	17.2	6.3
Maximum	34.6	53.3
Mean	25.54	21.09
Median	26.4	22.4
SD	4.938	10.5
SE of Mean	1.489	1.985

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	271
WMW Test U-Stat	205
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.115

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd SS vs SWMU 51 soil.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Cobalt(swmu 51 ss)

Background Data: Cobalt(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Non-Detect Data	0	8
Number of Detect Data	11	20
Minimum Non-Detect	N/A	0.11
Maximum Non-Detect	N/A	0.75
Percent Non detects	0.00%	28.57%
Minimum Detected	3.3	5.9
Maximum Detected	13.9	45.4
Mean of Detected Data	7.505	15.95
Median of Detected Data	7.2	12.1
SD of Detected Data	3.05	10.07

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.75 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	191
WMW Test U-Stat	125
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.374

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd SS vs SWMU 51 soil.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Copper(swmu 51 ss)

Background Data: Copper(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Non-Detect Data	0	2
Number of Detect Data	11	26
Minimum Non-Detect	N/A	0.17
Maximum Non-Detect	N/A	0.17
Percent Non detects	0.00%	7.14%
Minimum Detected	4.7	2.2
Maximum Detected	17.4	13.6
Mean of Detected Data	10.01	6.919
Median of Detected Data	10.7	5.35
SD of Detected Data	4.047	3.696

Wilcoxon-Mann-Whitney Site vs Background Test

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	295.5
WMW Test U-Stat	229.5
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.0192

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd SS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Iron(swmu 51 ss)

Background Data: Iron(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Distinct Samples	11	26
Minimum	11500	7250
Maximum	31600	63000
Mean	23436	20108
Median	26300	19750
SD	7213	11869
SE of Mean	2175	2243

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	263
WMW Test U-Stat	197
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.185

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd SS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Lead(swmu 51 ss)

Background Data: Lead(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Distinct Samples	11	26
Minimum	11	8.9
Maximum	34.1	225
Mean	16.58	26.96
Median	14.7	15.15
SD	6.325	41.34
SE of Mean	1.907	7.813

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	220.5
WMW Test U-Stat	154.5
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	1

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd SS vs SWMU 51 soil.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Magnesium(swmu 51 ss)

Background Data: Magnesium(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Non-Detect Data	0	3
Number of Detect Data	11	25
Minimum Non-Detect	N/A	4.7
Maximum Non-Detect	N/A	5
Percent Non detects	0.00%	10.71%
Minimum Detected	483	158
Maximum Detected	1930	20400
Mean of Detected Data	929.6	2498
Median of Detected Data	890	913
SD of Detected Data	417.9	4334

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 5 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	231
WMW Test U-Stat	165
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.743

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd SS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Manganese(swmu 51 ss)

Background Data: Manganese(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Distinct Samples	11	28
Minimum	251	43
Maximum	707	2040
Mean	443.4	695.9
Median	395	490
SD	159.1	591.5
SE of Mean	47.96	111.8

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	190
WMW Test U-Stat	124
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate *P*-Value	0.357

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd SS vs SWMU 51 soil C
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Mercury(swmu 51 ss)

Background Data: Mercury(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	8	28
Number of Non-Detect Data	1	25
Number of Detect Data	7	3
Minimum Non-Detect	0.016	0.019
Maximum Non-Detect	0.016	0.06
Percent Non detects	12.50%	89.29%
Minimum Detected	0.024	0.07
Maximum Detected	0.1	1.2
Mean of Detected Data	0.0565	0.467
Median of Detected Data	0.0515	0.13
SD of Detected Data	0.0312	0.636

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.06 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	163
WMW Test U-Stat	127
Lower Critical Value (0.025)	42
Upper Critical Value (0.975)	182
Approximate P-Value	0.581

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd SS vs SWMU 51 soil.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Nickel(swmu 51 ss)

Background Data: Nickel(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Non-Detect Data	0	11
Number of Detect Data	11	17
Minimum Non-Detect	N/A	0.21
Maximum Non-Detect	N/A	1.3
Percent Non detects	0.00%	39.29%
Minimum Detected	4.4	4.6
Maximum Detected	13.2	18.1
Mean of Detected Data	8.105	9.935
Median of Detected Data	8.4	9.4
SD of Detected Data	2.908	4.294

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 1.3 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	258.5
WMW Test U-Stat	192.5
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.236

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd SS vs SWMU 51 soil.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Potassium(swmu 51 ss)

Background Data: Potassium(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Non-Detect Data	0	6
Number of Detect Data	11	22
Minimum Non-Detect	N/A	201
Maximum Non-Detect	N/A	271
Percent Non detects	0.00%	21.43%
Minimum Detected	360	166
Maximum Detected	1610	2350
Mean of Detected Data	825.5	735.4
Median of Detected Data	843	509.5
SD of Detected Data	388.8	632.6

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 271 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	286
WMW Test U-Stat	220
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.0409

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd SS vs SWMU 51 soil.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Selenium(swmu 51 ss)

Background Data: Selenium(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Non-Detect Data	10	26
Number of Detect Data	1	2
Minimum Non-Detect	0.15	0.14
Maximum Non-Detect	0.44	0.36
Percent Non detects	90.91%	92.86%
Minimum Detected	0.605	0.64
Maximum Detected	0.605	0.77
Mean of Detected Data	0.605	0.705
Median of Detected Data	0.605	0.705
SD of Detected Data	N/A	0.0919

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.44 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	222
WMW Test U-Stat	156
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.963

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd SS vs SWMU 51 soil TI
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Thallium(swmu 51 ss)

Background Data: Thallium(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	7	28
Number of Non-Detect Data	5	24
Number of Detect Data	2	4
Minimum Non-Detect	0.355	0.13
Maximum Non-Detect	0.56	0.41
Percent Non detects	71.43%	85.71%
Minimum Detected	0.65	1.3
Maximum Detected	1.1	2.1
Mean of Detected Data	0.875	1.85
Median of Detected Data	0.875	2
SD of Detected Data	0.318	0.37

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.56 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	136
WMW Test U-Stat	108
Lower Critical Value (0.025)	35
Upper Critical Value (0.975)	161
Approximate P-Value	0.695

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd SS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Vanadium(swmu 51 ss)

Background Data: Vanadium(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Distinct Samples	11	27
Minimum	27.5	12.2
Maximum	64.1	101
Mean	49.42	33.89
Median	53.7	33.8
SD	12.63	17.78
SE of Mean	3.809	3.36

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	316
WMW Test U-Stat	250
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.0028

Conclusion with Alpha = 0.05

Reject H0, Conclude Site <> Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Data\Bkgrd SS vs SWMU 51 soil.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Zinc(swmu 51 ss)

Background Data: Zinc(bkgrd ss)

Raw Statistics

	Site	Background
Number of Valid Samples	11	28
Number of Missing Values	1	0
Number of Distinct Samples	11	28
Minimum	19.5	7.1
Maximum	37.6	216
Mean	29.81	41.21
Median	31.9	29.7
SD	6.063	40.24
SE of Mean	1.828	7.605

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	211.5
WMW Test U-Stat	145.5
Lower Critical Value (0.025)	63
Upper Critical Value (0.975)	245
Approximate P-Value	0.803

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd TS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Aluminum(swmu 51 ts)

Background Data: Aluminum(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	25	79
Number of Distinct Samples	22	75
Minimum	8620	3620
Maximum	29700	47900
Mean	17711	14204
Median	15800	12100
SD	6052	9433
SE of Mean	1210	1061

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	1693
WMW Test U-Stat	2.887
Lower Critical Value (0.025)	-1.96
Upper Critical Value (0.975)	1.96
P-Value	0.0038

Conclusion with Alpha = 0.05

Reject H0, Conclude Site <> Background

P-Value < alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd TS vs SWMU 51 soil St
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Antimony(swmu 51 ts)

Background Data: Antimony(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	18	38
Number of Missing Values	0	41
Number of Non-Detect Data	14	38
Number of Detect Data	4	0
Minimum Non-Detect	0.3	0.23
Maximum Non-Detect	0.82	0.36
Percent Non detects	77.78%	100.00%
Minimum Detected	0.25	N/A
Maximum Detected	5.4	N/A
Mean of Detected Data	2.498	N/A
Median of Detected Data	2.17	N/A
SD of Detected Data	2.475	N/A

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.82 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	551
WMW Test U-Stat	380
Lower Critical Value (0.025)	113
Upper Critical Value (0.975)	571
Approximate P-Value	0.511

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd TS vs SWMU 51 soil Sb
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Arsenic(swmu 51 ts)

Background Data: Arsenic(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	21	79
Number of Non-Detect Data	0	3
Number of Detect Data	21	76
Minimum Non-Detect	N/A	0.09
Maximum Non-Detect	N/A	0.12
Percent Non detects	0.00%	3.80%
Minimum Detected	1.5	1.2
Maximum Detected	15.3	35.9
Mean of Detected Data	5.824	4.989
Median of Detected Data	3.7	3.2
SD of Detected Data	4.794	5.36

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.12 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	1224
WMW Test U-Stat	1.379
Lower Critical Value (0.025)	-1.96
Upper Critical Value (0.975)	1.96
P-Value	0.168

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

P-Value >= alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd TS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Cobalt(swmu 51 ts)

Background Data: Cobalt(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	25	79
Number of Non-Detect Data	0	23
Number of Detect Data	25	56
Minimum Non-Detect	N/A	0.11
Maximum Non-Detect	N/A	0.84
Percent Non detects	0.00%	29.11%
Minimum Detected	3.2	5.9
Maximum Detected	179	130
Mean of Detected Data	14.4	22.23
Median of Detected Data	7.2	13.3
SD of Detected Data	34.46	23.94

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.84 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	1136
WMW Test U-Stat	1.343
Lower Critical Value (0.025)	-1.96
Upper Critical Value (0.975)	1.96
P-Value	0.179

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

P-Value >= alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd TS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Copper(swmu 51 ts)

Background Data: Copper(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	25	79
Number of Non-Detect Data	0	2
Number of Detect Data	25	77
Minimum Non-Detect	N/A	0.17
Maximum Non-Detect	N/A	0.17
Percent Non detects	0.00%	2.53%
Minimum Detected	4.6	1.6
Maximum Detected	360	38.7
Mean of Detected Data	33.02	12.25
Median of Detected Data	10.7	9.1
SD of Detected Data	72.17	9.397

Wilcoxon-Mann-Whitney Site vs Background Test

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	1475
WMW Test U-Stat	1.229
Lower Critical Value (0.025)	-1.96
Upper Critical Value (0.975)	1.96
P-Value	0.219

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

P-Value >= alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd TS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Iron(swmu 51 ts)

Background Data: Iron(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	25	79
Number of Distinct Samples	24	72
Minimum	11500	7250
Maximum	191000	67700
Mean	50804	26963
Median	23700	25200
SD	59867	11990
SE of Mean	11973	1349

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	1279
WMW Test U-Stat	0.255
Lower Critical Value (0.025)	-1.96
Upper Critical Value (0.975)	1.96
P-Value	0.799

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

P-Value >= alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd TS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Lead(swmu 51 ts)

Background Data: Lead(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	25	79
Number of Distinct Samples	25	70
Minimum	4.2	2.1
Maximum	4180	256
Mean	698.3	22.04
Median	14.7	12
SD	1443	39.85
SE of Mean	288.5	4.483

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	1549
WMW Test U-Stat	1.791
Lower Critical Value (0.025)	-1.96
Upper Critical Value (0.975)	1.96
P-Value	0.0732

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

P-Value >= alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd TS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Manganese(swmu 51 ts)

Background Data: Manganese(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	25	79
Number of Distinct Samples	25	78
Minimum	140	16.7
Maximum	3590	2040
Mean	506.4	471.4
Median	370	359
SD	657.1	467.1
SE of Mean	131.4	52.55

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	1396
WMW Test U-Stat	0.628
Lower Critical Value (0.025)	-1.96
Upper Critical Value (0.975)	1.96
P-Value	0.53

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

P-Value >= alpha (0.05)

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd TS vs SWMU 51 soil Tl
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Thallium(swmu 51 ts)

Background Data: Thallium(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	17	79
Number of Non-Detect Data	12	64
Number of Detect Data	5	15
Minimum Non-Detect	0.355	0.13
Maximum Non-Detect	2.8	0.45
Percent Non detects	70.59%	81.01%
Minimum Detected	0.65	1.3
Maximum Detected	5.9	5
Mean of Detected Data	1.902	2.527
Median of Detected Data	0.98	2.2
SD of Detected Data	2.241	0.932

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 2.8 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	816
WMW Test U-Stat	663
Lower Critical Value (0.025)	106
Upper Critical Value (0.975)	1237
Approximate P-Value	0.939

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd TS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Equal to Background Mean (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean Not Equal to Background Mean

Area of Concern Data: Vanadium(swmu 51 ts)

Background Data: Vanadium(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	25	79
Number of Distinct Samples	25	76
Minimum	21.2	12.2
Maximum	66.1	114
Mean	42.72	45.84
Median	38.8	41.4
SD	14.32	20.38
SE of Mean	2.863	2.293

Site vs Background Two-Sample t-Test

H0: Mu of Site = Mu of Background

Method	DF	t-Test Value	Critical - t (0.050)	P-Value
Pooled (Equal Variance)	102	-0.710	1.984	0.480
Satterthwaite (Unequal Variance)	57.4	-0.849	2.002	0.399

Pooled SD: 19.128

Conclusion with Alpha = 0.050

* Student t (Pooled): Do Not Reject H0, Conclude Site = Background
* Satterthwaite: Do Not Reject H0, Conclude Site = Background

Test of Equality of Variances

Numerator DF	Denominator DF	F-Test Value	P-Value
78	24	2.027	0.053

Conclusion with Alpha = 0.05

* Two variances appear to be equal

Goodness-of-Fit Test Statistics for Full Data Sets without Non-Detects

User Selected Options

From File H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd vs SWMU 51 Sample G

Full Precision OFF

Confidence Coefficient 0.95

Aluminum (bkgrd ts)

Raw Statistics

Number of Valid Samples	79
Number of Unique Samples	75
Minimum	3620
Maximum	47900
Mean of Raw Data	14204
Standard Deviation of Raw Data	9433
Kstar	2.689
Mean of Log Transformed Data	9.371
Standard Deviation of Log Transformed Data	0.618

Normal Distribution Test Results

Lilliefors Test Statistic	0.15
Lilliefors Critical (0.95) Value	0.0997

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

A-D Test Statistic	0.604
A-D Critical (0.95) Value	0.76
K-S Test Statistic	0.0772
K-S Critical(0.95) Value	0.101

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Lilliefors Test Statistic	0.0626
Lilliefors Critical (0.95) Value	0.0997

Data appear Lognormal at (0.05) Significance Level

Aluminum (swmu 51 sg 1)

Raw Statistics

Number of Valid Samples	17
Number of Unique Samples	16
Minimum	10600
Maximum	28100
Mean of Raw Data	18397
Standard Deviation of Raw Data	6036
Kstar	8.146
Mean of Log Transformed Data	9.768
Standard Deviation of Log Transformed Data	0.333

Normal Distribution Test Results

Shapiro Wilk Test Statistic	0.912
Shapiro Wilk Critical (0.95) Value	0.892
Lilliefors Test Statistic	0.173
Lilliefors Critical (0.95) Value	0.215

Data appear Normal at (0.05) Significance Level

Gamma Distribution Test Results

A-D Test Statistic	0.484
A-D Critical (0.95) Value	0.739
K-S Test Statistic	0.141
K-S Critical(0.95) Value	0.209

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Shapiro Wilk Test Statistic	0.927
Shapiro Wilk Critical (0.95) Value	0.892
Lilliefors Test Statistic	0.137
Lilliefors Critical (0.95) Value	0.215

Data appear Lognormal at (0.05) Significance Level

Manganese (bkgrd ts)

Raw Statistics

Number of Valid Samples	79
Number of Unique Samples	78
Minimum	16.7
Maximum	2040
Mean of Raw Data	471.4
Standard Deviation of Raw Data	467.1
Kstar	1.087
Mean of Log Transformed Data	5.647
Standard Deviation of Log Transformed Data	1.118

Normal Distribution Test Results

Lilliefors Test Statistic	0.165
Lilliefors Critical (0.95) Value	0.0997

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

A-D Test Statistic	0.359
A-D Critical (0.95) Value	0.779
K-S Test Statistic	0.0515
K-S Critical(0.95) Value	0.103

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Lilliefors Test Statistic	0.093
Lilliefors Critical (0.95) Value	0.0997

Data appear Lognormal at (0.05) Significance Level

Manganese (swmu 51 sg 1)

Raw Statistics

Number of Valid Samples	17
Number of Unique Samples	17
Minimum	251
Maximum	3590
Mean of Raw Data	592.7
Standard Deviation of Raw Data	784.8
Kstar	1.531
Mean of Log Transformed Data	6.084
Standard Deviation of Log Transformed Data	0.626

Normal Distribution Test Results

Shapiro Wilk Test Statistic	0.411
Shapiro Wilk Critical (0.95) Value	0.892
Lilliefors Test Statistic	0.383
Lilliefors Critical (0.95) Value	0.215

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

A-D Test Statistic	2.388
A-D Critical (0.95) Value	0.752
K-S Test Statistic	0.295
K-S Critical(0.95) Value	0.212

Data not Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Shapiro Wilk Test Statistic	0.724
Shapiro Wilk Critical (0.95) Value	0.892
Lilliefors Test Statistic	0.236
Lilliefors Critical (0.95) Value	0.215

Data not Lognormal at (0.05) Significance Level

Vanadium (bkgrd ts)

Raw Statistics

Number of Valid Samples	79
Number of Unique Samples	76
Minimum	12.2
Maximum	114
Mean of Raw Data	45.84
Standard Deviation of Raw Data	20.38

Kstar	4.792
Mean of Log Transformed Data	3.721
Standard Deviation of Log Transformed Data	0.477

Normal Distribution Test Results

Lilliefors Test Statistic	0.0967
Lilliefors Critical (0.95) Value	0.0997

Data appear Normal at (0.05) Significance Level

Gamma Distribution Test Results

A-D Test Statistic	0.228
A-D Critical (0.95) Value	0.754
K-S Test Statistic	0.054
K-S Critical(0.95) Value	0.101

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Lilliefors Test Statistic	0.0843
Lilliefors Critical (0.95) Value	0.0997

Data appear Lognormal at (0.05) Significance Level

Vanadium (swmu 51 sg 1)

Raw Statistics

Number of Valid Samples	17
Number of Unique Samples	17
Minimum	21.2
Maximum	66.1
Mean of Raw Data	45.05
Standard Deviation of Raw Data	15.18
Kstar	6.824
Mean of Log Transformed Data	3.746
Standard Deviation of Log Transformed Data	0.377

Normal Distribution Test Results

Shapiro Wilk Test Statistic	0.927
Shapiro Wilk Critical (0.95) Value	0.892
Lilliefors Test Statistic	0.142
Lilliefors Critical (0.95) Value	0.215

Data appear Normal at (0.05) Significance Level

Gamma Distribution Test Results

A-D Test Statistic	0.547
A-D Critical (0.95) Value	0.74
K-S Test Statistic	0.171
K-S Critical(0.95) Value	0.209

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Shapiro Wilk Test Statistic	0.905
Shapiro Wilk Critical (0.95) Value	0.892
Lilliefors Test Statistic	0.174
Lilliefors Critical (0.95) Value	0.215

Data appear Lognormal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd vs SWMU 51 Sample G
Full Precision	OFF
Confidence Coefficient	0.95

Arsenic (bkgrd ts)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Arsenic (bkgrd ts) Data	79	0	79	76	3	3.80%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	3	0.09	0.12	0.103	0.1	0.0153
Statistics (Detects Only)	76	1.2	35.9	4.989	3.2	5.36
Statistics (All: NDs treated as DL value)	79	0.09	35.9	4.804	3.1	5.339
Statistics (All: NDs treated as DL/2 value)	79	0.045	35.9	4.802	3.1	5.341
Statistics (Normal ROS Estimated Data)	79	-5.169	35.9	4.604	3.1	5.608
Statistics (Gamma ROS Estimated Data)	79	0	35.9	4.8	3.1	5.343
Statistics (Lognormal ROS Estimated Data)	79	0.728	35.9	4.828	3.1	5.32

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	1.819	1.759	2.742	1.308	0.692	0.529
Statistics (NDs = DL)	1.401	1.356	3.429	1.172	0.968	0.826
Statistics (NDs = DL/2)	1.323	1.281	3.631	1.146	1.067	0.932
Statistics (Gamma ROS Estimates)	0.568	0.555	8.454	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	1.246	0.748	0.6

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.282	0.102	Data Not Normal
Lilliefors (NDs = DL)	0.279	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.279	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.263	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	4.409	0.766	
Kolmogorov-Smirnov (Detects Only)	0.213	0.104	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	3.469	0.772	
Kolmogorov-Smirnov (NDs = DL)	0.182	0.102	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	3.587	0.774	
Kolmogorov-Smirnov (NDs = DL/2)	0.176	0.103	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	10.23	0.812	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.332	0.106	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.151	0.102	Data Not Lognormal

Lilliefors (NDs = DL)	0.159	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.187	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.134	0.0997	Data Not Lognormal

Note: DL/2 is not a recommended method.

Arsenic (swmu 51 sg 1)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Arsenic (swmu 51 sg 1) Data	15	0	15	15	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	15	1.5	5.7	3.36	3.3	1.236

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	7.327	5.906	0.459	1.142	0.4	0.351

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.959	0.881	Data Appear Normal
Lilliefors (Full: no NDs)	0.11	0.229	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.323	0.738	
Kolmogorov-Smirnov (Full: no NDs)	0.137	0.222	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.935	0.881	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.155	0.229	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd vs SWMU 51 Sample G
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Aluminum(swmu 51 sg 1)

Background Data: Aluminum(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	17	79
Number of Distinct Samples	16	75
Minimum	10600	3620
Maximum	28100	47900
Mean	18397	14204
Median	16700	12100
SD	6036	9433
SE of Mean	1464	1061

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	1111
WMW Test U-Stat	958
Lower Critical Value (0.025)	106
Upper Critical Value (0.975)	1237
Approximate P-Value	0.0060

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd vs SWMU 51 Sample G
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Arsenic(swmu 51 sg 1)

Background Data: Arsenic(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	15	79
Number of Non-Detect Data	0	3
Number of Detect Data	15	76
Minimum Non-Detect	N/A	0.09
Maximum Non-Detect	N/A	0.12
Percent Non detects	0.00%	3.80%
Minimum Detected	1.5	1.2
Maximum Detected	5.7	35.9
Mean of Detected Data	3.36	4.989
Median of Detected Data	3.3	3.2
SD of Detected Data	1.236	5.36

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.12 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	715
WMW Test U-Stat	595
Lower Critical Value (0.025)	91
Upper Critical Value (0.975)	1094
Approximate P-Value	0.984

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd vs SWMU 51 Sample G
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Manganese(swmu 51 sg 1)

Background Data: Manganese(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	17	79
Number of Distinct Samples	17	78
Minimum	251	16.7
Maximum	3590	2040
Mean	592.7	471.4
Median	381	359
SD	784.8	467.1
SE of Mean	190.3	52.55

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	924
WMW Test U-Stat	771
Lower Critical Value (0.025)	106
Upper Critical Value (0.975)	1237
Approximate P-Value	0.342

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options	
From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd vs SWMU 51 Sample G
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean Equal to Background Mean (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean Not Equal to Background Mean

Area of Concern Data: Vanadium(swmu 51 sg 1)

Background Data: Vanadium(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	17	79
Number of Distinct Samples	17	76
Minimum	21.2	12.2
Maximum	66.1	114
Mean	45.05	45.84
Median	46.6	41.4
SD	15.18	20.38
SE of Mean	3.682	2.293

Site vs Background Two-Sample t-Test

H0: Mu of Site = Mu of Background

Method	DF	t-Test Value	Critical - t (0.050)	P-Value
Pooled (Equal Variance)	94	-0.150	1.986	0.881
Satterthwaite (Unequal Variance)	29.9	-0.181	2.042	0.857

Pooled SD: 19.594

Conclusion with Alpha = 0.050

* Student t (Pooled): Do Not Reject H0, Conclude Site = Background
* Satterthwaite: Do Not Reject H0, Conclude Site = Background

Test of Equality of Variances

Numerator DF	Denominator DF	F-Test Value	P-Value
78	16	1.803	0.185

Conclusion with Alpha = 0.05

* Two variances appear to be equal

Goodness-of-Fit Test Statistics for Full Data Sets without Non-Detects

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd DS vs SWMU 51 soil.ws
Full Precision	OFF
Confidence Coefficient	0.95

Aluminum (bkgrd ts)

Raw Statistics

Number of Valid Samples	79
Number of Unique Samples	75
Minimum	3620
Maximum	47900
Mean of Raw Data	14204
Standard Deviation of Raw Data	9433
Kstar	2.689
Mean of Log Transformed Data	9.371
Standard Deviation of Log Transformed Data	0.618

Normal Distribution Test Results

Lilliefors Test Statistic	0.15
Lilliefors Critical (0.95) Value	0.0997

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

A-D Test Statistic	0.604
A-D Critical (0.95) Value	0.76
K-S Test Statistic	0.0772
K-S Critical(0.95) Value	0.101

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Lilliefors Test Statistic	0.0626
Lilliefors Critical (0.95) Value	0.0997

Data appear Lognormal at (0.05) Significance Level

Aluminum (swmu 51 ds)

Raw Statistics

Number of Valid Samples	13
Number of Unique Samples	13
Minimum	8650
Maximum	27700
Mean of Raw Data	17742
Standard Deviation of Raw Data	5282
Kstar	8.773
Mean of Log Transformed Data	9.739
Standard Deviation of Log Transformed Data	0.321

Normal Distribution Test Results

Shapiro Wilk Test Statistic	0.988
Shapiro Wilk Critical (0.95) Value	0.866
Lilliefors Test Statistic	0.0922
Lilliefors Critical (0.95) Value	0.246

Data appear Normal at (0.05) Significance Level

Gamma Distribution Test Results

A-D Test Statistic	0.165
A-D Critical (0.95) Value	0.734
K-S Test Statistic	0.105
K-S Critical(0.95) Value	0.237

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical (0.95) Value	0.866
Lilliefors Test Statistic	0.127
Lilliefors Critical (0.95) Value	0.246

Data appear Lognormal at (0.05) Significance Level

Manganese (bkgrd ts)

Raw Statistics

Number of Valid Samples	79
Number of Unique Samples	78
Minimum	16.7
Maximum	2040
Mean of Raw Data	471.4
Standard Deviation of Raw Data	467.1
Kstar	1.087
Mean of Log Transformed Data	5.647
Standard Deviation of Log Transformed Data	1.118

Normal Distribution Test Results

Lilliefors Test Statistic	0.165
Lilliefors Critical (0.95) Value	0.0997

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

A-D Test Statistic	0.359
A-D Critical (0.95) Value	0.779
K-S Test Statistic	0.0515
K-S Critical(0.95) Value	0.103

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal Distribution Test Results

Lilliefors Test Statistic	0.093
Lilliefors Critical (0.95) Value	0.0997

Data appear Lognormal at (0.05) Significance Level

Manganese (swmu 51 ds)

Raw Statistics

Number of Valid Samples	13
Number of Unique Samples	13
Minimum	221
Maximum	1330
Mean of Raw Data	484.4
Standard Deviation of Raw Data	285.2
Kstar	3.638
Mean of Log Transformed Data	6.072
Standard Deviation of Log Transformed Data	0.457

Normal Distribution Test Results

Shapiro Wilk Test Statistic	0.714
Shapiro Wilk Critical (0.95) Value	0.866
Lilliefors Test Statistic	0.333
Lilliefors Critical (0.95) Value	0.246

Data not Normal at (0.05) Significance Level

Gamma Distribution Test Results

A-D Test Statistic	0.735
A-D Critical (0.95) Value	0.736
K-S Test Statistic	0.268
K-S Critical(0.95) Value	0.238

Data follow Appr. Gamma Distribution at (0.05) Significance Level

Lognormal Distribution Test Results

Shapiro Wilk Test Statistic	0.913
Shapiro Wilk Critical (0.95) Value	0.866
Lilliefors Test Statistic	0.233
Lilliefors Critical (0.95) Value	0.246

Data appear Lognormal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd DS vs SWMU 51 soil ar
Full Precision	OFF
Confidence Coefficient	0.95

Arsenic (bkgrd ts)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Arsenic (bkgrd ts) Data	79	0	79	76	3	3.80%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	3	0.09	0.12	0.103	0.1	0.0153
Statistics (Detects Only)	76	1.2	35.9	4.989	3.2	5.36
Statistics (All: NDs treated as DL value)	79	0.09	35.9	4.804	3.1	5.339
Statistics (All: NDs treated as DL/2 value)	79	0.045	35.9	4.802	3.1	5.341
Statistics (Normal ROS Estimated Data)	79	-5.169	35.9	4.604	3.1	5.608
Statistics (Gamma ROS Estimated Data)	79	0	35.9	4.8	3.1	5.343
Statistics (Lognormal ROS Estimated Data)	79	0.728	35.9	4.828	3.1	5.32

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Detects Only)	1.819	1.759	2.742	1.308	0.692	0.529
Statistics (NDs = DL)	1.401	1.356	3.429	1.172	0.968	0.826
Statistics (NDs = DL/2)	1.323	1.281	3.631	1.146	1.067	0.932
Statistics (Gamma ROS Estimates)	0.568	0.555	8.454	--	--	--
Statistics (Lognormal ROS Estimates)	--	--	--	1.246	0.748	0.6

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.282	0.102	Data Not Normal
Lilliefors (NDs = DL)	0.279	0.0997	Data Not Normal
Lilliefors (NDs = DL/2)	0.279	0.0997	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.263	0.0997	Data Not Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	4.409	0.766	
Kolmogorov-Smirnov (Detects Only)	0.213	0.104	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	3.469	0.772	
Kolmogorov-Smirnov (NDs = DL)	0.182	0.102	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	3.587	0.774	
Kolmogorov-Smirnov (NDs = DL/2)	0.176	0.103	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	10.23	0.812	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.332	0.106	Data Not Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Lilliefors (Detects Only)	0.151	0.102	Data Not Lognormal

Lilliefors (NDs = DL)	0.159	0.0997	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.187	0.0997	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.134	0.0997	Data Not Lognormal

Note: DL/2 is not a recommended method.

Arsenic (swmu 51 ds)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Arsenic (swmu 51 ds) Data	10	0	10	10	0	0.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Full: no NDs)	10	0.96	6	2.831	2.15	1.759

	K Hat	K Star	Theta Hat	Log Mean	Log Stdv	Log C.V.
Statistics (Full: no NDs)	3.045	2.198	0.93	0.868	0.622	0.717

Normal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.88	0.842	Data Appear Normal
Lilliefors (Full: no NDs)	0.24	0.28	Data Appear Normal

Gamma Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Anderson-Darling (Full: no NDs)	0.372	0.732	
Kolmogorov-Smirnov (Full: no NDs)	0.19	0.268	Data Appear Gamma Distributed

Lognormal Distribution Test Results

	Test value	Crit. (0.95)	Conclusion with Alpha(0.05)
Shapiro-Wilks (Full: no NDs)	0.947	0.842	Data Appear Lognormal
Lilliefors (Full: no NDs)	0.151	0.28	Data Appear Lognormal

Note: DL/2 is not a recommended method.

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Deep Soil vs Bkgrd.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Aluminum(swmu 51 ds)

Background Data: Aluminum(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	13	79
Number of Distinct Samples	13	75
Minimum	8650	3620
Maximum	27700	47900
Mean	17742	14204
Median	17600	12100
SD	5282	9433
SE of Mean	1465	1061

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	811
WMW Test U-Stat	720
Lower Critical Value (0.025)	77
Upper Critical Value (0.975)	950
Approximate P-Value	0.0209

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Data Sets with Non-Detects

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Bkgrd DS vs SWMU 51 soil ar
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (2 Sided Alternative
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Arsenic(swmu 51 ds)

Background Data: Arsenic(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	10	79
Number of Non-Detect Data	0	3
Number of Detect Data	10	76
Minimum Non-Detect	N/A	0.09
Maximum Non-Detect	N/A	0.12
Percent Non detects	0.00%	3.80%
Minimum Detected	0.96	1.2
Maximum Detected	6	35.9
Mean of Detected Data	2.831	4.989
Median of Detected Data	2.15	3.2
SD of Detected Data	1.759	5.36

Wilcoxon-Mann-Whitney Site vs Background Test

All observations <= 0.12 (Max DL) are ranked the same

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	333.5
WMW Test U-Stat	278.5
Lower Critical Value (0.025)	56
Upper Critical Value (0.975)	734
Approximate P-Value	0.132

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

From File	H:\Risk DB\Radford\SWMU 51\SWMU_51_revised_Nov 2007\Background\Deep Soil vs Bkgrd.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0.000
Selected Null Hypothesis	Site or AOC Mean/Median Equal to Background Mean/Median (Two Sided Alternative)
Alternative Hypothesis	Site or AOC Mean/Median Not Equal to Background Mean/Median

Area of Concern Data: Manganese(swmu 51 ds)

Background Data: Manganese(bkgrd ts)

Raw Statistics

	Site	Background
Number of Valid Samples	13	79
Number of Distinct Samples	13	78
Minimum	221	16.7
Maximum	1330	2040
Mean	484.4	471.4
Median	434	359
SD	285.2	467.1
SE of Mean	79.1	52.55

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC = Mean/Median of Background

Site Rank Sum W-Stat	695.5
WMW Test U-Stat	604.5
Lower Critical Value (0.025)	77
Upper Critical Value (0.975)	950
Approximate P-Value	0.31

Conclusion with Alpha = 0.05

Do Not Reject H0, Conclude Site = Background

Appendix F

SLERA Site Reconnaissance Photographs and Supporting Information

Appendix F-1

SLERA Site Reconnaissance Photographs



Photo F-1. View of SWMU 51 habitat looking northwest.



Photo F-2. View of SWMU 51 habitat looking west.



Photo F-3. View of SWMU 51 habitat along eastern barbed wire fence.



Photo F-4. View of SWMU 51 habitat looking southwest.



Photo F-5. View of SWMU 51 habitat looking south.



Photo F-6. Close-up view of SWMU 51 habitat.



Photo F-7. Close-up view of SWMU 51 habitat.



Photo F-8. View of southeastern corner of SWMU 51 habitat and barbed wire fencing.



Photo F-9. View of SWMU 51 habitat looking southwest.

Appendix F-2

SLERA Supporting Information

Table F-1
Comparison of Maximum Detection Limits in Surface Soil with Ecological Screening Values at SWMU 51

Scenario Timeframe: Current
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Ecological Screening Value (2)	Region III BTAG Screening Levels (3)	Above Screening Value? (Y/N)
Surface Soil (0 - 2 feet)	71-55-6	1,1,1-Trichloroethane			mg/kg				5.50E-03	2.98E+01	3.00E-01	No
	79-34-5	1,1,2,2-Tetrachloroethane			mg/kg				5.50E-03	1.27E-01	3.00E-01	No
	79-00-5	1,1,2-Trichloroethane			mg/kg				5.50E-03	2.86E+01	3.00E-01	No
	75-34-3	1,1-Dichloroethane			mg/kg				5.50E-03	2.01E+01	3.00E-01	No
	75-35-4	1,1-Dichloroethene			mg/kg				5.50E-03	8.28E+00	NVA	No
	120-82-1	1,2,4-Trichlorobenzene			mg/kg				4.10E-01	2.00E+01	1.00E-01	**Yes**
	95-50-1	1,2-Dichlorobenzene			mg/kg				4.10E-01	2.96E+00	1.00E-01	**Yes**
	107-06-2	1,2-Dichloroethane			mg/kg				5.50E-03	2.12E+01	8.70E+02	No
	78-87-5	1,2-Dichloropropane			mg/kg				5.50E-03	3.27E+01	NVA	No
	99-35-4	1,3,5-Trinitrobenzene			mg/kg				1.00E-01	3.76E-01	NVA	No
	541-73-1	1,3-Dichlorobenzene			mg/kg				4.10E-01	3.77E+01	NVA	No
	106-46-7	1,4-Dichlorobenzene			mg/kg				4.10E-01	2.00E+01	1.00E-01	**Yes**
	39638-32-9	2,2'-Oxybis(2-Chloropropane)			mg/kg				4.10E-01	NVA	NVA	No
	93-76-5	2,4,5-T			mg/kg				1.20E-01	5.96E-01	NVA	No
	93-72-1	2,4,5-TP (Silvex)			mg/kg				1.20E-01	1.09E-01	NVA	**Yes**
	95-95-4	2,4,5-Trichlorophenol			mg/kg				4.10E-01	9.00E+00	1.00E-01	**Yes**
	88-06-2	2,4,6-Trichlorophenol			mg/kg				4.10E-01	4.00E+00	1.00E-01	**Yes**
	94-75-7	2,4-D			mg/kg				1.20E-01	2.73E-02	NVA	**Yes**
	94-82-6	2,4-DB			mg/kg				1.20E-01	NVA	NVA	No
	120-83-2	2,4-Dichlorophenol			mg/kg				4.10E-01	8.75E+01	1.00E-01	**Yes**
	105-67-9	2,4-Dimethylphenol			mg/kg				4.10E-01	1.00E-02	1.00E-01	**Yes**
	51-28-5	2,4-Dinitrophenol			mg/kg				8.10E-01	2.00E+01	NVA	No
	35572-78-2	2-amino-4,6-Dinitrotoluene			mg/kg				1.00E-01	5.30E+00	NVA	No
	78-93-3	2-Butanone			mg/kg				9.75E-03	8.96E+01	NVA	No
	91-58-7	2-Chloronaphthalene			mg/kg				4.10E-01	1.22E-02	NVA	**Yes**
	95-57-8	2-Chlorophenol			mg/kg				4.10E-01	2.43E-01	1.00E-01	**Yes**
	591-78-6	2-Hexanone			mg/kg				1.10E-02	1.26E+01	NVA	No
	88-74-4	2-Nitroaniline			mg/kg				4.10E-01	7.41E+01	NVA	No
	88-75-5	2-Nitrophenol			mg/kg				4.10E-01	1.60E+00	1.00E-01	**Yes**
	88-85-7	2-sec-butyl-4,6-dinitrophenol			mg/kg				1.20E-01	2.18E-02	NVA	**Yes**
	91-94-1	3,3'-Dichlorobenzidine			mg/kg				8.10E-01	6.46E-01	NVA	**Yes**
	99-09-2	3-Nitroaniline			mg/kg				4.10E-01	3.16E+00	NVA	No
	72-54-8	4,4'-DDD			mg/kg				2.00E-03	7.58E-01	1.00E-01	No
	72-55-9	4,4'-DDE			mg/kg				2.00E-03	5.96E-01	1.00E-01	No

Table F-1
Comparison of Maximum Detection Limits in Surface Soil with Ecological Screening Values at SWMU 51

Scenario Timeframe: Current
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Ecological Screening Value (2)	Region III BTAG Screening Levels (3)	Above Screening Value? (Y/N)
	50-29-3	4,4'-DDT			mg/kg				2.00E-03	1.75E-02	1.00E-01	No
	534-52-1	4,6-Dinitro-o-cresol			mg/kg				8.10E-01	1.44E-01	NVA	**Yes**
Surface	19406-51-0	4-amino-2,6-Dinitrotoluene			mg/kg				1.00E-01	3.60E+00	NVA	No
Soil	101-55-3	4-Bromophenyl phenylether			mg/kg				4.10E-01	NVA	NVA	No
(0 - 2 feet)	7005-72-3	4-Chlorophenyl phenylether			mg/kg				4.10E-01	NVA	NVA	No
	108-10-1	4-Methyl-2-pentanone			mg/kg				1.10E-02	4.43E+02	1.00E+02	No
	100-01-6	4-Nitroaniline			mg/kg				4.10E-01	2.19E+01	NVA	No
	100-02-7	4-Nitrophenol			mg/kg				8.10E-01	7.00E+00	1.00E-01	**Yes**
	83-32-9	Acenaphthene			mg/kg				8.10E-03	2.00E+01	1.00E-01	No
	208-96-8	Acenaphthylene			mg/kg				8.10E-03	6.82E+02	1.00E-01	No
	67-64-1	Acetone			mg/kg				1.10E-01	2.50E+00	NVA	No
	309-00-2	Aldrin			mg/kg				2.00E-03	3.32E-03	NVA	No
	319-84-6	alpha-BHC			mg/kg				2.00E-03	9.94E-02	NVA	No
	5103-71-9	alpha-Chlordane			mg/kg				2.00E-03	2.24E-01	1.00E-01	No
	120-12-7	Anthracene			mg/kg				8.10E-03	1.48E+03	1.00E-01	No
	12674-11-2	Aroclor 1016			mg/kg				4.10E-02	3.71E-01	1.00E-01	No
	11104-28-2	Aroclor 1221			mg/kg				4.10E-02	3.71E-01	1.00E-01	No
	11141-16-5	Aroclor 1232			mg/kg				4.10E-02	3.71E-01	1.00E-01	No
	53469-21-9	Aroclor 1242			mg/kg				4.10E-02	3.71E-01	1.00E-01	No
	12672-29-6	Aroclor 1248			mg/kg				4.10E-02	3.71E-01	1.00E-01	No
	11097-69-1	Aroclor 1254			mg/kg				4.10E-02	3.71E-01	1.00E-01	No
	11096-82-5	Aroclor 1260			mg/kg				4.10E-02	3.71E-01	1.00E-01	No
	71-43-2	Benzene			mg/kg				5.50E-03	2.55E-01	1.00E-01	No
	65-85-0	Benzoic Acid			mg/kg				8.10E-01	7.30E+00	NVA	No
	100-51-6	Benzyl alcohol			mg/kg				4.10E-01	6.58E+01	NVA	No
	319-85-7	beta-BHC			mg/kg				2.00E-03	3.98E-03	NVA	No
	111-91-1	bis(2-Chloroethoxy)methane			mg/kg				4.10E-01	3.02E-01	NVA	**Yes**
	111-44-4	bis(2-Chloroethyl)ether			mg/kg				4.10E-01	2.37E+01	NVA	No
	117-81-7	bis(2-Ethylhexyl) phthalate			mg/kg				4.10E-01	9.26E-01	NVA	No
	75-27-4	Bromodichloromethane			mg/kg				5.50E-03	5.40E-01	4.50E+02	No
	74-83-9	Bromomethane			mg/kg				1.10E-02	2.35E-01	NVA	No
	85-68-7	Butyl benzyl phthalate			mg/kg				4.10E-01	2.39E-01	NVA	**Yes**
	86-74-8	Carbazole			mg/kg				4.10E-01	NVA	NVA	No
	75-15-0	Carbon disulfide			mg/kg				5.50E-03	9.41E-02	NVA	No
	56-23-5	Carbon tetrachloride			mg/kg				5.50E-03	2.98E+00	3.00E-01	No

Table F-1
Comparison of Maximum Detection Limits in Surface Soil with Ecological Screening Values at SWMU 51

Scenario Timeframe: Current
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Ecological Screening Value (2)	Region III BTAG Screening Levels (3)	Above Screening Value? (Y/N)
	108-90-7	Chlorobenzene			mg/kg				5.50E-03	4.00E+01	1.00E-01	No
	75-00-3	Chloroethane			mg/kg				1.10E-02	NVA	NVA	No
Surface	67-66-3	Chloroform			mg/kg				5.50E-03	1.19E+00	3.00E-01	No
Soil	74-87-3	Chloromethane			mg/kg				1.10E-02	1.04E+01	NVA	No
(0 - 2 feet)	156-59-2	cis-1,2-Dichloroethene			mg/kg				5.50E-03	7.84E-01	3.00E-01	No
	10061-01-5	cis-1,3-Dichloro-1-propene			mg/kg				5.50E-03	3.98E-01	NVA	No
	121-82-4	Cyclonite			mg/kg				2.00E-01	NVA	NVA	No
	75-99-0	Dalapon			mg/kg				1.20E-01	NVA	NVA	No
	319-86-8	delta-BHC			mg/kg				2.00E-03	9.94E+00	NVA	No
	132-64-9	Dibenzofuran			mg/kg				4.10E-01	6.10E+00	NVA	No
	124-48-1	Dibromochloromethane			mg/kg				5.50E-03	2.05E+00	NVA	No
	124-48-1	Dibromochloromethane			mg/kg				5.50E-03	2.05E+00	NVA	No
	1918-00-9	Dicamba			mg/kg				1.20E-01	NVA	NVA	No
	120-36-5	Dichloroprop			mg/kg				1.20E-01	NVA	NVA	No
	131-11-3	Dimethylphthalate			mg/kg				4.10E-01	7.34E+02	1.00E+01	No
	84-74-2	Di-n-butyl phthalate			mg/kg				4.10E-01	2.00E+02	NVA	No
	117-84-0	Di-n-octyl phthalate			mg/kg				4.10E-01	7.09E+02	NVA	No
	959-98-8	Endosulfan I			mg/kg				2.00E-03	1.19E-01	NVA	No
	33213-65-9	Endosulfan II			mg/kg				2.00E-03	1.19E-01	NVA	No
	1031-07-8	Endosulfan sulfate			mg/kg				2.00E-03	3.58E-02	NVA	No
	72-20-8	Endrin			mg/kg				2.00E-03	1.01E-02	1.00E-01	No
	7421-93-4	Endrin aldehyde			mg/kg				2.00E-03	1.05E-02	NVA	No
	53494-70-5	Endrin ketone			mg/kg				2.00E-03	NVA	NVA	No
	100-41-4	Ethylbenzene			mg/kg				5.50E-03	5.16E+00	1.00E-01	No
	86-73-7	Fluorene			mg/kg				8.10E-03	1.22E+02	1.00E-01	No
	58-89-9	gamma-BHC (Lindane)			mg/kg				2.00E-03	5.00E-03	1.00E-01	No
	5103-74-2	gamma-Chlordane			mg/kg				2.00E-03	2.24E-01	1.00E-01	No
	76-44-8	Heptachlor			mg/kg				2.00E-03	5.98E-03	NVA	No
	1024-57-3	Heptachlor epoxide			mg/kg				2.00E-03	1.52E-01	1.00E-01	No
	118-74-1	Hexachlorobenzene			mg/kg				4.10E-01	1.99E-01	NVA	**Yes**
	87-68-3	Hexachlorobutadiene			mg/kg				4.10E-01	3.98E-02	NVA	**Yes**
	77-47-4	Hexachlorocyclopentadiene			mg/kg				4.10E-01	1.00E+01	NVA	No
	67-72-1	Hexachloroethane			mg/kg				4.10E-01	5.96E-01	NVA	No
	2691-41-0	HMX			mg/kg				2.00E-01	4.30E+01	NVA	No
	78-59-1	Isophorone			mg/kg				4.10E-01	1.39E+02	NVA	No

Table F-1
Comparison of Maximum Detection Limits in Surface Soil with Ecological Screening Values at SWMU 51

Scenario Timeframe: Current
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Ecological Screening Value (2)	Region III BTAG Screening Levels (3)	Above Screening Value? (Y/N)
	N/A	m&p-Xylenes			mg/kg				5.50E-03	1.00E+01	1.00E-01	No
	94-74-6	MCPA			mg/kg				1.20E+01	NVA	NVA	No
Surface	93-65-2	MCPP			mg/kg				1.20E+01	NVA	NVA	No
Soil	72-43-5	Methoxychlor			mg/kg				2.00E-03	1.99E-02	1.00E-01	No
(0 - 2 feet)	75-09-2	Methylene chloride			mg/kg				1.00E-02	4.05E+00	3.00E-01	No
	91-20-3	Naphthalene			mg/kg				8.10E-03	9.94E-02	1.00E-01	No
	55-63-0	Nitroglycerin			mg/kg				6.10E+00	1.50E+02f	NVA	No
	621-64-7	n-Nitroso-di-n-propylamine			mg/kg				4.10E-01	5.44E-01	NVA	No
	86-30-6	n-Nitrosodiphenylamine			mg/kg				4.10E-01	5.45E-01	NVA	No
	95-48-7	o-Cresol			mg/kg				4.10E-01	4.04E+01	1.00E-01	**Yes**
	95-47-6	o-Xylene			mg/kg				5.50E-03	1.00E+01	1.00E-01	No
	106-47-8	p-Chloroaniline			mg/kg				4.10E-01	1.10E+00	NVA	No
	59-50-7	p-Chloro-m-cresol			mg/kg				4.10E-01	7.95E+00	NVA	No
	106-44-5	p-Cresol			mg/kg				4.10E-01	1.63E+02	1.00E-01	**Yes**
	87-86-5	Pentachlorophenol			mg/kg				8.10E-01	3.00E+00	1.00E-01	**Yes**
	78-11-5	Pentaerythritol tetranitrate			mg/kg				5.00E-01	1.40E+04	NVA	No
	108-95-2	Phenol			mg/kg				4.10E-01	3.00E+01	1.00E-01	**Yes**
	110-86-1	Pyridine			mg/kg				4.10E-01	1.03E+00	NVA	No
	7440-22-4	Silver			mg/kg				1.30E-01	2.00E+00	9.80E-06	**Yes**
	7440-23-5	Sodium			mg/kg				8.45E+01	Nutrient	NVA	No
	100-42-5	Styrene			mg/kg				5.20E-03	3.00E+02	1.00E-01	No
	127-18-4	Tetrachloroethene			mg/kg				5.50E-03	9.92E+00	3.00E-01	No
	479-45-8	Tetryl			mg/kg				2.00E-01	2.00E+00	NVA	No
	108-88-3	Toluene			mg/kg				5.50E-03	2.00E+02	1.00E-01	No
	57-12-5	Total Cyanide			mg/kg				1.80E-01	1.33E+00	5.00E-03	**Yes**
	8001-35-2	Toxaphene			mg/kg				4.10E-02	1.19E-01	NVA	No
	156-60-5	trans-1,2-Dichloroethene			mg/kg				5.50E-03	7.84E-01	3.00E-01	No
	10061-02-6	trans-1,3-Dichloropropene			mg/kg				5.50E-03	3.98E-01	3.00E-01	No
	75-25-2	Tribromomethane			mg/kg				5.50E-03	1.59E+01	NVA	No
	79-01-6	Trichloroethene			mg/kg				5.50E-03	1.24E+01	3.00E-01	No
	75-01-4	Vinyl Chloride			mg/kg				1.10E-02	6.46E-01	3.00E-01	No

(1) Maximum non-detect limit value used for screening.
(2) Screening toxicity values from USEPA SSLs (2000c); Efroymson et al., PRGs (1997); and USEPA Region V EDQLs (1999); and other sources. See text for derivation.
(3) Screening toxicity values from USEPA Region III BTAG Screening Table (September, 1995).

Definitions: N/A = Not Applicable or Not Available
NVA = No Value Available

Table F-2
Selection of Ecological Soil Screening Toxicity Values, for Non Detect Constituents, for SWMU 51

Parameter	Ecological Soil Screening Levels[a] (mg/kg)	Ecological Preliminary Remediation Goals[b] (mg/kg)	Ecological Data Quality Levels[c] (mg/kg)	Other Ecological Soil Screening Levels[d] (mg/kg)	Selected Ecological Screening Toxicity Value[e] (mg/kg)
1,2,3,4,7,8,9-Heptachlorodibenzofuran	NVA	NVA	3.86E-05	--	3.86E-05
1,2,3,4,7,8-Hexachlorodibenzofuran	NVA	NVA	3.86E-05	--	3.86E-05
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	NVA	NVA	1.99E-07	--	1.99E-07
1,2,3,6,7,8-Hexachlorodibenzofuran	NVA	NVA	3.86E-05	--	3.86E-05
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	NVA	NVA	1.99E-07	--	1.99E-07
1,2,3,7,8,9-Hexachlorodibenzofuran	NVA	NVA	3.86E-05	--	3.86E-05
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	NVA	NVA	1.99E-07	--	1.99E-07
1,2,3,7,8-Pentachlorodibenzofuran	NVA	NVA	3.86E-05	--	3.86E-05
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	NVA	NVA	1.99E-07	--	1.99E-07
2,3,7,8-Tetrachlorodibenzofuran	NVA	8.40E-04	3.86E-05	--	3.86E-05
2,3,4,6,7,8-Hexachlorodibenzofuran	NVA	NVA	3.86E-05	--	3.86E-05
2,3,4,7,8-Pentachlorodibenzofuran	NVA	NVA	3.86E-05	--	3.86E-05
Total Hexachlorodibenzofuran	NVA	NVA	3.86E-05	--	3.86E-05
Total Pentachlorodibenzofuran	NVA	NVA	3.86E-05	--	3.86E-05
1,1,1-Trichloroethane	NVA	NVA	2.98E+01	--	2.98E+01
1,1,2,2-Tetrachloroethane	NVA	NVA	1.27E-01	--	1.27E-01
1,1,2-Trichloroethane	NVA	NVA	2.86E+01	--	2.86E+01
1,1-Dichloroethane	NVA	NVA	2.01E+01	--	2.01E+01
1,1-Dichloroethene	NVA	NVA	8.28E+00	--	8.28E+00
1,2,4-Trichlorobenzene	NVA	$20_{(earthworm)}$	1.11E+01	--	2.00E+01
1,2-Dichlorobenzene	NVA	NVA	2.96E+00	--	2.96E+00
1,2-Dichloroethane	NVA	NVA	2.12E+01	--	2.12E+01
1,2-Dichloropropane	NVA	NVA	3.27E+01	--	3.27E+01
1,3,5-Trinitrobenzene	NVA	NVA	3.76E-01	--	3.76E-01
1,3-Dichlorobenzene	NVA	NVA	3.77E+01	--	3.77E+01
1,4-Dichlorobenzene	NVA	$20_{(earthworm)}$	5.46E-01	--	2.00E+01
2,4,5-Trichlorophenol	NVA	$9_{(earthworm)}$	1.41E+01	--	9.00E+00
2,4,5-T	NVA	NVA	5.96E-01	--	5.96E-01
2,4,5-TP (Silvex)	NVA	NVA	1.09E-01	--	1.09E-01
2,4,6-Trichlorophenol	NVA	$4_{(plant)}$	9.94E+00	--	4.00E+00
2,4-D	NVA	NVA	2.73E-02	--	2.73E-02
2,4-DB	NVA	NVA	NVA	NVA	NVA
2,4-Dichlorophenol	NVA	NVA	8.75E+01	--	8.75E+01
2,4-Dimethylphenol	NVA	NVA	1.00E-02	--	1.00E-02
2,4-Dinitrophenol	NVA	$20_{(plant)}$	6.09E-02	--	2.00E+01
2,2'-Oxybis(2-Chloropropane)	NVA	NVA	NVA	NVA	NVA
2-amino-4,6-Dinitrotoluene	NVA	NVA	NVA	5.30E+00	5.30E+00
2-Butanone	NVA	NVA	8.96E+01	--	8.96E+01
2-Chloronaphthalene	NVA	NVA	1.22E-02	--	1.22E-02
2-Chlorophenol	NVA	NVA	2.43E-01	--	2.43E-01
2-Hexanone	NVA	NVA	1.26E+01	--	1.26E+01
2-Nitroaniline	NVA	NVA	7.41E+01	--	7.41E+01
2-Nitrophenol	NVA	NVA	1.60E+00	--	1.60E+00
2-sec-butyl-4,6-dinitrophenol	NVA	NVA	2.18E-02	--	2.18E-02
3,3'-Dichlorobenzidine	NVA	NVA	6.46E-01	--	6.46E-01
3-Nitroaniline	NVA	NVA	3.16E+00	--	3.16E+00
4,4'-DDD	NVA	NVA	7.58E-01	--	7.58E-01
4,4'-DDE	NVA	NVA	5.96E-01	--	5.96E-01
4,4'-DDT	NVA	NVA	1.75E-02	--	1.75E-02
4,6-Dinitro-o-cresol	NVA	NVA	1.44E-01	--	1.44E-01
4-amino-2,6-Dinitrotoluene	NVA	NVA	NVA	3.60E+00	3.60E+00
4-Bromophenyl phenylether	NVA	NVA	NVA	NVA	NVA
4-Chlorophenyl phenylether	NVA	NVA	NVA	NVA	NVA
4-Methyl-2-pentanone	NVA	NVA	4.43E+02	--	4.43E+02
4-Nitroaniline	NVA	NVA	2.19E+01	--	2.19E+01
4-Nitrophenol	NVA	$7_{(earthworm)}$	5.12E+00	--	7.00E+00
Acenaphthene	NVA	20(plant)	6.82E+02	--	2.00E+01
Acenaphthylene	NVA	NVA	6.82E+02	--	6.82E+02
Acetone	NVA	NVA	2.50E+00	--	2.50E+00

Table F-2
Selection of Ecological Soil Screening Toxicity Values, for Non Detect Constituents, for SWMU 51

Parameter	Ecological Soil Screening Levels[a] (mg/kg)	Ecological Preliminary Remediation Goals[b] (mg/kg)	Ecological Data Quality Levels[c] (mg/kg)	Other Ecological Soil Screening Levels[d] (mg/kg)	Selected Ecological Screening Toxicity Value[e] (mg/kg)
Aldrin	NVA	NVA	3.32E-03	--	3.32E-03
alpha-BHC	NVA	NVA	9.94E-02	--	9.94E-02
alpha-Chlordane	NVA	NVA	2.24E-01	--	2.24E-01
Anthracene	NVA	NVA	1480	--	1480
Aroclor 1016	NVA	$0.371_{(mammal)}$	3.32E-04	--	3.71E-01
Aroclor 1221	NVA	$0.371_{(mammal)}$	3.32E-04	--	3.71E-01
Aroclor 1232	NVA	$0.371_{(mammal)}$	3.32E-04	--	3.71E-01
Aroclor 1242	NVA	$0.371_{(mammal)}$	3.32E-04	--	3.71E-01
Aroclor 1248	NVA	$0.371_{(mammal)}$	3.32E-04	--	3.71E-01
Aroclor 1254	NVA	$0.371_{(mammal)}$	3.32E-04	--	3.71E-01
Aroclor 1260	NVA	$0.371_{(mammal)}$	3.32E-04	--	3.71E-01
Benzene	NVA	NVA	2.55E-01	--	2.55E-01
Benzoic acid	NVA	NVA	NVA	7.3[f]	7.3
Benzyl alcohol	NVA	NVA	6.58E+01	--	6.58E+01
beta-BHC	NVA	NVA	3.98E-03	--	3.98E-03
bis(2-Chloroethoxy)methane	NVA	NVA	3.02E-01	--	3.02E-01
bis(2-Chloroethyl)ether	NVA	NVA	2.37E+01	--	2.37E+01
bis(2-Ethylhexyl) phthalate	NVA	NVA	9.26E-01	--	9.26E-01
Bromodichloromethane	NVA	NVA	5.40E-01	--	5.40E-01
Bromomethane	NVA	NVA	2.35E-01	--	2.35E-01
Butyl benzyl phthalate	NVA	NVA	2.39E-01	--	2.39E-01
Carbazole	NVA	NVA	NVA	NVA	NVA
Carbon disulfide	NVA	NVA	9.41E-02	--	9.41E-02
Carbon tetrachloride	NVA	NVA	2.98E+00	--	2.98E+00
Chlorobenzene	NVA	$40_{(earthworm)}$	1.31E+01	--	4.00E+01
Chloroethane	NVA	NVA	NVA	NVA	NVA
Chloromethane	NVA	NVA	1.04E+01	--	1.04E+01
cis-1,2-Dichloroethene	NVA	NVA	7.84E-01	--	7.84E-01
cis-1,3-Dichloro-1-propene	NVA	NVA	3.98E-01	--	3.98E-01
Total Cyanide	NVA	NVA	1.33	--	1.33
Cyclonite	NVA	NVA	NVA	--	NVA
Dalapon	NVA	NVA	NVA	NVA	NVA
delta-BHC	NVA	NVA	9.94E+00	--	9.94E+00
Dibenzofuran	NVA	NVA	NVA	6.1	6.1
Dibromochloromethane	NVA	NVA	2.05E+00	--	2.05E+00
Dicamba	NVA	NVA	NVA	NVA	NVA
Dichloroprop	NVA	NVA	NVA	NVA	NVA
Dimethylphthalate	NVA	NVA	7.34E+02	--	7.34E+02
Di-n-butyl phthalate	NVA	$200_{(plant)}$	0.14979	--	200
Di-n-octyl phthalate	NVA	NVA	7.09E+02	--	7.09E+02
Endosulfan I	NVA	NVA	1.19E-01	--	1.19E-01
Endosulfan II	NVA	NVA	1.19E-01	--	1.19E-01
Endosulfan sulfate	NVA	NVA	3.58E-02	--	3.58E-02
Endrin	NVA	NVA	1.01E-02	--	1.01E-02
Endrin Aldehyde	NVA	NVA	1.05E-02	--	1.05E-02
Endrin ketone	NVA	NVA	NVA	NVA	NVA
Ethylbenzene	NVA	NVA	5.16E+00	--	5.16E+00
Fluorene	NVA	NVA	122	--	122
gamma-BHC (Lindane)	NVA	NVA	5.00E-03	--	5.00E-03
gamma-Chlordane	NVA	NVA	2.24E-01	--	2.24E-01
Heptachlor	NVA	NVA	5.98E-03	--	5.98E-03
Heptachlor epoxide	NVA	NVA	1.52E-01	--	1.52E-01
Hexachlorobenzene	NVA	NVA	1.99E-01	--	1.99E-01
Hexachlorobutadiene	NVA	NVA	3.98E-02	--	3.98E-02
Hexachlorocyclopentadiene	NVA	$10_{(plant)}$	7.55E-01	--	1.00E+01
Hexachloroethane	NVA	NVA	5.96E-01	--	5.96E-01
HMX	NVA	NVA	NVA	4.30E+01	4.30E+01
Isophorone	NVA	NVA	1.39E+02	--	1.39E+02

Table F-2
Selection of Ecological Soil Screening Toxicity Values, for Non Detect Constituents, for SWMU 51

Parameter	Ecological Soil Screening Levels[a] (mg/kg)	Ecological Preliminary Remediation Goals[b] (mg/kg)	Ecological Data Quality Levels[c] (mg/kg)	Other Ecological Soil Screening Levels[d] (mg/kg)	Selected Ecological Screening Toxicity Value[e] (mg/kg)
MCPA	NVA	NVA	NVA	NVA	NVA
MCPP	NVA	NVA	NVA	NVA	NVA
Methoxychlor	NVA	NVA	1.99E-02	--	1.99E-02
Methylene chloride	NVA	NVA	4.05E+00	--	4.05E+00
m&p-Xylenes	NVA	NVA	1.00E+01	--	1.00E+01
Naphthalene	NVA	NVA	9.94E-02	--	9.94E-02
Nitroglycerin	NVA	NVA	NVA	--	1.50E+02[f]
n-Nitroso-di-n-propylamine	NVA	NVA	5.44E-01	--	5.44E-01
n-Nitrosodiphenylamine	NVA	NVA	5.45E-01	--	5.45E-01
o-Cresol	NVA	NVA	4.04E+01	--	4.04E+01
o-Xylene	NVA	NVA	1.00E+01	--	1.00E+01
p-Chloroaniline	NVA	NVA	1.10E+00	--	1.10E+00
p-Chloro-m-cresol	NVA	NVA	7.95E+00	--	7.95E+00
p-Cresol	NVA	NVA	1.63E+02	--	1.63E+02
Pentachlorophenol	NVA	$3_{(plant)}$	1.19E-01	--	3.00E+00
Pentaerythritol tetranitrate (PETN)	NVA	NVA	NVA	1.40E+04	1.40E+04
Phenol	NVA	$30_{(earthworm)}$	1.20E+02	--	3.00E+01
Pyridine	NVA	NVA	1.03E+00	--	1.03E+00
Silver	4.2	$2_{(plant)}$	4.04	--	2
Sodium	NVA	NVA	NVA	NVA	Nutrient
Styrene	NVA	$300_{(plant)}$	4.69E+00	--	3.00E+02
Tetrachloroethene	NVA	NVA	9.92E+00	--	9.92E+00
Tetryl	NVA	NVA	NVA	2.00E+00	2.00E+00
Toluene	NVA	$200_{(plant)}$	5.45	--	200
Toxaphene	NVA	NVA	1.19E-01	--	1.19E-01
trans-1,2-Dichloroethene	NVA	NVA	7.84E-01	--	7.84E-01
trans-1,3-Dichloropropene	NVA	NVA	3.98E-01	--	3.98E-01
Tribromomethane	NVA	NVA	1.59E+01	--	1.59E+01
Trichloroethene	NVA	NVA	1.24E+01	--	1.24E+01
Trichloromethane	NVA	NVA	1.19E+00	--	1.19E+00
Vinyl Chloride	NVA	NVA	6.46E-01	--	6.46E-01

[a] Ecological Soil Screening Level Guidance, U.S.EPA, March 2005b.

[b] Preliminary Remediation Goals for Ecological Endpoints, R. A. Efroymson, et. al., August 1997.

[c] Ecological Data Quality Levels, U.S.EPA Region 5, October 1999.

[d] Other Values.

[e] The following hierarchy was utilized to select the final Ecological Screening Toxicity Values for this assessment:
1. The lower value of either the Ecological Soil Screening Level Guidance or the Preliminary Remediation Goals for Ecological Endpoints.
2. Ecological Data Quality Levels, U.S.EPA Region 5
3. Other Values.

NVA = No Value Available

[f] Value is from Los Alamos National Laboratory, 2002, Environmental Restoration Project, Environmental Screening Levels.

Table F-3
Data Used to Model Exposure[a] in the Indicator Wildlife Species

Indicator Species	Body Weight Range (average) (kg)	Average Home Range (ha) [ac]	Maximum Dietary Intake[b] (kg[dw]/day)	Average Dietary Intake[c] (kg[dw]/day)	Soil/Sed. Intake[d] (%Diet) (Avg – Max) (kg[dw]/day)	Maximum Water Intake[b] (L/day)	Average Water Intake[c] (L/day)	Trophic Level	Dietary Composition
Meadow vole (*Microtus pennsylvanicus*)	0.0170-0.0524 (0.037)	0.036 [0.089]	0.010	0.0080	(2.4%) 0.00019-0.00024	0.0070	0.0051	Herbivore	Plants: 100%
Short-tailed shrew *(Blarina brevicauda)*	0.0125-0.0225 (0.015)	0.39 [0.96]	0.0030	0.0022	(10.4%) 0.00023-0.00031	0.0033	0.0023	Insectivore	Terr. Inverts: 100%
American robin *(Turdus migratorius)*	0.0635-0.103 (0.0773)	0.48 [1.2]	0.020	0.016	(4%) 0.00064-0.00080	0.013	0.011	Omnivore	Plants: 62% Terr Inverts: 38%
Red-tailed hawk (*Buteo jamaicensis*)	0.957-1.235 (1.134)	842 [2081]	0.063	0.059	(0%)	0.068	0.064	Carnivore	Mammals: 76% Birds: 24%
Red fox *(Vulpes vulpes)*	2.95-7.04 (4.53)	892 [2204]	0.34	0.24	(2.8%) 0.0067-0.0095	0.57	0.39	Carnivore	Mammals: 65% Birds: 14% Plants: 17% Terr. Inverts: 4%

[a] From USEPA (1993), except as noted.
[b] Maximum dietary and water intake based on appropriate allometric equation using maximum body weight.
[c] Average dietary and water intake based on appropriate allometric equation using average body weight.
[d] Soil/sediment ingestion rate based on estimated percent soil in diet (dry weight), and maximum or average dietary intake.

Allometric equations for mammals and birds from USEPA (1993), as follows, where FI = food ingestion (dry weight [dw]), WI = water ingestion, Wt = body weight, kg = kilogram, L = liter, and g = gram:
FI (kg/day) = 0.0687 $Wt^{0.822}$ for mammals (shrew and red fox),
FI (g/day) = 0.577 $Wt^{0.727}$ for herbivores (meadow vole),
FI (g/day) = 0.301 $Wt^{0.751}$ for non-passerine birds (red-tail hawk),
FI (g/day) = 0.398 $Wt^{0.850}$ for passerine birds (American robin).
WI (L/day) = 0.099 $Wt^{0.90}$ (Wt in kg) for mammals,
WI (L/day) = 0.059 $Wt^{0.67}$ (Wt in kg) for birds.

ha = hectare
ac = acre, and a hectare = 2.471 acres.

Notes:
The soil ingestion rate for the shrew set equal to the rate for the American woodcock (10.4% of diet), as both species feed predominantly on earthworms.
The soil ingestion rate for the American robin set equal to 48% of the American woodcock value (0.38 x 10.4% = 4%), based on a robin diet of 38% invertebrates (earthworms).

Table F-4
Example Calculation of Tier 2 Chemicals of Potential Concern EEQs and Hazard Indices for Red Foxes at SWMU 51

Hazard Estimate - Tier 2
Red Fox

	Surface Water Exposure		Sediment Exposure		Soil Exposure		Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF
Chemical	**Point Concentration**	**Units**	**Point Concentration**	**Units**	**Point Concentration**	**Units**			
2,3,7,8-TCDD TE	NA	mg/L	NA	mg/kg	0.000002552	mg/kg	NA	NA	=IF(F8=0,"NA",(EXP(1.18*LN(F8)+3.53)/F8))
Benzo(a)anthracene	NA	mg/L	NA	mg/kg	0.00712465347511157	mg/kg	NA	NA	=IF(F9=0,"NA", (1.59))
Benzo(a)pyrene	NA	mg/L	NA	mg/kg	0.00536926475465218	mg/kg	NA	NA	=IF(F10=0,"NA", (1.33))
Benzo(b)fluoranthene	NA	mg/L	NA	mg/kg	0.00849450012779513	mg/kg	NA	NA	=IF(F11=0,"NA", (2.6))
Benzo(g,h,i)perylene	NA	mg/L	NA	mg/kg	0.00807527115881093	mg/kg	NA	NA	=IF(F12=0,"NA", (2.94))
Benzo(k)fluoranthene	NA	mg/L	NA	mg/kg	0.0100643773151073	mg/kg	NA	NA	=IF(F13=0,"NA", (2.6))
Chrysene	NA	mg/L	NA	mg/kg	0.0105110549906115	mg/kg	NA	NA	=IF(F14=0,"NA", (2.29))
Dibenz(a,h)anthracene	NA	mg/L	NA	mg/kg	0.0115701595908311	mg/kg	NA	NA	=IF(F15=0,"NA", (2.31))
Fluoranthene	NA	mg/L	NA	mg/kg	0.0192	mg/kg	NA	NA	=IF(F16=0,"NA", (3.04))
Indeno(1,2,3-cd)pyrene	NA	mg/L	NA	mg/kg	0.00906788316028361	mg/kg	NA	NA	=IF(F17=0,"NA", (2.86))
Phenanthrene	NA	mg/L	NA	mg/kg	0.018	mg/kg	NA	NA	=IF(F18=0,"NA", (1.72))
Pyrene	NA	mg/L	NA	mg/kg	0.0115	mg/kg	NA	NA	=IF(F19=0,"NA", (1.75))
Arsenic	NA	mg/L	NA	mg/kg	4.406	mg/kg	NA	NA	=IF(F20=0,"NA",(EXP(0.706*LN(F20)-1.421)/F20))
Cadmium	NA	mg/L	NA	mg/kg	0.36	mg/kg	NA	NA	=IF(F21=0,"NA",(EXP(0.795*LN(F21)+2.114)/F21))
Chromium	NA	mg/L	NA	mg/kg	28.24	mg/kg	NA	NA	=IF(F22=0,"NA",0.306)
Copper	NA	mg/L	NA	mg/kg	12.23	mg/kg	NA	NA	=IF(F23=0,"NA",0.515)
Lead	NA	mg/L	NA	mg/kg	20.28	mg/kg	NA	NA	=IF(F24=0,"NA", (EXP(0.807*LN(F24)-0.218)/F24))
Mercury	NA	mg/L	NA	mg/kg	0.0735	mg/kg	NA	NA	=IF(F25=0,"NA", (EXP(0.33*LN(F25)+0.078)/F25))
Nickel	NA	mg/L	NA	mg/kg	9.694	mg/kg	NA	NA	=IF(F26=0,"NA", (1.059))
Selenium	NA	mg/L	NA	mg/kg	0.264	mg/kg	NA	NA	=IF(F27=0,"NA", (EXP(0.733*LN(F27)-0.075)/F27))
Zinc	NA	mg/L	NA	mg/kg	33.12	mg/kg	NA	NA	=IF(F28=0,"NA", (EXP(0.328*LN(F28)+4.449)/F28))

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Table F-4
Example Calculation of Tier 2 Chemicals of Potential Concern EEQs and Hazard Indices for Red Foxes at SWMU 51

Hazard Estimate - Tier 2
Red Fox

Chemical	Plant BAF	Mammal BAF	Bird BAF	PDE Surface Water
	unitless	unitless	unitless	mg/kg-d
2,3,7,8-TCDD TE	=IF(F8=0,"NA",0.0039)	=IF(F8=0,"NA",2.2)	=IF(F8=0,"NA",2.2)	=IF(B8="NA","NA",$AA$46*B8*$AA$48/$AA$44)
Benzo(a)anthracene	=IF(F9=0,"NA", (EXP(0.5944*LN(F9)-2.7078)/F9))	NA	NA	=IF(B9="NA","NA",$AA$46*B9*$AA$48/$AA$44)
Benzo(a)pyrene	=IF(F10=0,"NA", (EXP(0.975*LN(F10)-2.0615)/F10))	NA	NA	=IF(B10="NA","NA",$AA$46*B10*$AA$48/$AA$44)
Benzo(b)fluoranthene	=IF(F11=0,"NA", (0.31))	NA	NA	=IF(B11="NA","NA",$AA$46*B11*$AA$48/$AA$44)
Benzo(g,h,i)perylene	=IF(F12=0,"NA", (EXP(1.1829*LN(F12)-0.9313)/F12))	NA	NA	=IF(B12="NA","NA",$AA$46*B12*$AA$48/$AA$44)
Benzo(k)fluoranthene	=IF(F13=0,"NA", (EXP(0.8595*LN(F13)-2.1579)/F13))	NA	NA	=IF(B13="NA","NA",$AA$46*B13*$AA$48/$AA$44)
Chrysene	=IF(F14=0,"NA", (EXP(0.5944*LN(F14)-2.7078)/F14))	NA	NA	=IF(B14="NA","NA",$AA$46*B14*$AA$48/$AA$44)
Dibenz(a,h)anthracene	=IF(F15=0,"NA", (0.13))	NA	NA	=IF(B15="NA","NA",$AA$46*B15*$AA$48/$AA$44)
Fluoranthene	=IF(F16=0,"NA", (0.5))	NA	NA	=IF(B16="NA","NA",$AA$46*B16*$AA$48/$AA$44)
Indeno(1,2,3-cd)pyrene	=IF(F17=0,"NA", (0.11))	NA	NA	=IF(B17="NA","NA",$AA$46*B17*$AA$48/$AA$44)
Phenanthrene	=IF(F18=0,"NA", (EXP(0.6203*LN(F18)-0.1665)/F18))	NA	NA	=IF(B18="NA","NA",$AA$46*B18*$AA$48/$AA$44)
Pyrene	=IF(F19=0,"NA", (0.72))	NA	NA	=IF(B19="NA","NA",$AA$46*B19*$AA$48/$AA$44)
Arsenic	=IF(F20=0,"NA", (0.03752))	=IF(F20=0,"NA", (EXP(0.8188*LN(F20)-4.8471)/F20))	=IF(F20=0,"NA", (EXP(0.8188*LN(F20)-4.8471)/F20))	=IF(B20="NA","NA",$AA$46*B20*$AA$48/$AA$44)
Cadmium	=IF(F21=0,"NA", (EXP(0.546*LN(F21)-0.475)/F21))	=IF(F21=0,"NA", (EXP(0.4723*LN(F21)-1.2571)/F21))	=IF(F21=0,"NA", (EXP(0.4723*LN(F21)-1.2571)/F21))	=IF(B21="NA","NA",$AA$46*B21*$AA$48/$AA$44)
Chromium	=IF(F22=0,"NA", (0.041))	=IF(F22=0,"NA", (EXP(0.7338*LN(F22)-1.4599)/F22))	=IF(F22=0,"NA", (EXP(0.7338*LN(F22)-1.4599)/F22))	=IF(B22="NA","NA",$AA$46*B22*$AA$48/$AA$44)
Copper	=IF(F23=0,"NA", (EXP(0.394*LN(F23)+0.668)/F23))	=IF(F23=0,"NA", (EXP(0.144*LN(F23)+2.042)/F23))	=IF(F23=0,"NA", (EXP(0.144*LN(F23)+2.042)/F23))	=IF(B23="NA","NA",$AA$46*B23*$AA$48/$AA$44)
Lead	=IF(F24=0,"NA", (EXP(0.561*LN(F24)-1.328)/F24))	=IF(F24=0,"NA", (EXP(0.4422*LN(F24)+0.0761)/F24))	=IF(F24=0,"NA", (EXP(0.4422*LN(F24)+0.0761)/F24))	=IF(B24="NA","NA",$AA$46*B24*$AA$48/$AA$44)
Mercury	=IF(F25=0,"NA", (EXP(0.54*LN(F25)-1)/F25))	=IF(F25=0,"NA", (0.192))	=IF(F25=0,"NA", (0.192))	=IF(B25="NA","NA",$AA$46*B25*$AA$48/$AA$44)
Nickel	=IF(F26=0,"NA", (EXP(0.748*LN(F26)-2.223)/F26))	=IF(F26=0,"NA", (EXP(0.4658*LN(F26)-0.2462)/F26))	=IF(F26=0,"NA", (EXP(0.4658*LN(F26)-0.2462)/F26))	=IF(B26="NA","NA",$AA$46*B26*$AA$48/$AA$44)
Selenium	=IF(F27=0,"NA", (EXP(1.104*LN(F27)-0.677)/F27))	=IF(F27=0,"NA", (EXP(0.0706*LN(F27)+4.3632)/F27))	=IF(F27=0,"NA", (EXP(0.0706*LN(F27)+4.3632)/F27))	=IF(B27="NA","NA",$AA$46*B27*$AA$48/$AA$44)
Zinc	=IF(F28=0,"NA", (EXP(0.554*LN(F28)+1.575)/F28))	=IF(F28=0,"NA", (EXP(0.0706*LN(F28)+4.3632)/F28))	=IF(F28=0,"NA", (EXP(0.0706*LN(F28)+4.3632)/F28))	=IF(B28="NA","NA",$AA$46*B28*$AA$48/$AA$44)

Notes:

$$EI = \left(\frac{A}{HR}\left[\sum_{i=1}^{n}\left(\frac{IR_i \times C_i}{BW}\right)\right]\right)$$

Tier 1 = Max EEQ using max EPC, max BAF/BCF, max Intake Rates, min BW, and FHR =1.
Tier 2 = EEQ using 95% EPC, non-max BAF/BCF, avg Intake Rates, avg BW and calculated FHR.
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
PDE = Predicted Daily Exposure
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
If BAF/BCF regression equation produced Tier 2 value exceeding maximum Tier 1 BAF/BCF value, Tier 1 value used as default.
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or NOAEL = LOAEL/UF or NOAEL/UF
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Table F-4
Example Calculation of Tier 2 Chemicals of Potential Concern EEQs and Hazard Indices for Red Foxes at SWMU 51

Hazard Estimate - Tier 2
Red Fox

Chemical	PDE Sediment mg/kg-d	PDE Soil mg/kg-d	PDE Fish mg/kg-d
2,3,7,8-TCDD TE	=IF(D8="NA","NA",$AA$42*D8*$AA$48/$AA$44)	=$AA$41*F8*$AA$48/$AA$44	=IF(H8="NA","NA",$AA$36*B8*H8*$AA$43*$AA$48/$AA$44)
Benzo(a)anthracene	=IF(D9="NA","NA",$AA$42*D9*$AA$48/$AA$44)	=$AA$41*F9*$AA$48/$AA$44	=IF(H9="NA","NA",$AA$36*B9*H9*$AA$43*$AA$48/$AA$44)
Benzo(a)pyrene	=IF(D10="NA","NA",$AA$42*D10*$AA$48/$AA$44)	=$AA$41*F10*$AA$48/$AA$44	=IF(H10="NA","NA",$AA$36*B10*H10*$AA$43*$AA$48/$AA$44)
Benzo(b)fluoranthene	=IF(D11="NA","NA",$AA$42*D11*$AA$48/$AA$44)	=$AA$41*F11*$AA$48/$AA$44	=IF(H11="NA","NA",$AA$36*B11*H11*$AA$43*$AA$48/$AA$44)
Benzo(g,h,i)perylene	=IF(D12="NA","NA",$AA$42*D12*$AA$48/$AA$44)	=$AA$41*F12*$AA$48/$AA$44	=IF(H12="NA","NA",$AA$36*B12*H12*$AA$43*$AA$48/$AA$44)
Benzo(k)fluoranthene	=IF(D13="NA","NA",$AA$42*D13*$AA$48/$AA$44)	=$AA$41*F13*$AA$48/$AA$44	=IF(H13="NA","NA",$AA$36*B13*H13*$AA$43*$AA$48/$AA$44)
Chrysene	=IF(D14="NA","NA",$AA$42*D14*$AA$48/$AA$44)	=$AA$41*F14*$AA$48/$AA$44	=IF(H14="NA","NA",$AA$36*B14*H14*$AA$43*$AA$48/$AA$44)
Dibenz(a,h)anthracene	=IF(D15="NA","NA",$AA$42*D15*$AA$48/$AA$44)	=$AA$41*F15*$AA$48/$AA$44	=IF(H15="NA","NA",$AA$36*B15*H15*$AA$43*$AA$48/$AA$44)
Fluoranthene	=IF(D16="NA","NA",$AA$42*D16*$AA$48/$AA$44)	=$AA$41*F16*$AA$48/$AA$44	=IF(H16="NA","NA",$AA$36*B16*H16*$AA$43*$AA$48/$AA$44)
Indeno(1,2,3-cd)pyrene	=IF(D17="NA","NA",$AA$42*D17*$AA$48/$AA$44)	=$AA$41*F17*$AA$48/$AA$44	=IF(H17="NA","NA",$AA$36*B17*H17*$AA$43*$AA$48/$AA$44)
Phenanthrene	=IF(D18="NA","NA",$AA$42*D18*$AA$48/$AA$44)	=$AA$41*F18*$AA$48/$AA$44	=IF(H18="NA","NA",$AA$36*B18*H18*$AA$43*$AA$48/$AA$44)
Pyrene	=IF(D19="NA","NA",$AA$42*D19*$AA$48/$AA$44)	=$AA$41*F19*$AA$48/$AA$44	=IF(H19="NA","NA",$AA$36*B19*H19*$AA$43*$AA$48/$AA$44)
Arsenic	=IF(D20="NA","NA",$AA$42*D20*$AA$48/$AA$44)	=$AA$41*F20*$AA$48/$AA$44	=IF(H20="NA","NA",$AA$36*B20*H20*$AA$43*$AA$48/$AA$44)
Cadmium	=IF(D21="NA","NA",$AA$42*D21*$AA$48/$AA$44)	=$AA$41*F21*$AA$48/$AA$44	=IF(H21="NA","NA",$AA$36*B21*H21*$AA$43*$AA$48/$AA$44)
Chromium	=IF(D22="NA","NA",$AA$42*D22*$AA$48/$AA$44)	=$AA$41*F22*$AA$48/$AA$44	=IF(H22="NA","NA",$AA$36*B22*H22*$AA$43*$AA$48/$AA$44)
Copper	=IF(D23="NA","NA",$AA$42*D23*$AA$48/$AA$44)	=$AA$41*F23*$AA$48/$AA$44	=IF(H23="NA","NA",$AA$36*B23*H23*$AA$43*$AA$48/$AA$44)
Lead	=IF(D24="NA","NA",$AA$42*D24*$AA$48/$AA$44)	=$AA$41*F24*$AA$48/$AA$44	=IF(H24="NA","NA",$AA$36*B24*H24*$AA$43*$AA$48/$AA$44)
Mercury	=IF(D25="NA","NA",$AA$42*D25*$AA$48/$AA$44)	=$AA$41*F25*$AA$48/$AA$44	=IF(H25="NA","NA",$AA$36*B25*H25*$AA$43*$AA$48/$AA$44)
Nickel	=IF(D26="NA","NA",$AA$42*D26*$AA$48/$AA$44)	=$AA$41*F26*$AA$48/$AA$44	=IF(H26="NA","NA",$AA$36*B26*H26*$AA$43*$AA$48/$AA$44)
Selenium	=IF(D27="NA","NA",$AA$42*D27*$AA$48/$AA$44)	=$AA$41*F27*$AA$48/$AA$44	=IF(H27="NA","NA",$AA$36*B27*H27*$AA$43*$AA$48/$AA$44)
Zinc	=IF(D28="NA","NA",$AA$42*D28*$AA$48/$AA$44)	=$AA$41*F28*$AA$48/$AA$44	=IF(H28="NA","NA",$AA$36*B28*H28*$AA$43*$AA$48/$AA$44)

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x Cij}{BW} \right) \right] \right)$$

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Table F-4
Example Calculation of Tier 2 Chemicals of Potential Concern EEQs and Hazard Indices for Red Foxes at SWMU 51

Hazard Estimate - Tier 2
Red Fox

Chemical	PDE Aq. Invert. mg/kg-d	PDE Terr. Invert. mg/kg-d	PDE Plants mg/kg-d
2,3,7,8-TCDD TE	=IF(I8="NA","NA",$AA$37*D8*I8*$AA$43*$AA$48/$AA$44)	=IF(J8="NA","NA",$AA$38*F8*J8*$AA$43*$AA$48/$AA$44)	=IF(K8="NA","NA",$AA$35*F8*K8*$AA$43*$AA$48/$AA$44)
Benzo(a)anthracene	=IF(I9="NA","NA",$AA$37*D9*I9*$AA$43*$AA$48/$AA$44)	=IF(J9="NA","NA",$AA$38*F9*J9*$AA$43*$AA$48/$AA$44)	=IF(K9="NA","NA",$AA$35*F9*K9*$AA$43*$AA$48/$AA$44)
Benzo(a)pyrene	=IF(I10="NA","NA",$AA$37*D10*I10*$AA$43*$AA$48/$AA$44)	=IF(J10="NA","NA",$AA$38*F10*J10*$AA$43*$AA$48/$AA$44)	=IF(K10="NA","NA",$AA$35*F10*K10*$AA$43*$AA$48/$AA$44)
Benzo(b)fluoranthene	=IF(I11="NA","NA",$AA$37*D11*I11*$AA$43*$AA$48/$AA$44)	=IF(J11="NA","NA",$AA$38*F11*J11*$AA$43*$AA$48/$AA$44)	=IF(K11="NA","NA",$AA$35*F11*K11*$AA$43*$AA$48/$AA$44)
Benzo(g,h,i)perylene	=IF(I12="NA","NA",$AA$37*D12*I12*$AA$43*$AA$48/$AA$44)	=IF(J12="NA","NA",$AA$38*F12*J12*$AA$43*$AA$48/$AA$44)	=IF(K12="NA","NA",$AA$35*F12*K12*$AA$43*$AA$48/$AA$44)
Benzo(k)fluoranthene	=IF(I13="NA","NA",$AA$37*D13*I13*$AA$43*$AA$48/$AA$44)	=IF(J13="NA","NA",$AA$38*F13*J13*$AA$43*$AA$48/$AA$44)	=IF(K13="NA","NA",$AA$35*F13*K13*$AA$43*$AA$48/$AA$44)
Chrysene	=IF(I14="NA","NA",$AA$37*D14*I14*$AA$43*$AA$48/$AA$44)	=IF(J14="NA","NA",$AA$38*F14*J14*$AA$43*$AA$48/$AA$44)	=IF(K14="NA","NA",$AA$35*F14*K14*$AA$43*$AA$48/$AA$44)
Dibenz(a,h)anthracene	=IF(I15="NA","NA",$AA$37*D15*I15*$AA$43*$AA$48/$AA$44)	=IF(J15="NA","NA",$AA$38*F15*J15*$AA$43*$AA$48/$AA$44)	=IF(K15="NA","NA",$AA$35*F15*K15*$AA$43*$AA$48/$AA$44)
Fluoranthene	=IF(I16="NA","NA",$AA$37*D16*I16*$AA$43*$AA$48/$AA$44)	=IF(J16="NA","NA",$AA$38*F16*J16*$AA$43*$AA$48/$AA$44)	=IF(K16="NA","NA",$AA$35*F16*K16*$AA$43*$AA$48/$AA$44)
Indeno(1,2,3-cd)pyrene	=IF(I17="NA","NA",$AA$37*D17*I17*$AA$43*$AA$48/$AA$44)	=IF(J17="NA","NA",$AA$38*F17*J17*$AA$43*$AA$48/$AA$44)	=IF(K17="NA","NA",$AA$35*F17*K17*$AA$43*$AA$48/$AA$44)
Phenanthrene	=IF(I18="NA","NA",$AA$37*D18*I18*$AA$43*$AA$48/$AA$44)	=IF(J18="NA","NA",$AA$38*F18*J18*$AA$43*$AA$48/$AA$44)	=IF(K18="NA","NA",$AA$35*F18*K18*$AA$43*$AA$48/$AA$44)
Pyrene	=IF(I19="NA","NA",$AA$37*D19*I19*$AA$43*$AA$48/$AA$44)	=IF(J19="NA","NA",$AA$38*F19*J19*$AA$43*$AA$48/$AA$44)	=IF(K19="NA","NA",$AA$35*F19*K19*$AA$43*$AA$48/$AA$44)
Arsenic	=IF(I20="NA","NA",$AA$37*D20*I20*$AA$43*$AA$48/$AA$44)	=IF(J20="NA","NA",$AA$38*F20*J20*$AA$43*$AA$48/$AA$44)	=IF(K20="NA","NA",$AA$35*F20*K20*$AA$43*$AA$48/$AA$44)
Cadmium	=IF(I21="NA","NA",$AA$37*D21*I21*$AA$43*$AA$48/$AA$44)	=IF(J21="NA","NA",$AA$38*F21*J21*$AA$43*$AA$48/$AA$44)	=IF(K21="NA","NA",$AA$35*F21*K21*$AA$43*$AA$48/$AA$44)
Chromium	=IF(I22="NA","NA",$AA$37*D22*I22*$AA$43*$AA$48/$AA$44)	=IF(J22="NA","NA",$AA$38*F22*J22*$AA$43*$AA$48/$AA$44)	=IF(K22="NA","NA",$AA$35*F22*K22*$AA$43*$AA$48/$AA$44)
Copper	=IF(I23="NA","NA",$AA$37*D23*I23*$AA$43*$AA$48/$AA$44)	=IF(J23="NA","NA",$AA$38*F23*J23*$AA$43*$AA$48/$AA$44)	=IF(K23="NA","NA",$AA$35*F23*K23*$AA$43*$AA$48/$AA$44)
Lead	=IF(I24="NA","NA",$AA$37*D24*I24*$AA$43*$AA$48/$AA$44)	=IF(J24="NA","NA",$AA$38*F24*J24*$AA$43*$AA$48/$AA$44)	=IF(K24="NA","NA",$AA$35*F24*K24*$AA$43*$AA$48/$AA$44)
Mercury	=IF(I25="NA","NA",$AA$37*D25*I25*$AA$43*$AA$48/$AA$44)	=IF(J25="NA","NA",$AA$38*F25*J25*$AA$43*$AA$48/$AA$44)	=IF(K25="NA","NA",$AA$35*F25*K25*$AA$43*$AA$48/$AA$44)
Nickel	=IF(I26="NA","NA",$AA$37*D26*I26*$AA$43*$AA$48/$AA$44)	=IF(J26="NA","NA",$AA$38*F26*J26*$AA$43*$AA$48/$AA$44)	=IF(K26="NA","NA",$AA$35*F26*K26*$AA$43*$AA$48/$AA$44)
Selenium	=IF(I27="NA","NA",$AA$37*D27*I27*$AA$43*$AA$48/$AA$44)	=IF(J27="NA","NA",$AA$38*F27*J27*$AA$43*$AA$48/$AA$44)	=IF(K27="NA","NA",$AA$35*F27*K27*$AA$43*$AA$48/$AA$44)
Zinc	=IF(I28="NA","NA",$AA$37*D28*I28*$AA$43*$AA$48/$AA$44)	=IF(J28="NA","NA",$AA$38*F28*J28*$AA$43*$AA$48/$AA$44)	=IF(K28="NA","NA",$AA$35*F28*K28*$AA$43*$AA$48/$AA$44)

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x \, Cij}{BW} \right) \right] \right)$$

See appropriate text tables for equations.

Table F-4
Example Calculation of Tier 2 Chemicals of Potential Concern EEQs and Hazard Indices for Red Foxes at SWMU 51

Hazard Estimate - Tier 2
Red Fox

Chemical	PDE Mammals mg/kg-d	PDE Birds mg/kg-d	Total PDE mg/kg-d	Chemical-Specific Toxicity Value UF	NOAEL mg/kg-d
2,3,7,8-TCDD TE	=IF(L8="NA","NA",$AA$39*F8*L8*$AA$43*$AA$48/$AA$44)	=IF(M8="NA","NA",$AA$40*F8*M8*$AA$43*$AA$48/$AA$44)	=SUM(N8:V8)	8	0.000001
Benzo(a)anthracene	=IF(L9="NA","NA",$AA$39*F9*L9*$AA$43*$AA$48/$AA$44)	=IF(M9="NA","NA",$AA$40*F9*M9*$AA$43*$AA$48/$AA$44)	=SUM(N9:V9)	8	1
Benzo(a)pyrene	=IF(L10="NA","NA",$AA$39*F10*L10*$AA$43*$AA$48/$AA$44)	=IF(M10="NA","NA",$AA$40*F10*M10*$AA$43*$AA$48/$AA$44)	=SUM(N10:V10)	8	1
Benzo(b)fluoranthene	=IF(L11="NA","NA",$AA$39*F11*L11*$AA$43*$AA$48/$AA$44)	=IF(M11="NA","NA",$AA$40*F11*M11*$AA$43*$AA$48/$AA$44)	=SUM(N11:V11)	8	1
Benzo(g,h,i)perylene	=IF(L12="NA","NA",$AA$39*F12*L12*$AA$43*$AA$48/$AA$44)	=IF(M12="NA","NA",$AA$40*F12*M12*$AA$43*$AA$48/$AA$44)	=SUM(N12:V12)	8	1
Benzo(k)fluoranthene	=IF(L13="NA","NA",$AA$39*F13*L13*$AA$43*$AA$48/$AA$44)	=IF(M13="NA","NA",$AA$40*F13*M13*$AA$43*$AA$48/$AA$44)	=SUM(N13:V13)	8	1
Chrysene	=IF(L14="NA","NA",$AA$39*F14*L14*$AA$43*$AA$48/$AA$44)	=IF(M14="NA","NA",$AA$40*F14*M14*$AA$43*$AA$48/$AA$44)	=SUM(N14:V14)	8	1
Dibenz(a,h)anthracene	=IF(L15="NA","NA",$AA$39*F15*L15*$AA$43*$AA$48/$AA$44)	=IF(M15="NA","NA",$AA$40*F15*M15*$AA$43*$AA$48/$AA$44)	=SUM(N15:V15)	8	1
Fluoranthene	=IF(L16="NA","NA",$AA$39*F16*L16*$AA$43*$AA$48/$AA$44)	=IF(M16="NA","NA",$AA$40*F16*M16*$AA$43*$AA$48/$AA$44)	=SUM(N16:V16)	8	12.5
Indeno(1,2,3-cd)pyrene	=IF(L17="NA","NA",$AA$39*F17*L17*$AA$43*$AA$48/$AA$44)	=IF(M17="NA","NA",$AA$40*F17*M17*$AA$43*$AA$48/$AA$44)	=SUM(N17:V17)	8	1
Phenanthrene	=IF(L18="NA","NA",$AA$39*F18*L18*$AA$43*$AA$48/$AA$44)	=IF(M18="NA","NA",$AA$40*F18*M18*$AA$43*$AA$48/$AA$44)	=SUM(N18:V18)	8	1
Pyrene	=IF(L19="NA","NA",$AA$39*F19*L19*$AA$43*$AA$48/$AA$44)	=IF(M19="NA","NA",$AA$40*F19*M19*$AA$43*$AA$48/$AA$44)	=SUM(N19:V19)	8	7.5
Arsenic	=IF(L20="NA","NA",$AA$39*F20*L20*$AA$43*$AA$48/$AA$44)	=IF(M20="NA","NA",$AA$40*F20*M20*$AA$43*$AA$48/$AA$44)	=SUM(N20:V20)	8	0.126
Cadmium	=IF(L21="NA","NA",$AA$39*F21*L21*$AA$43*$AA$48/$AA$44)	=IF(M21="NA","NA",$AA$40*F21*M21*$AA$43*$AA$48/$AA$44)	=SUM(N21:V21)	8	1
Chromium	=IF(L22="NA","NA",$AA$39*F22*L22*$AA$43*$AA$48/$AA$44)	=IF(M22="NA","NA",$AA$40*F22*M22*$AA$43*$AA$48/$AA$44)	=SUM(N22:V22)	8	2737
Copper	=IF(L23="NA","NA",$AA$39*F23*L23*$AA$43*$AA$48/$AA$44)	=IF(M23="NA","NA",$AA$40*F23*M23*$AA$43*$AA$48/$AA$44)	=SUM(N23:V23)	8	11.7
Lead	=IF(L24="NA","NA",$AA$39*F24*L24*$AA$43*$AA$48/$AA$44)	=IF(M24="NA","NA",$AA$40*F24*M24*$AA$43*$AA$48/$AA$44)	=SUM(N24:V24)	8	8
Mercury	=IF(L25="NA","NA",$AA$39*F25*L25*$AA$43*$AA$48/$AA$44)	=IF(M25="NA","NA",$AA$40*F25*M25*$AA$43*$AA$48/$AA$44)	=SUM(N25:V25)	8	1
Nickel	=IF(L26="NA","NA",$AA$39*F26*L26*$AA$43*$AA$48/$AA$44)	=IF(M26="NA","NA",$AA$40*F26*M26*$AA$43*$AA$48/$AA$44)	=SUM(N26:V26)	8	40
Selenium	=IF(L27="NA","NA",$AA$39*F27*L27*$AA$43*$AA$48/$AA$44)	=IF(M27="NA","NA",$AA$40*F27*M27*$AA$43*$AA$48/$AA$44)	=SUM(N27:V27)	8	0.2
Zinc	=IF(L28="NA","NA",$AA$39*F28*L28*$AA$43*$AA$48/$AA$44)	=IF(M28="NA","NA",$AA$40*F28*M28*$AA$43*$AA$48/$AA$44)	=SUM(N28:V28)	8	160

ıdex (Total EEQ):

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x Cij}{BW} \right) \right] \right)$$

Table F-4
Example Calculation of Tier 2 Chemicals of Potential Concern EEQs and Hazard Indices for Red Foxes at SWMU 51

Hazard Estimate - Tier 2
Red Fox

Chemical	Adjusted NOAEL mg/kg-d	EEQ N	LOAEL mg/kg-d	Adjusted LOAEL mg/kg-d	EEQ L	Percent Contribution to EEQ N
2,3,7,8-TCDD TE	=IF(Y8="NA","NA",Y8/X8)	=IF(Y8="NA","NA",W8/Z8)	0.00001	=IF(AB8="NA","NA",AB8/X8)	=IF(AB8="NA","NA",W8/AC8)	=IF(Y8="NA","NA",AA8/$AA$31)
Benzo(a)anthracene	=IF(Y9="NA","NA",Y9/X9)	=IF(Y9="NA","NA",W9/Z9)	10	=IF(AB9="NA","NA",AB9/X9)	=IF(AB9="NA","NA",W9/AC9)	=IF(Y9="NA","NA",AA9/$AA$31)
Benzo(a)pyrene	=IF(Y10="NA","NA",Y10/X10)	=IF(Y10="NA","NA",W10/Z10)	10	=IF(AB10="NA","NA",AB10/X10)	=IF(AB10="NA","NA",W10/AC10)	=IF(Y10="NA","NA",AA10/$AA$31)
Benzo(b)fluoranthene	=IF(Y11="NA","NA",Y11/X11)	=IF(Y11="NA","NA",W11/Z11)	10	=IF(AB11="NA","NA",AB11/X11)	=IF(AB11="NA","NA",W11/AC11)	=IF(Y11="NA","NA",AA11/$AA$31)
Benzo(g,h,i)perylene	=IF(Y12="NA","NA",Y12/X12)	=IF(Y12="NA","NA",W12/Z12)	10	=IF(AB12="NA","NA",AB12/X12)	=IF(AB12="NA","NA",W12/AC12)	=IF(Y12="NA","NA",AA12/$AA$31)
Benzo(k)fluoranthene	=IF(Y13="NA","NA",Y13/X13)	=IF(Y13="NA","NA",W13/Z13)	10	=IF(AB13="NA","NA",AB13/X13)	=IF(AB13="NA","NA",W13/AC13)	=IF(Y13="NA","NA",AA13/$AA$31)
Chrysene	=IF(Y14="NA","NA",Y14/X14)	=IF(Y14="NA","NA",W14/Z14)	10	=IF(AB14="NA","NA",AB14/X14)	=IF(AB14="NA","NA",W14/AC14)	=IF(Y14="NA","NA",AA14/$AA$31)
Dibenz(a,h)anthracene	=IF(Y15="NA","NA",Y15/X15)	=IF(Y15="NA","NA",W15/Z15)	10	=IF(AB15="NA","NA",AB15/X15)	=IF(AB15="NA","NA",W15/AC15)	=IF(Y15="NA","NA",AA15/$AA$31)
Fluoranthene	=IF(Y16="NA","NA",Y16/X16)	=IF(Y16="NA","NA",W16/Z16)	25	=IF(AB16="NA","NA",AB16/X16)	=IF(AB16="NA","NA",W16/AC16)	=IF(Y16="NA","NA",AA16/$AA$31)
Indeno(1,2,3-cd)pyrene	=IF(Y17="NA","NA",Y17/X17)	=IF(Y17="NA","NA",W17/Z17)	10	=IF(AB17="NA","NA",AB17/X17)	=IF(AB17="NA","NA",W17/AC17)	=IF(Y17="NA","NA",AA17/$AA$31)
Phenanthrene	=IF(Y18="NA","NA",Y18/X18)	=IF(Y18="NA","NA",W18/Z18)	10	=IF(AB18="NA","NA",AB18/X18)	=IF(AB18="NA","NA",W18/AC18)	=IF(Y18="NA","NA",AA18/$AA$31)
Pyrene	=IF(Y19="NA","NA",Y19/X19)	=IF(Y19="NA","NA",W19/Z19)	12.5	=IF(AB19="NA","NA",AB19/X19)	=IF(AB19="NA","NA",W19/AC19)	=IF(Y19="NA","NA",AA19/$AA$31)
Arsenic	=IF(Y20="NA","NA",Y20/X20)	=IF(Y20="NA","NA",W20/Z20)	1.26	=IF(AB20="NA","NA",AB20/X20)	=IF(AB20="NA","NA",W20/AC20)	=IF(Y20="NA","NA",AA20/$AA$31)
Cadmium	=IF(Y21="NA","NA",Y21/X21)	=IF(Y21="NA","NA",W21/Z21)	10	=IF(AB21="NA","NA",AB21/X21)	=IF(AB21="NA","NA",W21/AC21)	=IF(Y21="NA","NA",AA21/$AA$31)
Chromium	=IF(Y22="NA","NA",Y22/X22)	=IF(Y22="NA","NA",W22/Z22)	13690	=IF(AB22="NA","NA",AB22/X22)	=IF(AB22="NA","NA",W22/AC22)	=IF(Y22="NA","NA",AA22/$AA$31)
Copper	=IF(Y23="NA","NA",Y23/X23)	=IF(Y23="NA","NA",W23/Z23)	15.1	=IF(AB23="NA","NA",AB23/X23)	=IF(AB23="NA","NA",W23/AC23)	=IF(Y23="NA","NA",AA23/$AA$31)
Lead	=IF(Y24="NA","NA",Y24/X24)	=IF(Y24="NA","NA",W24/Z24)	80	=IF(AB24="NA","NA",AB24/X24)	=IF(AB24="NA","NA",W24/AC24)	=IF(Y24="NA","NA",AA24/$AA$31)
Mercury	=IF(Y25="NA","NA",Y25/X25)	=IF(Y25="NA","NA",W25/Z25)	5	=IF(AB25="NA","NA",AB25/X25)	=IF(AB25="NA","NA",W25/AC25)	=IF(Y25="NA","NA",AA25/$AA$31)
Nickel	=IF(Y26="NA","NA",Y26/X26)	=IF(Y26="NA","NA",W26/Z26)	80	=IF(AB26="NA","NA",AB26/X26)	=IF(AB26="NA","NA",W26/AC26)	=IF(Y26="NA","NA",AA26/$AA$31)
Selenium	=IF(Y27="NA","NA",Y27/X27)	=IF(Y27="NA","NA",W27/Z27)	0.33	=IF(AB27="NA","NA",AB27/X27)	=IF(AB27="NA","NA",W27/AC27)	=IF(Y27="NA","NA",AA27/$AA$31)
Zinc	=IF(Y28="NA","NA",Y28/X28)	=IF(Y28="NA","NA",W28/Z28)	320	=IF(AB28="NA","NA",AB28/X28)	=IF(AB28="NA","NA",W28/AC28)	=IF(Y28="NA","NA",AA28/$AA$31)
		=SUM(AA8:AA28)			=SUM(AD8:AD28)	=SUM(AE8:AE28)

Species-Specific Factors

$$EJ = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x \, Cij}{BW} \right) \right] \right)$$

Plant diet fraction =	0.17	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0.04	unitless
Mammal diet fraction =	0.65	unitless
Bird diet fraction =	0.14	unitless
Soil ingestion rate =	0.0067	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.24	kg/d
Body weight =	4.53	kg
Home range =	2204	acres
Water intake rate =	0.39	L/d
Site Area =	0.13	acres
Frac. home range (FHR) =	=IF(((AA47/AA45)>1),1,(AA47/AA	unitless

Table F-4
Example Calculation of Tier 2 Chemicals of Potential Concern EEQs and Hazard Indices for Red Foxes at SWMU 51

Hazard Estimate - Tier 2
Red Fox

Chemical	Percent Contribution to EEQ L
2,3,7,8-TCDD TE	=IF(AB8="NA","NA",AD8/$AD$31)
Benzo(a)anthracene	=IF(AB9="NA","NA",AD9/$AD$31)
Benzo(a)pyrene	=IF(AB10="NA","NA",AD10/$AD$31)
Benzo(b)fluoranthene	=IF(AB11="NA","NA",AD11/$AD$31)
Benzo(g,h,i)perylene	=IF(AB12="NA","NA",AD12/$AD$31)
Benzo(k)fluoranthene	=IF(AB13="NA","NA",AD13/$AD$31)
Chrysene	=IF(AB14="NA","NA",AD14/$AD$31)
Dibenz(a,h)anthracene	=IF(AB15="NA","NA",AD15/$AD$31)
Fluoranthene	=IF(AB16="NA","NA",AD16/$AD$31)
Indeno(1,2,3-cd)pyrene	=IF(AB17="NA","NA",AD17/$AD$31)
Phenanthrene	=IF(AB18="NA","NA",AD18/$AD$31)
Pyrene	=IF(AB19="NA","NA",AD19/$AD$31)
Arsenic	=IF(AB20="NA","NA",AD20/$AD$31)
Cadmium	=IF(AB21="NA","NA",AD21/$AD$31)
Chromium	=IF(AB22="NA","NA",AD22/$AD$31)
Copper	=IF(AB23="NA","NA",AD23/$AD$31)
Lead	=IF(AB24="NA","NA",AD24/$AD$31)
Mercury	=IF(AB25="NA","NA",AD25/$AD$31)
Nickel	=IF(AB26="NA","NA",AD26/$AD$31)
Selenium	=IF(AB27="NA","NA",AD27/$AD$31)
Zinc	=IF(AB28="NA","NA",AD28/$AD$31)
	=SUM(AF8:AF28)

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x \, Cij}{BW} \right) \right] \right)$$

Table F-15
Recommended Bioaccumulation/Bioconcentration Factors or Regression Equations Utilized for the Soil-to-Plant Pathway at SWMU 51

Constituent	USEPA (2005) Eco-SSL Uptake Equation [a]	Alternate Regression Equation [c, d]	Alternate BAF/BCF	Recommended Tier 1 (Maximum) BAF/BCF	Rationale for Recommended Tier 1 BAF/BCF	Recommended Tier 2 (RME) BAF/BCF	Rationale for Recommended Tier 2 BAF/BCF
2,3,7,8-TCDD TE	-- [b]	Log (BCF)= -0.578(Log[Kow])+1.588 [d]	--	0.011	Travis & Arms K_{ow} Regression Eq.	0.0039	Travis & Arms Kow Regression Eq.
Benzo(a)anthracene	ln (Pc)= 0.5944(ln[soil])-2.7078	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)
Benzo(a)pyrene	ln (Pc)= 0.9750(ln[soil])-2.0615	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)
Benzo(b)fluoranthene	Pc= 0.31(soil)	--	--	0.31	Recommended BAF from USEPA (2007)	0.31	Recommended BAF from USEPA (2007f)
Benzo(g,h,i)perylene	ln (Pc)= 1.1829(ln[soil])-0.9313	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)
Benzo(k)fluoranthene	ln (Pc)= 0.8595(ln[soil])-2.1579	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)
Chrysene	ln (Pc)= 0.5944(ln[soil])-2.7078	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)
Dibenz(a,h)anthracene	Pc= 0.13(soil)	--	--	0.13	Recommended BAF from USEPA (2007)	0.13	Recommended BAF from USEPA (2007f)
Fluoranthene	Pc= 0.50(soil)	--	--	0.50	Recommended BAF from USEPA (2007)	0.50	Recommended BAF from USEPA (2007f)
Indeno(1,2,3-cd)pyrene	Pc= 0.11(soil)	--	--	0.11	Recommended BAF from USEPA (2007)	0.11	Recommended BAF from USEPA (2007f)
Phenanthrene	ln (Pc)= 0.6203(ln[soil])-0.1665	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)
Pyrene	Pc= 0.72(soil)	--	--	0.72	Recommended BAF from USEPA (2007)	0.72	Recommended BAF from USEPA (2007f)
Arsenic	Pc= 0.03752(soil)	--	--	0.03752	Recommended BAF from USEPA (2007)	0.0375	Recommended BAF from USEPA (2007f)
Cadmium	ln (Pc)= 0.546(ln[soil])-0.475	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)
Chromium	Pc= 0.041(soil)	--	--	0.041	Recommended BAF from USEPA (2007)	0.041	Recommended BAF from USEPA (2007f)
Copper	ln (Pc)= 0.394(ln[soil])+0.668	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)
Lead	ln (Pc)= 0.561(ln[soil])-1.328	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)
Mercury	--	ln (Pc)=0.54(ln[soil])-1.00	--	Regression Eq.	Efroymson, et al. Regression Equation	Regression Eq.	Efroymson, et al. Regression Equation
Nickel	ln (Pc)= 0.748(ln[soil])-2.223	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)
Selenium	ln (Pc)= 1.104(ln[soil])-0.677	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)
Zinc	ln (Pc)= 0.554(ln[soil])+1.575	--	--	Regression Eq.	Recommended Equation (USEPA 2007)	Regression Eq.	Recommended Equation (USEPA 2007f)

Notes: Pc (plant tissue concentration [mg/kg d.w.]); soil (concentration in soil [mg/kg d.w.]); BAF/BCF (bioaccumulation/bioconcentration factor); log K_{ow} (octanol/water partition coefficient).

[a] USEPA, 2007f, Ecological Soil Screening Level Guidance, Soil to Plant Uptake Equations, OSWER Directive 9285.7-55.

[b] -- indicates that a BAF/BCF or regression equation is not available or not applicable.

[c] for organic chemicals: BAF estimated using Travis and Arms (1988) K_{ow} regression equation, with the the lowest log K_{ow} literature value (Tier 1) or the recommended log K_{ow} from http://www.syrres.com/esc/est_kowdemo.htm (Tier 2). summarized as follows:

Constituent	Tier 1 Log K_{ow}	Tier 1 Reference	Tier 2 Log K_{ow}
2,3,7,8-TCDD TE	6.15	Montgomery, 1996	6.92

[d] for inorganic chemicals: Efroymson, R.A. et al., 2001, Uptake of Inorganic Chemicals from Soil by Plant Leaves: Regressions of Field Data, Environ. Tox. Chem., 20:2561-2571.

Table F-16
Recommended Bioaccumulation/Bioconcentration Factors or Regression Equations Utilized for the Soil-to-Earthworm Pathway at SWMU 51

Constituent	USEPA (2007) Eco-SSL Uptake Equation [a]	Sample, et al. 1998 [b]			Sample et al. 1999 [c]	Recommended Tier 1 (Maximum) BAF/BCF	Rationale for Recommended Tier 1 BAF/BCF	Recommended Tier 2 (RME) BAF/BCF	Rationale for Recommended Tier 2 BAF/BCF
		Median BAF/BCF	90th Percentile BAF/BCF	Maximum BAF/BCF	Regression Equation				
2,3,7,8-TCDD TE	-- [d]	11.011	22.229	42.068	ln (EW)=1.18(ln[soil])+3.53	42.068	Maximum value	Regression Eq.	Chemical-specific Regression Eq.
Benzo(a)anthracene	(EW)= 1.59(soil)	--	--	--	--	1.59	Recommended BAF (USEPA 2007f)	1.59	Recommended BAF (USEPA 2007f)
Benzo(a)pyrene	(EW)= 1.33(soil)	--	--	--	--	1.33	Recommended BAF (USEPA 2007f)	1.33	Recommended BAF (USEPA 2007f)
Benzo(b)fluoranthene	(EW)= 2.6(soil)	--	--	--	--	2.6	Recommended BAF (USEPA 2007f)	2.6	Recommended BAF (USEPA 2007f)
Benzo(g,h,i)perylene	(EW)= 2.94(soil)	--	--	--	--	2.94	Recommended BAF (USEPA 2007f)	2.94	Recommended BAF (USEPA 2007f)
Benzo(k)fluoranthene	(EW)= 2.6(soil)	--	--	--	--	2.6	Recommended BAF (USEPA 2007f)	2.6	Recommended BAF (USEPA 2007f)
Chrysene	(EW)= 2.29(soil)	--	--	--	--	2.29	Recommended BAF (USEPA 2007f)	2.29	Recommended BAF (USEPA 2007f)
Dibenz(a,h)anthracene	(EW)= 2.31(soil)	--	--	--	--	2.31	Recommended BAF (USEPA 2007f)	2.31	Recommended BAF (USEPA 2007f)
Fluoranthene	(EW)= 3.04(soil)	--	--	--	--	3.04	Recommended BAF (USEPA 2007f)	3.04	Recommended BAF (USEPA 2007f)
Indeno(1,2,3-cd)pyrene	(EW)= 2.86(soil)	--	--	--	--	2.86	Recommended BAF (USEPA 2007f)	2.86	Recommended BAF (USEPA 2007f)
Phenanthrene	(EW)= 1.72(soil)	--	--	--	--	1.72	Recommended BAF (USEPA 2007f)	1.72	Recommended BAF (USEPA 2007f)
Pyrene	(EW)= 1.75(soil)	--	--	--	--	1.75	Recommended BAF (USEPA 2007f)	1.75	Recommended BAF (USEPA 2007f)
Arsenic	ln (EW)= 0.706(ln[soil])-1.421	--	--	--	--	Regression Eq.	Recommended Equation (USEPA 2007f)	Regression Eq.	Recommended Equation (USEPA 2007f)
Cadmium	ln (EW)= 0.795(ln[soil])+2.114	--	--	--	--	Regression Eq.	Recommended Equation (USEPA 2007f)	Regression Eq.	Recommended Equation (USEPA 2007f)
Chromium	(EW)= 0.306(soil)	--	--	--	--	0.306	Recommended BAF (USEPA 2007f)	0.306	Recommended BAF (USEPA 2007f)
Copper	(EW)= 0.515(soil)	--	--	--	--	0.515	Recommended BAF (USEPA 2007f)	0.515	Recommended BAF (USEPA 2007f)
Lead	ln (EW)= 0.807(ln[soil])-0.218	--	--	--	--	Regression Eq.	Recommended Equation (USEPA 2007f)	Regression Eq.	Recommended Equation (USEPA 2007f)
Mercury	--	1.693	20.625	33	ln (EW)=0.33(ln[soil])+0.078	33	Maximum value	Regression Eq.	Chemical-specific Regression Eq.
Nickel	--	1.059	4.73	7.8	--	7.8	Maximum value	1.059	Median Value
Selenium	ln (EW)= 0.733(ln[soil])-0.075	--	--	--	--	Regression Eq.	Recommended Equation (USEPA 2007f)	Regression Eq.	Recommended Equation (USEPA 2007f)
Zinc	ln (EW)= 0.328(ln[soil])+4.449	--	--	--	--	Regression Eq.	Recommended Equation (USEPA 2007f)	Regression Eq.	Recommended Equation (USEPA 2007f)

Notes: EW (earthworm tissue concentration [mg/kg d.w.]); soil (concentration in soil [mg/kg d.w.]); BAF/BCF (bioaccumulation/bioconcentration factor); log Kow (octanol/water partition coefficient).

[a] USEPA, 2007f, Ecological Soil Screening Level Guidance (Eco-SSL), Soil to Earthworm Uptake Equations, OSWER Directive 9285.7-55.

[b] Sample, B.E. et al., 1998. Development and Validation of Bioaccumulation Models for Earthworms, ES/ER/TM-220.

[c] Sample, B.E. et al., 1999, Literature-Derived Bioaccumulation Models for Earthworms: Development and Validation, Environ. Toxicol. Chem., 18:9; pp. 2,110-2,120. (models from Table 3 of publication).

[d] -- indicates that a BAF/BCF or regression equation is not available or not applicable.

Table F-17
Recommended Bioaccumulation/Bioconcentration Factors Utilized for the Soil-to-Small Mammal and Bird Pathways at SWMU 51

Constituent	USEPA (2005b) Eco-SSL Uptake Equation [a]	Sample et al., 1998 [b]						Recommended Tier 1 (Maximum) BAF/BCF	Rationale for Recommended Tier 1 BAF/BCF	Recommended Tier 2 (90^{th} Percentile - RME) BAF/BCF	Rationale for Recommended Tier 2 BAF/BCF
		Insectivore Median BAF/BCF	Herbivore Median BAF/BCF	Omnivore Median BAF/BCF	General [c] Median BAF/BCF	General [c] Maximum BAF/BCF	General [c] 90^{th} percentile BAF/BCF				
2,3,7,8-TCDD TE	--[d]	--	1.2857	0.7783	1.07	2.2	2.2	2.2	General maximum value	2.2	General 90th percentile value
Benzo(a)anthracene	Mam = 0 [e]	--	--	--	--	--	--	0	Uptake assumed to be negligible (USEPA 2007f)	0	Uptake assumed to be negligible (USEPA 2007f)
Benzo(a)pyrene	Mam = 0	--	--	--	--	--	--	0	Uptake assumed to be negligible (USEPA 2007f)	0	Uptake assumed to be negligible (USEPA 2007f)
Benzo(b)fluoranthene	Mam = 0	--	--	--	--	--	--	0	Uptake assumed to be negligible (USEPA 2007f)	0	Uptake assumed to be negligible (USEPA 2007f)
Benzo(g,h,i)perylene	Mam = 0	--	--	--	--	--	--	0	Uptake assumed to be negligible (USEPA 2007f)	0	Uptake assumed to be negligible (USEPA 2007f)
Benzo(k)fluoranthene	Mam = 0	--	--	--	--	--	--	0	Uptake assumed to be negligible (USEPA 2007f)	0	Uptake assumed to be negligible (USEPA 2007f)
Chrysene	Mam = 0	--	--	--	--	--	--	0	Uptake assumed to be negligible (USEPA 2007f)	0	Uptake assumed to be negligible (USEPA 2007f)
Dibenz(a,h)anthracene	Mam = 0	--	--	--	--	--	--	0	Uptake assumed to be negligible (USEPA 2007f)	0	Uptake assumed to be negligible (USEPA 2007f)
Fluoranthene	Mam = 0	--	--	--	--	--	--	0	Uptake assumed to be negligible (USEPA 2007f)	0	Uptake assumed to be negligible (USEPA 2007f)
Indeno(1,2,3-cd)pyrene	Mam = 0	--	--	--	--	--	--	0	Uptake assumed to be negligible (USEPA 2007f)	0	Uptake assumed to be negligible (USEPA 2007f)
Phenanthrene	Mam = 0	--	--	--	--	--	--	0	Uptake assumed to be negligible (USEPA 2007f)	0	Uptake assumed to be negligible (USEPA 2007f)
Pyrene	Mam = 0	--	--	--	--	--	--	0	Uptake assumed to be negligible (USEPA 2007f)	0	Uptake assumed to be negligible (USEPA 2007f)
Arsenic	ln(mam)= 0.8188(ln[soil])-4.8471	--	--	--	--	--	--	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)
Cadmium	ln(mam)= 0.4723(ln[soil])-1.2571	--	--	--	--	--	--	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)
Chromium	ln(mam)= 0.7338(ln[soil])-1.4599	--	--	--	--	--	--	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)
Copper	ln(mam)= 0.144(ln[soil])+2.042	--	--	--	--	--	--	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)
Lead	ln(mam)= 0.4422(ln[soil])+0.0761	--	--	--	--	--	--	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)
Mercury	--	1.046 [f]	0.0239 [f]	0.0543	0.0543	1.046	0.192	1.046	General maximum value	0.192	General 90th percentile value
Nickel	ln(mam)= 0.4658(ln[soil])-0.2462	--	--	--	--	--	--	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)
Selenium	ln(mam)= 0.3764(ln[soil])-0.4158	--	--	--	--	--	--	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)
Zinc	ln(mam)= 0.0706(ln[soil])+4.3632	--	--	--	--	--	--	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)	Regression Eq.	Recommended Regression Eq. (USEPA 2007f)

Notes: mam (mammal or bird tissue concentration [mg/kg d.w.]); diet (concentration in diet [mg/kg d.w.] assuming 100% earthworm consumption); soil (concentration in soil [mg/kg d.w.]); BAF/BCF (bioaccumulation/bioconcentration factor).
Bird BAF/BCF values were based on the recommended small mammal BAF/BCF values, as bird uptake values are not readily available.

[a] USEPA, 2007f, Ecological Soil Screening Level Guidance, Soil to Small Mammal Uptake Equations, OSWER Directive 9285.7-55.

[b] Sample et al., 1998, Development and Validation of Bioaccumulation Models for Small Mammals, ES/ER/TM-219.

[c] General = combination dataset used for insectivore, herbivore, and omnivore receptors to estimate a "general" receptor BAF/BCF value.

[d] -- indicates that a BAF/BCF is not available or not applicable.

[e] Uptake assumed to be negligible (USEPA, 2005b).

[f] Only one BAF/BCF value available for exposure to mercury in soil (median is also 90th percentile value and maximum value).

Table F-18
NOAEL Toxicity Reference Values Used to Derive
Wildlife Toxicity Benchmarks for COPECs at SWMU 51

COPEC	Mammalian Data				Avian Data			
	Toxicity Value	NOAEL (mg/kg/d)	Test Species	Reference	Toxicity Value	NOAEL (mg/kg/d)	Test Species	Reference
Organics								
2,3,7,8-TCDD TE	--	0.000001	rat	Sample et al. (1996)	--	0.000014	ring-necked pheasant	Sample et al. (1996)
Benzo(a)anthracene	--	1	mouse	Based on B(a)P, Sample et al. (1996)	--	553	mallard duck	Based on B(a)P, Eisler (1987)
Benzo(a)pyrene	10 (LOAEL)	1	mouse	Sample et al. (1996)	--	553	mallard duck	Eisler (1987)
Benzo(b)fluoranthene	--	1	mouse	Based on B(a)P, Sample et al. (1996)	--	553	mallard duck	Based on B(a)P, Eisler (1987)
Benzo(g,h,i)perylene	--	1	mouse	Based on B(a)P, Sample et al. (1996)	--	553	mallard duck	Based on B(a)P, Eisler (1987)
Benzo(k)fluoranthene	--	1	mouse	Based on B(a)P, Sample et al. (1996)	--	553	mallard duck	Based on B(a)P, Eisler (1987)
Chrysene	--	1	mouse	Based on B(a)P, Sample et al. (1996)	--	553	mallard duck	Based on B(a)P, Eisler (1987)
Dibenz(a,h)anthracene	--	1	mouse	Based on B(a)P, Sample et al. (1996)	--	553	mallard duck	Based on B(a)P, Eisler (1987)
Fluoranthene	125 (subchronic)	12.5	mouse	IRIS (USEPA, 2007c)	--	553	mallard duck	Based on B(a)P, Eisler (1987)
Indeno(1,2,3-cd)pyrene	--	1	mouse	Based on B(a)P, Sample et al. (1996)	--	553	mallard duck	Eisler (1987)
Phenanthrene	--	1	mouse	Based on B(a)P, Sample et al. (1996)	--	553	mallard duck	Eisler (1987)
Pyrene	75 (subchronic)	7.5	mouse	IRIS (EPA, 2007c)	--	553	mallard duck	Eisler (1987)
Inorganics								
Arsenic	--	0.126	mouse	Sample et al. (1996)	--	5.14	mallard duck	Sample et al. (1996)
Cadmium	--	1	rat	Sample et al. (1996)	--	1.45	mallard duck	Sample et al. (1996)
Chromium	--	2737	rat	Sample et al. (1996)	--	2.66	chicken, black duck, turkey	USEPA (2005b)
Copper	--	11.7	mink	Sample et al. (1996)	--	47	chicks	Sample et al. (1996)
Lead	--	8	rat	Sample et al. (1996)	--	3.85	American kestrel	Sample et al. (1996)
Mercury	--	1	mink	Sample et al. (1996)	--	0.45	Japanese quail	Sample et al. (1996)
Nickel	--	40	rat	Sample et al. (1996)	--	77.4	mallard duck	Sample et al. (1996)
Selenium	--	0.2	rat	Sample et. al. (1996)	--	0.5	mallard duck	Sample et al. (1996)
Zinc	--	160	rat	Sample et al. (1996)	--	14.5	hens	Sample et al. (1996)

NA indicates that the information is not available.

As recommended by Wentsel et al. (1996), Tri-Service Procedural Guidelines for Ecological Risk Assessments, the following adjustments were made to toxicity data when NOAEL or LOAEL data were not available:

- Subchronic LOAELs were converted to chronic NOAELs by dividing by a factor of 20.
- Chronic NOAELs were converted to chronic LOAELs by multiplying by a factor of 5.0.
- Subchronic NOAELs/LOAELs were converted to chronic NOAELs/LOAELs by dividing by a factor of 10.
- Chronic LOAELs were converted to chronic NOAELs by dividing by a factor of 10.
- LD_{50} concentrations were converted to chronic NOAELs by dividing by a factor of 100.
- LD_{50} concentrations were converted to chronic LOAELs by dividing by a factor of 20.

Eisler, 1987, PAH Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review.
Sample et al., 1996, Toxicological Benchmarks for Wildlife.
USEPA, 2005b, Ecological Screening Levels (Eco-SSL).
USEPA, 2007c, Integrated Risk Information System (IRIS).

Table F-19
LOAEL Toxicity Reference Values Used to Derive
Wildlife Toxicity Benchmarks for COPECs at SWMU 51

COPEC	Mammalian Data				Avian Data			
	Toxicity Value	LOAEL (mg/kg/d)	Test Species	Reference	Toxicity Value	LOAEL (mg/kg/d)	Test Species	Reference
Organics								
2,3,7,8-TCDD TE	--	0.00001	rat	Sample et al. (1996)	--	0.00014	ring-necked pheasant	Sample et al. (1996)
Benzo(a)anthracene	--	10.0	mouse	Based on Benzo(a)pyrene, Sample et al. (1996)	553 (NOAEL)	2765.0	mallard duck	Based on B(a)P, Eisler (1987)
Benzo(a)pyrene	--	10.0	mouse	Sample et al. (1996)	553 (NOAEL)	2765.0	mallard duck	Eisler (1987)
Benzo(b)fluoranthene	--	10.0	mouse	Based on Benzo(a)pyrene, Sample et al. (1996)	553 (NOAEL)	2765.0	mallard duck	Based on B(a)P, Eisler (1987)
Benzo(g,h,i)perylene	--	10.0	mouse	Based on Benzo(a)pyrene, Sample et al. (1996)	553 (NOAEL)	2765.0	mallard duck	Based on B(a)P, Eisler (1987)
Benzo(k)fluoranthene	--	10.0	mouse	Based on Benzo(a)pyrene, Sample et al. (1996)	553 (NOAEL)	2765.0	mallard duck	Based on B(a)P, Eisler (1987)
Chrysene	--	10.0	mouse	Based on Benzo(a)pyrene, Sample et al. (1996)	553 (NOAEL)	2765.0	mallard duck	Based on B(a)P, Eisler (1987)
Dibenz(a,h)anthracene	--	10.0	mouse	Based on Benzo(a)pyrene, Sample et al. (1996)	553 (NOAEL)	2765.0	mallard duck	Based on B(a)P, Eisler (1987)
Fluoranthene	25 (subchronic)	25.0	mouse	IRIS (EPA, 2007c)	553 (NOAEL)	2765.0	mallard duck	Based on B(a)P, Eisler (1987)
Indeno(1,2,3-cd)pyrene	--	10.0	mouse	Based on Benzo(a)pyrene, Sample et al. (1996)	553 (NOAEL)	2765.0	mallard duck	Based on B(a)P, Eisler (1987)
Phenanthrene	--	10.0	mouse	Based on Benzo(a)pyrene, Sample et al. (1996)	553 (NOAEL)	2765.0	mallard duck	Based on B(a)P, Eisler (1987)
Pyrene	125 (subchronic)	12.5	mouse	IRIS (EPA, 2007c)	553 (NOAEL)	2765.0	mallard duck	Based on B(a)P, Eisler (1987)
Inorganics								
Arsenic	--	1.26	mouse	Sample et al. (1996)	--	12.84	mallard duck	Sample et al. (1996)
Cadmium	--	10.0	rat	Sample et al. (1996)	--	20	mallard duck	Sample et al. (1996)
Chromium	2,737 (NOAEL)	13690	rat	Sample et al. (1996)	--	2.78	chicken, black duck, turkey	USEPA (2005b)
Copper	--	15.10	mink	Sample et al. (1996)	--	62	chicks	Sample et al. (1996)
Lead	--	80.0	rat	Sample et al. (1996)	3.85 (NOAEL)	19.25	American kestrel	Sample et al. (1996)
Mercury	1.0 (NOAEL)	5.00	mink	Sample et al. (1996)	--	0.9	Japanese quail	Sample et al. (1996)
Nickel	--	80.0	rat	Sample et al. (1996)	--	107	mallard duck	Sample et al. (1996)
Selenium	--	0.33	rat	Sample et. al. (1996)	--	1	mallard duck	Sample et. al. (1996)
Zinc	--	320	rat	Sample et al. (1996)	--	131	hens	Sample et al. (1996)

NA indicates that the information is not available.

As recommended by Wentsel, et. al. (1996), Tri-Service Procedural Guidelines for Ecological Risk Assessments, the following adjustments were made to toxicity data when NOAEL or LOAEL data were not available:

- Subchronic LOAELs were converted to chronic NOAELs by dividing by a factor of 20.
- Chronic NOAELs were converted to chronic LOAELs by multiplying by a factor of 5.0.
- Subchronic NOAELs/LOAELs were converted to chronic NOAELs/LOAELs by dividing by a factor of 10.
- Chronic LOAELs were converted to chronic NOAELs by dividing by a factor of 10.
- LD_{50} concentrations were converted to chronic NOAELs by dividing by a factor of 100.
- LD_{50} concentrations were converted to chronic LOAELs by dividing by a factor of 20.

Eisler, 1987, PAH Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review.
Sample et al., 1996, Toxicological Benchmarks for Wildlife.
USEPA, 2005b, Ecological Screening Levels (Eco-SSL).
USEPA, 2007c, Integrated Risk Information System (IRIS).

Table F-20
Uncertainty Factors[a] for Ecological TRV[b] Extrapolations[c] at SWMU 51

Laboratory Animals				Selected Site Receptor Species	
Rat	G: Rattus F: Muridae O: Rodentia	Japanese quail	G: Coturnix F: Phasianidae O: Galliformes	Meadow vole	G: Microtus F: Muridae O: Rodentia
Mouse	G: Mus F: Muridae O: Rodentia	Chick, Poultry	G: Gallus F: Phasianidae O: Galliformes	Short-tailed shrew	G: Blarina F: Soricidae O: Insectivora
Mink	G: Mustela F: Mustelidae O: Carnivora	Black duck, Mallard	G: Anas F: Anatidae O: Anseriformes	American robin	G: Turdus F: Muscicapidae O: Passeriformes
Pheasant	G: Phasianus F: Phasianidae O: Galliformes	American kestrel	G: Falco F: Falconidae O: Ciconiiformes	Red-tailed hawk	G: Buteo F: Accipitridae O: Ciconiiformes
				Red fox	G: Vulpes F: Canidae O: Carnivora

[a] From ***Tri-Service Procedural Guidelines for Ecological Risk Assessment*** (Wentsel et al. 1996)
[b] TRV = Toxicity Reference Value
[c] Interclass extrapolations not performed; only within bird class or within mammal class.

The Uncertainty Factors Used for TRV Extrapolations are Summarized Below:

- Extrapolation between two different species = uncertainty factor of 2
- Extrapolation between two different genera (G) = uncertainty factor of 4
- Extrapolation between two different families (F) or orders (O) = uncertainty factor of 8

Appendix G

USEPA Guidance Documents and Remedial Goal Calculations

Appendix G-1

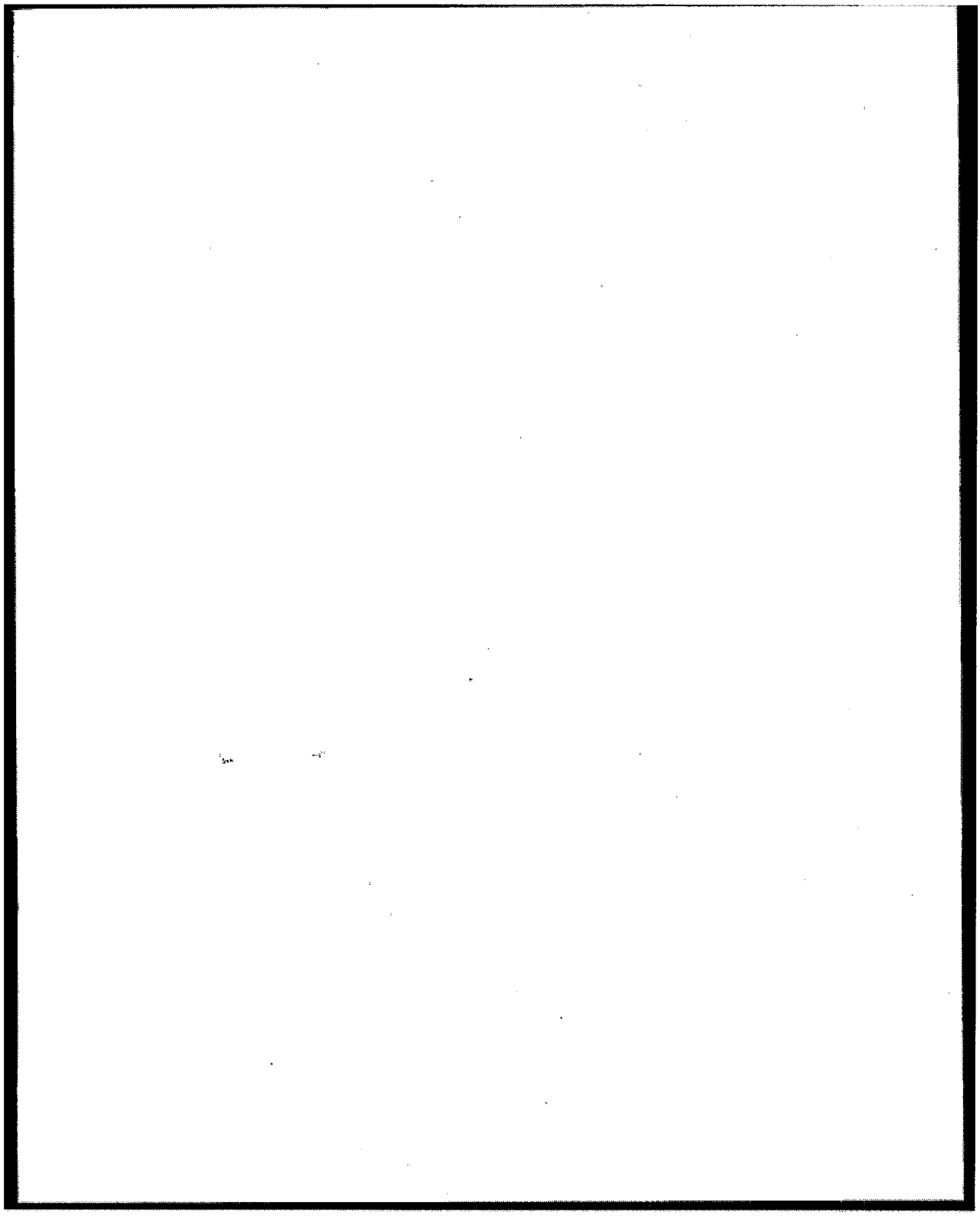
USEPA Guidance Documents

United States Environmental Protection Agency | Solid Waste and Emergency Response (5101) | EPA540-F-98-030 NTIS: PB98-963 244 August 1998

EPA

Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities

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CLARIFICATION TO THE 1994 REVISED INTERIM SOIL LEAD GUIDANCE FOR CERCLA SITES AND RCRA CORRECTIVE ACTION FACILITIES

OSWER DIRECTIVE # 9200.4-27

AUGUST 1998

OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

9200.4-27
EPA/540/F-98/030
PB98-963244

AUG 27 1998

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

OSWER Directive # 9200.4-27P

MEMORANDUM

SUBJECT: Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities

FROM: Timothy Fields, Jr.
Acting Assistant Administrator

TO: Regional Administrators I-X

PURPOSE

This directive clarifies the existing 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OSWER Directive 9355.4-12. Specifically, this directive clarifies OSWER's policy on (1) using EPA's Science Advisory Board (SAB) reviewed Integrated Exposure Uptake Biokinetic Model (IEUBK) and blood lead studies, (2) determining the geographic area to use in evaluating human exposure to lead contamination ("exposure units"), (3) addressing multimedia lead contamination and (4) determining appropriate response actions at lead sites. The purpose for clarifying the existing 1994 directive is to promote national consistency in decision-making at CERCLA and RCRA lead sites across the country.

BACKGROUND

OSWER Directive 9355.4-12, issued on July 14, 1994 established OSWER's current approach to addressing lead in soil at CERCLA and RCRA sites. The existing directive established a streamlined approach for determining protective levels for lead in soil at CERCLA sites and RCRA facilities as follows:

- It recommends a 400 ppm screening level for lead in soil at residential properties;
- It describes how to develop site-specific preliminary remediation goals (PRGs) at CERCLA sites and media cleanup standards at RCRA Corrective Action facilities for

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residential land use; and,

- It describes a strategy for management of lead contamination at CERCLA sites and RCRA Corrective Action facilities that have multiple sources of lead.

The existing interim directive provides direction regarding risk assessment and risk management approaches for addressing soil lead contaminated sites. The OSWER directive states that, " ... implementation of this guidance is expected to provide more consistent decisions across the country ..." However, since that directive was released, OSWER determined that clarification of the guidance is needed. Key areas being clarified by issuance of this directive include: (1) using the IEUBK model and blood lead studies, (2) determining exposure units to be considered in evaluating risk and developing risk management strategies, (3) addressing multimedia lead contamination and (4) determining appropriate response actions at residential lead sites. The existing directive provides the following guidance on these areas:

1. The OSWER directive recommends using the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children (Pub. # 9285.7-15-1, PB93-963510) for setting site-specific residential preliminary risk-based remediation goals (PRGs) at CERCLA sites and media cleanup standards (MCSs) at RCRA corrective actions Facilities. The directive states that the IEUBK model is the best tool currently available for predicting the potential blood lead levels of children exposed to lead in the environment. OSWER's directive also recommends the evaluation of blood lead data, where available, and states that well-conducted blood lead studies provide useful information to site managers. The directive however recommends that "... blood lead data not be used alone to assess risk from lead exposure or to develop soil lead cleanup levels."

2. The directive describes OSWER's risk reduction goal as "...generally, OSWER will attempt to limit exposure to soil lead levels such that a typical (or hypothetical) child or group of similarly exposed children would have an estimated risk of no more than 5% of exceeding a 10 ug/dl blood lead level." The directive also states that "... EPA recommends that a soil lead concentration be determined so that a typical child or group of children exposed to lead at this level would have an estimated risk of no more than 5% of exceeding a blood lead of 10 ug/dl." OSWER generally defines an exposure unit as a geographic area where exposures occur to the receptor of concern during the time of interest and believes that for a child or group of similarly exposed children, this is typically the individual residence and other areas where routine exposures are occurring.

3. The directive recommends that risk managers assess the contribution of multiple environmental sources of lead to overall lead exposure (e.g., consideration of the importance of soil lead levels relative to lead from drinking water, paint, and household dust) which promotes development of risk reduction strategies that address all sources that contribute significantly to exposure.

4. The OSWER directive states that the IEUBK model is not the only factor to be considered in establishing lead cleanup goals. Rather, the IEUBK model is the primary risk assessment tool available for evaluating lead risk and the results of the model are used to guide selection of appropriate risk management strategies for each site.

Since the OSWER directive was issued in 1994, there has been a trend toward a more consistent approach to managing risk at residential lead sites, however, OSWER was interested in identifying areas requiring additional clarification to facilitate more effective implementation of the directive. As a first step in the process, meetings were held with various EPA Regions, States and local governments to discuss how the directive has been implemented nationally at lead sites since 1994. By participating in these meetings and by reviewing the decisions that are being made across the country, OSWER believed that clarification of certain aspects of the 1994 directive would be useful.

All of the documents and guidance referenced in this directive are available through the National Technical Information Service (NTIS) at 703-605-6000 or could be downloaded electronically from: http//epa.gov/superfund/oerr/ini_prod/lead/prods.htm.

OBJECTIVE

At lead contaminated residential sites, OSWER seeks assurance that the health of the most susceptible population (children and women of child bearing age) is protected and promotes a program that proactively assesses and addresses risk. OSWER believes that predictive tools should be used to evaluate the risk of lead exposure, and that cleanup actions should be designed to address both current and potential future risk.

While health studies, surveys, and monitoring can be valuable in identifying current exposures and promoting improved public health, they are not definitive tools in evaluating potential risk from exposure to environmental contaminants. In the case of lead exposure, blood lead monitoring programs can be of critical importance in identifying individuals experiencing potential negative health outcomes and directing education and intervention resources to address those risks. However, CERCLA §121(b) requires EPA to select cleanup approaches that are protective of human health and the environment and that utilize permanent solutions to the maximum extent practicable. To comply with the requirements set forth in CERCLA § 121(b), OSWER will generally require selection of cleanup programs that are proactive in mitigating risk and that do not simply rely on biological monitoring programs to determine if an exposure has already occurred.

To meet these objectives, OSWER will seek actions that limit exposure to soil lead levels such that a typical child or group of similarly exposed children would have an estimated risk of no more than 5% of exceeding a 10 ug/dl blood lead level. If lead is predicted to pose a risk to the susceptible population, OSWER recommends that actions be taken to significantly minimize or eliminate this exposure to lead.

The principles laid out in the four attached factsheets (Appendix) support OSWER's goals by encouraging appropriate assessment and response actions at CERCLA and RCRA lead sites across the country.

This clarification directive emphasizes the following key messages regarding the four areas and encourages the users of this directive, be they EPA Regions, States, or other stakeholders, to adopt these principles in assessing and managing CERCLA and RCRA lead sites across the country. The critical elements of the attached papers are as follows:

I. Using Blood Lead Studies and IEUBK Model at Lead Sites:

OSWER emphasizes the use of the IEUBK Model for estimating risks for childhood lead exposure from a number of sources, such as soils, dust, air, water, and other sources to predict blood lead levels in children 6 months to 84 (7 years) months old. The 1994 directive also recommended evaluation of available blood lead data and stated that data from a well-conducted blood lead study of children could provide useful information to site managers. In summary, OSWER's clarification policy on the appropriate use of the IEUBK and blood lead studies is that:

- OSWER recommends that the IEUBK model be used as the primary tool to generate risk-based soil cleanup levels at lead sites for current or future residential land use. If Regions propose an alternative method for generating cleanup levels, they are required to submit their approach to the national Lead Sites Consultation Group (LSCG)(1) for review and comment ;
- Response actions can be taken using IEUBK predictions alone; blood lead studies are not required; and
- Blood lead studies and surveys are useful tools at lead sites and can be used to identify key site-specific exposure pathways and to direct health professionals to individuals needing immediate assistance in minimizing lead exposure; however, OSWER recommends that blood lead studies not be used for establishing long-term remedial or non-time-critical removal cleanup levels at lead sites.

II. Determining Exposure and Remediation Units at Lead Sites

OSWER recommends that cleanup levels at lead sites be designed to reduce risk to a typical or individual child receiving exposures at the residence to meet Agency guidelines (i.e., no greater

(1) The Lead Sites Consultation Group (LSCG) is comprised of senior management representatives from the Waste Management Divisions in all 10 EPA regions along with senior representatives from the Office of Emergency and Remedial Response in EPA headquarters. The LSCG is supported by EPA's Technical Review Workgroup (TRW) for lead and the national Lead Sites Workgroup (LSW). The TRW consists of key scientific experts in lead risk assessment from various EPA Regions, labs and headquarters. The LSW is comprised of senior Regional Project Managers from various Regions and key representatives from headquarters who are experienced in addressing lead threats at Superfund sites.

than a 5% chance of exceeding a 10 ug/dl blood-lead level for a full-time child resident).

Therefore, it is recommended that risk assessments conducted at lead-contaminated residential sites use the individual residence as the primary exposure unit of concern. This does not mean that a risk assessment should be conducted for every yard, rather that the soil lead contamination data from yards and other residential media (for example, interior dust and drinking water) should be input into the IEUBK model to provide a preliminary remediation goal (PRG) for the residential setting. When applicable, potential exposure to accessible site-related lead sources outside the residential setting should also be evaluated to understand how these other potential exposures contribute to the overall risk to children, and to suggest appropriate cleanup measures for those areas.

III. Addressing Multimedia Contamination at Lead Sites

EPA generally has limited legal authority to use Superfund to address exposure from **interior lead-based paint**. As a policy matter, OSWER recommends that such exposures not be addressed through actual abatement activities. However, EPA Regions should promote addressing interior paint risks through actions by others (e.g., potentially responsible parties (PRPs), other government programs, etc.) as a component of an overall site management strategy.

Because of other competing demands on the Superfund Trust Fund, OSWER recommends that EPA Regions avoid using the Superfund Trust Fund for removing **exterior lead-based paint** and soil contaminated from lead-based paint. Superfund dollars *may* however be used in limited circumstances to remediate exterior lead-based paint in order to protect the overall site remedy (i.e., to avoid re-contamination of soils that have been remediated) but generally only after determining that other funding sources are unavailable. As with interior lead-based paint abatement, EPA Regions should promote remediation of exterior lead-based paint by others, such as PRPs, local governments or individual homeowners.

IV. Determining Appropriate Response Actions at Lead Sites

In selecting site management strategies, it is OSWER's preference to seek early risk reduction with a combination of engineering controls (actions which permanently remove or treat contaminants, or create reliable barriers to mitigate the risk of exposure) and non-engineering response actions. All potential lead sources should be identified in site assessment activities. Non-engineering response actions, such as education and health intervention programs, should be considered an integral part of early risk reduction efforts because of their potential to provide immediate health benefits. In addition, engineering controls should be implemented early at sites presenting the greatest risk to children and other susceptible subpopulations.

As a given project progresses, OSWER's goal should be to reduce the reliance on education and intervention programs to mitigate risk. The goal should be cleanup strategies that move away from reliance on long-term changes in community behavior to be protective since behavioral

changes may be difficult to maintain over time. The actual remedy selected at each CERCLA site must be determined by application of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (55 FR 8666- 8865, March 8, 1990) remedy selection criteria to site-specific circumstances. This approach also recognizes the NCP preference for permanent remedies and emphasizes selection of engineering over non-engineering remedies for long-term response actions.

This directive clarifies OSWER's policy on four key issue areas addressed in the 1994 OSWER soil lead directive in order to promote a nationally consistent decision-making process for assessing and managing risks associated with lead contaminated sites across the country. The policy presented in these specific issue areas supersedes all existing OSWER policy and directives on these subjects. No other aspects of the existing 1994 directive are affected.

IMPLEMENTATION

The principles laid out in this directive (which includes the four attached factsheets) are meant to apply to all residential lead sites currently being evaluated through the CERCLA Remedial Investigation/Feasibility Study process and all future CERCLA Sites and RCRA Corrective Action Facilities contaminated with lead. The Regions will be required to submit their rationale for deviating from the policies laid out in this directive to the Lead Sites Consultation Group. This directive does not apply to previous remedy selection decisions.

Attachments

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NOTICE: This document provides guidance to EPA staff. The document does not, however, substitute for EPA's statutes or regulations, nor is it a regulation itself. Thus it cannot impose legally-binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA may change this guidance in the future, as appropriate.

Appendix
OSWER Directive # 9200.4-27P
August 1998

Factsheet: Using the IEUBK Model and Blood Lead Studies at Residential Lead Sites

Question: What is OSWER's policy on using the IEUBK model and blood-lead studies in conducting risk assessments and setting cleanup standards at residential lead contamination sites?

Answer: OSWER's policy on using the IEUBK model and blood-lead studies in conducting risk assessment and setting cleanup standards is as follows:

A. Use of the IEUBK Model:

1. The IEUBK model is a good predictor of potential long-term blood-lead levels for children in residential settings. OSWER recommends that the IEUBK model be used as the primary tool to generate risk-based soil cleanup levels at lead sites for current or future residential land use. If Regions propose an alternative method for generating cleanup levels, they are required to submit their approach to the National Lead Sites Consultation Group (LSCG) for review and comment.

2. Blood-lead distributions predicted by the IEUBK model illustrate a plausible range of variability in children's physiology, behavior, and household conditions.

3. Response actions can be taken, and remedial goals developed, using IEUBK predictions alone.

B. Use of Blood-Lead Studies/Data:

1. Blood-lead studies, surveys, and monitoring are useful tools at lead sites and can be used to help identify key site-specific exposure pathways and direct health professionals to individuals needing immediate assistance in minimizing lead exposure.

2. The utility of blood lead testing results and studies depends on how representative the information is of the population being evaluated, the design of the data collection, and the quality of the laboratory analysis. To this end, OSWER recommends that EPA Regions consult with ATSDR or CDC to assess or design studies according to their intended use.

3. Many blood-lead screening, monitoring, or testing programs differ from blood lead studies in that they do not attempt to identify risk factors for childhood exposure to lead sources. Although these programs may be extremely beneficial in identifying children with elevated blood lead levels and identifying candidates for referral to medical professionals for evaluation, they may not provide an accurate representation of community-wide exposure.

4. Well-designed blood lead studies may be used to identify site specific factors and pathways to be considered in applying the IEUBK model at residential lead sites. However, OSWER recommends that blood-lead studies not be used to determine future long-term risk where exposure conditions are expected to change over time; rather, they should be considered a snapshot of ongoing exposure under a specific set of circumstances (including community awareness and education) at a specific time. Long-term studies may be helpful in understanding exposure trends within a community and evaluating the effectiveness of cleanup strategies over time.

C. **IEUBK and Blood-Lead Studies/Data:**

1. Blood-lead data and IEUBK model predictions are expected to show a general concordance for most sites. However, some deviations between measured and predicted levels are expected. On some occasions, declines in blood-lead levels have been observed in association with lead exposure-reduction and health education. However, long-term cleanup goals should be protective in the absence of changes in community behavior as there is little evidence of the sustained effectiveness of these education/intervention programs over long periods of time.

2. Where actual blood-lead data varies significantly from IEUBK Model predictions, the model parameters should not automatically be changed. In such a case, the issue should be raised to the Lead Technical Review Workgroup (TRW) to further identify the source of those differences. Site work need not be put on hold while the issue is being reviewed by the TRW; the site manager should review other elements of the lead directive and the "Removal Actions at Lead Sites" guidance to determine appropriate interim actions to be taken at the site.

The Regions will be required to submit their rationale for deviating from the policies laid out in this factsheet to the Lead Sites Consultation Group.

Appendix
OSWER Directive # 9200.4-27P
August 1998

Factsheet: Determining Exposure and Remediation Units at Residential Lead Sites

Question: How does OSWER define an exposure unit, and subsequently apply this definition in conducting risk assessment and risk management activities at residential lead sites?

Answer: OSWER recognizes that defining and characterizing exposure unit(s) for a site is critically important in undertaking risk assessment activities and in designing protective cleanup strategies. An **exposure unit** is defined as a geographic area where exposures occur to the receptor of concern during the time of interest and that for a child, or group of similarly exposed children, this is typically the individual residence and other areas where chronic or ongoing exposures are occurring.

Various approaches to characterizing and managing risks by exposure units have been examined by OSWER. OSWER recognizes that lead ingestion can also cause adverse health effects in adults and fetuses but believes that by adequately limiting lead exposures to young children at residential sites, these other receptors will generally be likewise protected from adverse health impacts.

EPA's goal is to protect human health and the environment under current and future exposure scenarios. At lead sites, OSWER wants to assure that children's health is protected and promotes a program that proactively assesses risks rather than relying on biological monitoring to determine if an exposure has already occurred. OSWER emphasizes actions be taken at lead sites that will minimize or eliminate exposure of children to environmental lead contamination.

To achieve the above stated goal, OSWER recommends characterizing **exposure units as exposure potential at the individual residence as the primary unit of concern for evaluating potential risk at lead contaminated residential sites**. This recognizes that there are children whose domain and activities occur principally within the confines of a particular residential property. For determining exposure potential (and ultimately developing protective cleanup levels) at the individual home, OSWER recommends the scenario to be evaluated (through use of the IEUBK Model) would be a young child in full-time residence. This approach helps achieve OSWER's recommended health protection goal that an individual child or group of similarly exposed children would have <5% chance of exceeding a blood-lead concentration of 10 ug/dl. In designing community wide cleanup strategies, it is essential that non-residential areas (e.g., parks, day care facilities, playgrounds, etc.), where lead exposure may occur, also be characterized with respect to their contribution to soil-lead exposure, and appropriate cleanup actions implemented.

Appendix
OSWER Directive # 9200.4-27P
August 1998

OSWER recommends that risk management decisions for response to residential lead contamination sites focus on reducing risk at residences, but also recommends that response strategies be developed for other site locations (exposure units) where children receive exposure. Flexibility in determining appropriate response actions that provide protection at the individual residence should be considered in context of the NCP remedy selection criteria. The lead exposure issues are complex and OSWER recommends that EPA Regions try to communicate clearly the risk characterization and risk management decisions to the site residents. Affected communities must clearly understand the context of risk management decisions, how these decisions affect the health of their children, and how cleanup actions will influence the future growth and development of the community.

The Regions will be required to submit their rationale for deviating from the policies laid out in this factsheet to the Lead Sites Consultation Group.

Appendix
OSWER Directive # 9200.4-27P
August 1998

Factsheet: Addressing Multimedia Contamination at Residential Lead Sites

Question: What is OSWER's policy on addressing multimedia contamination at residential lead sites?

Answer: OSWER recognizes that several sources of lead-contamination, including soil, ground water, airborne particulates, lead plumbing, interior dust, and interior and exterior lead-based paint may be present at Superfund sites where children are at risk or have documented lead exposure. These lead sources may contribute to elevated blood-lead levels and may need to be evaluated in determining risks and cleanup actions at residential lead sites. However, there are limitations on the Agency's statutory authority under CERCLA to abate some of these sources, such as indoor lead-based paint and lead plumbing because CERCLA responses may be taken only to releases or threatened releases into the environment (CERCLA §104 (a)(3) and (4)).

When EPA's resources, or authority to respond or to expend monies under Superfund is limited, OSWER recommends that EPA Regions identify and coordinate to the greatest extent possible with other authorities and funding sources (e.g., other federal agencies and state or local programs). EPA Regions should coordinate with these other authorities to design a comprehensive, cost-effective response strategy that addresses as many sources of lead as practicable. These strategies should include actions to respond to lead-based paint, interior dust, and lead plumbing, as well as ground water sources and lead-contaminated soil.

Although OSWER will encourage that EPA Regions fully cooperate in the development of a comprehensive site management strategy, OSWER realizes that complete active cleanup of these other sources may be difficult to complete due to limited funding available to other authorities. Since complete cleanups of these sources is not guaranteed, and at most sites may be unlikely, OSWER recommends that the soil cleanup levels not be compromised. In other words, the soil cleanup levels should be calculated with the IEUBK model using existing pre-response action site specific data. This is due to the fact that soil cleanup levels at residential lead sites are generally established to protect individuals, from excess exposures to soils, and house dust attributable to those soils, and are not attributable to exposure to other sources such as interior lead paint which should be managed on a residence specific basis. Remediation of non-soil lead sources to mitigate overall lead exposure at individual residences should therefore not be used to modify sitewide soil lead cleanup levels.

The recommendations provided below represent OSWER's policy on addressing lead-contaminated media and/or sources for which EPA has limited or no authority to remediate.

Interior Paint: EPA has limited legal authority to use Superfund to address exposure from

interior lead-based paint. As a policy matter, OSWER recommends that such exposures not be addressed through actual abatement activities. However, EPA Regions should promote addressing interior paint risks through actions by others, such as HUD, local governments, or individual home owners as a component of an overall site management strategy. Any activities to clean up interior lead-based paint by PRPs or other parties should not result in an increase of the risk-based soil cleanup levels.

Exterior Paint: Because of other competing demands on the Superfund Trust Fund, OSWER recommends that EPA Regions avoid using the Superfund Trust Fund for removing exterior lead-based paint and soil contaminated from lead-based paint. Superfund dollars *may* be used to respond to exterior lead-based paint for protecting the overall site remedy (i.e., to prevent re-contamination of soils that have been remediated) but only after determining that other funding sources are unavailable. Where other sources of funding are not available, EPA may utilize the CERCLA monies to remediate exterior lead-based paint on homes/buildings, around which soil contaminated by other sources has been cleaned up to prevent recontamination of the soil. The Superfund should not be used to remediate exterior lead-based paint where no soil cleanup has occurred. As with interior lead-based paint abatement, EPA Regions should promote remediation of exterior lead-based paint by others, such as PRPs, local governments or individual homeowners. Cleanup activities of exterior paint conducted by PRPs or other parties should not result in an increase of the risk-based soil cleanup levels.

Interior Dust: Lead contaminated interior dust can be derived from several sources, including interior paint, home owner hobbies, exterior soil, and other exterior sources. In many cases, it may be difficult to differentiate the source(s) for the lead contamination in the dust. In general, EPA Regions should refrain from using the Superfund Trust Fund to remediate interior dust. Because of the multi-source aspects of interior dust contamination, potential for recontamination, and the need for a continuing effort to manage interior dust exposure, OSWER recommends the use of an aggressive health education program to address interior dust exposure. Such programs, administered through the local health department (or other local agency), should be implemented in conjunction with actions to control the dust source. At a minimum, the program should include blood-lead monitoring, and personal hygiene and good housekeeping education for the residents. OSWER believes that EPA Regions can also support the program by providing HEPA vacuums to the health agency for use in thoroughly cleaning home interiors.

Lead Plumbing: Generally CERCLA does not provide for legal authority to respond to risks posed by lead plumbing within residential dwellings. It should be noted that the water purveyor is responsible for providing clean water to the residences. As with interior dust, OSWER recommends that EPA Regions coordinate with local agencies to establish a health education program to inform residents of the hazards associated with lead plumbing and how to protect themselves by regularly flushing, or preferably, replacing lead pipes. Soil cleanup levels should not be adjusted to account for possible remediation of lead plumbing.

Appendix
OSWER Directive # 9200.4-27P
August 1998

Factsheet: Determining Appropriate Response Actions at Residential Lead Sites

Question: What is OSWER's position on the appropriate use of engineering and non-engineering response actions in developing risk management strategies for lead sites?

Answer: One goal emphasized in the recent third round of Superfund Reforms is for EPA to take a consistent approach in selecting and implementing both long- and short-term response actions at lead sites in all regions. One obstacle to achieving this consistency has been differing degrees of reliance on non-engineering response actions in reducing risk.

Site management strategies at lead sites typically include a range of response actions. Alternatives range from engineering controls that permanently remove or treat the contaminant source to non-engineering response actions, such as educational programs and land use restrictions. This continuum represents the range of response options available to risk managers. This position paper clarifies the relationship between engineering and non-engineering response actions in developing site management strategies.

In selecting site management strategies, OSWER's policy will be to seek early risk reduction with a combination of engineering controls (actions which permanently remove or treat contaminants, or which create reliable barriers to mitigate the risk of exposure) and non-engineering response actions. All potential lead sources should be identified in site assessment activities. Non-engineering response actions, such as education and health intervention programs, should be considered an integral part of early risk reduction efforts due to their potential to provide immediate health benefits [2]. In addition, engineering controls should be implemented early at sites presenting the greatest risk to children and other susceptible subpopulations. Community concerns should receive a high priority in site decision-making; local support is vital to the success of health intervention and education programs.

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(2) The actual effectiveness of health intervention and educational programs in reducing risk continues to be a subject of discussion. Anecdotal information suggests that such programs can provide short-term benefits in some populations. Rigorous statistical studies demonstrating the benefits of educational programs in preventing lead exposure are lacking. It is generally recognized that not all segments of the population will be influenced by such programs, and that long-term benefits are less certain. Local support for such programs is critical. The active (and long-term) participation of local and state public health agencies is needed in implementing institutional controls, including health intervention and education programs; without local implementation of such programs their success is uncertain. Additional research on the effectiveness of these programs is critical to consideration of their use in future cleanups.

As the project progresses, OSWER's goal should be to reduce reliance on education and intervention programs to mitigate risk. The goal should be cleanup strategies that move away from reliance on long-term changes in community behavior to be protective; behavioral changes may be difficult to maintain over time. The actual remedy selected at each site must be determined by application of the NCP remedy selection criteria to site-specific circumstances. However, this approach recognizes the NCP preference for permanent remedies and emphasizes the use of engineering controls for long-term response actions. This approach also recognizes that well-designed health intervention and education programs, when combined with deed restrictions and/or other institutional controls, may be appropriate for reducing future exposure potential and may supplement engineering controls.

In instances where Regions believe that the use of engineering controls is impracticable, and education, health intervention, or institutional controls are proposed as the sole remedy, Regions will be required to consult with the LSCG.

The LSW
Who Are We?
Risk Management

The TRW
Who Are We?
Risk Assessment
Technical Assistance
The IEUBK Model
IEUBK FAQs
The ALM (Adult Lead Methodology)
Workshops

Products
Lead and Human Health
Related Sites
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Adult Lead Methodology

The Adult Lead Methodology (*Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil*, December 1996), the TRW's review of adult lead models, and the NHANES Report (March 2002) may be downloaded from the Products page.

Adult Lead Methodology (ALM) Frequently Asked Questions (FAQs)

The following FAQs were compiled from requests for assistance on proper use of the Adult Lead Methodology made to the Pb Hotline either by telephone (1-866-282-8622) or e-mail. Please refer to Technical Assistance for further information on the Pb Hotline.

Who is the receptor population for the Adult Lead Methodology?

In the commercial/industrial setting, the most sensitive receptor is the fetus of a worker who develops a body burden as a result of non-residential exposure to lead. This body burden is available to transfer to the fetus for several years after exposure ends (Gulson *et al.*, 1998; Gulson *et al.*, 1999). Based on the available scientific data, a fetus is more sensitive to the adverse effects of lead than an adult (National Academy of Sciences, 1993). We assume that cleanup goals (preliminary remediation goals, 'PRGs') that are protective of a fetus will also afford protection for male or female adult workers (see Stern section of Adult Lead Methodology Review Report). The model equations were developed to calculate cleanup goals such that there would be no more than a 5% probability that fetuses exposed to lead would exceed a blood lead (PbB) of 10 µg/dL. This same approach also appears to be protective for lead's effect on blood pressure in adult males (see Adult Lead Methodology Review Report).

Does the adult lead methodology calculate a value for a commercial worker or an industrial worker?

The ALM guidance does not distinguish between commercial and industrial workers; rather, it is applicable to non-residential exposure scenarios. According to EPA's ALM guidance, a soil ingestion rate of 50 mg/day is recommended as a plausible central tendency value for non-contact-intensive activities (U.S. Environmental Protection Agency, 1997). Either commercial or industrial workers may work primarily indoors, so that exposure to soil occurs primarily via indoor dust. Workers' limited and occasional contact with outdoor soils (*e.g.*, walking at noontime, picnicking, walking to parking lots, standing on a loading dock) should be adequately accounted for via the 50 mg/day incidental soil ingestion.If an individual is performing a contact-intensive activity with soil, then a soil ingestion rate greater than 50 mg/day would be expected. At sites where lead materials have been

historically used, exposure scenarios would have to be evaluated individually to determine the indoor and outdoor activities that may result in greater exposure to soil and the corresponding soil ingestion rate.

What is a reasonable screening value for soil lead at commercial/industrial sites?

A screening goal is often more protective than a cleanup goal. A screening goal is intended to provide health protection without knowledge of the specific exposure conditions at a site. A cleanup goal can be derived using exposure assumptions based on site-specific data rather than default values (which are often more conservative). An updated screening level for soil lead at commercial/industrial (*i.e.*, non-residential) sites of 800 ppm is based on a recent analysis of the combined phases of NHANES III that choose a cleanup goal protective for all subpopulations.

What is a reasonable baseline blood lead level (PbB_0) to use for a future exposure scenario?

Although the best estimates for PbB_0 are based on site-specific data, such information may not be available for a future exposure scenario. Application of this value should consider the proportion of each population (present on the site or anticipated in the future) as defined by the NHANES III study and as described in the recommendations of the TRW for use of the NHANES III data for adult lead risk assessment (see section 3.4, page 9 of Report). For site applications of the ALM, estimates of the $PbB_{adult,0}$ and $GSD_{i,adult}$ parameters could be based on either race/ethnicity or geographic categories determined appropriate based on the specific demographic or geographic characteristics of the site... It is not recommended to base estimates of the $PbB_{adult,0}$ and $GSD_{i,adult}$ from the NHANES III survey that are stratified by both census region and race/ethnicity group in the ALM to estimate site-specific risks because of the small sample sizes.

What is an appropriate GSD for my site?

The Geometric Standard Deviation (GSD) blood lead (PbB) for a population is a measure of inter-individual variability of observed blood lead levels. Factors that may contribute to variability in a population include occupational exposure, exposure history, socioeconomic and ethnic characteristics, activity patterns, degree of urbanization, geographic location, and sources of lead. A homogeneous population (*i.e.*, expected to have a low GSD) may have similar characteristics and exposure histories, and live within a small geographic area; there may be a single dominant source of lead exposure (*e.g.*, an ethnically and culturally homogeneous population living in a small town). By contrast, individuals with diverse backgrounds, who are exposed to multiple sources of lead within an urban community, may be considered a heterogeneous population.In the absence of demographic and environmental information that would indicate that the population is either homogeneous or heterogenous, an appropriate value for GSD would be based on analysis of the combined phases of NHANES III across all quadrants appropriate for the site. For site applications of the ALM, estimates of the $PbB_{adult,0}$ and $GSD_{i,adult}$ parameters could be based on either race/ethnicity or geographic categories determined appropriate based on the specific demographic or geographic characteristics of the site... It is not recommended to base estimates of the $PbB_{adult,0}$ and $GSD_{i,adult}$ from the NHANES III survey that are stratified by both census region and race/ethnicity group in the ALM to estimate site-specific risks because of the small sample sizes. Site-specific values should consider the region

as well as the present and future ethnicity of the exposed population. Application of this value should consider future land uses or development plans if available, whether any sensitive groups are present, and whether any major future changes in population are anticipated.

Should I assume that the indoor dust lead level is the same as the outdoor soil (dust) lead concentration when I run the model?

An appropriate assumption is that the concentration of lead in (sieved) outdoor soil and indoor soil-derived dust is the same. This is not the same as assuming the concentration of lead in outdoor soil and all sources of dust (*i.e.*, aggregate dust) are equal. The concentration of lead in aggregate dust may reflect a combination of outdoor soil, indoor lead sources (*e.g.*, paint), and non-lead sources (*e.g.*, organic material). Since the default assumption for the model is that soil ingestion represents outdoor soil and indoor soil-derived dust only (without contributions from other sources of lead), no distinction is needed between soil and dust concentrations.

What is the appropriate exposure frequency for a typical commercial/industrial worker -- 250 days, 219 days, or some other derived value for intermittent exposure?

The model default value for exposure frequency (EF) is 219 days/year. This value is a central tendency estimate for non-residential exposure scenarios (*i.e.*, both commercial and industrial), and corresponds to the average time spent at work by both full- and part-time workers engaged in non-contact-intensive activities. If workers are engaged in full-time activities, then an EF greater than 219 days/year may be appropriate.The model is designed to estimate blood lead concentrations (PbB) for workers who have a sustained period of contact with exposure media. The default assumption for the averaging time (AT) is 1 year (365 days), which is sufficient time for PbB to approach quasi-steady state (see ALM Guidance). If exposures are expected to occur over a shorter time interval, then EF should not be prorated over the entire year. For example, average daily lead intake from soil for a construction worker who works 5 days a week on a 26-week construction project and is not on site during the other 26 weeks (EF=130 days) would be assessed using an averaging time of 26 weeks (AT=182 days) rather than 52 weeks to avoid "diluting" the exposures over the entire year.

What is the shortest period of time for which I can apply the model?

The exposure duration (ED) should be sufficiently long to allow blood lead concentrations (PbB) to approach quasi-steady state. As discussed in the guidance, the shortest period of time appropriate for ED is 3 months (90 days). A minimum frequency of exposure of 1 day per week is also recommended. The ALM is recommended for repeated intermittent or continuous exposures over extended periods of time; it should not be used for acute exposures.

Is soil lead (from Equation 1) the site soil concentration to which the adult is exposed?

Yes, the soil lead in Equation 1 refers to the exposure point concentration. In most cases, exposure is assumed to be predominantly to the top layers of the soil (the recommendation is the top 2 cm); however, if that is not representative or available

then the most shallow samples of contaminated soil that can be collected under site conditions (see EPA Soil Screening Guidance, 1996) which give rise to transportable soil-derived dust should be considered. Exposure to soil-derived dust occurs in both outdoor and indoor environments, the latter occurring where soil-derived dust has been transported indoors. The model accounts for exposures that occur on a regular basis. Under both current and future exposure scenarios, an arithmetic mean concentration should be estimated from sampling data within the exposure area that a worker would be expected to have access to on a regular basis. Half an acre is a reasonable default assumption. Site-specific information may suggest workers are exposed to a greater area (*e.g.*, lineman) or a smaller area (*e.g.*, small commercial facility site).

Can the model be used to estimate adolescent trespassing? How would the model be applied when the receptor is an adolescent? What baseline blood lead level is appropriate? What about other input parameter values?

The adolescent population may be considered sensitive, since exposures during these years may result in a body burden of lead that is available to transfer to the fetus later in life. Given the limitations of currently available modeling tools, it is reasonable to apply the model to adolescent receptors (*e.g.*, trespasser scenarios), provided that appropriate values can be selected for important model parameters: (1) exposure frequency (EF); (2) exposure duration (ED); (3) baseline blood lead (PbB_0); (4) absorption fraction (AF). At this time, while empirical data on biokinetic slope factors (BKSF) appear to be similar for young children and adults, uncertainty arises when applying a similar estimate for adolescence (Mahaffey *et al.*, 1998). In addition, selecting an appropriate baseline blood lead (PbB_0) is likely to be difficult. Brody *et al.* (1994) reported low PbB_0 for children between the ages of 12 and 18 years (which results in PRGs ranging from 1800 to 2000 ppm). The low PbB_0 may be due to a growth spurt in which there is a increase in bone deposition that results in a lower concentration of lead in the blood; the total body burden of lead may still be increasing (Muth & Globel, 1983). Other factors may also contribute, such as increases in blood volume during periods of rapid growth. National databases (*e.g.*, NHANES III) can provide quality information on PbB_0. Presentation of calculations using a range of PbB_0 values is recommended. There is also a potential that lead absorption (AF) will be higher in adolescents than in adults.

Is 10 µg/dL (in the construction scenario) a level that should never be exceeded?

No. The 10 µg/dL is a multi-Agency goal that has been designated by the US Centers for Disease Control (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR) as a level of concern to protect sensitive populations (neonates, infants, and children). The protection of sensitive populations is assumed to also provide protection for adults. The EPA's stated goal for lead is that children (up to 84 months of age) exposed at a risk-based cleanup level would have no more than a 5% probability of exceeding the level of concern (U.S. Environmental Protection Agency, 1994; U.S. Environmental Protection Agency, 1998). The ALM extends that same concept to develop cleanup goals preventive of fetal risk. As a statistical goal, a probability of exceedance of up to 5% of the goal is acceptable.

Can the adult lead methodology be used to determine dermal exposure to lead at a site?

Although percutaneous absorption is generally not a significant route of exposure for inorganic lead, technically, the model can evaluate dermal exposure by incorporating the lead uptake from this pathway into the appropriate equation (see Equation A-3 in the Guidance). However, at this time, quantifying uptake from dermal exposure to soil-borne lead is not recommended due to the uncertainty in assigning a dermal absorption fraction that would apply to the numerous inorganic forms of lead that are typically found in environmental settings.

Should sieving be used to characterize samples for non-residential sites?

The lead concentration in the sieved (250 micron) fraction of surface soil provides the best estimate of the soil lead that is incidentally ingested and should be used in the ALM. However, sieving of samples from all depths may be useful in site characterization; users should proceed with caution when developing ratios between sieved and unsieved samples. Link to Sieving Short Sheet [EPA-540-F-00-010] in PDF format (87 KB, 3 pages).

Is there an appropriate default value for fish ingestion rate, or is this a site-specific issue? Can the ALM be used to establish fish advisories?

Fish ingestion rate is a site-specific parameter and therefore no appropriate default value exists. For fish advisories, it is recommended that concentration data be used to back-calculate an acceptable intake of fish. An appropriate absorption fraction should be used based on site specific data (portion of fish consumed -- fillets or entire fish).

What is an appropriate soil ingestion rate for a construction scenario (*i.e.*, soil contact-intensive scenario)?

The TRW recommends 50 mg/day as the default ingestion rate for indoor workers. This soil ingestion value is cited in two EPA documents: Recommendation of the Technical Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil (U.S. EPA, 1996), and the Exposure Factors Handbook (U.S. EPA, 1997). A reasonable default value that has been commonly used as a central tendency estimate for contact-intensive adult scenarios (such as an agricultural or construction worker) is 100 mg/day.There is high uncertainty in soil ingestion rates (IRs) for adults due to sparse empirical data. Empirical data on adult soil ingestion rates are available from two studies (Calabrese *et al.*, 1990; Calabrese *et al.*, 1997), each conducted concurrently with a study of childhood soil ingestion rates. Neither study group targeted a population expected to engage in frequent contact with soil, such as construction workers. The purpose of the pilot studies was to verify the tracer mass balance methodology used in the child studies, rather than to investigate the amount of soil normally ingested by adults. Despite their limitations, these studies provide an estimate of the amount of soil ingested by adults.The value of 50 mg/day represents a reasonable central tendency estimate of adult soil ingestion based on available data and is the recommended mean value. The value of 100 mg/day is equal to the recommended mean soil ingestion rate for young children, whose daily ingestion rates are expected to exceed that of adults (U.S. EPA, 1997). For construction workers and other soil contact-intensive occupations, OSWER guidance recommends an upper bound value for IRs of 330 mg/day based on Stanek et al. (1997) (as cited by EPA's Supplemental Guidance for Developing Soil Screening

Levels for Superfund Sites, 2001). The basis of the default IR is the 95th percentile value (330 mg/day). In this study, Stanek *et al.* (1997) also report the median, 75th percentile, and mean values as 1, 49, and 10 mg/day (SD = 94), respectively. The CV of 9.4 is indicative of significant uncertainties in these estimates. Because central tendency values are recommended as inputs to both the IEUBK Model for Lead in Children and the ALM model, a more plausible range for a soil lead IR is 50 to 200 mg/day for adult contact-intense soil exposures. Thus, there is reasonable support for use of 100 mg/day as a soil ingestion rate for the contact-intense worker scenario in the ALM.Although studies to directly measure adult soil ingestion are currently lacking, soil ingestion rates can be compared to measures of soil adherence to hands to provide additional perspective. Soil adhered to hands is relevant to soil ingestion because it is available for ingestion from hand-to-mouth activities. While soil adhesion to hands could be helpful in estimating soil ingestion, an accepted methodology that reliably estimates soil ingestion using soil adhesion data has not been developed for hazardous waste risk assessments.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 13 1998

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

OSWER Directive 9200.4-26

MEMORANDUM

SUBJECT: Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites

FROM: Timothy Fields, Jr. Acting Administrator
Office of Solid Waste and Emergency Response

TO: Director, Office of Site Remediation and Restoration
Region I
Director, Emergency and Remedial Response Division
Region II
Director, Division of Environmental Planning and Protection
Region II
Director, Hazardous Waste Management Division
Regions IX
Director, Waste Management Division
Region IV
Director, Waste, Pesticides, & Toxics Division
Region V
Director, RCRA Multimedia Planning & Permitting Division
Region V
Director, Superfund Division
Regions III, V, VI, VII
Assistant Regional Administrator, Office of Ecosystems Protection and Remediation
Region VIII
Director, Hazardous Waste Program
Region VIII
Director, Office of Environmental Cleanup
Region X
Director, Office of Waste and Chemical Management
Region X

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PURPOSE

The purpose of this Directive is to recommend preliminary remediation goals (PRGs) or starting points for setting cleanup levels for dioxin in soil at Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) corrective action sites. These recommended levels are to be used pending the release of the U.S. Environmental Protection Agency (EPA) comprehensive dioxin reassessment report and cross-program assessment of the impacts of the report. One ppb (TEQs, or toxicity equivalents) is to be generally used as a starting point for setting cleanup levels for CERCLA removal sites and as a PRG for remedial sites for dioxin in surface soil involving a residential exposure scenario. For commercial/industrial exposure scenarios, a soil level within the range of 5 ppb to 20 ppb (TEQs) should generally be used as a starting point for setting cleanup levels at CERCLA removal sites and as a PRG for remedial sites for dioxin in surface soil. These levels are recommended unless extenuating site-specific circumstances warrant a different level.

The dioxin levels discussed in this Directive are also generally recommended for actions taken under RCRA at corrective action sites. The recommended levels of 1 ppb (TEQs) for residential soils and within the range of 5 ppb to 20 ppb (TEQs) for commercial/industrial soils should generally be used as starting points in setting soil cleanup levels at RCRA corrective action sites. These levels are generally consistent with soil cleanup levels set at RCRA facilities throughout the country where dioxin is a principal contaminant of concern at the facility. However, because states are the primary implementors of the RCRA Corrective Action program, this Directive does not prescribe specific procedures for implementation under RCRA.

This Directive sets forth the policy basis for these recommended levels and prescribes procedures for implementing these recommendations.

BACKGROUND

To date, EPA has generally selected 1 ppb as a cleanup level for dioxin in residential soils at Superfund and RCRA cleanup sites where dioxin is a principal contaminant of concern at the facility. EPA has also, to date, generally selected a cleanup level for dioxin within the range of 5 ppb to 20 ppb for commercial/industrial soils at Superfund and RCRA cleanup sites where dioxin is a principal contaminant of concern at the facility. The levels that EPA has selected at these sites are protective of human health and the environment. Based on presently available information, and using standard default assumptions for reasonable maximum exposure scenarios, the upper-

bound lifetime excess cancer risk from residential exposure to a concentration of 1 ppb dioxin is approximately 2.5×10^{-4}, which is at the higher end of the range of excess cancer risks that are generally acceptable at Superfund sites. The calculated upper-bound excess cancer risk associated with a lifetime commercial/industrial exposure to 5 ppb, or the lower end of the range recommended for commercial/industrial soils, is approximately 1.3×10^{-4}, which is also within the CERCLA risk range. It should be noted that there is more difficulty in generalizing about the cancer risk associated with commercial/industrial cleanup levels than there is with residential cleanup levels due to the greater variability in exposures associated with commercial/industrial scenarios. Accordingly, the consultation process for Superfund sites referenced in the implementation section of this Directive should be used to ensure the selection of appropriate, protective dioxin levels at CERCLA commercial/industrial sites. Similarly, for RCRA corrective action sites, please refer to the implementation section of this Directive.

EPA is presently completing work on a comprehensive reassessment of the toxicity of dioxin, to be embodied in the documents entitled "Health Assessment Document for 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds" and "Estimating Exposure to Dioxin-like Compounds." The reassessment report, which is scheduled to be issued in 1998, will represent the culmination of an Agency-wide effort to collect, analyze and synthesize all of the available information about dioxin. It has undergone significant internal and external review and is one of the most comprehensive evaluations of toxicity of a chemical ever performed by the Agency. Following release of the report, the Office of Solid Waste and Emergency Response (OSWER) will participate in a cross-program review of the implications of the report for the regulation and management of dioxin by EPA. We anticipate that this review will culminate in OSWER guidance addressing the management of dioxin at CERCLA and RCRA sites.

The Office of Solid Waste and Emergency Response does not believe it is prudent to establish new, and possibly varying, precedents for Superfund or RCRA dioxin levels just prior to the release of this reassessment report. As with any other pollutant, it is important that EPA ensure appropriate national consistency in remediation efforts. The Agency has used 1 ppb as a residential cleanup level and between 5 ppb and 20 ppb as a commercial/industrial cleanup level at CERCLA and RCRA cleanup sites for dioxin in soil in the past; it is anticipated that OSWER will be issuing guidance, informed by the reassessment effort, that will provide a basis for the selection of dioxin cleanup levels in the near future. In the interim, for sites that require the establishment of a final dioxin soil cleanup level prior to the release of the reassessment report and

development of OSWER guidance, EPA should generally use 1 ppb (TEQs) as a starting point for residential soil cleanup levels for CERCLA non-time critical removal sites (time permitting, for emergency and time critical sites) and as a PRG for remedial sites. EPA should generally use a level within the range of 5 ppb to 20 ppb (TEQs) as a starting point for cleanup levels at CERCLA non-time critical removal sites (time permitting, for emergency and time critical sites) and as a PRG for remedial sites for commercial/industrial soil. These levels should also be used as starting points in setting soil cleanup levels at RCRA corrective action sites.

For CERCLA remedial sites, consistent with 40 CFR § 300.430(f)(5)(iii)(D), EPA should commit to reviewing Records of Decision (RODs) (i.e., RODs in which this Directive has been used to develop dioxin soil cleanup levels) promptly following the release and analysis of the reassessment report and OSWER guidance, and, if necessary, to making changes to the RODs and cleanup actions, based on the information contained in the reassessment report and in the OSWER guidance. Similarly, in the case of non-time critical removal actions (time permitting, for emergency and time critical actions), EPA should commit to reviewing Action Memoranda promptly following the release and analysis of the reassessment report and OSWER guidance, and, if necessary, to making changes to the Action Memoranda and cleanup actions, based on the information contained in the reassessment report and the OSWER guidance. EPA should similarly commit to reviewing RCRA cleanup decisions (i.e., decisions for which this Directive has been used) promptly following the release and analysis of the reassessment report and OSWER guidance.

IMPLEMENTATION

Regional management should consult with the appropriate Office of Emergency and Remedial Response (OERR) Regional Centers on all proposed Fund and Potentially Responsible Party-lead site decisions under CERCLA, including other Federal agency-lead and state-lead site decisions, involving the development of dioxin soil cleanup levels for non-time critical removal sites (time permitting, for emergency and time critical removal sites) and remedial sites. Consultation should be initiated at the risk assessment stage. For Federal agency-lead sites, OERR will, in turn, notify the Federal Facilities Restoration Reuse Office of ongoing consultations. The Office of Site Remediation Enforcement will provide support if enforcement issues are identified. For consultation procedures, refer to the OSWER "Headquarters Consultation for Dioxin Sites", 9200.4-19, December 13, 1996, plus the OSWER "Consolidated Guide to Consultation Procedures for Superfund Response Decisions", 9200.1-18FS, May 1997.

In the case of EPA-lead RCRA corrective action sites, Regions should provide the Office of Solid Waste Permits and State Programs Division (OSW/PSPD) with proposed dioxin soil cleanup levels (i.e., prior to notice and comment) in order to ensure appropriate implementation of this Directive. For state-lead RCRA corrective action sites, it is also recommended that states use the dioxin levels recommended by this Directive as starting points in setting soil cleanup levels. States are encouraged to share their approaches with the Regions in a manner consistent with established procedures for EPA support and oversight of state RCRA Corrective Action programs.

The levels in this Directive are recommended unless extenuating site-specific circumstances warrant different levels, a more stringent state applicable or relevant and appropriate requirement (ARAR) establishes a cleanup level at CERCLA sites, or a more stringent state requirement applies at RCRA sites. We recommend that levels other than 1 ppb (TEQs) for residential soils and outside the range of 5 ppb to 20 ppb (TEQs) for commercial/industrial soils be used only where evidence exists that risks posed by the site differ from risks estimated using standard national default guidance values. These recommendations apply to RCRA corrective actions, CERCLA non-time critical removal actions (time permitting, for emergency and time-critical actions) and CERCLA remedial actions where cleanup levels are to be developed for dioxin in soil, regardless of whether dioxin itself drives the decision-making process.

The recommended levels found in this Directive, generally considered protective of human health and the environment, apply to surface soils. Please note that with respect to human health, these levels are based on the direct contact exposure pathway. The recommended levels in this Directive do not apply to other exposure pathways, such as migration of soil contaminants to ground water or to agricultural products. While the focus of this Directive is on soils, these recommended levels also apply to sediments in the event that this environmental medium is considered to be a direct exposure pathway for human receptors.

This document provides guidance to EPA staff. The guidance is designed to communicate national policy on dioxin cleanups for soil. The document does not, however, substitute for EPA's statutes or regulations, nor is it a regulation itself. Thus, it cannot impose legally-binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA may change this guidance in the future, as appropriate.

If you have any questions concerning this Directive, please contact either Marlene Berg at (703)603-8701 in Headquarters or Elmer Akin of Region 4 at (404)562-8634, as Marlene and Elmer are

co-chairs of the Superfund Dioxin Workgroup. For the RCRA Corrective Action program, please contact Robert Hall of the Office of Solid Waste Permits and State Programs Division at (703)308-8484. Attached, for your information, is a list of Regional points of contact who are serving on the dioxin workgroup.

Attachment: Superfund Dioxin Workgroup: Regional Points of Contact

cc: Mike Shapiro, OSWER
Peter Grevatt, OSWER
Steve Luftig, OERR
Elaine Davies, OERR
Larry Reed, OERR
Gershon Bergeisen, OERR
David Bennett, OERR
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Paul Nadeau, OERR
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Craig Hooks, FFEO
Earl Salo, OGC
Bill Sanders, OPPT
Bill Farland, ORD
Regional Counsel, Regions I-X
Peggy Schwebke, Region 5
Superfund Dioxin Workgroup

Appendix G-2

Remedial Goal Calculations

Appendix G-2
Calculation of Remedial Goals

This appendix describes the procedures used to develop remediation goals (RGs) for the chemicals of interest (COIs) identified in soil at SWMU 51. Based on the results of the baseline HHRA, these COIs are present at concentrations that resulted in cancer risks greater than 1×10^{-6} and/or hazard indices greater than 1. RGs were derived for three commercial/industrial scenarios (maintenance worker, excavation worker, and industrial worker) and two resident scenarios (adult and child).

For each scenario, RGs were calculated at target risk levels of 10^{-6}, 10^{-5}, and 10^{-4}. Target risk levels were calculated for each COI by apportioning risk equally among the total number of COIs identified for the scenario, as follows:

Target Risk Level (Total)/Total Number of COIs for Scenario = Target Risk Level (COI)

For example, seven constituents were identified as COIs for the adult resident based on cancer risk: 2,4-dinitrotoluene, 2,6-dinitrotoluene, dioxins, nitroglycerin, 4-nitrotoluene , 2,4,6-trinitrotoluene, and arsenic. Although dioxins were included in the total number of COIs for the purpose of apportioning risk, it is noted that USEPA's current cleanup levels for dioxins/furans (USEPA, 1998) were ultimately selected as the RGs for dioxins. The range of RGs for the industrial scenario is 0.005 – 0.020 mg/kg as TCDD TE. The RG for the residential scenario is 0.001 mg/kg. In addition, arsenic was shown to be within background levels in total soil. Consequently, an RG was not developed for arsenic. Therefore, RGs based on cancer effects were developed for six COIs in soil at SWMU 51: 2,4-dinitrotoluene, 2,6-dinitrotoluene, dioxins, nitroglycerin, 4-nitrotoluene, and 2,4,6-trinitrotoluene. The risk was apportioned, as follows:

$$(1 \times 10^{-5})/(6) = 1.667 \times 10^{-6}$$

By specifying the target risk, the RGs were back-calculated by re-arranging the risk calculations described in *Section 6.0*. To be consistent, the same exposure parameters that were used in the hazard calculations were applied to the derivation of RGs with the exception of the excavation worker. The exposure parameters for the industrial/commercial and residential receptors are summarized in **Appendix E-1, Tables E-14 through E-19**. Given the size of SWMU 51 (0.16 acres), however, the exposure frequency for the excavation worker was adjusted from 250 days/year to 90 days/year to reflect a more reasonable timeframe for excavation or construction projects at this site. As a result of the adjustment, the cumulative risk for dioxins was less than 1×10^{-6} and dioxin was not counted as a COI for the excavation worker.

The RGs were based on calculations for cancer effects, as follows:

$$RG = \frac{TR \times BW \times AT \times 10^{6}\ mg/kg}{EF \times ED \times FI\left[A+B+C\right]}$$

where:

RG = remediation goal (mg/kg)
TR = target risk (unitless)
BW = body weight (kg)
AT = averaging time (days)
EF = exposure frequency (days/year)
ED = exposure duration (years)
FI = fraction ingested (unitless)

A – Ingestion Pathway

$A = (CSF_{oral})\ (IR_{oral})$

where:

CSF_{oral} = oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$
IR_{oral} = ingestion rate (mg/day)

B – Dermal Absorption Pathway

$B = (CSF_{dermal})\ (SSA)\ (SSAF)\ (DABS)$

where:

CSF_{dermal} = oral Cancer Slope Factor, adjusted by oral absorption factor $(mg/kg\text{-}day)^{-1}$
SSA = skin surface area (cm^2)
SSAF = soil to skin adherence factor (mg/cm^2-day)
DABS = dermal absorption factor

C – Inhalation Pathway

$C = (CSF_{inhl})\ (IR_{inhl})\ (1/_{VF})\ (1/_{PEF})$

where:

CSF_{inhl} = inhalation Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$
IR_{inhl} = inhalation rate (m^3/day)
VF = volatilization factor (m^3/day)
PEF = particulate emission factor (m^3/day)

The RGs based on cancer effects are shown in **Table G-1** for each receptor group**.**

For each scenario, RGs were calculated at target hazard index (HI) values of 1.0, 0.5, and 0.1. Target hazard indices (HIs) were calculated for each COI by apportioning hazard equally among the total number of COIs identified for the scenario, as follows:

Target HI (Total)/Total Number of COIs for Scenario = Target HI (COI)

For example, eleven constituents were identified as COIs for the child resident based on noncancer hazard: 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, nitroglycerin, 2-nitrotoluene, 4-nitrotoluene, 2,4,6-trinitrotoluene, iron, lead, manganese, and vanadium. Because iron, manganese, and vanadium were shown to be within background levels in total soil, RGs were not developed for these constituents. In addition, lead was evaluated separately (*as described in Section 6.3*) and was not included in the apportioning process. USEPA's industrial and residential cleanup levels for lead were selected as RGs. The RG for the industrial scenario is 800 mg/kg and the RG for the residential scenario is 400 mg/kg. Therefore, RGs based on noncancer effects were developed for seven COIs in soil at SWMU 51: 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, nitroglycerin, 2-nitrotoluene, 4-nitrotoluene, and 2,4,6-trinitrotoluene. The HI was apportioned, as follows:

(1)/(7) = 0.143

By specifying the target HI, the RGs were back-calculated by re-arranging the hazard calculations described in *Section 6.0*. To be consistent, the same exposure parameters that were used in the hazard calculations were applied to the derivation of RGs with the exception of the excavation worker. The exposure parameters for the industrial/commercial and residential receptors are summarized in **Appendix E-1, Tables E-14 through E-19**. Given the size of SWMU 51 (0.16 acres), however, the exposure frequency for the excavation worker was adjusted from 250 days/year to 90 days/year to reflect a more reasonable timeframe for excavation or construction projects at this site. As a result of the adjustment, the cumulative HI for aluminum was less than 1 and aluminum was not counted as a COI for the excavation worker.

The RGs were based on calculations for noncarcinogenic effects, as follows:

$$RG = \frac{THI \ x \ BW \ x \ AT \ x \ 10^{6} \ mg/kg}{EF \ x \ ED \ x \ FI \left[A + B + C\right]}$$

where:

RG	=	remediation goal (mg/kg)
THI	=	target hazard index (unitless)
BW	=	body weight (kg)
AT	=	averaging time (days)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
FI	=	fraction ingested (unitless)

A – Ingestion Pathway

$A = (1/RfD_{oral})\ (IR_{oral})$

where:

RfD_{oral} = oral Reference Dose (mg/kg-day)
IR_{oral} = ingestion rate (mg/day)

B – Dermal Absorption Pathway

$B = (1/RfD_{dermal})\ (SA)\ (SSAF)\ (DABS)$

where:

RfD_{dermal} = oral Reference Dose, adjusted by oral absorption factor (mg/kg-day)
SSA = skin surface area (cm^2)
SSAF = soil to skin adherence factor (mg/cm^2-day)
DABS = dermal absorption factor

C – Inhalation Pathway

$C = (1/RfD_{inhl})\ (IR_{inhl})\ (1/_{VF})\ (1/_{PEF})$

where:

RfD_{inhl} = inhalation Reference Dose (mg/kg-day)
IR_{inhl} = inhalation rate (m^3/day)
VF = volatilization factor (m^3/day)
PEF = particulate emission factor (m^3/day)

The RGs based on noncancer effects are shown in **Table G-2** for each receptor group. As shown in **Table gG-2**, the calculated RGs for iron and manganese are less than the respective UTLs for background. Therefore, the RGs will be based on the background UTLs.

Table G-1
Summary of Remedial Goals[a]
Based on Cancer Risk
Total Soil - SWMU 51
July 2008

Chemical	Future Maintenance Worker			Future Industrial Worker			Future Excavation Worker[b]			Future Lifetime Resident			Future Child Resident		
	TR =10^{-6}	TR =10^{-5}	TR =10^{-4}	TR =10^{-6}	TR =10^{-5}	TR =10^{-4}	TR =10^{-6}	TR =10^{-5}	TR =10^{-4}	TR =10^{-6}	TR =10^{-5}	TR =10^{-4}	TR =10^{-6}	TR =10^{-5}	TR =10^{-4}
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	2.1	20.6	206.0	0.5	4.6	46.4	17.1	171.0	1710.0	0.1	1.2	12.0	0.2	1.7	17.3
2,6-Dinitrotoluene	2.1	21.1	211.0	0.5	4.6	46.3	17.1	171.0	1710.0	0.1	1.2	12.0	0.2	1.7	17.4
Dioxins (TCDD TE)[c]	0.005	0.005	0.005	0.005	0.005	0.005	NA	NA	NA	0.001	0.001	0.001	0.001	0.001	0.001
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitroglycerin	83.7	837.0	8370.0	18.8	188.0	1880.0	NA	NA	NA	4.8	47.7	477.0	7.0	69.8	698.0
2-Nitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrotoluene	92.4	924.0	9240.0	20.0	200.0	2000.0	713.0	7130.0	71300.0	5.1	51.0	510.0	7.4	73.9	739.0
2,4,6-Trinitrotoluene	63.8	638.0	6380.0	14.6	146.0	1460.0	458.0	4580.0	45800.0	3.2	31.9	319.0	4.7	46.8	468.0
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic[d]	Bkgd	Bkgd	Bkgd	Bkgd	Bkgd	Bkgd	NA	NA	NA	Bkgd	Bkgd	Bkgd	Bkgd	Bkgd	Bkgd
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Bkgd = Within Background
COI = Chemical of Interest; exceeded risk = 1.0E-06 in the baseline risk assessment.
NA = Not Applicable
TR = Target Cumulative Risk
All values are presented in milligrams per kilogram (mg/kg).
Shaded cells indicate COIs for each receptor group.

[a] For each receptor, the target risks for each COI are based on apportioning the cumulative risk across the total number of COIs with the exception of metals that were found to be within background concentrations.

[b] Due to the size of SWMU 51 (0.16 acres), RGs for the excavation worker are based on an exposure frequency of 90 days/year and exposure duration of 1 year.

[c] Dioxins were included in the apportionment of risk. RGs will be based, however, on USEPA industrial and residential cleanup levels for dioxins/furans (see text).

[d] COI was within background concentrations for total soil at SWMU 51.

Appendix H

National Environmental Policy Act Compliance Evaluation

Appendix H

Compliance with NEPA Requirements
SWMU 51

Environmental Consideration (i.e., Attributes)	**Alternative One:** No Further Action	**Alternative Two:** Institutional Controls (Land Use Controls, Groundwater Monitoring)	**Alternative Three:** Excavation of Sludge and Grossly Contaminated Soil and Off-site Disposal
Ecology – Impact on Wetlands	No wetlands identified at SWMU 51. No impact to wetlands.	No wetlands identified at SWMU 51. No impact to wetlands.	No wetlands identified at SWMU 51. No impact to wetlands.
Ecology – Impact on Endangered and/or Threatened Species	No endangered and/or threatened species affected.	No endangered and/or threatened species affected.	While not observed during site reconnaissance, several threatened and endangered species have been found within the grassland community type at RFAAP. Some habitat may be disturbed during excavation activities in the excavation area. The area affected is minimal compared to overall site. Therefore, effects are expected to be minimal.
Ecology – Impact on Vegetation	No impact.	No impact.	Limited vegetation will be removed during excavation activities. No impact otherwise.
Archeological	None present in the SWMU 51 area.	None present in the SWMU 51 area.	None present in the SWMU 51 area.
Noise	None.	None.	Slight increase in noise levels (dB) due to excavation activities. Increases will not be significant.
Water – surface water, groundwater	No impact to surface water or groundwater.	No impact to surface water or groundwater.	Contaminants would be removed. Therefore, no migration of contaminants to groundwater will occur. Erosion control measures will be employed to prevent impacts to surface water bodies.
Human Aspects	No human impact.	No human impact.	There will be minimal increase in traffic due to excavation activities.
Land – Soil erosion, land use	No effect.	No effect.	Erosion control measures must be implemented during excavation activities. No impacts on current land use.
Waste disposal – solid waste, hazardous waste	No effect. No waste generated.	No effect. No waste generated.	Will require disposal of decontamination water. In addition, soil will be disposed at appropriate (RCRA Subtitle C or D) landfill facility.
Resources	No effect. No increased use of resources.	No effect. No increased use of resources.	No effect. No increased use of resources.
Air	No effect. Contaminants are present subsurface.	No effect. Contaminants are present subsurface.	Increase in dust during excavation activities. Dust suppression measures will be employed to keep dust generation to a minimum.

RFAAP = Radford Army Ammunition Plant
RCRA = Resource Conservation and Recovery Act
dB = Decibels