DELIVERY ORDER NO. 0023
ENVIRONMENTAL SERVICES
PROGRAM SUPPORT
CONTRACT DACA31-00-D-0011

RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA

SWMU 6 DECISION DOCUMENT

FINAL DOCUMENT

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LIST OF ACRONYMS

bgs.....Below Ground Surface
CFR.....Code of Federal Regulations
COPC.....Constituent of Potential Concern
MDC .....Maximum Detected Concentration
mg/kg .....Milligrams Per Kilogram
MMA .....Main Manufacturing Area
NC.....Nitrocellulose
NRU.....New River Unit
PBS .....Production Base Support
RBC .....Risk-Based Concentration
RCRA .....Resource Conservation and Recovery Act
RFAAP .....Radford Army Ammunitions Plant
RFI .....RCRA Facility Investigation
SVOC.....Semi-Volatile Organic Compound
SWMU .....Solid Waste Management Unit
TAL.....Target Analyte List
TCL.....Target Compound List
TCLP .....Toxicity Characteristic Leaching Procedure
URS .....URS Corporation
USACE .....United States Army Corps of Engineers
USEPA .....United States Environmental Protection Agency
UTL.....Upper Tolerance Limit
VDEQ .....Virginia Department of Environmental Quality
VOC.....Volatile Organic Compound

1.0 INTRODUCTION

1.1 BACKGROUND

In accordance with Contract Number DACA31-00-D-0011, Delivery Order Nos. 18 and 27, URS Corporation (URS) was tasked by United States Army Corps of Engineers (USACE), Baltimore District to perform soil sampling and reporting at Solid Waste Management Unit (SWMU) 6, Acid Wastewater Lagoon, located in the Main Manufacturing Area (MMA) at the Radford Army Ammunition Plant (RFAAP), Radford, Virginia. The objective was to collect and analyze subsurface soil samples from SWMU 6 and perform an evaluation of the resultant data with respect to Resource Conservation and Recovery Act (RCRA) hazardous waste characteristics and United States Environmental Protection Agency, Region III (USEPA) Risk-Based Concentrations (RBCs).

Soil sampling at SWMU 6 was necessary to properly manage excavated soils that will be generated as part of the Production Base Support (PBS) project to construct nitrocellulose (NC) settling tanks at SWMU 6. The planned depth of excavation is 25 feet. The SWMU 6 sampling program results will allow RFAAP to properly manage the excavated material during construction and to prevent future sampling under the tanks once the construction is complete.

RFAAP submitted the SWMU 6 Soil Sampling Results Report to USEPA on May 11, 2001. Approval of the Report was granted in a letter dated June 12, 2001. As a point of clarification, the Report makes reference to reactivity (percent nitrocellulose) and reactivity (percent explosives). The Report should reference total reactivity regardless of the source. Section 7.0, Summary and Conclusions, of the SWMU 6 Soil Sampling Results Report (URS, 2001), indicated that RFAAP would present a comparison of SWMU 6 inorganic data to the Point Estimates derived from the Facility-Wide Background Study (IT Corp., 2002). This document represents a Decision Document based on the results of that comparison. The objective of this Summary Report is to provide the basis for an agreement between RFAAP, USEPA, and Virginia Department of Environmental Quality (VDEQ). Specifically, pursuant to the results presented in the SWMU 6 Sampling Results Report (URS, 2001) and based on the analyses presented herein, a RCRA Facility Investigation (RFI) is not required for SWMU 6 per the USEPA RCRA Corrective Action Permit, RFAAP, Part II, Section D.7.a. and b.

1.2 FACILITY-WIDE BACKGROUND STUDY

Subsequent to USEPA approval of the SWMU 6 Soil Sampling Results Report, IT Corporation (IT Corp.) completed a Facility-Wide Background Study at the MMA and the New River Unit (NRU) of RFAAP (note that this work was completed in accordance with Work Plan Addendum No. 10). Task objectives were to characterize naturally occurring background soil inorganic constituent concentrations within the MMA and the NRU (IT Corp., 2002). Scope of work activities included the collection of background soil samples to establish a baseline for inorganic compounds of concern at RFAAP. Background sample locations were selected based on soil types and collected in areas not impacted by Installation activities. Associated soils were evaluated based on formation properties and chemical and physical characteristics.

The final set of Point Estimates for the background data set is based on calculated 95% Upper Tolerance Limits (UTLs) for a single, Facility-wide data set that represents surface and subsurface soil from the MMA and NRU areas. These values are included in the Facility-Wide Background Study as a point of reference for point-by-point comparisons for site screening. For several constituents, the 95% UTLs are below the RBCs, which were used to screen chemicals of potential concern (COPCs) at this SWMU (see Section 3.0). Thus, by utilizing an additional screening tool (i.e., the 95% UTLs), the potential for identifying naturally occurring elements as contaminants is minimized.

2.0 OVERVIEW OF SWMU 6 SAMPLING PROGRAM

2.1 SOIL SAMPLING PROGRAM – OBJECTIVES

The specific objectives of soil sampling and reporting at SWMU 6 were (1) to collect and chemically analyze composite and discrete subsurface soil samples from overburden soils; (2) to perform an evaluation of the data with respect to RCRA hazardous waste characteristics; and (3) to provide data that can be used to evaluate residual risk through comparison to USEPA Region III Residential and Industrial RBCs and background concentrations.

2.2 SOIL SAMPLING PROGRAM – METHODS

To achieve these objectives, twelve soil borings were advanced. One representative composite sample was collected from the overburden soil, and one representative discrete sample was collected of the soils at depth from each of the twelve soil borings. The composite overburden samples were analyzed for full Toxicity Characteristic Leaching Procedure (TCLP) compounds including TCLP Metals, TCLP Volatile Organic Compounds (VOCs), TCLP Semi-volatile Organic Compounds (SVOCs), TCLP Pesticides, and TCLP Herbicides, plus corrosivity, ignitability, and paint filter liquids in accordance with SW-846 Test Methods. Results were compared to 40 Code of Federal Regulations (CFR) 261 Subpart C to assess the appropriate disposal methods for soil excavated as part of the PBS project. Reactivity was analyzed using the site laboratory methods for energetic material. RFAAP considers soils with less than 10 percent energetic material to be non-hazardous.

Discrete samples were collected from below the planned excavation depth of 25 feet below ground surface (bgs), or at probe refusal (if less than 25 feet bgs). Each of the twelve discrete samples was analyzed for Target Compound List (TCL) VOCs, TCL SVOCs, TCL Pesticides/Aroclors, Target Analyte List (TAL) Metals, and Explosives following SW-846 Test Methods. Soil analytical results were compared to USEPA Region III Residential and Industrial RBC Tables (hazard quotient adjusted to 0.1 for non-carcinogens) to evaluate the residual risk of compounds detected in the discrete samples. Although, exposure at depths of 25 feet bgs is not anticipated and the area is not likely to be developed residentially, the Residential RBCs were used as the initial screening levels.

3.0 EVALUATION OF SWMU 6 DATA

3.1 COMPARISON TO TCLP CRITERIA

The results of the laboratory analyses indicate that several of the TCLP analytes (for evaluation of overburden soils as hazardous waste) were reported at values that are above the laboratory detection limits. However, none of the analytes detected exceeded the Regulatory TCLP limits for hazardous waste (see section 5.3 of URS, 2001). Based on these results, the soil excavated as part of the construction project will not require disposal as hazardous waste.

3.2 COMPARISON TO RISK-BASED CONCENTRATIONS

3.2.1 Organic Data

As presented in the SWMU 6 Soil Sampling Results Report (Sections 5.4 and 5.5, URS, 2001), Maximum Detected Concentrations (MDCs) of TCL VOCs, SVOCs, Pesticide/PCBs and Explosives did not exceed either Residential or Industrial RBCs.

3.2.2 Inorganic Data

Table 1 presents the results of discrete sample data comparisons to screening criteria (USEPA Region III, April 2, 2002, RBCs, and background Point Estimates) for inorganic chemicals at SWMU 6. Seven constituents were present above Residential RBCs. Aluminum (10,200 to 49,600 milligrams per kilogram [mg/kg]) detections were above the Residential RBC of 7,800 mg/kg. Arsenic detections (3.8 to 7.6 mg/kg) were above the Residential RBC of 0.43 mg/kg. Chromium detections (18.6 to 51.5 mg/kg) were above the Chromium VI Residential RBC of 23 mg/kg. Iron detections (20,500 to 40,400 mg/kg) were above the Residential RBC of 2,300 mg/kg. Manganese detections (181 to 1,510 mg/kg) were above the Residential RBC Food value of 1,100 mg/kg. The Thallium detection (1.2 mg/kg) was above the Residential RBC of 0.55 mg/kg. Vanadium detections (45.9 to 89.9 mg/kg) were above the Residential RBC of 55 mg/kg.

Of the seven constituents present above Residential RBCs, only Arsenic detections (3.8 to 7.6 mg/kg) were above the Industrial RBC of 3.8 mg/kg. The MDC of arsenic at SWMU 6, detected above its Industrial RBC, is below background Point Estimates (i.e., 95% UTL Point Estimates) established in the Facility-Wide Background Study (IT Corp., 2002). Additionally, the six constituents that had MDCs between Residential RBCs and Industrial RBCs are below background Point Estimates (i.e., 95% UTL Point Estimates) with one exception, Aluminum. Aluminum was reported as present in sample 6SB12B at 49,600 mg/kg, which is above the 95% UTL Point Estimate of 40,041 mg/kg. This detection of aluminum is well below the Industrial RBC value of 200,000 mg/kg. Given the nature of this site, the depth bgs, the lack of viable pathways, and the toxicity of the constituent, this exceedance is not considered a risk at SWMU 6.

TABLE 1
COMPARISON OF SWMU 6 SUBSURFACE SOIL INORGANIC DATA TO COMPARISON CRITERIA
SWMU 6 DECISION DOCUMENT
RADFORD ARMY AMMUNITION PLANT, RADFORD, VIRGINIA

TAL METALS										
Sample ID	6SB3B	6SB4B	6SB5B	6SB6B	6SB6BFD	6SB7B	6SB8B	Comparison Criteria (mg/kg)		
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg			
Sample Depth (feet bgs)	25.9 - 27.9	25 - 27	15.4 - 17.4	25 - 27	25 - 27	25 - 27	25 - 27	RBC Values		Background^
								Res	Ind	
Aluminum	**19,000**	**36,800**	**23,600**	**22,800**	**26,100**	**21,100**	**28,600**	7,800	200,000	40,041
Antimony	0.45 UN	0.48 UN	0.43 UN	0.47 UN	0.46 UN	0.46 UN	0.46 UN	3.1	82	--
Arsenic	**3.8**	**7.6**	**4.3**	**6.8**	**6.4**	**5.6**	**4.5**	0.43	3.8	15.8
Barium	67.5	53.1	46.9	53.2	62.9	39.6	37.6	550	14,000	209
Beryllium	0.54 B	1.2	0.98	1.1	1.2	0.91	1.9	16	410	1.02
Cadmium[1]	0.3 B	0.56 B	0.38 B	0.25 B	0.29 B	0.28 B	0.61 B	7.8	200	0.69
Calcium	584	427	10400	509	536	590	411	--	--	--
Chromium[2]	**45.4 N**	**26.8 N**	**24.4 N**	18.6 N	20 N	**25.2 N**	**32.3 N**	23	610	65.3
Cobalt	17.8	15.5	9.7	6.7	9.8	6.5	6	160	4,100	72.3
Copper	16.3	34.6	20.8	20.3	22.7	18.4	33.3	310	8,200	53.5
Iron[3]	**28,700**	**38,100**	**26,800**	**26,300**	**29,400**	**31,900**	**29,800**	2,300	61,000	50,962
Lead[4]	20.3	31.4	10.3	15.2	19.4	17.1	18	400	1,000	26.8
Magnesium	2,250	7,560	12,300	9,090	9,490	3,760	4,400	--	--	--
Manganese[5]	**525 N**	**659 N**	**356 N**	**339 N**	**574 N**	**181 N**	**291 N**	1100	29000	2,543
Mercury[6]	0.14	0.11	0.063	0.085	0.11	0.12	0.1	2.3	61	0.13
Nickel	10.9	23.1	16.1	15.4	17.3	15.2	21.5	160	4,100	62.8
Potassium	1,010 E	3,550 E	2,140 E	3,030 E	3,130 E	1,610 E	1,350 E	--	--	--
Selenium	0.98	0.96	0.87	0.53 U	0.57 B	0.58 B	0.9	39	1,000	--
Silver	0.83	0.89	0.58 B	0.69	0.88	0.89	0.21 B	39	1,000	--
Sodium	33.9 U	36.2 U	32.6 U	36 U	35.1 U	35.3 U	34.9 U	--	--	--
Thallium	0.63 U	0.67 U	0.61 U	0.67 U	0.65 U	0.66 U	0.65 U	0.55	14	2.11
Vanadium	49.5 N	**75.6 N**	46.5 N	47.4 N	53.1 N	**55.4 N**	48.8 N	55	1,400	108
Zinc	36.3	75.6	35.4	56.4	58.5	54.3	56.8	2,300	61,000	202

TABLE 1 (Continued)
COMPARISON OF SWMU 6 SUBSURFACE SOIL INORGANIC DATA TO COMPARISON CRITERIA
SWMU 6 DECISION DOCUMENT
RADFORD ARMY AMMUNITION PLANT, RADFORD, VIRGINIA

TAL METALS										
Sample ID	6SB9B	6SB10B	6SB11B	6SB12B	6SB13B	6SB13BFD	6SB14B	Comparison Criteria (mg/kg)		
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg			
Sample Depth (feet bgs)	25 - 27	18.4 - 20.4	25 - 27	25 - 27	25 - 27	25 - 27	25 - 27	RBC Values		Background^
								Res	Ind	
Aluminum	**16,200**	**10,200**	**21,900**	**49,600**	**27,800**	**30,700**	**35,700**	7,800	200,000	40,041
Antimony	0.44 UN	0.4 UN	0.45 UN	0.45 UN	0.49 UN	0.48 UN	0.48 UN	3.1	82	--
Arsenic	**4.2**	**3.9**	**5.3**	**3.9**	**6.5**	**6.3**	**6.2**	0.43	3.8	15.8
Barium	50.4	78.6	50.1	68.1	102	77.8	58.9	550	14,000	209
Beryllium	0.37 B	0.58	0.91	1.4	1.2	1.2	1.8	16	410	1.02
Cadmium[1]	0.21 B	0.21 B	0.32 B	0.44 B	0.47 B	0.51 B	0.44 B	7.8	200	0.69
Calcium	1590	288	335	518	770	806	632	--	--	--
Chromium[2]	**24.6 N**	**30 N**	19.7 N	**33.6 N**	**33 N**	**51.5 N**	**33.7 N**	23	610	65.3
Cobalt	7.1	8	6.3	11.4	26.4	11.8	8.2	160	4,100	72.3
Copper	9.6	7.8	16.8	38.1	26	22.6	27.4	310	8,200	53.5
Iron[3]	**23,100**	**21,600**	**27,800**	**20,500**	**40,400**	**38,400**	**30,800**	2,300	61,000	50,962
Lead[4]	17.3	19.5	14.6	9.9	40.3	19.3	15	400	1,000	26.8
Magnesium	1,680	703	3,000	55,500	2,780	2,540	22,600	--	--	--
Manganese[5]	**324 N**	**812 N**	**227 N**	**317 N**	**1,510 N**	**583 N**	**253 N**	1,100	29,000	2,543
Mercury[6]	0.086	0.03 B	0.11	0.036 B	0.13	0.12	0.077	2.3	61	0.13
Nickel	7.2	6.2	16.5	20.1	21.5	18.6	23.2	160	4,100	62.8
Potassium	594 E	262 E	1,020 E	21,200 E	1,350 E	1,300 E	9,210 E	--	--	--
Selenium	0.68	0.44 U	0.64	0.5 U	1.5	1.9	0.64 B	39	1,000	--
Silver	0.75	0.57	0.89	0.3 B	1.6	1.5	0.9	39	1,000	--
Sodium	33.6 U	30.4 U	34 U	34.3 U	48.3 B	53.6 B	36.7 U	--	--	--
Thallium	0.63 U	0.57 U	0.63 U	**1.2 B**	0.7 U	0.68 U	0.68 U	0.55	14	2.11
Vanadium	49.6 N	45.9 N	51.8 N	**63.7 N**	**70.4 N**	**89.9 N**	**65.7 N**	55	1,400	108
Zinc	28.7	35.3	45.2	57.5	61.9	59.2	53.9	2,300	61,000	202

Notes:

U = Compound analyzed for and not detected
J = Estimated concentration below contract required detection limit.
N = Sample spike recovery outside of control limits
FD = Field Duplicate
B (inorganics) = Analyte value was below the contract required detection limit but greater than or equal to the instrument detection limit
E = Concentration exceeds upper level of the calibration range of instrument
RBC = Risk-based concentration (EPA Region III, April 2, 2002)
A hazard quotient (HQ) of 0.1 is used for non carcinogens and a target risk level of $1E10^{-6}$ is used for carcinogens
TAL = Target Analyte List
Background^ = 95% Upper Tolerance Limit (IT Corp., 2002)

XXXXXX = Exceedance of Residential RBC
XXXXXX = Exceedance of Residential and Industrial RBC
XXXXXX = Exceedance of Background Point Estimate (IT Corp., 2002)

-- = Value not published or calculated
ft = feet
mg/kg = Milligrams per kilogram
bgs = Below ground surface
Res = Residential
Ind = Industrial

1 = Cadmium RBC Food Value used
2 = Chromium VI RBC Value used
3 = Iron Value Changed April 2, 2002
4 = Lead Screening Values (not an RBC)
5 = Manganese RBC Food Value used
6 = Mercuric Chloride RBC Value used

4.0 SUMMARY & CONCLUSIONS

The SWMU 6 Soil Sampling Results Report (URS, 2001) presented a detailed comparison of site data to USEPA Region III RBCs for the residential and industrial scenarios. Based on MDC comparisons, the inorganic constituent arsenic was reported as present in exceedance of the Residential and Industrial RBCs. Other MDCs were reported as below Industrial RBCs. Subsequently, the data was compared to background Point Estimates as established in the Facility-Wide Background Study (IT Corp., 2002).

The MDC for arsenic is below background Point Estimates and therefore arsenic is not considered a risk at the site. One detection of aluminum, while above the background Point Estimate, is below the Industrial RBC (Table 2). This detection of aluminum is well below the Industrial RBC value of 200,000 mg/kg. Given the industrial nature of the site, the depth bgs, the lack of viable pathways, and the toxicity of the constituent, this exceedance is not considered a risk at SWMU 6.

Based on the information presented in the SWMU 6 Soil Sampling Results Report and herein, concentrations of chemicals detected in soil samples at the site do not present a residual risk.

TABLE 2
SUMMARY OF CONTAMINANTS OF POTENTIAL CONCERN
DISCRETE RESIDUAL RISK SAMPLE ANALYSES
SWMU 6 DECISION DOCUMENT
RADFORD ARMY AMMUNITION PLANT, RADFORD, VIRGINIA

Compound	Residential Comparisons		Industrial Comparisons		Background Comparisons	
	Residential RBC (mg/kg)	Value Exceeded in One or More Samples?	Industrial RBC (mg/kg)	Value Exceeded in One or More Samples?	Background Point Estimate* (mg/kg)	Value Exceeded in One or More Samples?
Aluminum	7,800	Yes (12)	200,000	No	40,041	Yes (1)
Arsenic	0.43	Yes (12)	3.8	Yes (11)	15.8	No
Chromium	23	Yes (10)	610	No	65.3	No
Iron	2,300	Yes (12)	61,000	No	50,962	No
Manganese	160	Yes (12)	4100	No	2,543	No
Thallium	0.55	Yes (1)	14	No	2.11	No
Vanadium	55	Yes (5)	1,400	No	108	No

Notes:

Yes (value) = Number of results that exceed either the Residential RBC, Industrial RBC, or background Point Estimates, as applicable - excludes field duplicate data

No = No applicable results exceed the Residential RBC, Industrial RBC, or background Point Estimates, as applicable

RBC = USEPA Region III Risk-Based Concentration (April 2, 2002)

A hazard quotient (HQ) of 0.1 is used for non-carcinogens and a target risk level of $1E10^{-6}$ is used for carcinogens

mg/kg = Milligrams Per Kilogram

* = 95% Upper Tolerance Limit (IT Corp., 2002)

5.0 REFERENCES

IT Corporation (IT Corp.). 2002. *Facility-Wide Background Study:* Prepared for USACE Baltimore District.

URS Corporation (URS). 2001. *SWMU 6 Soil Sampling Results Report:* Prepared for USACE Baltimore District.