Message from <Geiger.William@epamail.epa.gov> on Wed, 1 Oct 2008 15:07:04 -0400 -----

To: "McKenna, Jim J Mr CIV USA AMC" <jim.mckenna@us.army.mil>

cc: <diane.wisbeck@arcadis-us.com>, "jim spencer" <james_o_spencer@urscorp.com>, "Parks, Jeffrey N" <Jeffrey.Parks@shawgrp.com>, <jeremy.flint@atk.com>, <jerome.redder@atk.com>, <jlcutler@deq.virginia.gov>, "Mendoza, Richard R Mr CIV USA IMCOM" <richard.r.mendoza@us.army.mil>, "Davie, Robert N Mr CIV USA AMC" <robert.davie@us.army.mil>, <Timothy.Leahy@shawgrp.com>, "Llewellyn, Tim" <Tim.Llewellyn@arcadis-us.com>, <Tina_Devine@URSCorp.com>, "Meyer, Tom NAB02" <Tom.Meyer@usace.army.mil>

Subject: Re: List of Planned and Submitted Documents (UNCLASSIFIED)

Jim, EPA/VDEQ approve the SWMU 39 Interim Measures Work Plan, and the Final WPA 024 MMRP SSP Work Plan.

Per our previous agreement, hard copy letters from the regulatory

agencies are not required for work plans.

William A. Geiger

USEPA Region III

1650 Arch Street

Philadelphia, PA 19103

09/26/2008 11:59 AM

From: "McKenna, Jim J Mr CIV USA AMC" <jim.mckenna@us.army.mil>
To: William Geiger/R3/USEPA/US@EPA, <jlcutler@deq.virginia.gov>, "Meyer, Tom NAB02" <Tom.Meyer@usace.army.mil>, "Llewellyn, Tim" <Tim.Llewellyn@arcadis-us.com>, <Timothy.Leahy@shawgrp.com>, <Tina_Devine@URSCorp.com>, <diane.wisbeck@arcadis-us.com> "Parks, Jeffrey N" <Jeffrey.Parks@shawgrp.com>, "jim spencer" <james_o_spencer@urscorp.com>

cc "Mendoza, Richard R Mr CIV USA IMCOM" <richard.r.mendoza@us.army.mil>, <jeremy.flint@atk.com>, <jerome.redder@atk.com>, "Davie Robert N Mr CIV USA AMC" <robert.davie@us.army.mil>

Subject : List of Planned and Submitted Documents (UNCLASSIFIED)

Classification: UNCLASSIFIED

Caveats: NONE

All:

Please see attached file.

Text below has brief highlights from this file of where we stand as I see it. More details are in the attached file so check it closely for actions in your respective lanes that I might have missed. Let's discuss at our Oct 28, 2008 meeting.

Thanks,

Jim

Final SWMU 51 RFI/CMS submitted, need EPA and DEQ approval letter. Somewhat complicating issue/s, after we submitted the final RFI/CMS DEQ commented further in re LUC. We addressed this comment in the subsequent certification letter as the report had already been submitted. Need to get the RFI/CMS report approved in order to move ahead with the SWMU 51 IMWP and SWMU 39 IMWP (see SWMU 39 below)

Final SWMU 54 RFI/CMS submitted need EPA and DEQ approval letter.

FLFA RFI/CMS report, partial EPA/DEQ comments received need to get human health and ecological risk comments

WPA 25 RAAP047 Work Plan, approved and needs to get this on the website, coordinate with me on the correspondence trail

SWMU 39 IMWP, need EPA and DEQ approval letter. This action is tied to the SWMU 51 IMWP to achieve cost savings by consolidating field mobilization efforts, etc.

SWMU 40/71 RFI/CMS partial EPA/DEQ comments received need to get human health and ecological risk comments

Final WPA 024 MMRP SSP Work Plan, need EPA and DEQ approval letter
WPA 026 AOC A Work Plan, work was done 07/01/2008, need EPA and DEQ approval letter

WPA 027 NRU RI Work Plan, Like DEQ approval letter of this plan. Most of the work is complete, well drilling to start week of 29 Sep 2008.

Draft SWMU 57 RFI/CMS report, need EPA/DEQ comments.

HWMU 5 Revised to reflect we will need to submit a HWMU 5 Corrective Action Plan to DEQ on or before 12 Dec 2008.

Classification: UNCLASSIFIED
Caveats: NONE

(See attached file: List of Planned and Submitted Documents for

Regulatory Review 26 Sep 2008 jjm.doc)

Ammunition Systems Group
Energetic Systems Division
Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24143-0100

www.atk.com

September 22, 2008

Mr. William Geiger
RCRA General Operations Branch, Mail Code: 3WC23
Waste and Chemicals Management Division
U. S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Mr. James L. Cutler, Jr.
Virginia Department of Environmental Quality
629 East Main Street
Richmond, VA 24143-0100

Subject: Final Master Work Plan Addendum 024, Site Screening Process, with Certification
Military Munitions Response Program, September 2008
Radford Army Ammunition Plant, Radford, Virginia,
EPA ID# VA1 210020730

Dear Mr. Geiger and Mr. Cutler:

Enclosed is the certification for the subject document that was sent to you on September 16, 2008. Also enclosed is a copy of the transmittal email message.

Please coordinate with and provide any questions or comments to myself at (540) 639-8658, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 731-5782.

Sincerely,

P.W. Holt, Environmental Manager
Alliant Techsystems Inc.

c: Durwood Willis
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

E. A. Lohman
Virginia Department of Environmental Quality
West Central Regional Office
3019 Peters Creek Road
Roanoke, VA 24019

08-815-142
JMcKenna

Rich Mendoza
U.S. Army Environmental Command
1 Rock Island Arsenal
Bldg 90, 3rd Floor, Room 30A
IMAE-CDN
Rock Island, Illinois 61299

Tom Meyer
Corps of Engineers, Baltimore District
ATTN: CENAB-EN-HM
10 South Howard Street
Baltimore, MD 21201

Coordination: J. McKenna M. A. Miano

bc: Administrative File
J. McKenna, ACO Staff
Rob Davie-ACO Staff
M.A. Miano
P.W. Holt
J. J. Redder
Env. File

08-815-142
JMcKenna

Concerning the following:

Radford Army Ammunition Plant

Final Work Plan Addendum 24
Site Screening Process
Radford Army Ammunition Plant, Virginia
Military Munitions Response Program
September 2008

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

SIGNATURE:
PRINTED NAME: Jon R. Drushal
TITLE: Lieutenant Colonel, US Army
Commanding

SIGNATURE:
PRINTED NAME: Kent Holiday
TITLE: Vice President and General Manager
ATK Energetics Systems Division

08-815-142
JMcKenna

Greene, Anne

From: McKenna, Jim
Sent: Tuesday, September 16, 2008 2:42 PM
To: Sarah_Gettier@URSCorp.com; Greene, Anne; beth lohman; dennis.druck@us.army.mil; diane.wisbeck@arcadis-us.com; durwood willis2; Geiger.William@epamail.epa.gov; Redder, Jerome; jim spencer; jlcutler@deq.virginia.gov; Llewellyn, Tim; Mendoza, Richard R Mr CIV USA IMCOM; Parks, Jeffrey N; Timothy.Leahy@shawgrp.com; Tina_Devine@URSCorp.com; Tom.Meyer@nab02.usace.army.mil
Subject: RE: Final Master Work Plan Addendum 024 Site Screening Process Radford (UNCLASSIFIED)

Importance: High

Classification: UNCLASSIFIED
Caveats: NONE

All:

Note the contractor will ship the subject replacement pages and/or CDs with a copy of this email to the POCs listed below with their respective FedEx tracking numbers:

Mary Ellen Maly, Army Environmental Command
7905 7729 3748, 1 hard copy (replacement pages only), 1CD

Jim McKenna, Radford Army Ammunition Plant 7900 8523 1181, 2 hard copies (entire report)

Nancy Flaherty, USACE-Baltimore
7900 8523 8290, 1CD

William Geiger, USEPA Region III
7911 3776 4931, 1 hard copy (replacement pages only), 1CD

Jim Cutler, Virginia Dept of Environmental Quality (VDEQ)
7927 5015 2380, 2 hard copies (replacement pages only), 2 CDs (one for Durwood Willis)

Rich Mendoza, Army Environmental Command-RIA
7927 5015 5345, 1CD

Elizabeth A. Lohman, Virginia Dept of Environmental Quality 7900 8526 3603, 1CD

Jim Spencer, URS Corporation
7921 0658 5520, 1 hard copy (entire report)

Thank you for your support of the Radford AAP Installation Restoration Program.

Jim McKenna

Classification: UNCLASSIFIED
Caveats: NONE

Sarah Gettier/Gaithersburg/URSCorp
09/17/2008 02:11 PM

To "McKenna, Jim J Mr CIV USA AMC" <jim.mckenna@us.army.mil>
cc "beth lohman" <ealohman@deq.state.va.us>, Geiger.William@epamail.epa.gov, "jim spencer" <james_o_spencer@urscorp.com>, jerome.redder@atk.com,
bcc
Subject RE: Final Master Work Plan Addendum 024 Site Screening Process Radford (UNCLASSIFIED)

MMRP Team -

You should be receiving the replacement pages and/or CD for the subject document either today or tomorrow.

In addition, I am attaching the revised telecon summary from our September 9, 2008 call for your records. This version has the requested revisions from VDEQ.


9 sept 08 telecon summary for WP_revised.pdf

Fieldwork is tentatively planned for the last week of September.

Sarah

Sarah M. Gettier, P.E.
Senior Environmental Engineer
URS Corporation
200 Orchard Ridge Drive, Suite 101
Gaithersburg, MD 20878
Tel: 301.258.9780
Direct: 301.721.2299
Fax: 301.258.5857

This e-mail and any attachments are confidential. If you receive this message in error or are not the intended recipient, you should not retain, distribute, disclose or use any of this information and you should destroy the e-mail and any attachments or copies.

"McKenna, Jim J Mr CIV USA AMC" <jim.mckenna@us.army.mil>

Teleconference Summary

PURPOSE: Radford Army Ammunition Plant (RFAAP) MMRP Site Screening Process (SSP) Master Work Plan Addendum 024 Approval Meeting

LOCATION: Teleconference Call

DATE: 09 September 2008

TIME: 1300 - 1340

Attendees	Organization	Phone	email
Jim Cutler	VDEQ	804.698.4498	jlcutler@deq.virginia.gov
Will Geiger	EPA, Region III	215.814.3413	geiger.william@epa.gov
Mike Cramer	EPA, Region III	215.814.3446	cramer.mike@epa.gov
Betty Ann Quinn	EPA, Region III	215.814.3388	quinn.elizabeth@epa.gov
Mary Ellen Maly	USAEC	410.436.7083	maryellen.h.maly@us.army.mil
Nancy Flaherty	USACE, Bal District	410.779.2796	nancy.E.Flaherty@usace.army.mil
Jim McKenna	RFAAP	540.639.8641	jim.mckenna@us.army.mil
Sarah Gettier	URS	301.721.2299	sarah_gettier@urscorp.com
Jim Spencer	URS	804.474.5420	james_O_Spencer@urscorp.com

VDEQ = Virginia Department of Environmental Quality
EPA = Environmental Protection Agency
USAEC = U.S. Army Environmental Command
USACE = U.S. Army Corps of Engineers, Baltimore District

The meeting began at 1315.

I. Introduction of meeting attendees

- Attendees introduced themselves.
- Mr. Geiger informed all that Ms. Quinn (EPA – toxicologist) and Mr. Cramer (EPA - hydrogeologist) are sitting in on this meeting.

II. Discussion of the Master Work Plan Addendum 024 Site Screening Process

- Ms. Gettier informed the participants that the purpose of this call was to discuss the Work Plan and talk about any comments by VDEQ and EPA.
- Mr. Cutler (VDEQ) had two comments
  1. Page 1-17, Section 1.8.1 first sentence seems to have incorrect references to subsections 3.2.1 and 3.2.2.
     - *Ms. Gettier indicated that those subsections are incorrect and the sentence will be revised to direct the reader to Section 1.8.2 where there is a discussion on Composite Soil Sample procedures.*
  2. Pate 1-17, Section 1.8.1, Please clarify the field procedures in this paragraph. Provide more details as to how the field crew will determine the location of the soil sample locations.
     - *The text is revised to state; "Soil sampling for MC will include collecting 15 composite soil samples, which is further discussed in subsection 1.8.2. Before soil sampling, field personnel will examine the berm and the hillside for bullet fragments. If none are seen on the*

surface a shovel will be used to scrape the surface of the berm to locate shallowly buried bullet fragments. At up to 20 locations, field personnel will shovel the soil to a depth of several inches (up to one foot if necessary) searching for bullet fragments at random locations on the berm (lower, middle and top of berm). Six composite soil samples from the berm will be collected where bullets or bullet fragments are observed. If none are seen, locations will be selected at random. The same procedure will be followed for the hillside behind the berm; several locations will be shoveled in an attempt to identify bullet fragments. Seven composite samples will be collected from the hillside. In addition, two soil samples will be collected at random location near the construction debris pile located behind the berm."

- Mr. Geiger indicated that the EPA has no comments on the document and approves the document pending the VDEQ comments are incorporated.
- Due to the changes of the document only affecting a few pages. Replacement pages will be issued to all partied to make the document final. The pages to be replaced include:
    - Spines
    - Front Cover
    - Inside Cover with signatures
    - Page with revised Section 1.8.1 text and any affected pages
- No formal comments will be submitted by the regulators, the purpose of this conference call summary is to document the comments received during this 9 September 2008 call.
- Fieldwork is planned for late September after the Radford notification process is completed. Jim Spencer (URS) stated that this process takes approximately two weeks.

III. Adjournment

The meeting adjourned at 1340. URS will distribute the summary of the call by email directly to all attendees for review and comment.

09/12/08 1:27 PM
Geiger.William@epamail.epa.gov
EPA also agrees with the suggested change.

William A. Geiger
USEPA Region III
1650 Arch Street
Philadelphia, PA 19103
(215)814-3413

09/10/2008 11:51 AM
Sarah_Gettier@URSCorp.com

To: "Cutler,Jim" jlcutler@deq.virginia.gov, William Geiger/R3/USEPA/US@EPA, James_O_Spencer@URSCorp.com, Jerome.Redder@ATK.COM, "McKenna, Jim Mr. RFAAP ACO Staff" <jim.mckenna@us.army.mil>, "Maly, Mary Ellen USAEC" <maryellen.h.maly@us.army.mil>, nancy.e.flaherty@nab02.usace.army.mil, "Mendoza, Richard R USAEC" <richard.r.mendoza@us.army.mil>

Subject RE: Radford MMRP Conference Call - September 8th 1pm EST

Yes, I agree with your change. I will revise the text as you suggested. Thank you for the quick reply.

Sarah

Sarah M. Gettier, P.E.
Senior Environmental Engineer
URS Corporation
200 Orchard Ridge Drive, Suite 101
Gaithersburg, MD 20878
Tel: 301.258.9780
Direct: 301.721.2299
Fax: 301.258.5857

09/10/2008 11:47 AM
<jlcutler@deq.virginia.gov>

To <Sarah_Gettier@URSCorp.com>,<Geiger.William@epamail.epa.gov>, <James_O_Spencer@URSCorp.com>, <Jerome.Redder@ATK.COM>,"McKenna, Jim Mr. RFAAP ACO Staff"<jim.mckenna@us.army.mil>,"Maly, Mary Ellen USAEC" <maryellen.h.maly@us.army.mil>, <nancy.e.flaherty@nab02.usace.army.mil>, "Mendoza, Richard richard.r.mendoza@us.army.mil

RE: Radford MMRP Conference Call - September 8th 1pm EST

Sarah,

My only comment is change the second sentence on page two to read "...shovel the soil to a depth of several inches (up to one foot if necessary) searching for bullet fragments…" I just want to make sure we don't miss anything be going too shallow. Let me know if that would work for you.,

Thanks,

Jim

-----Original Message-----
From: Sarah_Gettier@URSCorp.com [
mailto:Sarah_Gettier@URSCorp.com]
Sent:: Wednesday, September 10, 2008 10:25 AM
To: Geiger.William@epamail.epa.gov;
James_O_Spencer@URSCorp.com; Jerome.Redder@ATK.COM; McKenna,
Jim Mr. RFAAP ACO Staff; Cutler,Jim; Maly, Mary Ellen USAEC;
Nancy Flaherty (nancy.e.flaherty@nab02.usace.army.mil);
Mendoza, Richard R USAEC
Subject: Re: Radford MMRP Conference Call - September 8th
1pm EST

MMRP Team -

I have attached a "Teleconference Summary" from our call
Monday, September 8th. This document includes the VDEQ
comments and the revised Section 1.8.1 text based on those
comments.

Please review the responses as quickly as possible so we can
send out the replacement pages to make the document Final by
the end of the week.

Thanks in advance.

Don't hesitate to call or email me with questions or
concerns.

Sarah

(See attached file: 9 sept 08 telecon summary for WP.doc)

Sarah M. Gettier, P.E.
Senior Environmental Engineer
URS Corporation
200 Orchard Ridge Drive, Suite 101
Gaithersburg, MD 20878
Tel: 301.258.9780
Direct: 301.721.2299
Fax: 301.258.5857

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Sarah Gettier/Gaithersburg/URSCorp

09/02/2008 03:58 PM
Geiger.William@epamail.epa.gov,Jerome.Redder@ATK.COM,"McKenna, Jim Mr.
RFAAP ACO Staff"<jim.mckenna@us.army.mil>,jlcutler@deq.virginia.gov,
"Maly, Mary Ellen USAEC"<maryellen.h.maly@us.army.mil>, "Nancy Flaherty
(nancy.e.flaherty@nab02.usace.army.mil)"<nancy.e.flaherty@nab02.usace.ar
my.mil>,"Mendoza,Richard R USAEC"<richard.r.mendoza@us.army.mil>, James
O Spencer/Richmond/URSCorp@URSCORP

Radford MMRP Conference Call -September 8th 1pm EST

Radford MMRP Team -

Since it has been a few months since the Stakeholder Draft Master Work Plan Addendum 024, Site Screening Process for Radford was submitted (April 08). We would like to have a teleconference to summarize the proposed field activities and sampling plan and get everyone on the same page.

Please let me know if Monday, September 8th at 1pm is a good time for all of you. Once I receive confirmation from everyone, I will send out a dial in number for the teleconference.

Thank you,
Sarah

Sarah M. Gettier, P.E.
Senior Environmental Engineer
URS Corporation
200 Orchard Ridge Drive, Suite 101
Gaithersburg, MD 20878
Tel: 301.258.9780
Direct: 301.721.2299
Fax: 301.258.5857

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Ammunition Systems Group
Energetic Systems Division
Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24143-0100

www.atk.com

April 23, 2008

Mr. William Geiger
RCRA General Operations Branch, Mail Code: 3WC23
Waste and Chemicals Management Division
U. S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Mr. James L. Cutler, Jr.
Virginia Department of Environmental Quality
629 East Main Street
Richmond, VA 24143-0100

Subject: With Certification, Stakeholder Draft Master Work Plan Addendum 024, Site Screening Process
Radford Army Ammunition Plant
Virginia, Military Munitions Response Program, April 2008, EPA ID# VA1 210020730

Dear Mr. Geiger and Mr. Cutler:

Enclosed is the certification for the subject document that was sent to you on March 31, 2008. Also enclosed is a copy of the transmittal email message.

Please coordinate with and provide any questions or comments to myself at (540) 639-8658, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

P.W. Holt, Environmental Manager
Alliant Techsystems Inc.

c: Durwood Willis
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

E. A. Lohman
Virginia Department of Environmental Quality
West Central Regional Office
3019 Peters Creek Road
Roanoke, VA 24019

Rich Mendoza
U.S. Army Environmental Command
1 Rock Island Arsenal
Bldg 90, 3rd Floor, Room 30A
IMAE-CDN
Rock Island, Illinois 61299

08-815-78
JMcKenna

Tom Meyer
Corps of Engineers, Baltimore District
ATTN: CENAB-EN-HM
10 South Howard Street
Baltimore, MD 21201

bc: Administrative File
J. McKenna, ACO Staff
Rob Davie-ACO Staff
M.A. Miano
P.W. Holt
J. J. Redder
Env. File

Coordination: J. McKenna

M. Miano by J. Yeakley
M. A. Miano

08-815-78
JMcKenna

Concerning the following:

Radford Army Ammunition Plant

Stakeholder Draft
Work Plan Addendum 24
Site Screening Process
Radford Army Ammunition Plant, Virginia
Military Munitions Response Program
April 2008

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

SIGNATURE: _____
PRINTED NAME: Jon R. Drushal
TITLE: Lieutenant Colonel, US Army
Commanding

SIGNATURE: _____
PRINTED NAME: Kent Holiday
TITLE: Vice President and General Manager
ATK Energetics Systems

Greene, Anne

From: McKenna, Jim
Sent: Friday, April 18, 2008 12:47 PM
To: McKenna, Jim; Greene, Anne; beth lohman; dennis.druck@us.army.mil; diane.wisbeck@arcadis-us.com; durwood willis2; Geiger.William@epamail.epa.gov; Redder, Jerome; jim spencer; jlcutler@deq.virginia.gov; Llewellyn, Tim; Mendoza, Richard R Mr CIV USA IMCOM; Meyer, Tom NAB02; Parks, Jeffrey N; Timothy.Leahy@shawgrp.com; Tina_Devine@URSCorp.com; Sarah_Gettier@URSCorp.com
Subject: Radford AAP - Draft Site Screening Process Work Plan Addendum 024 under the MMRP (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

All:

Note the contractor will ship the subject document with a copy of this email to the POCs and tracking numbers below.

Certification letter will follow from Radford AAP under separate cover.

Immediately below are the POCs with tracking numbers:

Jim McKenna, Radford Army Ammunition Plant, 798422901093, 1 hard copy, 2 CDs (one for Jerry Redder, ATK) Rich Mendoza, Army Environmental Command-RIA, 791047882276 , 1 CD Jim Cutler, Virginia Dept of Environmental Quality, 799310133513, 2 hard copies, 2 CDs (one for Durwood Willis) Elizabeth A. Lohman, Virginia Dept of Environmental Quality, 798922834453, 1 CD Nancy Flaherty, USACE-Baltimore, 791047894832, 1 CD Mary Ellen Maly, U.S. Army Environmental Command, 798422907584, 1 hard copy, 1 CD William Geiger, US EPA Region III, 790495730206, 1 hard copy, 1CD

Thank you for your support of the Radford AAP Installation Restoration Program.

Jim McKenna

Classification: UNCLASSIFIED
Caveats: NONE

FINAL

MASTER WORK PLAN
ADDENDUM 024
SITE SCREENING PROCESS
RADFORD ARMY AMMUNITION PLANT, VIRGINIA
MILITARY MUNITIONS RESPONSE PROGRAM

Prepared for

U.S. Army Corps of Engineers, Baltimore District
10 South Howard Street
Baltimore, MD 21201

September 2008

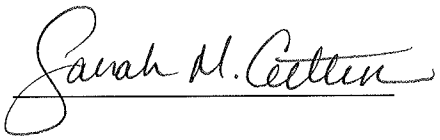
URS Group, Inc.
200 Orchard Ridge Drive, Suite 101
Gaithersburg, MD 20878
15299885

FINAL

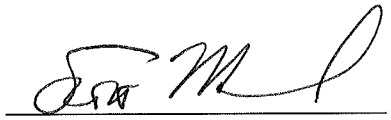
MASTER WORK PLAN ADDENDUM 024
SITE SCREENING PROCESS
RADFORD ARMY AMMUNITION PLANT, VIRGINIA
MILITARY MUNITIONS RESPONSE PROGRAM

Contract W912DR-06-C-0028, Work Order 001AD

Reviewed and Approved by:



Sarah Gettier
Project Manager
URS Group, Inc.



Scott McClelland
Program Manager
URS Group, Inc.

September 2008

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PREFACE

A two-stage approach has been developed to facilitate and streamline Resource Conservation and Recovery Act (RCRA) site investigations at Radford Army Ammunition Plant (RFAAP) pursuant to the Permit for Corrective Action and Waste Minimization (October, 2000). The approach consists of a single facility-wide Master Work Plan and multiple site-specific Work Plan Addenda.

The Master Work Plan provides comprehensive discussions of standard procedures, protocol, and methodologies that are to be followed during execution of field investigations at RCRA sites within the RFAAP. The Master Work Plan is a generic plan designed to streamline site-specific Work Plan Addenda development, review, and approval.

Each Work Plan Addendum describes the site-specific information for each RCRA site, providing detailed data on past site operations, potential chemicals of concern, sampling strategy, etc. Each addendum, through reference to the Master Work Plan, is developed as a concise document, focused on site-specific investigations.

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MASTER WORK PLAN ADDENDUM 024
RCRA SITE SCREENING PROCESS INVESTIGATION
ARMY RESERVE SMALL ARMS RANGE
MILITARY MUNITIONS RESPONSE PROGRAM

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MASTER WORK PLAN ADDENDUM 024
RCRA SITE SCREENING PROCESS INVESTIGATION
ARMY RESERVE SMALL ARMS RANGE
MILITARY MUNITIONS RESPONSE PROGRAM

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LIST OF ABBREVIATIONS AND ACRONYMS

%.....Percent
AEDB-R.....Army Environmental Database-Restoration
AES.....Atomic Emission Spectroscopy
ANSAR.....Army Reserve Small Arms Range
ATK.....Alliant Techsystems, Inc
bgs.....Below Ground Surface
CA.....Corrective Action
CERCLA.....Comprehensive Environmental Response, Compensation, and Liability Act
CLP.....Contract Laboratory Program
COC.....Chain of Custody
COPCs.....Chemicals of Potential Concern
COR.....Contracting Officer's Representative
CSM.....Conceptual Site Model
DAF.....Dilution attenuation factor
DoD.....Department of Defense
DQO.....Data Quality Objective
EPIC.....Environmental Photographic Interpretation Center
ERIS.....Environmental Restoration Information System
ft.....Feet
GPS.....Global Positioning System
HAZCOM.....Hazard Communication
HRR.....Historical Records Review
HSP.....Health and Safety Plan
HSPA.....Health and Safety Plan Addendum
HTRW.....Hazardous, Toxic, and Radioactive Waste
MC.....Munitions Constituents
MDL.....Method Detection Limit
MEC.....Munitions and Explosives of Concern
µL.....Microliter
mL.....Milliliter
MHSP.....Master Health and Safety Plan
MMA.....Main Manufacturing Area
MMRP.....Military Munitions Response Program
MQAP.....Master Quality Assurance Plan
MRS.....Munitions Response Site
MRSPP.....Munitions Response Site Prioritization Protocol
MS/MSD.....Matrix Spike/Matrix Spike Duplicate
MSDS.....Material Safety Data Sheet
msl.....Mean Sea Level
MWP.....Master Work Plan
NELAP.....National Environmental Laboratory Accreditation Program
NFA.....No Further Action
OSHA.....Occupational Safety and Health Administration
PARCC.....Precision, accuracy, representativeness, completeness, and comparability
PM.....Project Manager
PPE.....Personal Protective Equipment
QA.....Quality Assurance

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(CONTINUED)

QC.....Quality Control
QA/QC.....Quality Assurance/Quality Control
QAP .....Quality Assurance Plan
QAPA.....Quality Assurance Plan Addendum
QSM.....Quality Systems Manual
RBC .....Risk-Based Concentration
RCRA.....Resource Conservation and Recovery Act
RFA.....RCRA Facility Assessment
RFAAP.....Radford Army Ammunition Plant
RFI .....RCRA Facility Investigation
RL .....Reporting Limit
SHSO .....Site Health and Safety Officer
SI.....Site Inspection
SOP .....Standard Operating Procedure
SOW.....Statement of Work
SSL.....Soil Screening Level
SSP.....Site Screening Process
TNT.....2,4,6-Trinitotoluene
TPP.....Technical Project Planning
UCL .....Upper Confidence Limit
URS.....URS Group, Inc.
USACE .....United States Army Corps of Engineers
USAEC .....United States Army Environmental Command
USEPA.....United States Environmental Protection Agency
VDEQ .....Virginia Department of Environmental Quality
WPA.....Work Plan Addendum

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1.0 WORK PLAN ADDENDUM

In accordance with Contract Number W912DR-06-C-028, URS Group, Inc. (URS) has been tasked by the United States Army Corps of Engineers (USACE), Baltimore District to perform a Resource Conservation and Recovery Act (RCRA) Site Screening Process (SSP) Investigation of Military Munitions Response Program (MMRP) eligible sites at Radford Army Ammunition Plant (RFAAP), Radford, Virginia. The SSP Work Plan for the one eligible site, the Army Reserve Small Arms Range, is presented as Work Plan Addendum (WPA) 024 to, and incorporates by reference, the elements of the RFAAP Master Work Plan (MWP) (URS 2003). This WPA serves the same purpose as an MMRP Site Inspection (SI) Work Plan.

This SSP WPA was developed to describe the necessary tasks to complete this project and to ensure that the project will be in conformance with the USACE project Scope of Work (SOW). In addition, this SSP WPA incorporates the ideas and resolutions generated during the Technical Project Planning (TPP) process.

This SSP WPA will be used with the understanding that unanticipated conditions may dictate a change in the plan as written. Any necessary deviations from the plan will be brought to the attention of the USACE, Baltimore District Project Manager as soon as possible, and a written request for variance will be submitted to document the decision made.

1.1 PROJECT TERMINOLOGY

The Department of Defense (DoD) is currently establishing policy and guidance for munitions response actions under the MMRP. Key program drivers developed to date conclude that munitions response actions will be conducted under the process outlined in the National Contingency Plan, as authorized by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). While it is DoD's intent to address MMRP sites under CERCLA, the Army recognizes that some installations will need to address MMRP sites under the RCRA Corrective Action (CA) program. RFAAP is owned by the Army and is operated by contractor Alliant Techsystems, Inc. (ATK). RFAAP investigates sites under the RCRA Corrective Action Permit issued by the United States Environmental Protection Agency, Region III (USEPA) in October 2000. Therefore, the SSP will follow RCRA terminology not CERCLA terminology. The Final *CTT Range Inventory Report* (Malcolm Pirnie, 2002) for RFAAP marked the completion of the RCRA Facility Assessment (RFA) phase of MMRP work under RCRA, and the next phase of the MMRP is the execution of a MMRP SSP Report.

This WPA blends the established work plan formats from both the MMRP and the SSP. Where appropriate, references are made to previous investigations and the MWP to avoid redundancy.

1.2 MMRP SSP PROJECT OBJECTIVES

The purpose of this project is to assess the presence or absence of munitions and explosives of concern (MEC) and munitions constituents (MC) that may remain from activities conducted by the DoD during operation of these sites and that may pose a threat to human health or the environment. The primary goal of the MMRP SSP typically is to collect the appropriate amount of information necessary to make one of the following decisions:

- Whether a RCRA Facility Investigation (RFI) is required at a site;
- Whether an immediate response is needed; or
- Whether the site qualifies for no further action (NFA).

The secondary goal of the SSP is to collect information for developing the MMRP program, including Cost to Complete estimates and site prioritization for the MMRP-eligible sites. The prioritization is established by performing the Munitions Response Site Prioritization Protocol (MRSPP).

1.3 ADDITIONAL SSP OBJECTIVES

The SSP process includes additional objectives that partially overlap the MMRP SSP objectives. The SSP consists of the following steps (USEPA 2001):

- Performance of a desktop audit and site visit to develop the scope of the SSP Work Plan (accomplished during the Historical Records Review (HRR));
- Preparation of a SSP site-specific WPA (equivalent to the MMRP SI Work Plan);
- Performance of the field work in accordance with the approved WPA;
- Evaluation of the SSP data and completion of pre-remedial risk screening; and
- Assessment of the need for further investigation, interim removal action, or preparation of a "No Further Action" Decision Document, per the RCRA Corrective Action permit based on the results of the SSP and risk screening.

The SSP risk screening for human health comprises the following five steps:

- Identification of chemicals of potential concern (COPCs) and cumulative risk screening;
- Chemical specific screening for lead;
- Comparison to soil screening levels (SSLs) for the soil-to-groundwater migration pathway;
- Comparison to applicable relevant and appropriate requirements; and
- Comparison to RFAAP background point estimates for metals.

Ecological risk screening for the SSP comprises the following elements: site reconnaissance, screening-level problem formulation, exposure assessment, ecological effects assessment, and risk calculation. The findings of this ecological risk screen are used as input to risk management decision-making for the site. The scientific/management decision point reached from the ecological risk screening concludes that one of the following statements is true:

- There is adequate information to conclude that ecological risks are negligible and therefore there is no need for further action at the site on the basis of ecological risk;
- The information is not adequate to make a decision at this point and further refinement of data is needed to augment the ecological risk screening; or
- The information collected and presented indicates that a more thorough assessment is warranted.

The proposed SSP field program is designed to meet the above project objectives.

This site-specific WPA provides the rationale and methods for field activities at the only MMRP eligible MRS, The Army Reserve Small Arms Range in support of the SSP investigation. Consistent with the MWP, this addendum includes of the following sections:

- Section 1, WPA;
- Section 2, Quality Assurance Plan (QAP) Addendum (QAPA);
- Section 3, Health and Safety Plan (HSP) Addendum (HSPA); and
- Section 4, References.

Also incorporated as part of this WPA are these key components:

- Appendix A –TPP Meeting Minutes
- Appendix B – Standard Operating Procedures (SOPs)
- Appendix C – Forms
- Appendix D – Laboratory Quality Assurance (QA) Manual and Analytical SOPs (available only as a compact disk)
- Appendix E – Environmental Restoration Information System (ERIS) Database Format

This WPA references sections and SOPs contained in the MWP for the investigation at the Army Reserve Small Arms Range Munitions Response Site (MRS). Relevant SOPs are included in Appendix B of this WPA. The MWP will be kept on site and used during field activities.

Table 1-1 lists the specific MWP investigative activities planned. The tasks performed as part of this WPA will be conducted in accordance with the MWP and the SOPs contained therein and included herein as Appendix B.

Changes to the approved WPA will be documented using the Work Plan Revision Form (Form C-1; Appendix C). Revisions must be reviewed and approved by the USACE Contracting Officer's Representative (COR) and the RFAAP designee prior to implementation. Project personnel will be required to read this WPA and to sign and date a Worker Acknowledgement Form (Form C-2; Appendix C). The Site Health and Safety Officer (SHSO) will retain this form on the site during investigative activities. Appropriate health and safety precautions will be taken due to the potential for exposure to or handling of hazardous materials, energetics, and/or their degradation compounds.

Table 1-1

Applicable MWP Activities and Related SOPs

Subject	MWP Section	SOPs MWP Appendix A and Appendix B to WPA 024
Documentation	4.3	10.1 Field Logbook 10.2 Surface Water, Groundwater, and Soil/Sediment Field Logbooks 10.4 Chain-of-Custody Form
Sample Management	5.1	50.1 Sample Labels 50.2 Sample Packaging
Decontamination Requirements	5.12	80.1 Not Applicable
Investigation-Derived Material	5.13	70.1 Not Applicable
Subsurface Investigation	5.2	20.8 Magnetic and Metal Detection Surveys 30.1 Soil Sampling 30.7 Sampling Strategies

1.4 SITE BACKGROUND – DESCRIPTION

RFAAP (also referred to as the "Installation") is a government-owned, contractor-operated industrial complex located 40 miles southwest of Roanoke, Virginia as illustrated in Figure 1-1. The Installation is owned by the U.S. Department of the Army and was operated under contract with Hercules, Inc., from 1941 until 1995 when ATK became the operating contractor.

The HRR Report (URS, 2008) identified one MRS at RFAAP, which is described in detail in this section. Table 1-2 summarizes the MRS name, Army Environmental Database-Restoration (AEDB-R) number, and size in acres. The location of this MRS is presented in Figure 1-2.

Table 1-2: Summary of the MRS at RFAPP

Site Name	AEDB-R Number	HRR Acreage
Army Reserve Small Arms Range	RFAAP-001-R-01	7.6

1.4.1 Army Reserve Small Arms Range MRS



The Army Reserve Small Arms Range is a former small arms firing range used for small arms training from approximately 1941 to 1968. Based on HRR findings the range was used by both the National Guard and the Army Reserve for .30 caliber firing. The closed range is located along the southeastern boundary of the Main Manufacturing Area (MMA) of RFAAP and occupies approximately 7.6 acres. As illustrated on Figure 1-3, a berm is still present indicating the direction of fire was southeast. The berm is overgrown with a tangle of weeds and mature trees (see inset figure below). The berm is approximately 10 feet high. Stroubles Creek flows behind the perimeter fence directly behind the berm. A steep hill is located south of Stroubles Creek. It is possible that this hill was used as a backstop before the berm was constructed. No bullets were observed during the HRR. URS did observe building debris, including pieces of conductive flooring, behind the berm. Currently, public access to RFAAP is controlled and includes the former range site although public access may have been possible in the past. The former range is an unused grass baseball field surrounded by a fence that is separate from the control measures used for public access.

The Army Reserve Small Arms Range was added to RFAAPs RCRA Corrective Action Permit on July 15, 2005.

MEC is not expected at this site; expended small arms are not MEC. There is no evidence or data regarding MC at the site. However, based on findings for similar small arms ranges operated by the Army, there is a potential for MC to be present. The most likely indicator for MC is in the form of lead in soil, or elemental lead from bullets at the berm behind the target locations.



URS
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Gaithersburg, MD 20878

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0 50 100 Miles

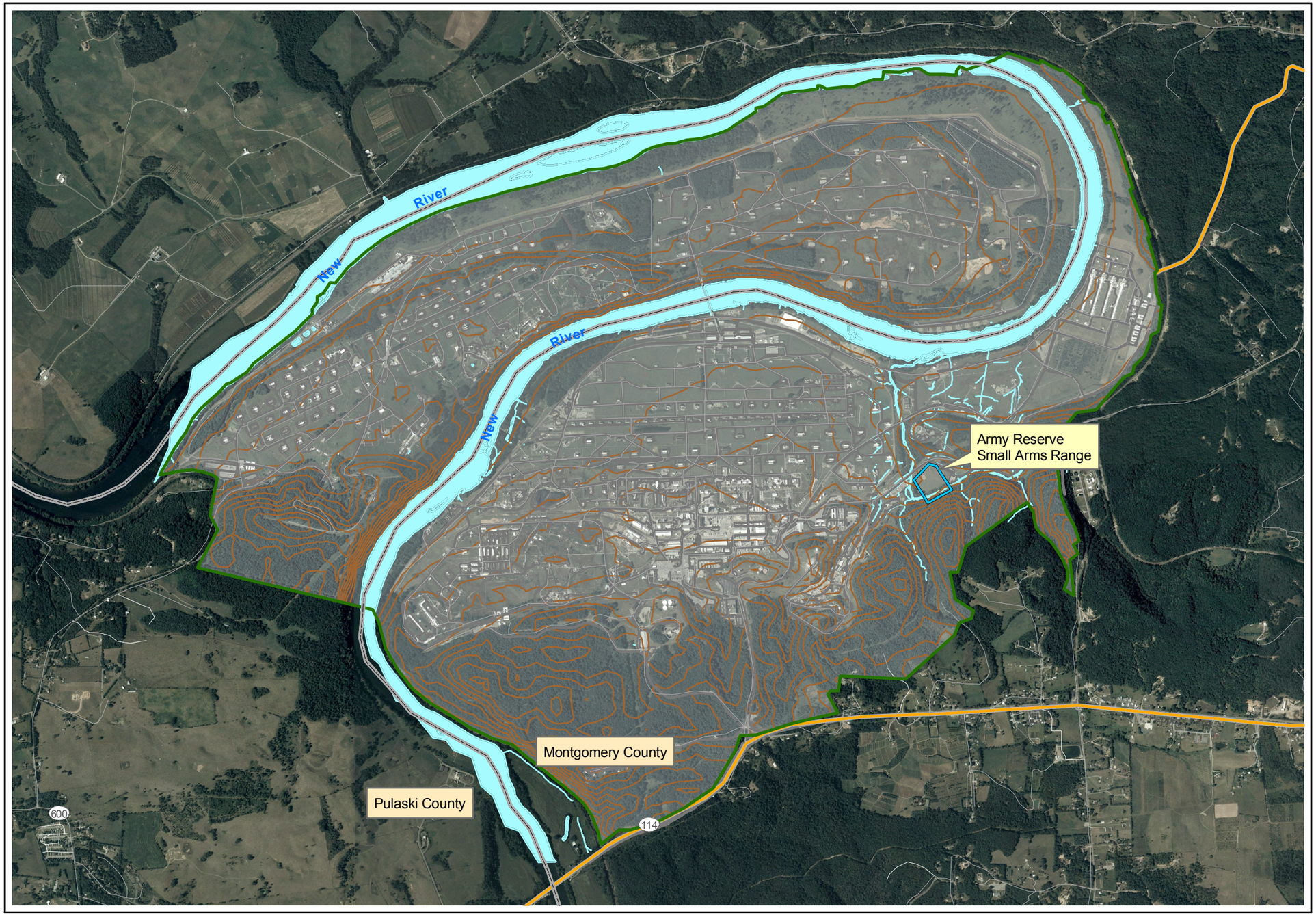
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Senior: SG

Figure 1-1
Installation Location Map
RFAAP, VA

Back of figure

Main Manufacturing Area, RFAAP, VA

URS
200 Orchard Ridge Drive
Gaithersburg, MD 20878



Installation Location



Radford AAP

Legend

- MRS Boundary
- Installation Boundary
- Counties
- Roads
- Contours
- Waterbodies
- Streams

Projection	UTM, Zone 17
Horizontal Datum	NAD83
Units	Meters
Grid	500 Meters

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0 1,000 2,000 Feet

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Figure 1-2
Army Reserve Small Arms Range
Main Manufacturing Area
RFAAP, VA

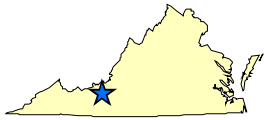
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Army Reserve Small Arms Range

URS
200 Orchard Ridge Drive
Gaithersburg, MD 20878



Installation Location



Radford AAP

Legend

- MRS Boundary
- Historic Feature
- Streams

Source of Aerial:
USDA NAIP 2005 imagery



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Figure 1-3
MRS Site Layout
Army Reserve Small Arms Range
RFAAP, VA

Back of figure

1.5 SITE BACKGROUND – ENVIRONMENTAL SETTING

1.5.1 Physiography

The Army Reserve Small Arms Range MRS comprises an approximate 7.6-acre area located in the southeastern section of the MMA at RFAAP (Figure 1-2) adjacent to Stroubles Creek. The site is located within a nearly level alluvial plain at an elevation of approximately 1715 ft mean sea level (msl). Areas across Stroubles Creek to the south slope steeply upward from the creek to an elevation of more than 1950 ft msl. Most of the site is an open grass field with wooded areas located along the banks of Stroubles Creek.

1.5.2 Tanks and Structures

Tanks or structures are not located in or near the Army Reserve Small Arms Range.

1.5.3 Surface Water

Stroubles Creek is a perennial stream that flows through the southern portion of the Army Reserve Small Arms Range MRS and then turns northward from the site area toward the New River, where it discharges approximately 3,000 ft north of the site. Other surface water bodies, drainage ditches, manholes, catch basins are not located on the site.

Overland storm water flow from the site is generally expected to flow toward Stroubles Creek. In the area of the firing berm, which parallels the creek, runoff on the southside of the berm would flow toward Stroubles Creek, while runoff on the opposite side of the berm would flow away from Stroubles Creek toward the north. Across the firing berm from Stroubles Creek, runoff would be expected to flow down the relatively steep slopes northward toward Stroubles Creek. Areas adjacent to Stroubles Creek may experience inundations during periods of high flow and flooding.

1.5.4 Soil and Geology

The site area is underlain by Weaver soil, which consists of moderately well drained and deep soil located in nearly level areas within flood plains. This soil has low to moderate permeability, low to moderate organic content, and it is neutral to moderately alkaline. Available water capacity is high and surface runoff is slow. A seasonally high water table exists in the Weaver soil at a depth of 18 to 30 inches. A typical profile of undisturbed soil consists of a 10-inch thick surface layer of dark brown silt loam underlain by a 39-inch thick subsoil of silt loam of variable color. The substratum is dark gray gravel sandy clay loam below approximately 49 inches. Depth to bedrock is greater than 40 inches (URS 2003).

Soil underlying the hillside across Stroubles Creek from the site is underlain by the Berks-Weikert Complex, which consists of well-drained soil on moderately steep to steep side slopes. Reaction of this soil is extremely acid to strongly acid. Permeability ranges from moderate to moderately rapid with high to rapid surface water runoff. A typical profile of the soil includes a surface layer of shaley silt loam underlain by a subsoil of shaley silt loam. Soft shale bedrock is typically present at a depths ranging from 20 to 40 inches (URS 2003).

The geologic map presented below the site is alluvium, which consists of unconsolidated alluvial deposits within the flood plain of Stroubles Creek. Carbonate bedrock of the Cambrian Elbrook Formation underlies these alluvial deposits. Mississippian rocks of the Price Formation crop out across Stroubles Creek from the site. This formation consists of mottled red and green shale and mudstone interspersed with brownish-green siltstone and sandstone (URS 2003).

1.5.5 Groundwater

Groundwater investigations have not been conducted at the Army Reserve Small Arms Range MRS site. Based on site characteristics, groundwater is expected to occur at shallow depths (15 ft or less) within

alluvium and within underlying weathered and fractured bedrock. Local groundwater flow direction is expected to be toward the south and Stroubles Creek. Stroubles Creek is a local discharge point for groundwater in the site area.

1.6 SCOPE OF WORK

The MMRP SSP includes the following three interrelated tasks:

- HRR – consists of identifying data gaps from the Phase 3 CTT Inventory (Preliminary Assessment) and obtaining and reviewing historical records to fill these gaps;
- TPP Session – consists of planning activities to identify project objectives and designing data collection programs to meet these objectives; and
- SSP Field Sampling and Reporting – consists of performing field investigations at the MRSs, and preparing an SSP report of the findings; and scoring each MRS using the MRSPP.

1.6.1 Historical Records Review

The Final HRR Report was submitted in January 2008 to USACE, Baltimore District, the U.S. Army Environmental Command (USAEC), RFAAP, USEPA, and the Virginia Department of Environmental Quality (VDEQ).

The HRR was completed to support the SSP (URS, 2008). The HRR expanded on the information collected during the *CTT Range Inventory* and provided information pertinent to identifying, verifying, and establishing the physical limits and potential for MEC and MC at each site. Historical records, aerial photographs, existing site maps, and existing environmental restoration documents were reviewed, and interviews with installation personnel were conducted. Available existing installation-specific background studies were reviewed.

1.6.2 TPP Process/Data Gap Analysis

The TPP process is a comprehensive and systematic method that involves four phases of planning activities. It was developed for identifying project objectives and designing data collection programs for hazardous, toxic, and radioactive waste (HTRW) sites. Use of the TPP process is consistent with the philosophy of taking a graded approach to planning that will produce the type and quality of results needed for site-specific decision making.

A TPP session was held by teleconference on December 18, 2007, and the minutes of this meeting are presented in Appendix A. The decision of the TPP session was to conduct MC sampling as described in this SSP WPA.

Table 1-3 provides a summary of TPP decisions for activities to be performed at Army Reserve Small Arms Range MRS.

Table 1-3: Summary of SSP Activities from TPP2

MRS	SI Activities	
	Activity	**Purpose**
Army Reserve Small Arms Range	MC sampling at the former berm. MC analytes are arsenic, antimony and lead. Use a shovel to examine berm for bullet fragments. Collect 6 composite surface soil samples located in the berm. Collect 7 composite surface soil samples located in the hillside behind the berm. In addition, collect 2 composite surface soil samples in the construction debris pile behind berm for arsenic, chromium and lead. Environmental media to be sampled is surface soil (0-6 inches).	Compare site data to the following: - Lead comparison criteria associated with Commercial/Industrial and Recreational Use. - EPA residential lead comparison criteria of 400 mg/kg, published in the *Revised Interim Soil Lead Guidance for CERCLA Sites, OSWER Directive 9355.4*-12 (EPA, 1994) - EPA Region 3 residential Risk Based Concentrations (RBCs) October 2007. - EPA Region 3 Soil Screening Levels (soil-to-groundwater) - Background Facility-Wide Point Estimates for Soil Aid in completing MRSPP, Module 3.

1.6.3 Field Activities

Field investigations will include the collection of sufficient information to show whether MC is present at the MMRP eligible site at RFAPP. The MRS site and sampling locations are provided in Figure 1-4.

1.6.3.1 MEC Field Activities

Small arms ranges do not typically have MEC, and no historical evidence was found of any other use of the Army Reserve Small Arms Range MRS that would suggest MEC presence. Therefore, no field investigation of MEC will be conducted at the site.

1.6.3.2 MC Field Activities

The goal of the field sampling activities for MC is to determine whether the site has been affected by MC. Recommendations will be developed concerning the scope of the RFI based on a weight-of-evidence approach that considers: a) the analytical data exceeding background levels, b) results of screening the analytical data against appropriate comparison criteria, and c) other factors such as MC distribution.

The SSP field sampling activities are not intended to determine the nature and extent of all contaminants. The MC decision point is whether MC is present at levels of concern at locations deemed most likely to contain MC (i.e., 'hotspot' evaluation).

All fieldwork will be of sufficient quality to meet the data quality objectives (DQOs) for the project as dictated in the QAPA (Section 2.0) and the TPP meeting minutes (Appendix A). The details of the planned MC field sampling activities are provided in Section 1.8.

Figure 1-4 shows the approximate soil sample locations at the site in its current condition. The actual locations will be determined by the field team. The vegetative cover shown in the inset figure (Section 1.4.1) indicates that site clearing (in the area of the samples) will be necessary.

1.6.3.3 Laboratory Analysis

The number of samples to be collected for each analysis, including the associated field quality control samples, is summarized in Table 1-4. The planned analytical method was selected on the basis of the munitions items known to have been used at the site. The standard analytical method to be is used is USEPA Method 6010B Trace for a specific list of total metals.

Table 1-4: Sample Summary

Army Reserve Small Arms Range MRS	Number of Samples	QA/QC Samples (b)	Analytical Parameters
Berm	6 Composite (a)	1 Field Duplicate 1 MS/MSD	Arsenic, Antimony, and Lead (6010B Trace)
Hillside	7 Composite (a)		
Construction Debris Area	2 Composite (a)	1 Field Duplicate 1 MS/MSD	Arsenic, Chromium, and Lead (6010B Trace)

(a) Spoke and hub compositing technique as discussed in Section 1.8.2.
(b) Collected at a rate of field duplicates 1 for every 20 field samples and MS/MSD at 1 for every 10 field samples per location.
QA/QC = Quality Assurance/Quality Control
MS/MSD = Matrix spike/matrix spike duplicate samples

URS will meet the project-specific DQOs for sampling, analysis, and quality assurance/quality control (QA/QC) objectives by collecting the proper quantities and types of samples, using the correct analytical methodologies, implementing field and laboratory QA/QC procedures, and using data validation and evaluation processes. The DQOs for each analytical method are provided in the QAPA (Section 2). Laboratory requirements for the analytical methods being used for this project are provided in this section and in the QAPA. These procedures include requirements for sample preparation, sampling containers, preservation methods, and holding times.

The QAPA has been developed to support the sampling, analysis, and evaluation activities associated with this project. The QAPA consists of policies, procedures, specifications, standards, and documentation sufficient to produce data of quality adequate to meet the DQOs for the project.

The QAPA has been prepared to ensure that this responsibility is met throughout the duration of this project. It addresses procedures to assure the precision, accuracy, representativeness, completeness, and comparability (PARCC) of field and laboratory data generated during the course of this project. The QAPA defines the first stage of the quality requirements for sample and data acquisition, handling, and assessment.

Quality procedures such as tracking, reviewing, and auditing are implemented as necessary to ensure that all project work is performed in accordance with professional standards, EPA and USACE regulations and guidelines, and the specific goals and requirements stated in this WPA.

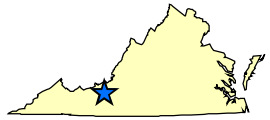
Oversight of sample collection, analysis, and assessment will be performed by technical project personnel. Laboratory equipment will be maintained and calibrated, and records of these activities will be kept in

Army Reserve Small Arms Range

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Installation Location



Radford AAP

Legend

- HRR Range Boundary
- Historic Feature
- Streams
- Proposed Soil Sample Location

Source of Aerial:
USDA NAIP 2005 imagery



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0 5 10 20 30 40 Meters

0 25 50 100 150 200 Feet

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Checked: SG
Senior: SG

Figure 1-4
SSP Sample Locations
Army Reserve Small Arms Range
RFAAP, VA

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accordance with established procedures. This will include laboratory oversight by URS project personnel, as well as laboratory data and document review.

Per the EPA criteria for data quality for risk-based projects, at least 10% of the analytical data are required to meet a comprehensive data substantiation related to sample collection, laboratory analysis, and data validation techniques. Following the process identified in the QAPA, final data usability will be determined by the URS Project Chemist in coordination with the URS Project Manager and independent Project Data Validator. Overall QA review of documentation, field sampling, and laboratory QC will allow determination of the acceptability of these data for use in this project.

Chemical analyses are discussed in greater detail in the QAPA.

1.7 CONCEPTUAL SITE MODEL (CSM)

A draft CSM is provided in Section 5 of the HRR. The final CSM will be developed after the field work and be provided in the SSP Report.

1.8 PLANNED FIELD ACTIVITIES

The Army Reserve Small Arms Range MRS SSP field program is designed to address the data gaps identified in Section 1.6.2 and meet both the MMRP and the SSP objectives identified in Sections 1.2 and 1.3, respectively. The selection of the investigation areas and soil sample locations followed SOP 30.7 (Sampling Strategies, included in Appendix B) using a combination of biased and systematic sampling technique to identify potential releases.

The MWP is referenced where routine activities will be performed in accordance with the MWP specifications, SOPs, and the Master Health and Safety Plan (MHSP; URS 2003). Variances to the specifications are documented in this WPA. Table 1-1 identifies the MWP SOPs that will be followed as part of the SSP for field documentation, surface investigation, sampling, field evaluations, and sample management. Copies of the SOPs identified in Table 1-1 are included in Appendix B.

1.8.1 MC Investigation Activities

Soil sampling for MC will include collecting 15 composite soil samples, which is further discussed in subsection 1.8.2. Before soil sampling, field personnel will examine the berm and the hillside for bullet fragments. If none are seen on the surface a shovel will be used to scrape the surface of the berm to locate shallowly buried bullet fragments. At up to 20 locations, field personnel will shovel the soil to a depth of a several inches (up to one foot if necessary) searching for bullet fragments at random locations on the berm (lower, middle and top of berm). Six composite soil samples from the berm will be collected where bullets or bullet fragments are observed. If none are seen, locations will be selected at random. The same procedure will be followed for the hillside behind the berm, several locations will be shoveled in an attempt to identify bullet fragments. Seven composite samples will be collected from the hillside. In addition, two soil samples will be collected at random location near the construction debris pile located behind the berm.

All soil samples will be collected from a depth of 0 to 6 inches. Composite samples will be collected using the "spoke and hub" technique, as described in Section 1.8.2. Soil samples will be analyzed for arsenic, antimony, and lead from the berm and hillside and for arsenic, chromium, and lead from the construction debris area using EPA SW-846 6010B Trace.

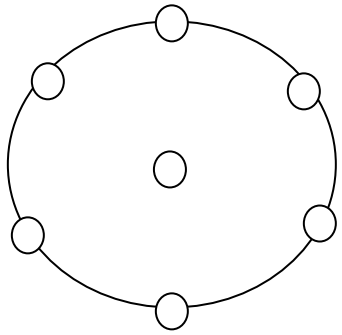
Analytical data from this site will be compared to the criteria listed in Table 1-3.

1.8.2 Composite Soil Samples

The composite soil samples will be collected using the "spoke and hub" method. Six grab soil samples will be collected from a wheel-shaped layout and a seventh grab sample from the center of the wheel using either a new polyethylene disposable scoop, or a dedicated, pre-cleaned stainless steel spoon, and combined in a stainless steel bowl or dedicated plastic sampling bag. A sample layout is shown below. The radius of the

wheel will be 1.5 feet (ft) unless field observations (i.e., stressed vegetation suggestive of MC) suggest an alternative radius.

Sample Layout



The seven sub-samples per sampling grid will be composited into one sample. The procedure for sample collection and compositing is as follows:

- Lay out the intended sample location and record the location in the field logbook. Prior to sample collection, don clean nitrile gloves and do not allow sampling equipment to contact potential sources of contamination.
- At each of the seven sub-sample locations, dig down approximately 6 inches using a dedicated, pre-cleaned spoon/trowel. The radius from the center sub-sample should be approximately 1 foot from the center sample. Avoid vegetation when collecting the samples if possible.
- Place soil from each sampling location into a disposable stainless steel bowl or dedicated plastic bag. Mix the composited soil sample by hand with a dedicated, pre-cleaned stainless steel spoon or disposable trowel until the sample color is homogeneous.
- Once the sample is collected, a Global Positioning System (GPS) point will be logged to locate the hub of the "spoke".

The analytical samples will be collected and placed directly into the appropriate sample containers, labeled, and placed in an ice chest chilled to a temperature of 4 degrees Celsius. A portion of the sample will be set aside and used to log a description of the soil characteristics (using the Unified Soil Classification System) on a soil sampling log form. After a sample is put into the ice chest, the chain of custody (COC) will be filled out. Only pre-cleaned or dedicated sampling equipment will be used to avoid the need for sampling equipment decontamination. Any excess soil will be returned to the sample holes and used as backfill material. Sample locations, at the center of the spoke and hub grid will be recorded using GPS.

Soil sample analysis will be conducted consistent with the requirements of the Master Quality Assurance Plan (MQAP) and Section 2.0 of this WPA. Sample management and analytical methods are discussed in detail in Sections 2.4 and 2.5 of this WPA, respectively.

1.8.3 Utility Clearance

Utility clearance is not an issue with the planned sampling involving only surface soil samples.

1.8.4 GPS Surveying

Each sample location will be surveyed to document the location. Field conditions, such as the number of satellites available at the reading time and density of the tree canopy, dictate the amount of time needed to acquire a reading. Coordinates will be established for each sample location to an accuracy of 1 meter.

Although there is no anticipation of MEC at this site, if confirmed or suspected MEC is observed, the coordinates will be recorded on the MEC Discovery Form (Form C-3) located in Appendix C; Munitions debris in the form of expended shells or bullets will not be recorded via GPS, but will be photographed and recorded in field notes.

1.8.5 Field Equipment

A variety of equipment will be used to perform the field activities for this project. All equipment will be appropriately calibrated (if necessary) and used in accordance with the manufacturer's specifications. For this project, field equipment will consist of personal protective equipment, sampling equipment, and a camera.

1.8.6 Laboratory Analysis

The analytical methods were selected on the basis of the munitions items known to have been used at the site and include the standard suite of range-related analytical parameters to account for unknown items. The planned standard USEPA analytical methods for soil sample analysis are Method 6010B Trace for lead, antimony, chromium, and arsenic.

The method reporting limits and method detection limits for this method are included in the QAPA, (Section 2). Table 2-2 details the number of analyses to be conducted.

1.8.7 Quality Assurance/Quality Control Samples

The QA and QC procedures are documented in the QAPA (Section 2). QA and QC samples are samples analyzed for the purpose of assessing the quality of the sampling effort and of the analytical data. QA samples, also known as split samples, are not planned for this site investigation. QC samples planned to be collected as part of the investigation include field duplicates and MS/MSD.

1.8.7.1 Field Duplicates

Field duplicate samples will be collected to monitor sample variability and sampling procedures. The collection frequency for field duplicates will be one for every 10 environmental samples collected (10 percent). The field duplicate samples will be analyzed for the same parameters as the associated field sample. For spoke and hub samples, a duplicate sample will be collected at each of the seven original points; a second spoke and hub wheel will not be used for duplicate sampling.

1.8.7.2 MS/MSD

MS/MSD samples will be collected to assess the effect of sample matrices on the analytical methods, and as a means of determining analytical precision and accuracy. The collection frequency for MS/MSDs will be 1 for every 20 (5 percent) environmental samples collected per matrix. The MS and MSD samples will be analyzed for the same parameters as the associated field samples.

1.8.8 Sampling Equipment Decontamination

In an effort to achieve the highest level of QC, one-time use, pre-cleaned sampling equipment will be used to avoid the need to decontaminate equipment between sampling locations. This type of equipment includes sampling gloves, scoops/trowels, mixing bowls, plastic sampling bags, and pre-cleaned sample jars.

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2.0 QUALITY ASSURANCE PLAN ADDENDUM

2.1 INTRODUCTION

This QAPA establishes function-specific responsibilities and authorities to ensure data quality for investigative activities at RFAAP. The project objectives will be met through the execution of the SOPs included in the MWP and appended to this document. The applicable SOPs are referenced below. Specific QC requirements include development of DQOs, performance of internal QC checks, and execution of appropriate analytical procedures during investigative activities. This QAPA is designed to be used in conjunction with the MQAP. Table 2-1 provides a list of general QA measures that will be implemented as specified in the MQAP.

Table 2-1

Quality Assurance Measures Discussed in the MQAP

Quality Assurance Measure	Section in MQAP	SOP No. (MWP Appendix A and Appendix B of WPA 024)
Project Organization and Responsibilities	2.0	--
Lines of Authority	2.2	--
Chemical Data Measurements	3.2	--
Levels of Concern	3.3	--
Site Investigation	4.0/5.0	20.8, 30.1, 30.7, 50.1, 50.2
Documentation Requirements	5.6	10.1, 10.2, 10.3, 50.1
Chain-of-custody Requirements	5.7	10.4, 50.2
Calibration Procedures	7.0	--
Data Reduction, Validation, Reporting, and Management	9.0	--
Corrective Action	10.0	--
Quality Assessments	11.0	--

The distribution list for submittals associated with this SSP is defined in the Facility Permit (USEPA, 2000a). At least one copy of draft documents and two copies of the final plans, reports, notifications, or other documents submitted as part of the SSP for the Army Reserve Small Arms Range MRS is to be submitted to the USEPA Regional Administrator, and shall be sent Certified Mail, Return Receipt Requested, overnight mail, or hand-carried to:

Mr. William A. Geiger
USEPA Region III
Federal Facilities Branch (3WC23)
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

In addition, one copy each such submission shall be sent to:

Jim Cutler
Commonwealth of Virginia
Department of Environmental Quality
Waste Division
629 East Main Street
Richmond, Virginia 23219

Elizabeth Lohman
Commonwealth of Virginia
Department of Environmental Quality
West Central Regional Office
Executive Office Park, Suite D
5338 Peters Creek Road
Roanoke, VA 24109

Moreover, one or more copies of each such submission shall be sent to:

Nancy Flaherty
USACE, Baltimore District
ATTN: CENAB-EN-HM (10000-B)
10 South Howard Street
Baltimore, Maryland 21201

Rich Mendoza
U.S. Army Environmental Command
1 Rock Island Arsenal
Bldg 90, 3rd Fl, NW Wing, Room 30A
IMAE-CDN (Attn: Rich Mendoza)
Rock Island, Illinois 61299-7050

James McKenna
Radford Army Ammunition Plant
Route 114, Peppers Ferry Road
Building 220
Attn: SJMRF-OP-EQ
Radford, Virginia 24143-0099

Mary Ellen Maly
U.S. Army Environmental Command
Attn: SFIM-AEC-CDP
5179 Hoadley Road, Building 4480
Aberdeen Proving Ground, MD 21010-5401

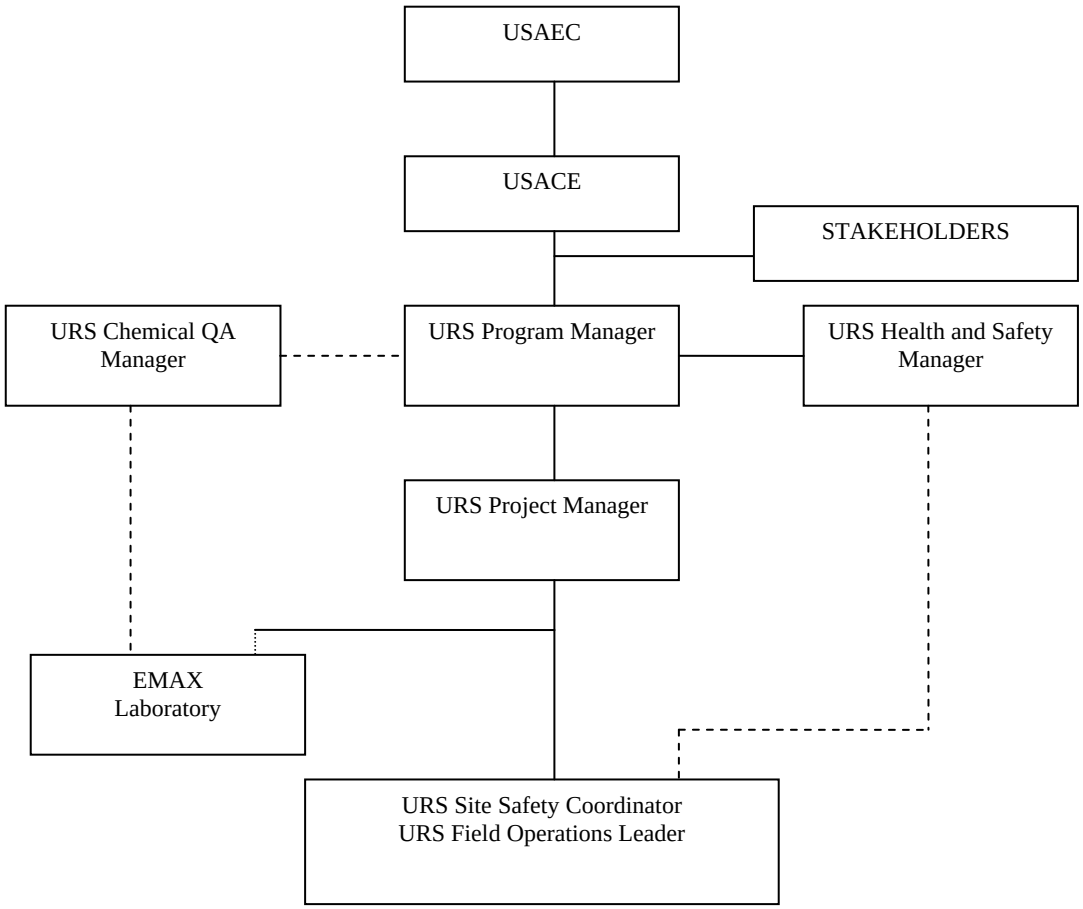
2.2 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.2.1 Contractor and Subcontractor Responsibilities

Contractor and subcontractor personnel requirements for implementing the technical, quality, and health and safety programs are described in Section 2.1 of the MQAP. Figure 2-1 is an organization chart that shows the lines of authority between the program, projects, and subcontractors personnel.

Figure 2-1

Project Organizational Chart



2.2.2 Key Points of Contact

Table 2-2 provides the names and points of contact for URS personnel and subcontractors.

The Project Manager (PM) is responsible for ensuring that activities are conducted in accordance with contractual specifications, the SOW, and approved work plans. The PM will also provide technical coordination with the Installation's designated counterpart. The PM is responsible for management of operations conducted for this project. In addition, the PM will ensure that personnel assigned the project, including subcontractors, will review the technical plans prior to initiation of each task associated with the project. The PM will monitor the project budget and schedule and will ensure availability of necessary personnel, equipment, subcontractors, and services. The PM will participate in the development of the field program, evaluation of data, reporting, and the development of conclusions and recommendations.

Table 2-2

Key Points of Contact

Name	Phone	Email	Title
James McKenna	540-639-8641	jim.mckenna@us.army.mil	RFAAP Installation Point of Contact (POC) (Stakeholder)
Jerome Redder	540.639.7536	Jerome.Redder@ATK.COM	RFAAP ATK POC (Stakeholder)
Mary Ellen Maly	410-436-7083	maryellen.h.maly@us.army.mil	USAEC Project Manager
Richard Mendoza	309-782-1871	Richard.r.Mendoza@us.army.mil	USAEC Environmental Restoration Manager
Nancy Flaherty	410-779-2796	Nancy.E.Flaherty@nab02.usace.army.mil	USACE, Baltimore District MMRP Project Manager
Jim Cutler	804-698-4498	jlcutler@deq.virginia.gov	VDEQ Regulator
William A. Geiger	215-814-3413	Geiger.William@epamail.epa.gov	EPA Regulator
Scott McClelland	301-258-5876	Scott_McClelland@urscorp.com	URS Program Manager
Sarah Gettier	301-721.2299	Sarah_Gettier@urscorp.com	URS Project Manager
James O Spencer	804-474-5420	James_O_Spencer@urscorp.com	URS Client Manager
Patsy Glinsmann, CIH	301-258-9780	Patsy_Glinnsman@urscorp.com	URS Health and Safety Manager
Andrea Sansom	410-859-5049	Andrea_Sansom@urscorp.com	URS Chemical QA Manager
Jim Carter	804-965-9000	Jim_Carter@urscorp.com	URS Field Operations Leader and Site Safety Coordinator

The Field Operations Leader will provide management of the field activities during the fieldwork. The Field Operations Leader is responsible for ensuring that technical matters pertaining to the field-sampling program are addressed. They will participate extensively in preparation of deliverables and will ensure that work is being conducted as specified in the technical plans. In addition, the Field Operations Leader is responsible for field QA/QC procedures and for safety-related issues. Prior to initiation of field activities, the Field Operations Leader will conduct a field staff orientation and briefing to acquaint project personnel with the sites and assign field responsibilities.

The Health and Safety Manager will review and internally approve the HSPA that will be tailored to the specific needs of the project in the task specific addendum. In consultation with the PM, the Health and Safety Manager will ensure that an adequate level of personal protection exists for anticipated potential hazards for field personnel. On-site health and safety will be the responsibility of the SHSO who will work in coordination with the PM and the project Health and Safety Manager.

The QA Manager is responsible for ensuring that the QA procedures and objectives in the project-specific work plans are met, reviewing field and analytical data to ensure adherence to QA/QC procedures, and approving the quality of data prior to inclusion in associated reports. This may include the performance of field and laboratory audits during the investigation. In addition, the QA Manager will be responsible for the review, evaluation, and validation of analytical data for the project and will participate in

interpreting and presenting analytical data. Quality Control (QC) coordination is under the technical guidance of the QA Manager to direct the task leaders on a day-to-day or as-needed basis to ensure the application of QA/QC procedures.

2.3 QUALITY ASSURANCE OBJECTIVES

QA is defined as the overall system of activities for assuring the reliability of data produced. Section 2.1, of this WPA, references investigative, chemical, and regulatory measures associated with the QA objectives of this project. Conformance with appended SOPs will ensure attainment of QA objectives. The system integrates the quality planning, assessment, and corrective actions of various groups in the organization to provide the independent QA program necessary to establish and maintain an effective system for collection and analysis of environmental samples and related activities. The program encompasses the generation of complete data with its subsequent review, validation, and documentation.

The DQO process is a strategic planning approach to ensure environmental data is of the appropriate type, quantity, and quality for decision-making. Project-specific DQOs are included in Table 2-3 for investigative activities. The overall QA objective is to develop and implement procedures for sample and data collection, shipment, evaluation, and reporting that will allow reviewers to assess whether the field and laboratory procedures meet the criteria and endpoints established in the DQOs. DQOs are qualitative and quantitative statements that outline the decision-making process and specify the data required to support corrective actions. DQOs specify the level of uncertainty that will be accepted in results derived from environmental data. *Guidance for the Data Quality Objectives Process* (USEPA 2000b), and *Guidance for Data Quality Objectives for Hazardous Waste Sites* (USEPA 2000c) formed the basis for the DQO process and development of RFAAP data quality criteria and performance specifications.

The objectives of the SSP are discussed in detail in Section 1.2 and 1.3 of this MWP Addendum 024.

The DQO process consists of the seven elements included in Table 2-3 below.

Table 2-3

Summary of Project Data Quality Objectives

DQO Element	Project DQO Summary
Problem Statement	• Assess whether releases of hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents have occurred to the environment at the site. • Complete human health and ecological SSP risk evaluations to assess whether further investigation or action (i.e., risk assessment, RCRA Facility Investigation, interim action), or NFA is appropriate at the site. • Reach a decision regarding future action at the site.

DQO Element	Project DQO Summary
Identify Decision/Study Question	<u>Principal Study Questions</u> • Are hazardous constituent concentrations in surface soil at levels above SSP criteria? • Have hazardous constituents leached from disposed material/waste to surface soil at levels above SSP criteria? • Do hazardous constituent concentrations in soil pose an unacceptable risk to human health and the environment? <u>Resultant Alternative Actions</u> • If completion of the release assessment, human health SSP risk evaluation, and ecological SSP risk evaluation indicate that no further action is appropriate at the site, then the SSP Report will present this information. • If it is concluded from human health and ecological SSP risk evaluations that further investigation or action is required at the site, then the SSP Report will present recommendations for additional investigations, further risk assessment, or other actions.
Decision Inputs	• Results of an examination of site use, operational history, environmental setting, land use, and groundwater use and characteristics. • Details of a visual inspection of the site and site reconnaissance for ecological assessment. • Surface soil data. • Validated results of chemical analyses performed on site soil samples. • Soil (human health) – residential RBCs, industrial RBCs, and soil to groundwater SSL in the most recent version of the EPA Region III RBC table, and lead action level from the Revised Interim Soil Lead Guidance for CERCLA Sites, OSWER 9355.4-12, August 1994. • Soil (ecological) – EPA ecological screening levels. • Laboratory MDLs and RLs for lead, antimony, arsenic, and chromium.
Study Boundaries	• Physical boundaries of the site are defined within the scope of the SSP by combining site historical data, previous site investigation findings, surface soil information, and site reconnaissance completed for this WPA. • The media that will be investigated is surface soil. • Practical constraints that could interfere with sampling include weather and site vegetation.

DQO Element	Project DQO Summary
Decision Rule	Parameters of Interest • Lead, antimony, arsenic, and chromium Action Levels • Action levels for identification of COPCs include: EPA Region III RBCs, EPA Region III ecological screening levels, and RFAAP background estimates for soil. • Laboratory MDLs and RLs. Appropriate analytical methods have been selected to provide for MDLs and RLs that, where possible, will achieve human health and ecological risk screening levels. Decision Rules • COPCs will be identified by comparing maximum detected concentrations to established risk-based screening levels in order to decide the need for further evaluation, investigation, or response action. • Analytical laboratory decision rules are presented in this Addendum and the laboratory Quality Assurance Manual and SOPs provided in Appendix D. These include specific action levels and decision rules based on accuracy and precision. • Results of site activities will be used to refine CSMs and assist in reaching decisions on future actions at sites.
Tolerable Limits on Decision Errors	• MDLs and RLs are established for each analyte and analytical methods have been selected to provide MDLs that will achieve human health and ecological risk screening levels, when possible. The contract laboratory will provide a CLP-like data package for data validation. Data quality will be compared to the standards outlined in this Addendum, the MWP, and the DoD QSM Version 3; and, validation will follow relevant USEPA Region III guidance. • The main baseline condition decision error is to decide that the true mean concentration of a site-related contaminant does not exceed the action level for further study when in fact the mean concentration exceeds the action level and further action is needed (Type I, false rejection). Conversely, consequences of incorrectly deciding that the true mean concentration of a site-related contaminant is above the action level when in fact the mean concentration is below the action level include spending un-necessary resources to study further or remediate a site with insignificant risk (Type II, false acceptance). • Information from previous studies, physical features of the site area, and the geophysical survey conducted for this WPA were used to develop a field sampling plan design that allows for a low probability of decision error.

DQO Element	Project DQO Summary
Optimize the Design for Obtaining Data	• DQO outputs will be reviewed based on the data collection activities; the validity of the data could be verified if necessary based on the review; • Data collection is based upon site-specific characteristics and the end use of the data; and • This addendum contains the proposed sampling design program based on the DQOs. Project documentation will be implemented in accordance with the MWP.

2.4 SAMPLE MANAGEMENT

Sample management objectives will be met through adherence to the sample identification procedures (identification convention), documentation requirements, and chain-of-custody procedures in the MWP.

2.4.1 Number and Type

Table 2-4 provides an itemization of the sample identifiers, sample depths (if applicable), and analytical parameters for environmental samples proposed during this investigation.

2.4.2 Sample Container, Preservation Method, and Holding Time Requirements

Table 2-5 identifies analytical parameters, container and preservation requirements, and holding times.

2.4.3 Sample Identification

Sample identification will consist of an alphanumeric designation related to the sampling location, media type, and sequential order according to the sampling event. The identification number will not exceed thirty-two characters for entry into ERIS. Samples will be coded in the following order to ensure a unique identification.

- **Site Location Code**: The first five characters will be "ARSAR" for the Army Reserve Small Arms Range.
- **Sample/Media Type:** The next two characters will be the sample/media types. In this case, the characters will be SS for surface soil borings.
- **Sampling Location Number:** The next one or two characters will be the number of the sampling location (e.g., 3, 4, 5).
- **Sample Depth:** There are no samples at depth. Only surface samples (0 to 6 inches) will be collected.
- **Duplicate:** Duplicate samples will be identified with a "Dup" designation followed by a numeric designation corresponding to the sequence of duplicates collected (e.g., Dup-1). A record of the sample that corresponds to the duplicate will be kept in the field logbook. In this manner, duplicates will be submitted as blind duplicates, eliminating the potential for laboratory bias in analysis.

Sample Identification Examples:

1) A surface soil sample collected at a depth of 0 to 0.5 ft at location four at the Army Reserve Small Arms Range would be identified as sample ARSARSS4 (for the Army Reserve Small Arms Range surface soil sample location four).

2) QC Samples: QC samples will be identified an appropriate acronym. The QC sample types include Matrix Spike (ARSARSS4 MS), Matrix Spike Duplicate (ARSARSS4 MSD), and field duplicate (see above).

2.4.4 Documentation

SOPs 10.1 and 10.2 in Appendix B specify documentation protocols. Appropriate field forms are included in Appendix C as forms C-1 through C-8.

2.5 ANALYTICAL PROCEDURES

Laboratory analytical services will be subcontracted to EMAX Laboratories Inc. for lead, antimony, arsenic, and chromium.

Analytical methods and procedures that will be used for the SSP to be conducted at the Army Reserve Small Arms Range MRS are discussed in the following sections. MDLs and RLs for these methods are presented in Table 2-6. The MDLs are at a low enough concentrations for screening against the criteria, with the exception of the SSL for arsenic. However, for all metals, the facility-wide background concentration is what is expected to be naturally occurring and representative of site conditions for this SSP.

Table 2-4

Summary of Proposed Sample Identifiers, Depths, and Analytical Methods

Army Reserve Small Arms Range MRS	Number of Samples	Sample Identifiers	Depths	QA/QC Samples (Identifier)	Analytical Parameters
Berm	6	ARSARSS1 ARSARSS2 ARSARSS3 ARSARSS4 ARSARSS5 ARSARSS6	0-6 inches	1 Field Duplicate (DUP-1) 1 MS/MSD (ARSARSSx MS) (ARSARSSx MSD)	Arsenic, Antimony, and Lead (6010B Trace)
Hillside	7	ARSARSS7 ARSARSS8 ARSARSS9 ARSARSS10 ARSARSS11 ARSARSS12 ARSARSS13			
Construction Debris Area	2	ARSARSS14 ARSARSS15		1 Field Duplicate (DUP-2) 1 MS/MSD (ARSARSSx MS) (ARSARSSx MSD)	Arsenic, Chromium, and Lead (6010B Trace)

Table 2-5

Summary of Sample Container, Preservation, and Holding Time Requirements

PARAMETER	SAMPLE CONTAINER		PRESERVATION METHODS	Holding Time
	Quantity	Type		
As, Sb, Pb by 6010B Trace or As, Cr, Pb by 6010B Trace	1	250-mL wide-mouth glass jar	Cool to 4 ± 2 °C	6 months

°C = Degrees Celsius
mL = milliliter

Table 2-6

Summary of Analyte Method Detection Limits, Reporting Limits, and Risk Screening Criteria for a Select List of Site Specific Metals by EPA Method 6010B Trace

Analyte	units	EMAX MDL 6010B Trace	EMAX RL 6010B Trace	EPA Residential RBCs[3]	EPA Industrial RBCs[3]	EPA Soil Screening Levels (SSLs) (Soil-to-Groundwater) DAF20[3]	Background Facility-Wide Point Estimates for Soil
Antimony	mg/kg	1	10	31	410	13.2	NA
Arsenic	mg/kg	0.4	1	0.43	1.9	0.026	15.8
Chromium[1]	mg/kg	0.2	1	230	3100	42.05	65.3
Lead	mg/kg	0.2	1	400[2]	750[2]	NA	26.8

1: Hexavalent chromium criteria is displayed
2: Revised Interim Soil Lead Guidance for CERCLA Sites, OSWER 9355.4-12, August 1994
3: Region III RBCs and SSLs as of October 2007
NA = Not Available
Value in red indicates that the analytical method is not low enough to meet the SSL for Arsenic.

2.5.1 Metals

The following techniques will be used for analysis of inorganics.

2.5.1.1 Target Analyte List Metals by ICP SW-846 Test Method 6010B Series

Prior to analysis, samples are prepared by Method 3050B for solid media. This method describes multi-elemental determinations by Inductively Coupled Plasma (ICP) - Atomic Emission Spectroscopy (AES) using sequential or simultaneous optical systems and axial or radial viewing of the plasma. The instrument measures characteristic emission spectra by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by radio frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and photosensitive devices monitor the emission line intensities. Background correction is required for trace element determination. Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background-intensity measurement, on either or both sides of the analytical line, will be defined by the complexity of the spectrum adjacent to the analyte line. In one mode of analysis, the position used should be as free as possible from spectral interference and should reflect the same change in background intensity as occurs at the analyte wavelength measured.

Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result. The possibility of additional interferences named in Section 3.0 of Method 3050B should also be recognized and appropriate corrections made; tests for their presence are described in Section 8.5 of Method 3035B. Alternatively, users may choose multivariate calibration methods. In this case, point selections for background correction are superfluous since entire spectral regions are processed.

2.6 INTERNAL QUALITY CONTROL CHECK

Internal QC components that will be used by URS during operations at RFAAP are presented below. The internal quality components include the field QC samples and the laboratory QC elements to be followed. Field duplicates will be collected during the acquisition of environmental samples at RFAAP. Table 2-7 presents guidelines for the collection of QC samples that will be taken in conjunction with environmental sampling. Field QC acceptance criteria are summarized in Table 2-8.

Table 2-7
Field Quality Control Samples

Control	Purpose of Sample	Collection Frequency
Field Duplicate	Ensure precision in sample homogeneity during collection and analysis	10% of field samples per matrix

Table 2-8
Field Quality Control Elements Acceptance Criteria

Item	DQO	Parameter	Frequency of Association	Criteria Goal
Field Duplicate	P	Metals	1 per 10 samples	RPD ≤ 35% Solid; difference ± 2xMRL*
Chain of Custody Forms	R	Entire	Every sample	Filled out correctly to include signatures; no missing or incorrect information.
Representative Sampling Forms	R	Entire	Every sample	Filled out correctly to include signatures; no missing or incorrect information.
Field Logbook	R	Entire	Every sample	Filled out correctly to include analytical parameters; map file data; and applicable coding information.
Field Instrument Calibration Logs	A/C	Entire	Every measurement	Measurements must have associated calibration reference

Legend: A = Accuracy C = Comparability R = Representativeness P = Precision
*The difference will be evaluated when either of the field duplicate results is less than the reporting limit.

2.6.1 Laboratory Quality Control Elements

The laboratory QC elements are summarized in Table 2-9. Specific laboratory analytical QC criteria and corrective actions are summarized in Tables 2-10 for metals.

Table 2-9
Analytical Quality Control Elements of a Quality Assurance Program

Item	DQO	Parameter	Frequency of Association	Criteria Requirement
Analytical Method	C	Entire	Each analysis	Method analyses based on USEPA methods as defined in Section 2.5
Chemical Data Packages	C	Entire	Each lot/batch	Pass peer review and formal QA/QC check.
Laboratory Chain of Custody	R	Entire	Each lot/batch	Custody of sample within laboratory fully accounted for and documented
Laboratory System Controls	A,C,P, R	Entire	During laboratory operations	No deficiencies
Holding Time	A,C,P, R	Entire	Each analysis	No deficiencies
Method Blanks	A,R	Entire	Each lot/batch	No target analyte detected in the method blanks greater than ½MRL
Laboratory Control Spike	A	Entire	Each lot/batch	80-120%
Matrix Spikes and Duplicates	A,P	Entire	Each lot/batch	80-120%
Serial dilution	A	Metals	Inorganic Fractions, Each lot/batch	Must meet criteria as defined in Table 2-10

Legend: A = Accuracy C = Comparability R = Representativeness P = Precision

Table 2-10

Quality Control Method Criteria for Target Analyte List Metals by USEPA SW-846 Method 6010B SuperTrace

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method-specified criteria	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	NA	This is a demonstration of analyst ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.
Method detection limit (MDL) study	At initial set-up and subsequently once per 12 months; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study	NA	Samples cannot be analyzed without a valid MDL.
Instrument detection limit (IDL) study	At initial set-up and after significant change	Detection limits established shall be < MDL.	NA	NA	Samples cannot be analyzed without a valid IDL.
Linear dynamic range or high-level Check standard	Every 6 months	Within ± 10% of expected value	NA	NA	
Initial calibration for all analytes (ICAL) (ICP: minimum one high standard and a calibration blank)	Daily initial calibration prior to sample analysis	ICP: No acceptance criteria unless more than one standard is used, in which case r > 0.995. CVAA: r > 0.995	Correct problem and repeat initial calibration.	Flagging criteria are not appropriate	Problem must be corrected. No samples may be run until ICAL has passed.
Second source initial calibration verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.

Table 2-10 (Continued)
Quality Control Method Criteria for Target Analyte List Metals by USEPA SW-846 Method 6010B SuperTrace

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	ICP: within ± 10% of expected value CVAA: within ± 20% of expected value	Correct problem, rerun calibration verification. If that fails, then repeat initial calibration. Reanalyze all samples since the last successful calibration verification.	Flagging criteria are not appropriate.	Problem must be corrected. Results may not be reported without a valid CCV.
Low-level calibration check standard	Daily, after one-point initial calibration	Within ±20% of expected value	Correct problem, then reanalyze.	Flagging criteria are not appropriate.	No samples may be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the reporting limit.
Method blank	One per preparatory batch	No analytes detected > ½ MRL. For common laboratory contaminants, no analytes detected > MRL	Correct problem. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	
Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > 2 x MDL	Correct problem, then reprep and reanalyze calibration blank and previous 10 samples	Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.	
Interference check solutions (ICS)	At the beginning of an analytical run	ICS-A: Absolute value of concentration for all non- spiked analytes < 2 x MDL (unless they are a verified trace impurity from one of the spiked analytes) ICS-AB: Within ± 20% of expected value	Terminate analysis; locate and correct problem; reanalyze ICS.	Flagging criteria are not appropriate.	No samples may be analyzed without a valid ICS.

Table 2-10 (Continued)
Quality Control Method Criteria for Target Analyte List Metals by USEPA SW-846 Method 6010B SuperTrace

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
LCS containing all analytes required to be reported	One LCS per preparatory batch	QC acceptance criteria specified by Table 6-2	Correct problem, then reprepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available	If corrective action fails, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	
Dilution test	Each preparatory batch or when a new or unusual matrix is encountered	Five-fold dilution must agree within ± 10% of the original determination	ICP: Perform post-digestion spike (PDS) addition CVAA: Perform matrix spike	Flagging criteria are not appropriate.	Only applicable for samples with concentrations > 50 x MDL (ICP) or > 25 x MDL (CVAA).
Post-digestion spike (PDS) addition	When dilution test fails or analyte concentration in all samples < 50 x MDL	Recovery within 75-125% of expected result.	Run samples by method of standard additions (MSA) or see flagging criteria.	Apply J-flag to all sample results (for same matrix) for specific analyte(s) for all samples associated with the post-digestion spike addition.	The spike addition should produce a level between 10 - 100 x MDL.
MSA or ICS	When matrix interference is suspected	NA	NA	NA	Document use of MSA in the case narrative.
Matrix spike (MS)	One MS per preparatory batch per matrix	For matrix evaluation, use QC acceptance criteria specified for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
Matrix spike duplicate (MSD) or sample duplicate	One per preparatory batch per matrix	RPD < 20% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	The data shall be evaluated to determine the source of difference.
Results reported between MDL and MRL	NA	NA	NA	Apply J-flag to all results between MDL and MRL	

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2.7 DATA COLLECTION AND VALIDATION

Non-CLP SW-846 Test Methods are proposed for analytical work for this WPA and analyses will be conducted by a NELAP accredited analytical laboratory. Level IV CLP-like raw data will be provided along with the Form 1. Data will be made available to the USEPA upon request and presented in the SSP Report.

Data validation will be conducted on 100% of the data and documented based USEPA SW-846 Test Method criteria, DoD QSM, and USEPA Region III guidance. Data qualifiers will follow the USEPA Region III Modifications to the USEPA National Functional Guidelines for Evaluating Inorganic Analysis. Verification for inorganic data will be performed at level IM2.

Manual data validation will be conducted by an independent, third party data validator not directly associated with the field-sampling program. Data validation will be performed by knowledgeable and experienced individuals who can best perform evaluations within the necessary validation components. The data validator's qualifications will include experience with each of the elements required for the data verification and validation including ensuring that the measuring system meets the user's needs, assigning qualifiers to individual data values, assessing the relevancy of performance criteria, and concluding that data can proceed to quality assessment and reporting.

URS will direct the overall data management. The laboratory will perform data entry and manipulation operations associated with the analysis of raw analytical data and provisions of chemical analysis results by sampling location. These data will be transmitted to URS for evaluation and interpretation in the latest ERIS format as well as in excel. URS will upload the flagged ERIS database to the client. In addition, URS will review sample location maps.

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3.0 HEALTH AND SAFETY PLAN ADDENDUM

3.1 INTRODUCTION

This site-specific HSPA was developed to provide the requirements for protection of site personnel, including government employees, URS personnel, regulators, subcontractors, and visitors, which are expected to be involved with soil boring advancement/sampling at the Army Reserve Small Arms Range MRS.

This HSPA addresses project-specific hazards, which include physical hazards, biological hazards, and chemical hazards, as identified in Section 3.2.2, below.

This addendum addresses site-specific training, personal protective equipment (PPE), and air monitoring requirements. General health and safety issues that are also applicable to this scope of work are addressed in Master Health and Safety Plan, as shown in Table 3-1.

Table 3-1

Health and Safety Issues Discussed in the MHSP

Health and Safety Issue	Section in MHSP
Site Safety and Health Documentation	1.4
Safety Statement	1.5
Health and Safety Personnel and Responsibilities	2.1
Hazard Assessment and Hazard Control	3.0
Training Plan	4.0
Medical Surveillance Plan	5.0
Site Safety and Control	6.0
PPE	7.0
Personnel and Equipment Decontamination	8.0
Monitoring Plan	9.0
Emergency Response and Contingency Plan	10.0

URS, subcontractor personnel, and site visitors will read this HSPA and will be required to follow its protocols as minimum standards. This HSPA is written for the site-specific conditions at the Army Reserve Small Arms Range MRS and must be amended if conditions change. A copy of this HSPA will be available at each work site.

The contractor will provide a safe work environment for personnel involved in RFAAP investigative activities. The contractor will emphasize the importance of personnel injury and illness prevention at the work site.

3.2 TRAINING PLAN

Training will be used to review important topics outlined in this addendum and to inform URS personnel and subcontractor personnel of the hazards and control techniques associated with facility-wide conditions.

Site personnel will be informed of the specific PPE that will be worn during field activities. This includes, at a minimum, steel-toed boots, safety glasses (with side shields), and gloves. Prior to initiation of fieldwork, the staff will be required to review the manual *Safety, Security and Environmental Rules for Contractors and Subcontractors* (ATK 2000). Additional training, which will be conducted during daily

safety "tailgate" meetings, will include emergency and evacuation procedures, general safety rules, and use of automobiles. Written documentation of safety briefings will be kept on the site.

3.2.1 Hazard Information Training

Hazard information training will be presented to URS and subcontractor personnel to provide a description of the HTRW with the potential to be found at the Army Reserve Small Arms Range MRS. Training will also be provided on the potential biological, chemical, and physical hazards to be found at the Installation. The URS SHSO will conduct this training based on information provided by the operating contractor.

3.2.2 Project-Specific Hazard Analysis

The following hazards must be recognized and controlled during applicable investigative activities:

(1) Physical Hazards

- Cold stress – refer to Section 3.2.2 of the MHSP;
- Falls, open excavation, confined-space entry;
- Noise from heavy equipment;
- Cuts, abrasions, and lacerations;
- Manual lifting – refer to Section 3.2.4 of the MHSP;
- Slips, trips, and falls associated with walking through heavily vegetated areas – refer to Section 6.1.1; and of the MHSP;
- MMA – overhead power lines.

(2) Biological Hazards (refer to Section 3.3 of the MHSP)

- Insect bites and stings;
- Tick bites;
- Snake, rodent, or other animal bites; and
- Dangerous plants.

(3) Chemical Hazards

- Potential exposure to toxic chemicals; and

3.2.3 Hearing Conservation Training

Hearing Conservation Training will not be required for fieldwork, as there will be no heavy equipment operation during this investigation.

3.2.4 Hazard Communication Training

In order to comply with the requirements of the Occupational Safety and Health Administration (OSHA) Hazard Communication (HAZCOM) Standard, 29 CFR 1910.1200, URS will have a written HAZCOM

Program in place. The written hazard communication program addresses training (including potential safety and health effects from exposure), labeling, current inventory of hazardous chemicals on the site, and the location and use of Material Safety Data Sheets (MSDSs). The SHSO will arrange HAZCOM training for site personnel at the time of initial site assignment. Whenever a new hazardous substance is introduced into the work area or an employee changes job locations where new chemicals are encountered, supplemental HAZCOM training shall be scheduled and presented. HAZCOM training shall be documented by the SHSO using a HAZCOM Employee Training Record. This documentation and the URS HAZCOM Program will be maintained on the site for the duration of the project, and later incorporated in the employees' personal training file.

3.2.5 Confined Space Entry Training

Confined space entry training will not be required for fieldwork, as there will be no confined spaces entered during this investigation.

3.3 PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING

The minimum and initial level of PPE for these activities will be Level D. The initial selection of PPE is based on a hazard assessment, including the review of existing analytical data and related toxicological information with respect to the proposed field activities. PPE assignments are subject to change based upon site conditions and task variation. The SHSO will review the required level of protection and safety equipment for each task with the sampling crew. The decisions on which protective level is most appropriate will be made by the SHSO.

In accordance with 29 CFR 1910.134, URS personnel working on the site will be required to participate in the written URS respiratory protection program. Personnel slated for fieldwork will have a qualitative fit test performed at least once per year or more frequently as required by law. Site personnel will be trained on the use, limitations, maintenance, inspection, and cleaning of respirators.

3.4 EMERGENCY RESPONSE PLAN

Emergency response will follow the protocols set fort in MHSP, Section 10.0. Table 3-2 presents the current emergency telephone numbers applicable to activities performed at RFAAP.

Table 3-2
Emergency Telephone Numbers*

Contact	Telephone Number
Emergency Response Services	
Installation Fire Department**	16 (on post)
Installation Security Police**	7325 (on post) (540) 639-7325 (off post)
Installation Safety Department**	7294 (on post) (540) 639-7294 (off post)
Installation Spill Response**	7323, 7324 or 7325 (on post) (540) 639-7323, 7324, or 7325 (off post)
Installation Medical Facility** (RFAAP Hospital)	7323 or 7325 (on post) (540) 639-7323 or 7325 (off post)
Local Police Department	911
New River Valley Medical Center	(540) 731-2000 – General Telephone Number
National Poison Control Center	(800) 222-1222
National Response Center	(800) 424-8802
Regional USEPA Emergency Response	(215) 814-9016
Chemical Manufacturers Association Chemical Referral Center	(800) 262-8200
Directions from the Main Gate: New River Valley Medical Center 2900 Lamb Circle Christiansburg, VA 24073 Take Route 114 toward Radford to first traffic light. Take U.S. Route 11 South and go across the bridge over the New River. Turn left after crossing the bridge, continue to Virginia Route 177 South, and turn right. Proceed on VA 177 South and cross over Interstate 81. New River Valley Medical Center is on the left. ** These telephone numbers are referenced from *Safety, Security and Environmental Rules for Contractors and Subcontractors* (ATK 2000).	

*Project Personnel Telephone numbers are located in Table 2-2.

4.0 REFERENCES

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Appendix A

Technical Project Planning (TPP) Meeting Minutes

MEETING MINUTES

PURPOSE: Radford Army Ammunition Plant (RFAAP) MMRP Site Inspection Technical Project Planning (TPP1) Meeting

LOCATION: Radford, VA, Building 220

DATE: 18 July 2007

TIME: 1530 - 1630

Attendees	Organization	Phone	email
Jim Cutler	VDEQ	804.698.4498	jlcutler@deq.virginia.gov
Will Geiger	EPA, Region III	215.814.3413	Geiger.william@epa.gov
Mary Ellen Maly	USAEC	410.436.7083	Maryellen.h.maly@us.army.mil
Rich Mendoza	ÚSAEC	309.782.1871	richard.r.mendoza@us.army.mil
Nancy Flaherty	USACE, Bal District	410.779.2796	Nancy.E.Flaherty@usace.army.mil
Jim McKenna	RFAAP	540.639.8641	Jim.mckenna@us.army.mil
Jerry Redder	ATK	540.639.7536	Jerome.redder@atk.com
Sarah Gettier	URS	301.721.2299	Sarah_gettier@urscorp.com
James Spencer	URS	804.474.5420	James_O_Spencer@urscorp.com

VDEQ = Virginia Department of Environmental Quality
EPA = Environmental Protection Agency
USAEC = U.S. Army Environmental Command
USACE = U.S. Army Corps of Engineers, Baltimore District
ATK = Alliant Techsystems, Inc.

The meeting began with introductions at 1530.

I. Presentation

A hardcopy of the PowerPoint presentation was distributed to all attendees. The slides outlined the development of the MMRP, how it is implemented, and information pertaining to Radford Army Ammunition Plant provided in the Phase 3 Closed, Transferring, and Transferred Inventory Report. Mary Ellen Maly and Sarah Gettier led a discussion during the presentation, including the following items:

- Discussed legal basis of MMRP and definitions.
- Discussed the status of MMRP within the Defense Environmental Restoration Program, and the relationship of funding sources.
- Summarized the MMRP process (Preliminary Assessment, Historical Records Review [HRR], Site Inspection [SI], etc.), and status at RFAAP. The distinction between a site inspection and site investigation was discussed.
- Presented primary and secondary goals of the MMRP SI (including the Munitions Response Site Prioritization Protocol).
- Described the one RFAAP defense site included in the MMRP SI.
- Discussed MMRP SI deliverables and schedule.

II. Discussion

The following topics were discussed after the presentation.

1. S.Gettier can provide a copy of the Phase 3 (Closed, Transferring and Transferred Range/Site Inventory) Report if anyone needs it. J.McKenna noted that this document, along with other documents, is also available on the RFAAP IRP website. http://www.radfordaapirp.org/inforepo/online-index.htm
2. RFAPP is working under a Resource Conservation and Recovery Act (RCRA) Corrective Action Permit. The installation is operated by ATK, for the Army's Joint Munitions Command through a facilities use contract.
3. EPA Region III is the lead agency; however VDEQ has the authority at RFAAP. W.Geiger and J.Cutler said they would accept Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) terminology but would prefer to see RCRA. Therefore, it was agreed that during the MMRP process, documents would use RCRA terminology.
4. J. Redder and J. McKenna said that the Army Reserve Small Arms Range was added to the RCRA Corrective Action permit July 15, 2005.
5. The Northern Burning Grounds and the Western Burning Grounds are sites handled under the Installation Restoration Program (IRP) and are not eligible for MMRP. They are located on a non-contiguous unit (The New River Unit).
6. J. McKenna explained that the installation has a unique Site Screening Process (SSP) that he would like the MMRP to follow.
7. Discussed the importance of adopting the TPP and review of Data Quality Objectives (DQOs) prior to executing any field activities. M.Maly asked the VDEQ and EPA if they would agree that lead is the only analyte necessary to be analyzed at this site, as lead is a very good indicator for small arms use. It would not be necessary to sample the soil for other chemicals at this site. She indicated that at almost 70% of the installations where a firing berm was present, lead is the indicator compound. W.Geiger and J.Cutler said they would have to discuss that back at the office and would get back to the MMRP team before the next meeting (TPP2).
8. M. Maly mentioned that the intent is for the site at RFAAP to go through the SI, but from that point forward, the MRS Site Prioritization Protocol (MRSPP) will be used to rank sites and prioritize funding in a manner similar to IRP sites.
9. N.Flaherty said that Bryan Frey from USACE will be conducting MRSPP training for the Formerly Used Defense Sites (FUDS) program at the EPA Region III offices in Philadelphia soon. She will obtain the information and send to W.Geiger.
10. Document distribution was discussed. It was agreed that URS may submit documents to the regulators directly. However, before sending the documents

to the regulators and stakeholders, the installation will provide a cover letter after the document as been certified by the installation.

11. EPA and VDEQ agreed to a 30-day review structure. EPA requested two (2) hardcopies and electronic copies. W.Geiger said these documents will not be sent to multiple reviewers and he will most likely consult with in house personnel when providing his comments. VDEQ would like one (1) hardcopy of draft documents, and two (2) hardcopies and electronic copies of final documents.
12. J.Mckenna indicated that the distribution list for the Army can be found on the cover letters of existing documents on the IRP website, however, Russ Fish should be removed from the distribution.
13. S.Gettier briefed the team of the earlier review of the Environmental Photographic Interpretation Center (EPIC) Aerial Photographs that J.Redder had in his office.
    - ✓ 1949 Aerial Photograph - ground scarring is apparent in the area of the Army Reserve Small Arms Range.
    - ✓ 1962 Aerial Photograph –ground scarring visible however there is a noticeable shadow near the Stroubles Creek and a berm is not discernible.
    - ✓ 1971 Aerial Photograph – A berm is clearly observable.
14. S.Gettier briefed the team of the discussions held with Mr. Doug Day. He works at RFAAP in the Hazards Analysis Group. The following information was obtained from D.Day:
    - ✓ D. Day joined the National Guard (Christiansburg) in 1968, Unit Company B, 116 Infantry.
    - ✓ He indicated that after the TNT Area was built the firing range use was discontinued by the National Guard.
    - ✓ He recalled that up to 150 soldiers at time would use the Army Small Arms Firing Range and verified that there were approximately 10-15 stations located in front of the berm. He said that the firing distance was approximately 100 meters.
    - ✓ The weapons of use at this time were M1s and M14s (30 caliber). No M16s were used by the National Guard at this range to his knowledge.
15. J.Redder indicated that there is another pistol range located on RFAAP and said this range should be considered an “operational range”. This range is approximately 1-2 acres in size and is mainly used by security for training. A map of the range will be provided to AEC for the Operational Range Inventory Sustainment (ORIS) program.
16. RFAAP does have an active Restoration Advisory Board (RAB). J. McKenna suggested that URS present the MMRP at the next RAB. The next meeting is September 20. Due to the timing of the submitting the Stakeholder Draft HRR in November, the next RAB in December would probably work best. It is believed that due to the holidays the RAB will be held the second Thursday in December (Dec 13th). It was also suggested to coordinate the TPP2 meeting with this RAB meeting.

The meeting concluded at 1630 and J.McKenna, J.Redder, S.Gettier, J.Cutler, and W.Geiger went on a site visit.

III. Site Visit

1. Team walked the flat grassy field of the Army Reserve Small Arms Range. It was apparent that the site had previously been used for playing baseball with two designated fields and deteriorating backstops.
2. A helicopter mark (looks like the letter H made of concrete) is located in the center of the field and J.Redder indicated that this field is currently used for helicopter landings.
3. The berm is still present and overgrown. Mature trees are found on the berm.
4. An unlocked fence surrounds the site.
5. Stroubles Creek flows behind the berm on the other side of the fence. There is a steep hill behind Stroubles Creek. This hill could have acted as a secondary backstop or a primary one if the Army used the range before construction of the berm.
6. During this initial visit, no bullets were visible on the surface of the berm or near any areas where soil was disturbed by groundhogs.
7. Concrete building debris was found behind the berm, including pieces of conductive flooring.

FINAL MEETING MINUTES

PURPOSE: Radford Army Ammunition Plant (RFAAP) MMRP Site Screening Process (SSP) Technical Project Planning (TPP2) Meeting

LOCATION: Teleconference Call

DATE: 18 December 2007

TIME: 1330 - 1445

Attendees	Organization	Phone	email
Jim Cutler	VDEQ	804.698.4498	jlcutler@deq.virginia.gov
Will Geiger	EPA, Region III	215.814.3413	geiger.william@epa.gov
Mike Cramer	EPA, Region III	215.814.3446	cramer.mike@epa.gov
Betty Ann Quinn	EPA, Region III	215.814.3388	quinn.elizabeth@epa.gov
Mary Ellen Maly	USAEC	410.436.7083	maryellen.h.maly@us.army.mil
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Nancy Flaherty	USACE, Bal District	410.779.2796	nancy.E.Flaherty@usace.army.mil
Jim McKenna	RFAAP	540.639.8641	jim.mckenna@us.army.mil
Jerry Redder	ATK	540.639.7536	jerome.redder@atk.com
Sarah Gettier	URS	301.721.2299	sarah_gettier@urscorp.com
Jim Spencer	URS	804.474.5420	james_O_Spencer@urscorp.com

VDEQ = Virginia Department of Environmental Quality
EPA = Environmental Protection Agency
USAEC = U.S. Army Environmental Command
USACE = U.S. Army Corps of Engineers, Baltimore District
ATK = Alliant Techsystems, Inc.

The meeting began with introductions at 1330.

I. Introduction of meeting attendees

- Attendees introduced themselves.
- Mr. Geiger informed all that Ms. Quinn (EPA – toxicologist) and Mr. Cramer (EPA - hydrogeologist) are sitting in on this meeting and have reviewed the read-ahead presentation slides.

II. Presentation

- A presentation handout was distributed to all attendees by email, consisting of a pdf of a PowerPoint presentation that 1) provided background information concerning the MMRP SSP program, 2) summarized the RFAAP Historical Records Review (HRR) findings, and 3) summarized the RFAAP SSP sampling approach.
- **SSP Primary Goals:** For each Munition Response Site (MRS), determine which of the following recommendations apply:
  - RCRA Facility Investigation (RFI)/ Corrective Measures Study (CMS)
  - Interim Response (i.e., removal action)
  - No Further Action (NFA)
- **SSP Secondary Goals:**
  - Collect necessary information required to improve Cost to Complete (CTC) estimate of the remediation of the MMRP site.

- Develop information for, and complete the draft MRS Prioritization Protocol scoring.

III. HRR Findings – Presented by Ms. Gettier (URS)

Ms. Gettier identified that only one MRS qualifies as MMRP eligible based on the HRR findings: Army Reserve Small Arms Range.

- **Army Reserve Small Arms Range**
  - The site was used for small arms training from 1941 to 1968.
  - Munitions and explosives of concern (MEC) are not present at the site; it was only used for .30 caliber small arms.
  - The berm is still present.
  - Firing direction appears to have shifted from directly south to southeast over time based on the historical aerial photography review.
  - It is suspected that prior to berm construction (before 1971) firing could have been directed at the steep hillside behind the berm.
  - Size of MRS increased from 3 acres in the Closed, Transferring and Transferred Range/Site Inventory to 7.6 acres.
  - Building debris including pieces of conductive flooring was observed behind the berm during the initial site walk.

IV. Army Reserve Small Arms Range SSP Field Work Approach – Presented by Ms. Gettier

- MEC is not a concern at this site. No Further Action is proposed for MEC.
- Munitions constituents (MC) is likely to be detected at the target areas (berm and hillside). The purpose for sampling is to determine the presence or absence of MC at the site.
- It was proposed to bias the sampling location by first digging approximately 20 random locations on the berm with a shovel to look for bullets.
- Sampling locations will be where bullets are identified. If no bullets are identified the 6 shallow (0-6") "spoke and hub" composite samples will be collected randomly on the berm. Seven shallow composite samples will be collected on the hillside behind the berm.
- It is proposed that the samples on the berm and hillside be analyzed for lead using analytical method SW6010.
- In addition, it was proposed to collect two shallow samples from the area of building debris with conductive flooring and analyze them for lead, arsenic and chromium.
- Compare results to EPA residential and industrial lead screening levels of 400 and 750 ppm, respectively.
- GPS coordinates of each sample location will be recorded.

V. Army Reserve Small Arms Range SSP Field Work Approach Discussion

- Mr. Geiger is concerned that the residential lead screening level of 400 ppm is higher than the ecological screening levels for lead. Mr. Spencer explained that the approved SSP steps for the human health risk screen are followed which include the following:
    - Screening under residential and industrial scenarios
    - Cumulative risk screen
    - Chemical specific screen for lead
    - Comparison to soil screening levels
    - Comparison to ARARs
    - Background comparison.

  The ecological risk screen is basically a screening level ecological risk assessment (SLERA) and the SSP process will be followed.
- Ms. Quinn asked if taking a sample from the stream had been considered. Ms. Gettier explained that the purpose of sampling is to determine the presence or absence of MC at the site. From the history of the site it has been determined that the berm or the hillside is the most likely place to find MC and, therefore, the samples should be concentrated there. It was agreed that no samples will be collected in the stream during the SSP Field Work.
- Mr. Redder also indicated that for the future when considering sampling the stream, an upgraident sample must be taken to provide any background information from potential offsite sources.
- Mr. Cramer asked if a metal detector will be used onsite. Ms. Gettier replied that a metal detector will be used onsite to help find potential sampling locations.
- Ms. Quinn asked about sieving samples, and that the USEPA Guidance on Small Arms Firing Ranges indicated samples were to be sieved. Ms. Gettier indicated that since the goal was to determine the presence or absence of lead, a chunk of lead in the sample could skew the results high, but ultimately this would be confirmation that MC was present and the site would move forward to an RFI. Ms. Maly also indicated that there have been studies that have shown that there was not a significant difference in the lead concentration between sieved vs. unsieved samples. It appears that the lead tends to smear onto the soil and is detected either way.
- Mr. Cramer asked if there was concern about any other chemicals besides lead as an indicator like tracers. Ms. Maly stated that there is no evidence that this firing range was used for nighttime firing which is where tracers would be typically found, thus it is not necessary at this site.
- Ms. Quinn raised concerns that if the purpose is to look for presence or absence of a release then why are we not comparing all contaminants to background rather than residential levels. Mr. Spencer described that the SPP involves the comparison to facility wide point background values at the end of the SSP.

- Ms. Quinn said that based on an EPA guidance document on small arms shooting ranges there are other chemicals of potential concern (COPCs) to be considered. She specifically mentioned the following chemicals: Arsenic, Antimony, Nickel, Copper, Zinc and Strontium. She felt strongly that because the analytical cost would not be that much higher and that because this guidance document lists them as COPCs that they must be analyzed for. It was decided that URS will add arsenic and antimony to the analyte list for the berm and hillside samples in addition to lead.
- Ms. Quinn had some questions about the construction debris and conductive flooring. Ms. Gettier described that the construction debris and conductive flooring pieces were located behind the berm in the southeast corner and that there has been a SSP done on conductive flooring for the New River Unit (NRU). Mr. Spencer described the results of this study indicated that the best indicator analytes would be lead, arsenic and chromium. Therefore, lead is a good indicator of a release at this range for all issues (the potential bullets in the berm and hillside and any conductive flooring present).
- Mr. Quinn asked if there was asbestos in the material. Mr. Mendoza stated that from his experience working with the conductive flooring, even if it is chipped it is not friable. He stated that the NRU conductive flooring report was not sent to EPA and recommended that the Army could gather some of the summary information and email it Ms. Quinn for reference.
- Mr. McKenna asked that Mr. Spencer pull some summary information from the NRU conductive flooring report and email it to all the Army participants and include Tom Meyer.
- Mr. Redder described conductive flooring as flooring developed to prevent static electricity.
- Mr. Cutler concluded that it is likely that lead will be present in the soil at this site. Ms. Maly concurred and indicated that it is very rare to have a site with a berm present with bullets in the soil and not have a lead problem.
- Mr. Cramer asked if there were concerns about the field itself; e.g., should the soil be tested for pesticides? Mr. Mendoza said that if pesticides were used at this site they would have been applied in accordance with Army guidance for applying pesticides and therefore, would not be eligible for investigation.
- Ms. Gettier asked the regulators if they will be sending formal comments. Mr. Cutler and Mr. Geiger both indicated that they do not foresee any additional comments on the Stakeholder Draft HRR other than the comments made during this meeting.

VI. Adjournment

The meeting adjourned at 1445. URS will distribute the draft meeting minutes by email directly to all attendees for review and comment.

Appendix B

Standard Operating Procedures

Standard Operating Procedures

SOP SERIES	TITLE
10.0	**DOCUMENTATION**
10.1	Field Logbook
10.2	Surface Water, Groundwater, and Soil/Sediment Field Logbooks
10.3	Boring Logs
10.4	Chain-of-Custody Forms
20.0	**SUBSURFACE INVESTIGATION**
20.1	Monitoring Well Installation
20.2	Monitoring Well Development
20.3	Well and Boring Abandonment
20.4	Test Pits
20.5	Active Soil Gas Survey
20.6	Ground-Penetrating Radar Surveys
20.7	Resistivity and Electromagnetic Induction Surveys
20.8	Magnetic and Metal Detection Surveys
20.9	Piezometer Installation
20.10	Placement of Dye Detector Holders
20.11	Drilling Methods and Procedures
20.12	Direct Push Groundwater Sampling
30.0	**SAMPLING**
30.1	Soil Sampling
30.2	Groundwater Sampling
30.3	Surface Water Sampling
30.4	Sediment Sampling with Scoop or Tube Sampler
30.5	Sediment and Benthic Macroinvertebrate Sampling with Eckman Sampler or Ponar Sampler
30.6	Containerized Material
30.7	Sampling Strategies
30.8	VOC Sample Collection Using Sodium Bisulfate Preservation (Low Level) and Methanol Preservation (High Level)
30.9	Collection of Soil Samples By USEPA SW 846 Method 5035 Using Disposable Samplers
30.10	Collection of Wipe Samples
30.11	Lead Check Soil Screening Kit
30.12	Vibracore Deep Sediment Sampling
40.0	**FIELD EVALUATION**
40.1	Multiparameter Water Quality Monitoring Instrument
40.2	Water Level and Well-Depth Measurements
40.3	Slug Tests
40.4	Water Flow Measurements Using Water Flow Probe
50.0	**SAMPLE MANAGEMENT**
50.1	Sample Labels
50.2	Sample Packaging
60.0	**DATA MANAGEMENT**
70.0	**INVESTIGATION-DERIVED MATERIAL**
70.1	Investigation-Derived Material
80.0	**DECONTAMINATION**
80.1	Decontamination
90.0	**AIR MONITORING EQUIPMENT**
90.1	Photoionization Detector (HNu Model PI-101 and HW-101)
90.2	Photoionization Detector (Microtip HL-200)
90.3	Personal Air Sampling Pump (GilAir)

SOPs highlighted in yellow pertain to MWP Addendum 024

STANDARD OPERATING PROCEDURE 10.1
FIELD LOGBOOK

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for recording daily site investigation activities.

Records should contain sufficient information so that anyone can reconstruct the sampling activity without relying on the collector's memory.

2.0 MATERIALS

- Field Logbook;
- Indelible ink pen; and
- Clear tape.

3.0 PROCEDURE

Information pertinent to site investigations will be recorded in a bound logbook. Each page/form will be consecutively numbered, dated, and signed. All entries will be made in indelible ink, and all corrections will consist of line out deletions that are initialed and dated. If only part of a page is used, the remainder of the page should have an "X" drawn across it. At a minimum, entries in the logbook will include but not be limited to the following:

- Project name (cover);
- Name and affiliation of personnel on site;
- Weather conditions;
- General description of the field activity;
- Sample location;
- Sample identification number;
- Time and date of sample collection;
- Specific sample attributes (e.g., sample collection depth flow conditions or matrix);
- Sampling methodology (grab or composite sample);
- Sample preservation, as applicable;
- Analytical request/methods;
- Associated quality assurance/quality control (QA/QC) samples;
- Field measurements/observations, as applicable; and
- Signature and date of personnel responsible for documentation.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None.

6.0 REFERENCES

USEPA. 1990. *Sampler's Guide to the Contract Laboratory Program*. EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, DC.

USEPA. 1991. *User's Guide to the Contract Laboratory Program*. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response, January.

USEPA. 1998. *EPA Requirements for Quality Assurance Project Plans.* EPA/600/R-98/018, QA/R5, Final, Office of Research and Development, Washington, D.C.

STANDARD OPERATING PROCEDURE 10.2
SURFACE WATER, GROUNDWATER, AND SOIL/SEDIMENT FIELD LOGBOOKS

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for recording surface water, groundwater, and soil/sediment sampling information, as well as instrument calibration data in field logbooks.

2.0 MATERIAL

- Applicable field logbook (see attached forms); and
- Indelible ink pen.

3.0 PROCEDURE

All information pertinent to surface water, groundwater, or soil/sediment sampling will be recorded in the appropriate logbook. Each page/form of the logbook will be consecutively numbered. All entries will be made with an indelible ink pen. All corrections will consist of line out deletions that are initialed and dated.

3.1 SOIL/SEDIMENT

3.1.1 Field Parameters/Logbook (Form 10.2-a)

1. HIGH CONCENTRATION EXPECTED?: Answer "Yes" or "No.";
2. HIGH HAZARD?: Answer "Yes" or "No.";
3. INSTALLATION/SITE: Record the complete name of the installation or site;
4. AREA: Record the area designation of the sample site;
5. INST. NAME: Record the two-letter installation name for Radford Army Ammunition Plant – "RD";
6. SAMPLE MATRIX CODE: Record the appropriate sample matrix code. Common codes are "SD" for solid - sediment, "SI" for soil - gas, "SL for solid sludge, "SO" for surface other, "SS" for solid – soil, "SW" for surface wipe, "WD" for water – potable, "WG" for water – ground, "WS" water – surface, "WT" – water treated and "WW" water -waste;
7. SITE ID: Record a code up to 20 characters or numbers that is unique to the site;
8. ENV. FIELD SAMPLE IDENTIFIER: Record a code up to 20 characters specific for the sample;
9. DATE: Enter the date the sample was taken;
10. TIME: Enter the time (12-hour or 24-hour clock acceptable as long as internally consistent) the sample was taken;
11. AM PM: Circle "AM" or "PM" to designate morning or afternoon (12-hour clock);
12. SAMPLE PROG: Record "RFI" (RCRA Facility Investigation) or other appropriate sample program;
13. DEPTH (TOP): Record the total depth sampled;
14. DEPTH INTERVAL: Record the intervals at which the plug will be sampled;

15. UNITS: Record the units of depth (feet, meters);
16. SAMPLE MEASUREMENTS: Check the appropriate sampling method;
17. CHK: Check off each container released to a laboratory;
18. ANALYSIS: Record the type of analysis to be performed on each sample container;
19. SAMPLE CONTAINER: Record the sample container type and size;
20. NO.: Record the number of containers;
21. REMARKS: Record any remarks about the sample;
22. TOTAL NUMBER OF CONTAINERS FOR SAMPLE: Record the total number of containers;
23. SITE DESCRIPTION: Describe the location where the sample was collected;
24. SAMPLE FORM: Record the form of the sample (i.e., clay, loam, etc.) using The Unified Soil Classification System (USCS);
25. COLOR: Record the color of the sample as determined from standard Munsell Color Charts;
26. ODOR: Record the odor of the sample or "none";
27. PID: Record the measured PID values or other similar measurement instrument value;
28. UNUSUAL FEATURES: Record anything unusual about the site or sample;
29. WEATHER/TEMPERATURE: Record the weather and temperature; and
30. SAMPLER: Record your name.

3.1.2 Map File Form (refer to form 10.2-c)

1. SITE ID: Record the Site ID from the field parameter form;
2. POINTER: Record the field sample number for the sample being pointed to;
3. DESCRIPTION/MEASUREMENTS: Describe the location where the sample was taken, along with distances to landmarks;
4. SKETCH/DIMENSIONS: Diagram the surroundings and record the distances to landmarks;
5. MAP REFERENCE: Record which U.S.G.S. Quad Map references the site;
6. COORDINATE DEFINITION: Write the compass directions and the X- and Y-coordinates of the map run;
7. COORDINATE SYSTEM: Write "UTM" (Universal Transverse Mercator);
8. SOURCE: Record the 1-digit code representing the Map Reference;
9. ACCURACY: Give units (e.g., write "1-M" for 1 meter);
10. X-COORDINATE: Record the X-coordinate of the sample site location;
11. Y-COORDINATE: Record the Y-coordinate of the sample site location;
12. UNITS: Record the units used to measure the map sections;
13. ELEVATION REFERENCE: Record whether topography was determined from a map or a topographical survey;
14. ELEVATION SOURCE: Record the 1-digit code representing the elevation reference;

15. ACCURACY: Record the accuracy of the map or survey providing the topographical information;
16. ELEVATION: Record the elevation of the sampling site;
17. UNITS: Write the units in which the elevation is recorded; and
18. SAMPLER: Write your name.

3.2 SURFACE WATER

3.2.1 Field Parameter Logbook (Forms 10.2-b and 10.2-c)

1. CAL REF: Record the calibration reference for the pH meter;
2. pH: Record the pH of the sample;
3. TEMP: Record the temperature of the sample in degrees Celsius;
4. COND: Record the conductivity of the water;
5. Description of site and sample conditions (refer to 10.2-b);
6. Map File Form (refer to Section 3.1.2).

3.3 GROUNDWATER (FORMS 10.2- D)

3.3.1 Field Parameter Logbook (Form 10.2.b)

Refer to Section 3.2.1.

3.3.2 Map File and Purging Forms

1. WELL NO. OR ID: Record the abbreviation appropriate for where the sample was taken. Correct abbreviations can be found on pages 18-21 of the IRDMIS User's Guide for chemical data entry;
2. SAMPLE NO.: Record the reference number of the sample;
3. WELL/SITE DESCRIPTION: Describe the location where the sample was taken, along with distances to landmarks;
4. X-COORD AND Y-COORD: Record the survey coordinates for the sampling site;
5. ELEV: Record the elevation where the sample was taken;
6. UNITS: Record the units the elevation was recorded in;
7. DATE: Record the date in the form MM/DD/YY;
8. TIME: Record the time, including a designation of AM or PM;
9. AIR TEMP.: Record the air temperature, including a designation of C or F (Celsius or Fahrenheit);
10. WELL DEPTH: Record the depth of the well in feet and inches;
11. CASING HEIGHT: Record the height of the casing in feet and inches;
12. WATER DEPTH: Record the depth (underground) of the water in feet and inches;
13. WELL DIAMETER: Record the diameter of the well in inches;
14. WATER COLUMN HEIGHT: Record the height of the water column in feet and inches;
15. SANDPACK DIAM.: Record the diameter of the sandpack. Generally, this will be the same as the bore diameter;

16. EQUIVALENT VOLUME OF STANDING WATER: Use one of the following equations to determine one equivalent volume (EV);

    1 EV = volume in casing + volume in saturated sandpack. Or:

    1 EV = $[\pi R_w^2 h_w + 0.30p(R_s^2-R_w^2)h_s] * (0.0043)$

Where:

R_s = radius of sandpack in inches
R_w = radius of well casing in inches
h_s = height of sandpack in inches
h_w = water depth in inches

$0.0043 = gal/in^3$
and filter pack porosity is assumed as 30%, or

Volume in casing =
$(0.0043\ gal/in^3)(p)(12\ in/ft)(R_c^2)(W_h)$

Where:

R_c = radius of casing in inches, and
W_h = water column height in feet

Vol. in sandpack =
(0.0043 gal/in3)(p)(12 in/ft)(Rb2 - Rc2)(Wh)(0.30)

(if Wh is less than the length of the sandpack), or

Vol. in sandpack =
(0.0043 gal/in3)(p)(12 in/ft)(Rb2 - Rc2)(Sh)(0.30)

(if Wh is greater than the length of the sandpack).

where:

Rb = radius of the borehole, and
Sh = length of the sandpack.

Show this calculation in the comments section.

1. PUMP RATE: Record pump rate;
2. TOTAL PUMP TIME: Record total purge time and volume;
3. WELL WENT DRY? Write “YES” or “NO”;
4. PUMP TIME: Record pump time that made the well go dry;
5. VOLUME REMOVED: Record the volume of water (gal) removed before the well went dry;
6. RECOVERY TIME: Record the time required for the well to refill;

7. PURGE AGAIN?: Answer “YES” or “NO”;
8. TOTAL VOL. REMOVED: Record the total volume of water (in gallons) removed from the well;
9. CAL REF.: Record the calibration reference for the pH meter;
10. TIME: Record time started (INITIAL T(0)), 2 times DURING the sampling and the time sampling ended (FINAL);
11. pH: Record the pH at start of sampling (INITIAL), twice DURING the sampling, and at the end of sampling (FINAL);
12. TEMP: Record the water temperature (Celsius) at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL);
13. COND: Record the conductivity of the water at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL);
14. D.O.: Record the dissolved oxygen level in the water at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL);
15. TURBIDITY: Record the readings from the turbidity meter (nephelometer) and units at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL);
16. ORD: Record the oxidation/reduction (RedOx) potential of the water sample at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL);
17. HEAD SPACE: Record any positive readings from organic vapor meter reading taken in well headspace before sampling;
18. NAPL: Record the presence and thickness of any non-aqueous phase liquids (LNAPL and DNAPL)
19. COMMENTS: Record any pertinent information not already covered in the form; and
20. SIGNATURE: Sign the form.

3.4 FIELD CALIBRATION FORMS (REFER TO FORM 10.2-E)

1. Record time and date of calibration;
2. Record calibration standard reference number;
3. Record meter ID number;
4. Record initial instrument reading, recalibration reading (if necessary), and final calibration reading on appropriate line;
5. Record value of reference standard (as required);
6. COMMENTS: Record any pertinent information not already covered on form; and
7. SIGNATURE: Sign form.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None.

6.0 REFERENCE

USEPA. 1991. *User's Guide to the Contract Laboratory Program*. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response, January.

FIELD PARAMETER/LOGBOOK FORM 10.2-a
SOIL AND SEDIMENT SAMPLES

HIGH CONCENTRATION EXPECTED? _____ HIGH HAZARD?

INSTALLATION/SITE _____ AREA _____

INST NAME _____ FILE NAME _____

SAMPLE MATRIX CODE _____ SITE ID _____
ENV. FIELD SAMPLE IDENTIFIER _____

DATE (MM/DD/YY) __/__/__ TIME _____ AM PM SAMPLE PROGRAM

DEPTH (TOP) _____ DEPTH INTERVAL _____ UNIT _____

SAMPLING METHOD:

SPLIT SPOON ___ AUGER ___ SHELBY TUBE ___ SCOOP ___ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS

TOTAL NUMBER OF CONTAINERS FOR SAMPLE_____

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION:_____

_____

_____

SAMPLE FORM _____ COLOR _____ ODOR _____

PID (HNu)_____ UNUSUAL FEATURES_____

_____

WEATHER/TEMPERATURE

SAMPLER _____

FIELD PARAMETER/LOGBOOK FORM 10.2-b
GROUNDWATER AND SURFACE WATER SAMPLES

HIGH CONCENTRATION EXPECTED? _____ HIGH HAZARD?

INSTALLATION/SITE _____ AREA

INST CODE _____ FILE NAME _____ SITE TYPE

SITE ID _____ FIELD SAMPLE NUMBER

DATE (MM/DD/YY) __/__/__ TIME _____ AM PM SAMPLE PROG.

DEPTH (TOP) _____ DEPTH INTERVAL _____ UNITS

SAMPLING MEASUREMENTS

CAL REF. _____ pH _____ TEMPERATURE °C _____ CONDUCTIVITY _____ REDOX _____

DISSOLVED OXYGEN ____ TURBIDITY _____ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS

TOTAL NUMBER OF CONTAINERS FOR SAMPLE_____

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION_____

SAMPLING METHOD_____

SAMPLE FORM _____ COLOR _____ ODOR _____

PID (HNu)_____

UNUSUAL FEATURES_____

WEATHER/TEMPERATURE_____ SAMPLER _____

EXAMPLE MAP FILE LOGBOOK FORM 10.2-c
SURFACE WATER, SOIL, AND SEDIMENT SAMPLES

SITE ID_____ POINTER_____

DESCRIPTION/MEASUREMENTS_____

SKETCH/DIMENSIONS :

MAP REFERENCE_____

COORDINATE DEFINITION (X is _____ Y is _____)

COORDINATE SYSTEM _____ SOURCE _____ ACCURACY_____

X-COORDINATE _____ Y-COORDINATE _____ UNITS_____

ELEVATION REFERENCE_____

ELEVATION SOURCE _____ ACCURACY _____ELEVATION_____

UNITS_____

SAMPLER_____

EXAMPLE MAP FILE AND PURGING LOGBOOK FORM 10.2-d
GROUNDWATER SAMPLES

WELL COORD. OR ID _____ SAMPLE NO._____

WELL/SITE DESCRIPTION_____

_____

X-COORD. _____ Y-COORD. _____ ELEV. _____ UNITS

DATE ____/____/____ TIME _____ AIR TEMP.

WELL DEPTH _____ FT. _____ IN. CASING HT. _____ FT. _____ IN.

WATER DEPTH _____ FT. _____ IN. WELL DIAMETER _____ IN.

WATER COLUMN HEIGHT _____ FT. _____ IN. SANDPACK DIAM. _____ IN.

EQUIVALENT VOLUME OF STANDING WATER _____ (GAL) (L)

VOLUME OF BAILER _____ (GAL) (L) or PUMP RATE _____ (GPM) (LPM)

TOTAL NO. OF BAILERS (5 EV) _____ or PUMP TIME _____ MIN.

WELL WENT DRY? [Yes] [No] NUM. OF BAILERS _____ or PUMP TIME

VOL. REMOVED _____ (GAL) (L) RECOVERY TIME

PURGE AGAIN? [Yes] [No] TOTAL VOL. REMOVED _____ (GAL) (L)

DATE & TIME	QUANTITY REMOVED	TIME REQ'D	pH	Cond	Temp	ORD	Turb	DO	Character of water (color / clarity / odor / partic.)
(before)									
(during)									
(during)									
(during									
(after)									

COMMENTS_____

SIGNATURE_____

EXAMPLE FIELD CALIBRATION FORM 10.2-e
FOR pH, CONDUCTIVITY, TEMPERATURE, TURBIDITY,
ORD, AND DISSOLVED OXYGEN METERS

INITIAL CALIBRATION	FINAL CALIBRATION
DATE:	**DATE:**
TIME:	**TIME:**

pH METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

pH STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
7.0			
10.0			
4.0			

CONDUCTIVITY METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

COND. STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

TEMPERATURE METER CALIBRATION

METER ID_____

TEMP. STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
ICE WATER			
BOILING WATER			
OTHER _____			

EXAMPLE FIELD CALIBRATION FORM 10.2-e
FOR pH, CONDUCTIVITY, TEMPERATURE, TURBIDITY,
ORD, AND DISSOLVED OXYGEN METERS

TURBIDITY METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

ORD METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

DISSOLVED OXYGEN METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

COMMENTS_____

SIGNATURE_____

STANDARD OPERATING PROCEDURE 10.4
CHAIN-OF-CUSTODY FORM

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for use of the chain-of-custody form. An example is provided as part of this SOP. Other formats with similar levels of detail are acceptable.

2.0 MATERIALS

- Chain-of-custody form; and
- Indelible ink pen.

3.0 PROCEDURE

1. Record the project name and number.
2. Record the project contact's name and phone number.
3. Print sampler's names in "Samplers" block.
4. Enter the Field Sample No.
5. Record the sampling dates for all samples.
6. List the sampling times (military format) for all samples.
7. Indicate, "grab" or "composite" sample with an "X."
8. Record matrix (e.g., aqueous, soil).
9. List the analyses/container volume across top.
10. Enter the total number of containers per Field Sample No. in the "Subtotal" column.
11. Enter total number of containers submitted per analysis requested.
12. State the carrier service and airbill number, analytical laboratory, and custody seal numbers.
13. List any comments or special requests in the "Remarks" section.
14. Sign, date, and time the "Relinquished By" section when the cooler is relinquished to the next party.
15. Upon completion of the form, retain the shipper copy and place the forms and the other copies in a zip seal bag to protect from moisture. Affix the zip seal bag to the inside lid of the sample cooler to be sent to the designated laboratory.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None.

6.0 REFERENCES

USEPA. 1990. *Sampler's Guide to the Contract Laboratory Program.* EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, DC, December 1990.

USEPA. 1991. *User's Guide to the Contract Laboratory Program..* EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response, January 1991.

USEPA. 1998. *EPA Requirements for Quality Assurance Project Plans.* EPA/600/R-98/018, QA/R5, Final, Office of Research and Development, Washington, D.C.

FIGURE 10.4-a
EXAMPLE CHAIN-OF-CUSTODY FORM

Project Number	Project Name				Matrix	A N A L Y S E S									LAB :
Project Contact (Name and Phone Number)															AIRBILL No:
Samplers:															Courier:
Field Sample No.	Date (MM-DD-YY)	Time	Comp	Grab										Subtotal	REMARKS
TOTAL															

Relinquished by:	Date/time	Received by:	Relinquished by:	Date/Time	Received by:
Relinquished by:	Date/time	Received by: (for lab)	Date/Time	Remarks	

STANDARD OPERATING PROCEDURE 20.8
MAGNETIC AND METAL DETECTION SURVEYS

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide a general description of and technical management guidance on the use of Magnetic and Metal Detection Surveys.

2.0 MATERIALS

- Work Plans;
- Site maps;
- Field logbook;
- Metal detectors;
- Magnetometers;
- Pin flags;
- Surveys tape; and
- Personal protective equipment and clothing (PPE) per the site-specific health and safety plan.

3.0 PROCEDURE

3.1 DESCRIPTION OF METHODS

3.1.1 Theory and Principles of Operation

Magnetometry: All materials subjected to a magnetic field (including the magnetic field of the earth) will develop an induced magnetization, the intensity of which is proportional to the applied magnetic field and the magnetic susceptibility of the material. Ferromagnetic materials, such as iron or steel, have very high magnetic susceptibilities.

Induced magnetization in an object produces a local magnetic field that either reinforces (positive magnetic susceptibility) or reduces (negative susceptibility) the external applied field. The variations in an otherwise homogenous field caused by the presence of the object are called a magnetic anomaly, and observations of such anomalies can be used to infer the presence of nearby objects.

Magnetometry consists of measuring local variations in the earth's magnetic field along a traverse or across an area on the surface. Because the intensity of the earth's magnetic field depends in part on the magnetic susceptibility of subsurface material, a knowledge of variations in field intensity provides an indication of variations in the distribution of materials with different magnetic susceptibilities. In particular, the anomalies produced by buried ferromagnetic objects can be detected by magnetometers, which are instruments designed to measure the earth's magnetic field at a given location. In addition, many natural subsurface features, some of which are of interest in geohydrologic site investigations, may produce magnetic anomalies.

The intensity and inclination, or dip, of the earth's magnetic field varies smoothly (except for anomalies) with latitude. From the south to north across the United States, the intensity and inclination vary from about 49,000

to 60,000 gammas and from about 580 to 760, respectively. Nominal values for the Middle Atlantic Region (Washington, DC) are about 56,500 gammas and 690 for intensity and inclination, respectively. The intensity can vary ("drift") daily due to changes in the ionosphere, sunspots, and other phenomena. Therefore, the latitude, time, and regional magnetic trends are important considerations during the magnetic surveys.

The myriad features of both natural and artificial origin that influence magnetic field measurements means that there is no unique interpretation of a set of magnetometry data. Conversely, there is no unique magnetic anomaly produced by a particular kind of buried object. Factors that influence the response of a magnetometer include the size, shape, depth, orientation, magnetic susceptibility, and permanent magnetism of a buried object. The sensitivity of magnetometers is such that many objects of interest at hazardous waste sites (particularly buried ferromagnetic materials such as drums, tanks, pipes, and iron scrap) are detectable. However, it is often difficult to interpret and identify the source of magnetic anomalies.

Metal Detection: When a radio frequency electromagnetic field generated by a transmitter coil encounters a highly conductive object such as a metal (not necessarily ferromagnetic), alternating currents are induced in the object that, in turn, generate alternating secondary magnetic fields which can be detected as alternating voltages by a receiver coil. The presence of the metal object effectively "couples" the transmitter and receiver coils, which otherwise are oriented so that little or no coupling exists. The principles of metal detector operation are very similar to those associated with electromagnetic induction instruments.

A number of factors influence the response of a metal detector. The receiver response increases with the size and surface area and decreases with the depth of a buried object. Factors such as soil properties and shape complicate detectability and interpretation of responses. Certain shapes, such as elongated metal rods, are difficult to detect. Iron minerals and conductive fluids will affect the detector response in much the same manner as a target of interest. Generally, metal detectors show greater response to smaller nearby targets than to larger targets at greater depth, and the presence of widespread metallic debris at a site can interfere with attempts to detect buried drums and other objects.

3.2 GENERAL APPLICABILITY

Magnetic Surveys (Magnetometry): Applications of magnetic surveys at hazardous waste sites center on confirming the presence (or absence) and location of buried ferromagnetic objects. Location of buried waste containers such as drums or tanks and surveying of proposed drill sites to detect interfering pipes, cables, or tanks are two important applications. Typically, a single 55-gallon drum can be detected at depths of up to 6 meters and large drum deposits or large tanks can be detected at depths of 20 meters or more.

Magnetic surveys can more readily detect metallic masses than identify or characterize targets. Calculations of the mass or size of detected objects generally yields only approximate results.

Magnetic surveys may be impractical in areas where metal pipes, fences, railroad tracks, buildings, and other ferrous metal artifacts are abundant. However, proper selection of equipment and survey techniques can often alleviate some of these problems.

Metal Detection: Metal detectors (MDs) can be used for locating buried metallic containers of various sizes; defining the boundaries of trenches containing metallic containers; locating buried metallic storage tanks; locating buried metallic pipes; avoiding buried utilities when drilling or trenching; or locating utility trenches that may provide a permeable pathway for contaminants.

The detection range of a MD is relatively short. Its sensitive areas are focused directly above and below the coil, providing good definition of object location. Quart-sized metal objects can be detected at a distance of about 1 meter; objects the size of a 55-gallon drum can be detected at depth up to 3 meters; and massive piles

of metals can be detected at depths of 3 to 6 meters. Deeper objects are difficult to detect with a MD. Although most MDs are operated on foot, some can be vehicle-mounted if desired.

3.2.1 Instrumentation

Magnetometers: Two types of magnetometers, the fluxgate and proton procession magnetometers, are commonly used at hazardous waste sites. The fluxgate magnetometer uses an iron core sensor of high magnetic susceptibility. The amount of coiled electrical current necessary to induce magnetic saturation of the rod is directly dependent upon, and thus measures, the strength of the ambient magnetic field. In a proton magnetometer, a strong magnetic field is applied to a bottle of proton-rich fluid (e.g., kerosene), which realigns the protons. The field is then turned off and the frequency of the signal generated by the protons as they realign themselves ("process") to the earth's magnetic field is dependent upon, and thus measures, the strength of the field at that point. Some magnetometers, such as the fluxgate, are extremely sensitive to orientation during measurement. To alleviate this problem, two sensors are connected by a rigid pole to form a "gradiometer" that measures only a certain directional component of the earth's magnetic field. These gradiometers are commonly used at hazardous waste sites.

The type of magnetometer best suited for a particular site investigation depends upon characteristics of that site and should be chosen by a person familiar with the different instruments available. Proton magnetometers, for example, while very useful in some situations, will cease to function in an area with high magnetic gradients such as a junkyard or near a steel bridge.

Different instruments have different levels of sensitivity. In some cases, high sensitivity may be desired to detect deeply buried objects; in other instances, a low sensitivity instrument may be desired to reduce the effects of "noise" from nearby fences or cars. Furthermore, the size of the survey area and the resolution required will determine whether the magnetometer used is hand-held for stationary measurements or a vehicle-mounted continuous sensor model.

Metal Detectors (MDs): Three general classes of metal detectors are commonly used in hazardous waste site studies: pipeline/cable locators, conventional "treasure hunter" detectors, and specialized detectors. EPA field investigation teams commonly use the pipeline/cable detectors; they do not respond to small objects like soda cans. Although most of the "treasure hunter" type detectors are used for locating coin-sized objects, some can be fitted with larger sensor coils suitable for detection of larger objects at greater depths. Some of these models also can operate with adverse soil conditions such as high iron content. Specialized detectors are also available to operate to greater depths, operate over a wide sweep area, operate continuously, cope with special field problems, or operate while vehicle-mounted. These special MDs require an experienced operator and are not commonly available.

3.3 DATA ACQUISITION

3.3.1 Field Procedures

Magnetics: Magnetic measurements are generally made in a cross-grid pattern or if a continuous sensor is used, in a series of parallel lines across the survey area. The desired resolution (reconnaissance or high density) and the size and depth of the objects sought determine the spacing of measurement stations or surveys lines. Because of the phenomenon of temporal magnetic drift, a magnetic survey must include a base station at which magnetic measurements are made at regular intervals. These base stations are later used to correct all survey data for temporal differences due to drift. If the survey area permits, surveys are often conducted in a loop, the base station forming the end and starting points.

Magnetometers require special care during use. An experienced technician is recommended. The operator must not take measurements with the sensor near ferromagnetic objects such as belt buckles or steel-toed boots. The orientation of the magnetometer and its height from the ground must also be carefully controlled

during operation. Recorded data must be annotated with station locations to allow construction of a site magnetic map.

Metal Detector: Planning surveys with metal detectors are similar to surveys with magnetometers. A grid pattern of evenly spaced parallel lines is used. Desired resolution and the size of objects determine the grid spacing. In some cases, elevating the MD a few feet off the ground may help to eliminate noise from small surface objects. An experienced operator is recommended. Recorded data must be annotated with station locations to allow construction of a site metal detection map.

3.3.2 Data Format

Magnetics: The output of a magnetometer is a numerical value (in gausses) of the intensity of the earth's magnetic field at a location. It may be displayed electronically or printed on tape depending on the instrument used. Because the object of a magnetic survey is often to complete a map of the survey area, each magnetic reading must be coupled with a record of its precise location.

The time of each reading must also be recorded to allow temporal drift connection. Some recent proton magnetometers include microprocessors for recording information on readings, locations, and times in one memory for playback at the survey's completion.

Metal Detection: The data provided by a metal detector is less quantitative than that of a magnetometer. The MD signal strength may vary (depending on the instrument) with object depth, size and shape, but this signal does not translate into a quantity such as field strength. It merely indicates the presence of a metal object. This on/off type of signal is useful because it can indicate the boundaries of a metal-bearing zone more clearly than some quantitative data such as magnetometer recordings.

3.4 DATA INTERPRETATION

3.4.1 Magnetics

Before interpreting magnetic data, it must first be corrected for regional trends and temporal drift. Regional trends, as determined from magnetic maps, are subtracted from the observed values to resolve magnetic anomalies due to objects at the site. Temporal drift is corrected by calculating the base station field strength changes over time and subtracting the appropriate time-dependent value from each observation. Other corrections for terrain or for compliance with other magnetic data are also sometimes employed.

The calculations can be done by hand or via computer processing. Once these mathematical corrections have been performed, the result is a set of profiles on a magnetic contour map. Interpretation then involves matching the observed anomalies with inferred underground shapes of given magnetic properties. This "modeling" of the subsurface (or data conversion) can involve mathematical techniques such as upward and downward continuations that reduce topographic and other interfering effects. The interpretation of magnetic anomalies must be based upon auxiliary evidence of what is at the site because there is no unique geometric solution for any magnetic anomaly. Furthermore, because of magnetic inclination, magnetic anomalies do not appear directly above their source. An experienced geophysicist must perform interpretation of magnetic maps.

3.4.2 Metal Detection

Very little interpretation is necessary for metal detection surveys performed to provide qualitative data on the presence of metallic objects in the survey area as a precursor to more detailed subsequent geophysical surveys. For these cases, the positive audible response or meter deflections are recorded on site grid maps, and no further processing or interpretation is made. More detailed metal detection surveys using strip chart or magnetic tape recording are possible. Typically, data is plotted on site grid maps following computer processing. Corrections are made for nonlinearities and to eliminate small-target responses.

3.5 POTENTIAL PROBLEMS

Magnetic and metal detection surveys are geophysical methods that, although frequently applied, are subject to a wide variety of problems. Problems can be expected to arise in the following areas:

Planning and Execution: Rarely is a survey accomplished exactly according to the original plan. Site features not previously specified and other variations can occur that force changes in the details of the approach. However, the objectives of the survey, the general methodology, the amount of data required, and the degree of data interpretation requested should remain unchanged. Project work scopes should be written with some degree of latitude to allow a change in plans whenever justified.

Noise and Interferences: Measurements can be affected severely by both natural and man-made sources of metal and electrical currents. Iron-bearing minerals, metallic structures, and the presence of metal on the operator can adversely affect both types of surveys. Large masses of buried metal, fences, railroad tracks, and underground pipes or cables can strongly distort measurements and reduce instrument sensitivity to features of interest. These problems generally can be overcome but must be recognized early in the survey so that appropriate avoidance measures can be implemented. Known or suspected sources of interference should be included in the initial planning for a project.

Weather Conditions: It is possible to conduct the surveys under almost any conditions that permit traverse of the site. However, snow covers, standing water, heavy rainfall, or thoroughly saturated surface soils adversely affect metal detection surveys.

Technical Difficulties: Preventable difficulties include equipment malfunction or misapplication, poor operator training, and lack of applications experience. Other difficulties may arise because the magnetic character of the site is not as initially conceptualized. Early recognition and response by trained geophysicists can minimize the effect of any problems. Interim, real-time scrutiny of the data by the site geophysicists is essential. The geophysicist must be responsive regarding equipment replacement and/or repair or changes in personnel.

3.6 QUALITY CONTROL

Geophysical surveys, including magnetic and metal detection surveys, are subject to misapplication, erroneous interpretations, and use of incomplete or inadequate data, all of which can severely affect both the cost of subsequent site investigations and the validity of the survey. This susceptibility to misuse and the potential for negative effects demands that appropriate quality control measures have been implemented. Quality control aspects common to most types of geophysical field programs include the following:

- Program management personnel (i.e., the field operations leaders, RI leader and site manager) with adequate technical expertise in the subject for preparing statements of work; reviewing proposals, work plans, and reports; and supervising technical subcontracts.
- Insistence on a defined scope of work, specifications, and data validation procedures.
- Requirement of a field quality control program.
- No data point should be rejected from a data set without appropriate justification; field data sheets should contain all observed data and the conditions that could affect data validation.
- All field data should be recorded in permanent ink in a bound logbook with each page signed and dated by the operator. Original unaltered logbooks should remain in the project files of the RI/FS contractor.

- In general, the objectives of geophysical surveys can be met by relative measurements across an area or with depth. Absolute calibration is therefore of lesser importance than precision of measurements. However, a properly calibrated instrument provides an added measure of data validity and permits correlation and comparison of the associated data with site features and geohydrologic characteristics not evident at the time of the field effort.
- An evaluation should be made of noise, interferences, and obstructions at a site and such measurements, inferences, and explanations should be recorded in the field. These real-time quality control procedures aid field personnel in correcting noise sources over which they have control and validating suspected external sources and in early detection of problems that might jeopardize the survey objectives.

3.6.1 Magnetic Surveys

Calibration: Magnetometer readings should regularly be compared with readings of a reference base station magnetometer; this procedure is necessary if corrections are to be made for changes in the earth's magnetic field over time. Absolute calibration should be performed periodically by use of a reference magnet or a standard laboratory electromagnet. Calibration should be recorded on an instrument calibration sheet, a copy of which accompanies the instrument to the field. Fluxgate magnetometers are inherently calibrated except for the crystal-controlled frequency counter, which requires periodic laboratory calibration.

Daily Quality Control: All data sets should be accompanied by quality control data that indicate the level of quality of each individual data point. Periodically, replicate measurements should be made so that measurement precision can be established. This procedure also requires corrections for variations in the earth's magnetic field with time. Each data set should be referenced to the most recent calibrations. All data obtained before a calibration requiring significant changes in instrument controls is suspect and the measurements should be repeated or otherwise validated. Data should be preliminarily reduced and plotted during the field program to determine the overall quality of the data and whether the survey results are consistent with the site conceptualization. Data points representing discontinuities in the curves should be validated by repetition and, if necessary, a fine grid of measurements made to determine whether the anomaly represents a site feature of interest, a spurious reading, or an obstructive interference.

3.6.2 Metal Detection

Calibration: Metal detectors normally are not calibrated, and only relative response is of interest. Periodically, nulling the instrument at a fixed location known to be free of metal and adjusting the gain to provide a proper response over a known target should check the sensitivity.

Daily Quality Control: Metal detector data should be accompanied by sufficient quality control data to verify that the instrument was operating properly. Occasional repetitive measurements and a log of the sensitivity adjustments usually suffice for this purpose.

4.0 HEALTH AND SAFETY CONSIDERATIONS

All procedures for hazardous waste site entrance, traverse, and egress that apply to general field operations also apply to the conduct of geophysical surveys. Magnetic and metal detection surveys depend on traverse of the site on foot or in vehicles, and there are extended periods during which personnel are subject to adverse environments at the site. A site health and safety survey must be performed before the geophysical survey, and an appropriate level of protection must be provided during the geophysical surveys.

The geophysical methods discussed here do not require sub-surface penetration and do not require extremely strenuous activity. Exposure to heat or cold is similar to that experienced during other field activities.

Extreme weather conditions will have adverse effects on the time required to obtain validated data, thereby increasing the duration of personnel exposure to the elements and to hazardous site influences.

Although the instruments themselves are held above the ground (unless sled mounted) the probes should be covered with non-metallic (i.e., plastic) covers to avoid the possibility of accidental contamination.

5.0 REFERENCES

Discussion of various geophysical survey techniques and applications can be found in the following references:

ASTM Standard D 6429-99 (2006). 2006. *Standard Guide for Selecting Surface Geophysical Methods.*

Benson, R.C., R.A. Glaccum and M.R. Noel. 1982. *Geophysical Techniques for Sensing Buried Wastes and Waste Migration.* Technos, Inc., Miami, FL, Contract No. 68-03-3050, US EPA Environmental Monitoring Systems Laboratory, Las Vegas, NV.

Costello, R.L. 1980. *Identification and Description of Geophysical Techniques.* Report No. DRXTH-TE-CR-80084, US Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD; Defense Technical Information System Number ADA 123939.

McKown, G.L., G. A. Sandness and G.W. Dawson. 1980. *Detection and Identification of Buried Waste and Munitions.* Proceedings of the 11th American Defense Preparedness Association Environmental Systems Symposium, Arlington, VA, 1980.

Olhoeft, Gary R. 1989. *Geophysics Advisor Expert System: Version 1.0.* Interagency Agreement DW 14932497, USEPA EMSL, Las Vegas, NV.

USACE. 1995. *Geophysical Exploration for Environmental and Engineering Investigations.* EM 1100-1-19802. 31 August.

STANDARD OPERATING PROCEDURE 30.1
SOIL SAMPLING

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for sampling surface and subsurface soils.

2.0 MATERIALS

- Stainless steel scoop, spoon, trowel, knife, spatula, (as needed);
- Split-spoon, Shelby tube, or core barrel sampler;
- Hand auger or push tube sampler;
- Drill rig and associated equipment (subsurface soil);
- Stainless steel bowls;
- Photoionization detector or other appropriate instrument as specified in site-specific health and safety plan;
- Sampling equipment for collection of volatile organic samples;
- Appropriate sample containers;
- Appropriate sample labels and packaging material.;
- Personal protective equipment and clothing (PPE) per site-specific health and safety plan; and
- Decontamination equipment and supplies (SOP 80.1).

3.0 PROCEDURE

3.1 DOCUMENTATION

Soil sampling information should be recorded in the field logbooks as described in SOPs 10.1 and 10.2.

3.2 SURFICIAL SOIL SAMPLES

The targeted depths for surficial soil samples (surface and near surface) will be specified in the work plan addenda developed for site-specific investigations.

1. All monitoring equipment should be appropriately calibrated before beginning sampling according to the requirements of the work plan addenda and SOP 90.1 or 90.2.
2. All sampling equipment should be appropriately decontaminated before and after use according to the requirements of the work plan addendum and SOP 80.1.
3. Use a spade, shovel, or trowel or other equipment (manufactured from material, which is compatible with the soil to be sampled) to remove any overburden material present (including vegetative mat) to the level specified for sampling.
4. Measure and record the depth at which the sample will be collected with an engineers scale or tape.

5. Remove the thin layer that was in contact with the overburden removal equipment using a clean stainless steel scoop or equivalent and discard it.
6. Begin sampling with the acquisition of any discrete sample(s) for analysis of volatile organic compounds (VOCs), with as little disturbance as possible. VOC samples will not be composited or homogenized.
7. When a sample will not be collected with a core type of sampler (push tube, split spoon, etc.), the sample for VOC analysis will be collected from freshly exposed soil. The method of collection will follow the procedures specified in SOP 30.8 (Methanol Preservation Method) or 30.9 (En Core® Method) based on the requirements of the work plan addenda.
8. Field screen the sample with properly calibrated photoionization detector (PID) or other appropriate instrument. Cut a cross-sectional slice from the core or center of the sample and insert the monitoring instrument(s). Based on the screening results, collect the VOC fraction, as applicable.
9. Collect a suitable volume of sample from the targeted depth with a clean stainless steel scoop (or similar equipment), push tube sampler, or bucket auger
10. For core type of samplers, rough trimming of the sampling location surface should be considered if the sampling surface is not fresh or other waste, different soil strata, or vegetation may contaminate it. Surface layers can be removed using a clean stainless steel, spatula, scoop, or knife. Samples collected with a bucket auger or core type of sampler should be logged per the requirements of SOP 10.3.
11. If homogenization or compositing of the sampling location is not appropriate for the remaining parameters, the sample should be directly placed into appropriate sample containers with a stainless steel spoon or equivalent.
12. If homogenization of the sample location is appropriate or compositing of different locations is desired, transfer the sample to a stainless steel bowl for mixing. The sample should be thoroughly mixed with a clean stainless steel spoon, scoop, trowel, or spatula and then placed in appropriate sample containers per the requirements for containers and preservation specified in work plan addenda. Secure the cap of each container tightly.
13. Appropriately, label the samples (SOP 50.1), complete the chain-of-custody (SOP 10.4), and package the samples for shipping (SOP 50.2).
14. Return any remaining unused soil to the original sample location. If necessary, add clean sand to bring the subsampling areas back to original grade. Replace the vegetative mat over the disturbed areas.

3.3 SUBSURFACE SAMPLES

All sampling equipment should be appropriately decontaminated before and after use according to the requirements of the work plan addendum and SOP 80.1.

1. All monitoring equipment should be appropriately calibrated before sampling according to the requirement of the work plan addendum and SOP 90.1 or SOP 90.2.
2. All sampling equipment should be appropriately decontaminated before and after use according to the requirements of the work plan addendum and SOP 80.1.
3. Collect split-spoon; core barrel, Shelby tube, sonic core or other similar samples during drilling.
4. Upon opening sampler or extruding sample, immediately screen soil for VOCs using a PID or appropriate instrument. If sampling for VOCs, determine the area of highest concentration; use a

stainless steel knife, trowel, or lab spatula to cut the sample; and screen for VOCs with monitoring instrument(s).

5. Log the sample on the boring log before extracting from the sampler per the requirements of SOP 10.3.
6. Any required VOC samples will be collected first followed by the other parameters. VOC samples will not be composited or homogenized and will be collected from the area exhibiting the highest screening level. The method of VOC sample collection will follow the procedures specified in SOP 30.8 (Methanol Preservation Method) or 30.9 (En Core® Method) based on the requirements of the work plan addenda.
7. Field screen the sample with properly calibrated photoionization detector (PID) or other appropriate instrument. Cut a cross-sectional slice from the core or center of the sample and insert the monitoring instrument(s). Based on the screening results, collect the VOC fraction, as applicable.
8. Rough trimming of the sampling location surface should be considered if the sampling surface is not fresh or other waste, different soil strata, or vegetation may contaminate it. Surface layers can be removed using a clean stainless steel, spatula, scoop, or knife.
9. If homogenization or compositing of the sampling location is not appropriate for other parameters, the sample should be directly placed into appropriate sample containers with a stainless steel spoon or equivalent.
10. If homogenization of the sample location is appropriate or compositing of different locations is desired, transfer the sample to a stainless steel bowl for mixing. The sample should be thoroughly mixed with a clean stainless steel spoon, scoop, trowel, or spatula and placed in appropriate sample containers per the requirements for containers and preservation specified in work plan addenda. Secure the cap of each container tightly.
15. Appropriately, label the samples (SOP 50.1), complete the chain-of-custody (SOP 10.4), and package the samples for shipping (SOP 50.2).
16. Discard any remaining sample into the drums used for collection of cuttings.
17. Abandon borings according to procedures outlined in SOP 20.2.

3.4 INVESTIGATION-DERIVED MATERIAL

Investigation-derived material will be managed in accordance with procedures defined in the work plan addenda for the site being investigated and SOP 70.1.

NOTES: If sample recoveries are poor, it may be necessary to composite samples before placing them in jars. In this case, the procedure will be the same except that two split-spoon samples (or other types of samples) will be mixed together. The boring log should clearly state that the samples have been composited, which samples were composited, and why the compositing was done. In addition, VOC fraction should be collected from the first sampling device.

When specified, samples taken for geotechnical analysis (e.g., percent moisture, density, porosity, and grain size) will be undisturbed samples, such as those collected using a thin-walled (Shelby tube) sampler, sonic core sampler, etc.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

Refer to the site-specific health and safety plan.

Soil samples will not include vegetative matter, rocks, or pebbles unless the latter are part of the overall soil matrix.

6.0 REFERENCES

ASTM Standard D 1586-99. 1999. *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.*

ASTM Standard D 1587-00 (2007) e1. 2007. *Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes.*

ASTM Standard D 5633-04. 2004. *Standard Practice for Sampling with a Scoop.*

USACE. 2001. *Requirements for the Preparation of Sampling and Analysis Plans.* EM 200-1-3. 1 February.

STANDARD OPERATING PROCEDURE 30.7
SAMPLING STRATEGIES

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate sampling strategies for sampling various media.

2.0 MATERIALS

- Historical site data;
- Site topography;
- Soil types; and
- Sampled media.

3.0 PROCEDURE

The primary goal of any investigation is to collect samples representative of existing site conditions. Statistics are generally used to ensure samples are as representative as possible. Sampling plans may employ more than one approach to ensure project data quality objectives are adequately addressed. A comparison of sampling strategies is presented in Table 1.

3.1 CLASSICAL STATISTICAL SAMPLING

Classical statistical sampling strategies are appropriately applied to either sites where the source of contamination is known or small sites where the entire area is remediated as one unit. Primary limitations of this sampling approach include (1) inability to address media variability; (2) inadequate characterization of heterogenous sites; and (3) inadequate characterization of sites with unknown contamination characteristics.

3.1.1 Simple Random Sampling

Simple random sampling is generally more costly than other approaches because of the number of samples required for site characterization. This approach is generally used when minimal site information is available and visible signs of contamination are not evident and includes the following features:

- Sampling locations are chosen using random chance probabilities.
- This strategy is most effective when the number of sampling points is large.

3.1.2 Stratified Random Sampling

This sampling approach is a modification to simple random sampling. This approach is suited for large site investigations that encompass a variety of soil types, topographic features, and/or land uses. By dividing the site into homogenous sampling strata based on background and historical data, individual random sampling techniques are applied across the site. Data acquired from each stratum can be used to determine the mean or total contaminant levels and provide these advantages:

- Increased sampling precision results due to sample point grouping and application of random sampling approach.
- Control of variances associated with contamination, location, and topography.

3.1.3 Systematic Grid

The most common statistical sampling strategy is termed either systematic grid or systematic random sampling. This approach is used when a large site must be sampled to characterize the nature and extent of contamination.

Samples are collected at predetermined intervals within a grid pattern according to the following approach:

- Select the first sampling point randomly; remaining sampling points are positioned systematically from the first point.
- Determine the grid design: one or two-dimensional. One-dimensional sample grids may be used for sampling along simple man-made features. Two-dimensional grid systems are ideal for most soil applications.
- Determine the grid type: square or triangular. Sampling is usually performed at each grid-line intersection. Other strategies include sampling within a grid center or obtaining composite samples within a grid.
- Each stratum is sampled based on using the simple random sampling approach but determined using a systematic approach.

3.1.4 Hot-Spot Sampling

Hot spots are small, localized areas of media characterized by high contaminant concentrations. Hot-spot detection is generally performed using a statistical sampling grid. The following factors should be addressed:

- Grid spacing and geometry. The efficiency of hot-spot searches is improved by using a triangular grid. An inverse relationship exists between detection and grid point spacing, e.g., the probability of hot-spot detection is increased as the spacing between grid points is decreased.
- Hot-spot shape/size. The larger the hot spot, the higher the probability of detection. Narrow or semi-circular patterns located between grid sampling locations may not be detected.
- False-negative probability. Estimate the false negative (β-error) associated with hot-spot analysis.

3.1.5 Geostatistical Approach

Geostatistics describe regional variability in sampling and analysis by identifying ranges of correlation or zones of influence. The general two-stage approach includes the following:

- Conducting a sampling survey to collect data defining representative sampling areas.
- Defining the shape, size, and orientation of the systematic grid used in the final sampling event.

3.2 NON-STATISTICAL SAMPLING

3.2.1 Biased Sampling

Specific, known sources of site contamination may be evaluated using biased sampling. Locations are chosen based on existing information.

3.2.2 Judgmental Sampling

This sampling approach entails the subjective selection of sampling locations that appear to be representative of average conditions. Because this method is highly biased, it is suggested that a measure of precision be included through the collection of multiple samples.

4.0 MAINTENANCE

Not applicable.

5.0 REFERENCES

Gilbert, R.O. 1987. *Statistical Methods for Environmental Pollution Monitoring.* John Wiley & Sons, Inc. 320 p.

USACE. 2001. *Requirements for the Preparation of Sampling and Analysis Plans.* EM200-1-3. 1 February.

TABLE 1
SAMPLING STRATEGIES

SAMPLING STRATEGY	DESCRIPTION	APPLICATION	LIMITATIONS
Classical Statistical Sampling Strategies			
Simple Random Sampling	Representative sampling locations are chosen using the theory of random chance probabilities.	Sites where background information is not available and no visible signs of contamination are present.	May not be cost-effective because samples may be located too close together. Does not take into account spatial variability of media.
Stratified Random Sampling	Site is divided into several sampling areas (strata) based on background or site survey information.	Large sites characterized by a number of soil types, topographic features, past/present uses, or manufacturing storage areas.	Often more cost-effective than random sampling. More difficult to implement in the field and analyze results. Does not take into account spatial variability of media.
Systematic Grid Sampling	Most common statistical strategy; involves collecting samples at predetermined, regular intervals within a grid pattern.	Best strategy for minimizing bias and providing complete site coverage. Can be used effectively at sites where no background information exists. Ensures that samples will not be taken too close together.	Does not take into account spatial variability of media.
Hot-Spot Sampling	Systematic grid sampling strategy tailored to search for hot spots.	Sites where background information or site survey data indicate that hot spots may exist.	Does not take into account spatial variability of media. Tradeoffs between number of samples, chance of missing a hot spot, and hot spot size/shape must be weighed carefully.
Geostatistical Approach	Representative sampling locations are chosen based on spatial variability of media. Resulting data are analyzed using kriging, which creates contour maps of the contaminant concentrations and the precision of concentration estimates.	More appropriate than other statistical sampling strategies because it takes into account spatial variability of media. Especially applicable to sites where presence of contamination is unknown.	Previous investigation data must be available and such data must be shown to have a spatial relationship.
Non-Statistical Sampling Strategies			
Biased Sampling	Sampling locations are chosen based on available information.	Sites with known contamination sources.	Contaminated areas can be overlooked if background information or visual signs of contamination do not indicate them. Best used if combined with a statistical approach, depending on the project objectives.
Judgmental Sampling	An individual subjectively selects sampling locations that appear to be representative of average conditions.	Homogenous, well-defined sites.	Not usually recommended due to bias imposed by individual, especially for final investigations.

STANDARD OPERATING PROCEDURE 50.1
SAMPLE LABELS

1.0 SCOPE AND APPLICATION

Every sample will have a sample label uniquely identifying the sampling point and analysis parameters. The purpose of this standard operating procedure (SOP) is to delineate protocols for the use of sample labels. An example label is included as Figure 50.1-A. Other formats with similar levels of detail are acceptable.

2.0 MATERIALS

- Sample label; and
- Indelible marker.

3.0 PROCEDURE

The use of preprinted sample labels is encouraged and should be requested from the analytical support laboratory during planning activities.
As each sample is collected, fill out a sample label ensuring the following information has been collected:

- Project name;
- Sample ID: enter the SWMU number and other pertinent information concerning where the sample was taken. This information should be included in site-specific work plan addenda;
- Date of sample collection;
- Time of sample collection;
- Initials of sampler(s);
- Analyses to be performed (NOTE: Due to number of analytes, details of analysis should be arranged with lab *a priori*); and
- Preservatives (water samples only).

Double-check the label information to make sure it is correct. Detach the label, remove the backing and apply the label to the sample container. Cover the label with clear tape, ensuring that the tape completely encircles the container.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None.

6.0 REFERENCES

USEPA. 2001 (Reissued May 2006). *EPA Requirements for Quality Assurance Project Plans.* EPA/240/B-01/003, QA/R5, Final, Office of Research and Development, Washington, D.C. March 2001

FIGURE 50.1-A
SAMPLE LABEL

PROJECT NAME _____

SAMPLE ID _____

DATE: ____/____/____ TIME: _____:_____

ANALYTES: VOC SVOC P/P METALS CN
PAH D/F HERBs ANIONS TPH
ALK TSS

PRESERVATIVE: [HCl] [HNO_3] [NaOH] [H_2SO_4]

SAMPLER: _____

STANDARD OPERATING PROCEDURE 50.2
SAMPLE PACKAGING

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for the packing and shipping of samples to the laboratory for analysis.

2.0 MATERIALS

- Waterproof coolers (hard plastic or metal);
- Metal cans with friction-seal lids (e.g., paint cans);
- Chain-of-custody forms;
- Chain-of-custody seals (optional);
- Packing material;
- Sample documentation;
- Ice;
- Plastic garbage bags;
- Clear Tape;
- Zip-top plastic bags; and
- Temperature blanks provided by laboratory for each shipment.

3.0 PROCEDURE

1. Check cap tightness and verify that clear tape covers label and encircles container.
2. Wrap sample container in bubble wrap or closed cell foam sheets. Samples may be enclosed in a secondary container consisting of a clear zip-top plastic bag. Sample containers must be positioned upright and in such a manner that they will not touch during shipment.
3. Place several layers of bubble wrap, or at least 1 in. of vermiculite on the bottom of the cooler. Line cooler with open garbage bag, place all the samples upright inside the garbage bag and tie.
4. Double bag and seal loose ice to prevent melting ice from soaking the packing material. Place the ice outside the garbage bags containing the samples.
5. Pack shipping containers with packing material (closed-cell foam, vermiculite, or bubble wrap). Place this packing material around the sample bottles or metal cans to avoid breakage during shipment.
6. A temperature blank (provided by laboratory) will be included in each shipping container to monitor the internal temperature. Samples should be cooled to 4 degrees C on ice immediately after sampling.
7. Enclose all sample documentation (i.e., Field Parameter Forms, Chain-of-Custody forms) in a waterproof plastic bag and tape the bag to the underside of the cooler lid. If more than one cooler is

being used, each cooler will have its own documentation. Add the total number of shipping containers included in each shipment on the chain-of-custody form.

8. Seal the coolers with signed and dated custody seals so that if the cooler were opened, the custody seal would be broken. Place clear tape over the custody seal to prevent damage to the seal.
9. Tape the cooler shut with packing tape over the hinges and place tape over the cooler drain.
10. Ship all samples via overnight delivery on the same day they are collected if possible.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

5.1 PERMISSIBLE PACKAGING MATERIALS

- Non-absorbent
  - — Bubble wrap; and
  - — Closed cell foam packing sheets.
- Absorbent
  - — Vermiculite.

5.2 NON-PERMISSIBLE PACKAGING MATERIALS

- Paper;
- Wood shavings (excelsior); and
- Cornstarch “peanuts”.

6.0 REFERENCES

USEPA. 1990. *Sampler's Guide to the Contract Laboratory Program.* EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C., December 1990.

USEPA. 1991. *User's Guide to the Contract Laboratory Program.* EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response. January 1991.

USEPA. 2001 (Reissued May 2006). *EPA Requirements for Quality Assurance Project Plans.* EPA/240/B-01/003, QA/R5, Final, Office of Research and Development, Washington, D.C. March 2001

Appendix C

Forms

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Work Plan – Quality Assurance Plan – Health and Safety Plan – Addendum 024
SSP at Army Reserve Small Arms Range
Radford Army Ammunition Plant, Radford, Virginia

Form C-1 Work Plan Revision Form

Form C-2 Worker Acknowledgement Form

Form C-3 MEC/Multiple Anomaly Discovery Form

Form C-4 Site Safety Tailgate Meeting

Form C-5 Surface Soil Collection Record

Form C-6 Quality Control Field Audit Report

Form C-7 Nonconformance and Corrective Action Report

Form C-8 Daily Quality Control Report

Form C-1
Work Plan Revision Form
Work Plan – Quality Assurance Plan – Health and Safety Plan – Addendum 024
SSP at Army Reserve Small Arms Range
Radford Army Ammunition Plant, Radford, Virginia

SITE DESIGNATION / LOCATION:

Radford Army Ammunition Plant

Radford, VA

Section: _____

Addendum: _____

Version: _____

Effective Date: _____

SUBJECT:

Approved by:

Field Operations Leader

_____

Date: _____

Concurrence:

Project Manager

_____

Date _____

Sheet _____ of _____

Form C-2
Worker Acknowledgement Form
SSP at Army Reserve Small Arms Range
Radford Army Ammunition Plant, Radford, Virginia

Document: Master Work Plan/QAP/HSP and Work Plan Addendum 024

Version: Final

Project: Radford Army Ammunition Plant

Location: Army Reserve Small Arms Range

Prior to the initiation of field activities, I have been given an opportunity to read and question the contents of this Master Work Plan/QAP/HSP, this Site-Specific Addendum, and approved revisions through the number listed above. With my signature, I certify that I have read, understood, and agree to comply with the information and directions set forth in these plans. I further certify that I am in full compliance with 20 Code of Federal Regulations (CFR) 1910.120 concerning training and medical monitoring requirements.

Site Personnel:

Name (please print)	**Signature**	**Date**

MEC/MULTIPLE ANOMALY DISCOVERY FORM

UXO Supervisor:_____ **Date:**_____

Anomaly ID No. (i.e. FAR A-001						
Anomaly Longitude (X) / Latitude (Y)	**X:**			**Y:**		
Object Length				**Inches**		
Object Diameter/Thickness				**Inches**		
Object Weight (Estimated)				**Pounds**		
Slope of Terrain (Check one box)	□	**<10°**	□	**10° to 30°**	□	**>30°**
Vegetation Cover (Check one box)	□	**Cleared**	□	**Vegetated**	□	**Wetland**
Soil Type (Check one box)	□	**Sand**	□	**Silt**	□	**Clay**
Inclination (Circle one)	**0°**	**45°**	**90°**	**135°**	**180°**	
Orientation (Circle one)	**N-S**	**NW-SE**	**E-W**	**SW-NE**		

Item Description/Justification/Comments

Anomaly Type/Category (Check Appropriate Box)

□ **UXO** □ **DMM** □ **Munitions Debris** □ **Practice Ordnance** □ **Inert Ordnance**
□ **Metal Waste** □ **Sub-surface Anomaly** □ **Other** _____

Was photo taken?	□ **Yes**	□ **No**	**File Name:**

Ordnance Positive Identification (If known, record below. Include fuze condition and disposition)

Quantity:	**Ordnance Mark/Mod:**	**Nose Fuze Mark/Mod:**	**Tail Fuze Mark/Mod:**
Ordnance Filler:	□ **Explosive** □ **Propellant** □ **Pyrotechnic** □ **Other**		**N.E.W.**

Ordnance Category:

□ **Bombs**	□ **Clusters/Dispensers**	□ **Grenades**	□ **Guided Missiles**
□ **Land Mines**	□ **Misc. Explosive Devices**	□ **Mortars**	□ **Underwater Ordnance**
□ **Rockets**	□ **Pyrotechnics and Flares**	□ **Projectiles**	□ **Small Arms**

Fuzing Types

Piezo-Electric	**Proximity (VT)**		
All-ways Acting (PD)	**Electric**	**Impact**	**Base Detonating**
Mech Long Delay	**Point-Initiating, Base-Detonating**	**Point Detonating**	**Influence**
Powder Train Time Fuze (PTTF)	**MT Superquick**	**Mechanical Time**	**Pressure**

Status of MEC/UXO

□ **Armed** □ **Unarmed**

Physical Condition of MEC/UXO (Check all that apply)

□ **Broken Open**	□ **Soil Staining**	□ **Filler Visible**	□ **Soil Sample Taken**

FOR UXOSS USE

Disposition: (Clarify Under Remarks) **Transport** **Leave In Place** **Other**	**Date:**

Notifications To Installation By:	**Signature:**	**Date:**
Transported By:	**Signature:**	**Date:**
Transferred To:	**Signature:**	**Date:**
Storage Location:		
Destroyed By:	**Signature:**	**Date:**

Remarks:

Signature:

UXOSS

UXO – Ordnance fuzed, armed or otherwise prepared for action and fired or placed in such a manner that it constitutes a hazard
DMM – Ordnance that was disposed of by abandonment; may have been fuzed or armed, but was not employed
Inert – Same physical features as an ordnance item but does not and never did contain energetic material
Munitions Debris – Ordnance material that contained or was in contact with energetic material, which has been expended (e.g., fragments from projectile)

URS Group, Inc
SITE SAFETY TAILGATE MEETING

PROJECT NAME:		CLIENT NAME:	
PROJECT NUMBER:		PROJECT LEADER:	
PREPARED BY:		DATE:	

ON-SITE SAFETY MEETING RECORD

LOCATION:

TASK TO BE PERFORMED:

I. Purpose for meeting: (check all that apply)

	DAILY SAFETY BRIEFING
	Begin New Task. Task:
	Periodic Safety Meeting
	New Site Procedures
	New Site Conditions / Information
	New Site Workers

MEETING ATTENDEES:

NAME (Print)	**SIGNATURE**	**COMPANY**
1.		
2.		
3.		
4.		
5.		

ON-SITE SAFETY MEETING RECORD *Page 2 of 2*

II. Topic (check all that apply)

	Site Safety Personnel		Decontamination
	Work Area Description		Emergency Response
	Site Characterization		Hazard Communication
	Equipment Hazard(s)		On-site Emergency
	Biological Hazard(s)		On-site Injuries
	Chemical Hazard(s)		Evacuation Procedures
	Physical Hazard(s)		Rally Point
	Heat Stress		Emergency Communications
	Cold Stress		Directions to Hospital
	Site Control		Emergency Equipment
	Work and Support Zones		Drug and Alcohol Policies
	PPE		Medical Monitoring
	Air Monitoring		Task Training
	Safe Work Practices		Unexploded Ordnance (UXO)

III. Remarks

V. Verification I certify that the personnel listed on this roster received the briefing described above. Site personnel not attending this meeting will be briefed before beginning their assigned duties.

Field Project Manager Date

UXO Safety Supervisor Date

URS GROUP INC.

SURFACE SOIL SAMPLE COLLECTION RECORD

Date: _____ **Project Title:** _____ **Contract Number:** _____

Sampler: _____ **Location:** _____

Coordinate Accuracy	unknown	0.001	0.01	0.1	1	10	100	1000	State Plane System	
Elevation Accuracy	unknown	0.001	0.01	0.1	1	10	100	1000	Horizontal Datum	
Elevation Type	Land Surface Pt	Measured Elevation Pt			Sea Floor Pt	Sea Surface Pt		Unspecified	Vertical Datum	

Sample ID	Time Collected	X-coordinate	Y-coordinate	Elevation	Description

Date:_____

URS GROUP INC.
Quality Control Field Audit Report

Report Number: _____
Project Title: _____
Location: _____
Contract Number: _____

WEATHER	BRIGHT SUN	CLEAR	OVERCAST	RAIN	SNOW
TEMPERATURE	< 32	32 - 50	50 - 70	70-85	>85
WIND	STILL	MODERATE	HIGH		
HUMIDITY	DRY	MODERATE	HUMID		

Auditor's Name: _____ **Phone:** _____
Facility Contact: _____ **Phone:** _____
Contractor Contact: _____ **Phone:** _____

Personnel On-Site			
No.	Name	Phone	Affiliation
a.			
b.			
c.			
d.			
e.			
f.			
g.			

Level of Personnel Protection Required in Work Plan:				Level of Personnel Protection Actually Donned:			
A	B	C	D	A	B	C	D

Field Survey Equipment				
Instrument	Model	Calibration Check	Calibration Standard	Span Setting
GPS				
Magnetometer				
Observations:				

Are Surface Soil Sampling Forms and Daily Quality Control Reports being logged every day?	YES	NO	N/A
Are any NCR Reports filed and were any corrective actions implemented?	YES	NO	N/A
Did the sampling team take periodic surveys of the ambient air conditions?	YES	NO	N/A
Did the sampling team provide a decon zone designating clean and contaminated areas?	YES	NO	N/A
Were photographs taken?	YES	NO	N/A
Auditor's Comments:			

Date:_____

URS GROUP INC.
Nonconformance and Corrective Action Report

Report Number: _____

Project Title: _____

Location: _____

Contract Number: _____

Description of Nonconformance and Cause:	
Proposed Disposition:	

Submitted by: _____ **Date:** _____

Approved by: _____

Actual Disposition approved by Project Manager:	
Implementation of Disposition assigned to::	

Completed by: _____ **Date:** _____

Verified by: _____ **Date:** _____

Date: _____

URS GROUP INC.

DAILY QUALITY CONTROL REPORT

Report Number: _____
Project Title: _____
Location: _____
Contract Number: _____

WEATHER	BRIGHT SUN	CLEAR	OVERCAST	RAIN	SNOW
TEMPERATURE	< 32	32 - 50	50 - 70	70-85	>85
WIND	STILL	MODERATE	HIGH		
HUMIDITY	DRY	MODERATE	HUMID		

Personnel On-Site

No.	Name	Hrs.	Affiliation	Location/Description of Work
a.				
b.				
c.				
d.				
e.				
f.				
g.				

Sampling equipment on site:

Type	Serial Number	Calibration Verification	Initial Time	Initial Reading	End Use Time	End Use Reading
GPS						
Magnetometer						

Field Changes: YES_____ NO_____

If yes, filed Nonconformance and Corrective Action Report number (NCR No.):_____

Health & Safety (Briefing held, PPE, injuries, near misses, etc.)	
Work Performed (including sampling)	
QA/QC Samples Collected/Analyses Requested	
Problems Encountered/Resolved	
Visitors On Site	
Special Notes	
Tomorrow's Expectations	

Contractor Verification: On behalf of the contractor, URS Group, Inc., I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as may be noted above.

_____ _____

Signature Date

Appendix D

Laboratory QA Manual and Analytical SOPs
(available only as a compact disk)



EMAX QUALITY SYSTEMS MANUAL 2006

BASED ON

NATIONAL ENVIRONMENTAL LABORATORY ACCREDITATION CONFERENCE (NELAC)
CHAPTER 5 (QUALITY SYSTEMS)
JUNE 2003

&
DEPARTMENT OF DEFENSE QUALITY SYSTEMS MANUAL FOR ENVIRONMENTAL LABORATORIES
VERSION 3 FINAL
JANUARY 2006

This manual is considered confidential within EMAX. The Quality Systems Manual is available for use by the laboratory personnel through the EMAX browser and by means of controlled distribution. The procedure for controlled distribution of this manual is detailed in EMAX-DM02, Controlled Documents. The manual must not be altered other than by a duly authorized representative of EMAX.

If the document has been provided to external users or regulators, it is for the exclusive purpose of reviewing EMAX quality systems. The external party(ies) shall not use it in any other way without the prior written permission of an authorized representative of EMAX Laboratories, Inc.

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QUALITY SYSTEMS MANUAL

EFFECTIVE DATE: DECEMBER 4, 2006

DOCUMENT ID: EMAX-QS00

REVISION 2

APPROVED BY:

KENETTE PIMENTEL
QUALITY ASSURANCE MANAGER

KAM PANG, PH.D.
CHIEF EXECUTIVE OFFICER & LAB DIRECTOR

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INTRODUCTION

EMAX Laboratories, Inc., (***EMAX***) has provided comprehensive environmental laboratory services to governmental, state and local agencies since 1987. ***EMAX*** was founded to fill a need within the California marketplace for a flexible, reliable, and cost-effective analytical laboratory for consulting firms involved in the early stages of site investigation and remediation. ***EMAX*** provided fundamental services for the development of statewide and regional environmental compliance, enforcement, and remedial action programs.

Similarly, ***EMAX*** had the opportunity to provide large-scale analytical support to the initial and then burgeoning environmental restoration programs of the branches of the Department of Defense, the Department of Energy, and the United States Environmental Protection Agency. ***EMAX*** occupies a state-of-the-art, 27,000 square foot physical plant in Torrance, California.

The industry ***EMAX*** supports has undergone periods of growth, uncertainty, and consolidation. ***EMAX*** however, has maintained levels of stability and consistency. With a strong dedication to the continuation of our technical proficiency, we place extreme emphasis on in-house training, third-party review of procedures and protocols, and the audit and peer-review processes.

Over the years, ***EMAX*** has distinguished itself within the laboratory services industry by its stability in staff, its recognized technical proficiency, and its commitment to providing analytical deliverables in a wide variety of either agency-specified or client-developed reporting formats. We must share a large portion of our success in these areas with our clients, for it is a product of their dedication, input, and communication with us.

EMAX, a ***woman-owned business*** (***WBE/SDB*****),** has been evaluated and audited by numerous governmental agencies and private-sector clients, and has provided analytical services in support of the overall environmental programs of:

- The United States Environmental Protection Agency
- The United States Air Force, The Air Force Center for Environmental Excellence
- The United States Army, Army Corps of Engineers
- The United States Navy, and
- The United States Department of Energy

DOCUMENT FORMAT

This manual is designed to complement and implement the DoD QSM and the NELAC Chapter 5 (Quality Systems) where the NELAC Chapter 5 serves as the primary text for this manual. The section numbering is similar to the DoD QSM. For the same purpose as the DoD QSM the numbering has been slightly changed from that of NELAC Chapter 5, as the manual is meant to be a stand-alone document. The number 5 has been eliminated from all section and subsection headings. However, second-level numbering has been retained to maintain an organization parallel to the NELAC Quality Systems requirements. For instance, Section 5.4.2 in NELAC Chapter 5 is equivalent to Section 4.2 in this manual. In fulfillment of the DoD requirements, the DoD clarifications boxes are incorporated in this manual as well. In addition, NELA appendices and DoD appendices are included.

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ACRONYM LIST

°C	Degrees Celsius
ANSI/ASQC	American National Standards Institute/American Society for Quality Control
ASTM	American Society for Testing and Materials
CAS	Chemical Abstract Service
CCV	Continuing calibration verification
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	Chain of custody
CV	Coefficient of variation
DO	Dissolved oxygen
DOC	Demonstration of capability
DoD	Department of Defense
DQOs	Data quality objectives
EC	Exposure concentration
EPA	Environmental Protection Agency
g/L	Grams per liter
GC/MS	Gas chromatography/mass spectrometry
ICP-MS	Inductively coupled plasma-mass spectrometer
ICV	Initial calibration verification
ID	Identifier
ISO/IEC	International Organization for Standardization /International Electro technical Commission
LC50	Lethal concentration at 50%
LCS	Laboratory control sample
MDL	Method detection limit
mg/kg	Milligrams per kilogram
MQO	Measurement quality objective
MS	Matrix spike
MSD	Matrix spike duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program

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NIST	National Institute of Standards and Technology
NOEC	No-observable-effects concentration
OSHA	Occupational Safety and Health Administration
PC	Personal computer
PCBs	Polychlorinated biphenyls
PSR	Project Specific Requirement
PT	Proficiency testing
PTOB/PTPA	Proficiency Testing Oversight Body/Proficiency Testing Provider Accreditor
QA	Quality assurance
QAD	Quality Assurance Division (EPA)
QAMS	Quality Assurance Management Section
QAPP	Quality Assurance Project Plan
QC	Quality control
RL	Reporting limit
RPD	Relative percent difference
RSD	Relative standard deviation
SD	Serial dilutions
SMSD	Statistical minimum significant difference
SOP	Standard operating procedure
TAC	Test acceptability criteria
TSS	Total suspended solids
UV	Ultraviolet
VOC	Volatile organic compound
WET	Whole effluent toxicity

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1.0 SCOPE

1.1. EMAX Quality Systems provides requirements and guidance to competently carry out all of the specified environmental testing activities it undertakes. It also describes EMAX's overall management commitment to the Quality Systems, the various tests it performs using standard methods, non-standard methods, and laboratory-developed methods.

Where more stringent standards or requirements are included in a mandated test method or by regulation, EMAX shall perform demonstration of capability to meet the requirement. Where ambiguity exists, ***EMAX*** shall attempt to clarify the issue with the client, otherwise EMAX shall apply the reference method requirement or the regulation.

1.2. Requirements contained in this manual are enforced in the absence of project-specific requirements, Federal, State, and/or local regulations as well as Project/Contract requirements shall supersede this document.

1.3. This manual is an integral part of the Quality systems. The QA Manager maintains the Quality Manual. The manual is reviewed annually and revisions are issued as appropriate to keep it up to date. Retention time for obsolete versions is at least 5 years.

1.4. This document is based on the National Environmental Laboratory Accreditation Conference's (NELAC) Chapter 5 Quality Systems Standard, and the Department of Defense Quality Systems Manual. It is designed to serve as a standard reference for EMAX in implementing analytical services for environmental testing.

1.5. Compliance to regulatory and safety requirements EMAX health and safety plan is described in EMAX Health & Safety Manual and EMAX Radiation Safety Manual). In addition, safety procedures are included in the SOPs where applicable.

1.6. EMAX operates a quality system that meets the requirements of NELAC, the DoD and standards guided by ISO 9001, 9002 and 17025.

1.7. Data integrity procedures are integrated as part of EMAX quality systems. They are imbedded in its SOPs and practiced across the board. Data are produced of known and documented quality for whatever purpose it may serve. The following sections in this manual references data integrity procedures:

Management Responsibilities	4.2.6, 4.2.6.1, and 4.2.6.2
Training	5.2.7
Control and Documentation	4.15

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2.0 REFERENCES

Refer to NELAC Appendix A DoD Attachment

3.0 TERMS AND DEFINITIONS

Refer to NELAC Appendix B DoD Attachment

4.0 MANAGEMENT REQUIREMENTS

4.1 Organization

4.1.1 ***EMAX*** Laboratories, Inc. is legally responsible for the activities and the data it produces. Its business license BUS-00757723 is issued by the city of Torrance and its consolidated permit/license to operate is issued by Los Angeles County certified unified program agency administered by Los Angeles County Fire Department.

4.1.2 ***EMAX*** is responsible to carry out its environmental testing activities in such a way as to meet the requirements of the NELAC Standard, and the DoD QSM, to satisfy the needs of the client, the regulatory authorities or organizations providing recognition.

4.1.3 ***EMAX*** management system shall cover all work carried out in the laboratory as well as its business constituents representing EMAX externally.

4.1.4 The facility of ***EMAX*** located at Torrance, CA is the only entity where environmental testing activities are performed. The responsibilities of key personnel that have an involvement or influence on the environmental testing activities are defined in order to identify potential conflicts of interest.

a) The organizational structure of ***EMAX*** is configured as such that functions of each department shall have no conflicting interests to prevent adverse influence on the laboratory's compliance with the requirements of the adopted Standards.

b) Likewise, ***EMAX*** promotes impartiality and its personnel attest that they are free from any undue commercial, financial and other pressures which might influence their technical judgment. ***EMAX*** does not engage in any activities that may endanger the trust in its independence of judgment and integrity in relation to its environmental testing activities.

4.1.5 ***EMAX*** employs:

a) Managerial and technical personnel with the authority and resources needed to carry out their duties and to identify the occurrence of departures from the quality system or from the procedures for performing environmental tests, and to initiate actions to prevent or minimize such departures (refer 5.2);

b) Processes to ensure that its management and personnel are free from any undue internal and external commercial, financial and other pressures and influences that may adversely affect the quality of their work; Refer to EMAX-QA10.

c) Policies and procedures to ensure the protection of its clients' confidential information and proprietary rights, including procedures for protecting the electronic storage and transmission of results; Refer to EMAX-QA10.

d) Policies and procedures to avoid involvement in any activities that would diminish confidence in its competence, impartiality, judgment or operational integrity; Refer to EMAX-QA10.

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e) Policies defining the organization and management structure of EMAX and the relationships between quality management, technical operations and support services; Refer to EMAX Appendices for the organizational structure.

f) Specific responsibilities, authority and interrelationships of all personnel who manage, perform or verify work affecting the quality of the environmental tests; Refer to Section 4.2.3.e of this manual.

Documentation includes a clear description of the lines of responsibility in the laboratory and shall be proportioned such that adequate supervision is ensured.

g) Adequate supervision of environmental testing staff, including trainees, by persons familiar with methods and procedures, purpose of each environmental test, and with the assessment of the environmental test results;

h) Technical management which has overall responsibility for the technical operations and the provision of the resources needed to ensure the required quality of laboratory operations;

The technical director(s) shall certify that personnel with appropriate educational and/or technical background perform all tests for which the laboratory is accredited; such certification shall be documented.

The technical director(s) shall meet the requirements specified in the Accreditation Process (see 4.1.1.1 of NELAC).

i) A member of staff as quality assurance manager who, irrespective of other duties and responsibilities, shall have defined responsibility and authority for ensuring that the quality system is implemented and followed at all times; the quality manager shall have direct access to the highest level of management at which decisions are made on laboratory policy or resources;

Where staffing is limited, the quality manager may also be the technical director or deputy technical director.

The duties and responsibilities of the quality manager (and/or his/her designees) are listed in 4.2.3.3).

j) Deputies for key managerial personnel, including the technical director(s) and/or quality manager; and

k) Policy to participate in a proficiency test program as outlined in Chapter 2 of NELAC and procedures for corrective action to ensure effectiveness of the corrective action taken.

4.2 Quality System

4.2.1 ***EMAX*** quality system is established, implemented and maintained based on the required elements contained in NELAC Chapter 5, and DoD QSM. It is appropriate to the type, range and volume of environmental testing activities it undertakes. Its policies, systems, programs, procedures and instructions to the extent necessary are documented to assure the quality of the environmental test results. Its system's documentation is communicated to, understood by, available to, and implemented by the appropriate personnel. This documentation includes the quality systems manual, standard operating procedures (SOP), and other appropriate reference documents and texts.

4.2.2 The management team of ***EMAX*** is committed to assure that its quality system policies and objectives are habitually practiced and imbedded in its operations. The quality system policies and objectives include:

a) Commitment to good professional practice in servicing its clients such that contract agreement and project specific requirements are attentively employed.

b) Assurance to provide a standard practice that data collection and processing are precisely performed, accurately presented, scientifically valid, and legally defensible.

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c) Quality Systems Objectives

1) Promote quality culture through leadership, quality management, and organizational learning;

2) Uphold data integrity by addressing ethical practices through employee training, and practicing impartiality among employees;

3) Provide a healthy work environment by maintaining a clean, well ventilated and lighted facility

4) Afford adequate equipment to produce reliable data.

5) Deliver client satisfaction by producing data of known quality on time.

6) Establish a continuous process of improvement through lessons learned, preventive measures, and quality control.

d) Require all personnel concerned with environmental testing activities within the laboratory to familiarize themselves with the quality documentation and implement the policies and procedures in their work; and

e) Commitment to comply with the adopted Standards.

4.2.3 The Quality Systems Manual (QSM) and related quality documentations describe the quality culture of ***EMAX*** and its entity.

a) To assure that the objectives of the quality system are achieved and to provide stability and consistency in its practice, Standard Operating Procedures (SOPs) are established. The SOPs are typified as follows:

1) Quality Assurances SOPs are established to manage and detail the execution to the overall quality assurance objectives and policies.

2) Supplemental Quality Control SOPs are established controls auxiliary to Analytical and Quality Assurance SOPs.

3) Sample Management SOPs are established policies and procedures for sample custody from cradle to grave.

4) Analytical SOPs are established tests manuals adopted from approved reference methods e.g., EPA Methods, Standard Methods, or other industry approved methods.

5) Data Management Procedures are established guidelines for data control from generation to archival.

6) Information Systems Procedures are guidelines to manage electronic media from software development to electronic data archival.

7) Radiation Safety SOPs are established policies and procedures for handling samples from DoE sponsored projects or samples suspected to have limited quantity of radioactive material.

EMAX manuals and SOPs are downloaded to the network for employees' easy access. SOP revisions are emailed to supervisors so that concerned personnel can review them accordingly. This manual and the SOPs are reviewed at least once a year and revised as necessary. Department Supervisors and/or Managers review SOPs pertinent to their Department to ensure that they are currently practiced as prescribed by approved methods and this manual. Reviews are documented in the document review form.

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b) ***EMAX*** Organizational Structure ensures that its organization shall be able to function as expected by the industry standard. Its organizational chart is included in EMAX Appendices.

c) Relationship between management, technical operations, support services and the quality system are distinct with authority and resources to exemplify and discharge their duties as needed.

d) Document Control procedure is detailed in EMAX-DM02. This procedure describes the process of document control. It covers the generation of control numbers, distribution, control, and archival of controlled documents. The control process applies to Standard Operating Procedures (SOPs), Quality Assurance Manual, Laboratory Logbooks, and other related documents that have similar importance for the proper operation of the laboratory.

e) Listed below are the job descriptions of key staff and support staff

1. Executive Staffs

i. Chief Executive Officer & Laboratory Director

- Provide intellectual leadership in technical operations, project management and logistics of domain technical knowledge;
- Provide a healthy work environment
- Interface with Operations and Quality Assurance in the formulation and implementation of the Quality Systems;
- Ensuring clear and consistent communication, and coordinate a team of professionals and their respective departments to solve all encountered problems;
- Drive project management activities to influence quality output with the goal of enhancing customer satisfaction;
- Review the effectiveness of Quality Systems and instigate improvement accordingly;
- Delegate deputies in case of absence of the Laboratory Director, Technical Operations Manager and/or Quality Assurance Manger;

ii. Vice President & Information Systems Manager

- Assure data integrity and security;
- Design and develop software solutions to enhance and expand EMAX capabilities;
- Provide programming and technical support to Data Management in order to implement systems that meet customer requirements to include proactive and reactive incident resolution;
- Collaborating with Project Managers to clarify definition of client requirements;
- Ensure the quality and delivery of technical operations supporting the business in accordance with the adopted Standards and project requirements;
- Work closely with Data Management and Network Administration to understand recurring incidents impacting user population, help identify root cause, and initiate remedial measures

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- Perform Capacity Planning to ensure appropriate storage and/or processing capability of Network within the technical infrastructure to support present and future initiatives.
- Provide hardware and software for information systems backup systems;
- Initiate improvements on design systems to meet the industry demand.

iii. Business Development Manager

- Responsible for all aspects of business development.
- Identify clients with whom EMAX can develop long-term relationships.
- Responsible for maintaining current clients as well as to attract new clients
- Oversees all aspects of proposals and customer relations.

iv. Operations Manager

- Provide direction in technical operations, guidance of project execution and assessment of operations capacity.
- Certify quality technical staff to perform the test methods specified in this manual.
- Plan and adjust work operations to meet various project requirements or quick turn-around-time without sacrificing the quality and quantity of work;
- Coordinate and integrate the work activities and resources of the different departments or organizational segments;
- Analyze organizational and operational problems and develop timely and economical solutions;
- Establish performance goals and assess progress toward their achievement;
- Deal effectively with the department supervisors and assume their tasks in their absence.
- Sign off on reports to clients in the absence of the Lab Director and perform secondary data review as necessary..
- Devise ways to accommodate work operations to new and changing programs or requirements such as method development and staffing

2. Quality Systems Director referred to as Quality Assurance Manager

- Serve as the focal point for QA/QC and be responsible for the oversight and/or review of quality control data;
- Have functions independent from laboratory operations for which they have quality assurance oversight;
- Be able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence;
- Have documented training and/or experience in QA/QC procedures and be knowledgeable in the quality system as defined under NELAC;
- Have a general knowledge of the analytical test methods for which data review is performed;
- Arrange for or conduct internal audits as per 4.13 annually; and,

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- Notify laboratory management of deficiencies in the quality system and monitor corrective action.
- Responsible for ensuring continuous improvement at the laboratory through the use of control charts and other method performance indicators (for example, proficiency testing (PT) samples and internal and external audits).
- Maintains the Quality Systems Manual.

3. Technical Directors

i. Laboratory Supervisors

- Assign and review the work of subordinates;
- Train and work effectively with subordinates;
- Accomplish the quantity of work expected within set limits of cost and time employing the quality systems of EMAX;
- Plan own work and carry out assignments effectively;
- Arrange for or conduct maintenance of instrumentation to produce quality data and minimize downtimes;
- Review and resolve reported anomalies when they are encountered;
- Communicate orally and in writing in working out solutions to problems or questions relating to the work and institute program(s) to prevent problem recurrence;
- Ensure initial and continuing demonstration of capability of subordinates;
- Review and revise test methods related to respective work as necessary;
- Understand and advance management goals as these affect day-to-day work operations; and
- Develop improvements or design new test methods through method development process;

4. Support Systems Directors

i. Project Managers

- Review project requirements;
- Generate technical summary of project specific requirements (PSR), including test methods, reporting limits, QC procedures and QC limits;
- Review data packages for completeness in accordance to PSR
- Maintain a line of communication and documentation of all transactions with the client.
- Initiate request for variance whenever necessary and disseminate project change orders to respective parties.

ii. Sample Management Supervisor

- Supervise sample management as described in the sample management SOPs;
- Check that the sample control room is within the prescribed condition as described in EMAX-QC03.
- Check and monitor the thermometer calibrations.

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- Train and work effectively with subordinates;
- Accomplish the quantity of work expected within set limits of cost and time employing the quality systems of EMAX;
- Plan own work and carry out assignments effectively;
- Arrange for or conduct maintenance of instrumentation to produce quality data and minimize downtimes;
- Review and resolve reported anomalies when they are encountered;
- Communicate orally and in writing in working out solutions to problems or questions relating to the work and institute program(s) to prevent problem recurrence;
- Ensure initial and continuing demonstration of capability of subordinates;
- Review and revise test methods related to respective work as necessary;
- Understand and advance management goals as these affect day-to-day work operations; and
- Initiate improvements on sample management systems to meet the industry demand.

iii. Sample Preparation Supervisor

- Supervise sample preparation as described in the sample preparation SOPs;
- Prioritize work order in accordance to holding time and turn-around-time.
- Assign and review the work of subordinates;
- Check and monitor the thermometer calibrations.
- Train and work effectively with subordinates;
- Accomplish the quantity of work expected within set limits of cost and time employing the quality systems of EMAX;
- Plan own work and carry out assignments effectively;
- Arrange for or conduct maintenance of instrumentation to produce quality data and minimize downtimes;
- Review and resolve reported anomalies when they are encountered;
- Communicate orally and in writing in working out solutions to problems or questions relating to the work and institute program(s) to prevent problem recurrence;
- Ensure initial and continuing demonstration of capability of subordinates;
- Review and revise test methods related to respective work as necessary;
- Understand and advance management goals as these affect day-to-day work operations; and
- Initiate improvements on sample preparation systems to meet the industry demand.

iv. Data Management Supervisor

- Manage data processing, packaging and archiving employing project specific requirements and EMAX quality systems;

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- Accomplish the quantity of work expected within set limits of cost and time;
- Schedule, assign and review the work of subordinates;
- Train and work effectively with subordinates;
- Plan own work and carry out assignments effectively;
- Review and resolve reported anomalies when they are encountered;
- Review and revise as necessary, all SOPs related to data management activities.
- Communicate orally and in writing in working out solutions to problems or questions relating to data management and information systems;
- Provide support in developing and maintaining programs for generating and validating electronic data acquisitions and processing and deliverables;
- Identify and advance management goals as these affect day-to-day work operations; and
- Initiate improvements on design systems to meet the industry demand.

v. Network Administrator

- Implement and administer network security policy as described in EMAX-IS08;
- Perform and monitor network backup jobs and process restore requests as well as perform configuration of workstations and mail server as described in EMAX-IS09;
- Manage network password and access control by establishing and maintaining users in regard to their files, rights, and account restrictions. Establish virus protection and perform virus disaster recovery as described in EMAX-IS10;
- Execute software or system releases as requested and maintain documentation of new hardware purchase as described in EAMX-IS12;
- Perform proactive review of systems performance and alerts to ensure event correlation and trend analysis are performed on a regular basis;
- Review system logs to identify signs of potential problems;
- Review and revise as necessary, all SOPs related to network activities.
- Stay current on technologies affecting current systems infrastructure issues
- Respond to users request on problems encountered regarding hardware, commercially purchased software or any other related network.
- Install, configure, and maintain software and applications needed by the operations.
- Initiate improvements on design systems to meet the industry demand.

vi. Purchasing Officer

- Monitor purchase order log;
- Authorize purchases and have them place accordingly as described in EMAX-QA09;

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- Supervise verification of material received against requisitions and invoices to determine propriety of order and inspect articles for quality control purposes;
- Review and reconcile purchase order with packing slips;
- Discuss and return defective or unacceptable goods to vendors and obtain appropriate credit;
- Expedite delivery of goods to users;

vii. Analysts

- Complete initial demonstration of capability before assuming responsibility and ensure continuing demonstration of capability in accordance with the quality systems;
- Plan own work and carry out assignments effectively
- Review and employ appropriate test methods and SOPs related to respective works;
- Perform first level of 100% review on sample results in accordance to work order specifications, method requirements and as described in EMAX-DM01.
- Report anomalous circumstances to the Supervisor or the Technical Operations Manager; and
- Accomplish the quality and quantity of work expected within set limits of cost and time;

viii. Technicians

- Complete initial demonstration of capability before assuming responsibility and ensure continuing demonstration of capability in accordance with the quality systems;
- Plan own work and carry out assignments effectively
- Review and employ appropriate test methods and SOPs related to respective works;
- Report anomalous circumstances to the Supervisor or the Technical Operations Manager; and
- Accomplish the quality and quantity of work expected within set limits of cost and time;

f) ***EMAX*** approved signatories.

1) Kam Pang, the CEO & Lab Director is the primary signatory for EMAX.

2) In the absence of the Laboratory Director, the QA Manager and the Laboratory Operations Manager, assume the technical functions of the Laboratory Director. The assumption of this duty carries with it the responsibility to assure that all of their actions shall be in accordance but not limited to EMAX approved policies and procedures, EMAX Quality Systems, EMAX Standard Operating Procedures, Project Specific Requirements, Project Contract Specifications, and other directives related to EMAX laboratory activities.

3) Alternatively, the Project Managers, limited to the specific project(s) they handle may also assume the technical functions of the Laboratory Director. Likewise, this duty carries with it the responsibility to assure that all of their actions shall be in

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accordance but not limited to EMAX approved policies and procedures, EMAX Quality Systems, EMAX Standard Operating Procedures, Project Specific Requirements, Project Contract Specifications, and other directives related to EMAX laboratory activities.

4) List of approved signatories is included in EMAX Appendices.

g) Procedures for achieving traceability of measurements are included in Section 5.6 (Measurement Traceability), Section 5.6.4 (Documentation and Labeling of Standards, Reagents, and Reference Materials), and Section 4.12 (Control of Records).

h) The list of all test methods under which the laboratory performs its accredited testing is included in EMAX Appendices.

i) Mechanisms for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work are detailed in Project Management SOP (EMAX-QA01).

j) Calibration and/or verification test procedures used included in every test method manual. Applicable calibration and verification in compliance to PSR are also attached to every analytical work order to assure that data quality objectives are followed.

k) Procedures for handling submitted samples are detailed in Sample Receiving SOP (EMAX-SM02)

l) The list of major equipment is included in EMAX Appendices.

Reference measurement standards, as well as facilities and services used by the laboratory in conducting tests, are described in the specific SOPs. These procedures are listed in 5.6.3.1.

m) Procedures for calibration, verification and maintenance of equipment are included in the analytical SOPs.

n) Verification practices include inter-laboratory comparisons through laboratory control samples, proficiency testing programs and internal quality control schemes (e.g., control charts, QA data review).

o) When testing discrepancies are detected or departures from documented policies and procedures occur due to unavoidable circumstances or allowable exceptions, procedures for feedback and corrective action are detailed in Corrective Action SOP (EMAX-QA08). Corrective action related to analytical procedure is also included in each of the analytical SOPs.

p) Departures from documented policies and procedures or from standard specifications should be saved, and if it unavailable the laboratory management will treat it on a case by case basis taking into consideration the impact of the quality of data.

Departures and deviations from SOP that are due to project DOQ/PRS are handled by the project management system. Other departures and deviations are classified as minor or major changes. When a departure and/or deviation from SOP will have no impact on data quality, the change is deemed to be a minor change requiring approval of either the immediate supervisor or the Technical Operations Manager. Any departure and/or deviation from SOP that may affect the quality of data is deemed a major change and requires the approval of both the Technical Director and the QA Manager. When granting such approval, the Laboratory Director and the QA Manager shall consider whether the justifying circumstances are of such significance that an addendum to the SOP, a revision of the SOP or a new SOP is needed

q) Procedures for dealing with complaints

EMAX shall treat customer satisfaction with high priority. All customer complaints shall be entertained and assessed appropriately. A Project Manager (PM) shall be designated as primary point of contact at the

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inception of the project and shall serve as an interface between the customer and EMAX. The PM shall be responsible in resolving issues from the time sampling supplies are ordered to the time the data deliverables are delivered. The PM is also responsible for responding to future questions that may arise from submitted data, hard copy and/or electronic. EMAX-QA08 details the guidelines for taking care of customer complains.

r) Procedures for protecting confidentiality (including national security concerns), and proprietary rights

EMAX will not intentionally disclose to any person (other than the representative(s) designated by the client) services rendered or information received and/or generated by EMAX. Likewise, information known to be potentially endangering the national security or an entity's propriety rights will not be released.

All employees, upon joining EMAX are informed of the importance of the policy on protecting confidentiality and propriety rights. All data received and generated at EMAX shall remain confidential within EMAX Laboratories, Inc. Reports and other pertinent information is only disclosed by authorized personnel to the clients concerned. No one is permitted to remove or make copies of any EMAX records, reports or documents without prior management approval. Disclosure of confidential information could lead to dismissal.

s) Procedures for audits are detailed in SOP for Internal Assessment (EMAX-QA07). Procedures for conducting adequate data review are detailed in SOP for Data Flow and Review (EMAX-DM01).

t) Processes/procedures for establishing that personnel are adequately experienced in the duties they are expected to carry out and are receiving any needed training are detailed in SOP for Training (EMAX-QA05).

u) Procedures for reporting analytical results are integrated in analytical SOPs. Procedures for data packaging are detailed in SOP for Data Package Assembly and Archiving (EMAX-DM03).

v) Table of Contents and applicable lists of references and glossaries, and appendices are found in this manual.

4.2.4 The Technical Operations Manager and the Quality Assurance Manager are responsible for ensuring compliance with the adopted Standards.

4.2.5 The Quality Assurance Manger is responsible for maintaining the quality systems manual.

4.2.6 Procedures to establish and maintain data integrity are detailed in the Ethics Program SOP (EMAX-QA10). These procedures include the following elements: 1) data integrity training, 2) signed data integrity documentation for all laboratory employees, 3) in-depth, periodic monitoring of data integrity, and 4) data integrity procedure documentation. The procedures are signed and dated by senior management. These procedures and the associated implementation records are properly maintained and shall be made available for assessor review. The data integrity procedures are annually reviewed and updated by management.

4.2.6.1 Mechanism for confidential reporting of data integrity issues in their laboratory is also detailed in EMAX-QA10. The SOP also assures confidentiality and a receptive environment in which all employees may privately discuss ethical issues or report items of ethical concern.

4.2.6.2 In instances of ethical concern, the SOP includes a process whereby management determines the need for any further detailed investigation.

4.3 Document Control

4.3.1 General

EMAX established a standard operating procedure for writing SOP (EMAX-QA00) to standardize the process on generating, maintaining and controlling standard operating procedures. Document Control SOP (EMAX-

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DM02) is established to cover document identification, filing, distribution, control, changes, retention, protection, preservation, archival, retrieval, and disposal of controlled documents.

Document control policies and procedures related to or supplementary to analytical processes (e.g. calibration of support instruments) are imbedded in the analytical SOPs or in SOPs specific to the activity being performed.

The control of data related to environmental testing is covered in 5.4.7. The control of records is covered in 4.12.

4.3.2 Document Approval and Issue

4.3.2.1 All documents in the laboratory as part of the quality system are reviewed and approved by authorized personnel for use prior to issue. EMAX Browser was established to provide an easy access to these documents for laboratory personnel. The QA Department controls the documents loaded in the Browser so that only the most recent edition is available for use to preclude the use of invalid and/or obsolete documents. A database is also maintained to list the SOPS, its current version and the latest document review date. Other distributions are recorded on the document control ledger kept with the original SOP.

4.3.2.2 The procedure(s) adopted ensure that:

a) authorized editions of appropriate documents are downloaded to EMAX Browser available at network computers located in the laboratory where they are easily accessed by laboratory personnel;

b) documents are periodically reviewed and, where necessary, revised to ensure continuing suitability and compliance with applicable requirements;

c) invalid or obsolete documents can not be accessed by the laboratory personnel.

d) obsolete documents are marked “VOID” and retained by the QA Department for either legal or knowledge preservation purposes.

4.3.2.3 Quality system documents are uniquely identified. Such identification includes the date of issue and/or revision identification, page numbering, the total number of pages, and the issuing authority(ies).

4.3.3 Document Changes

4.3.3.1 Changes to documents are reviewed and approved by the same function that performed the original review unless specifically designated otherwise. The designated personnel obtain pertinent background information upon which to base their review and approval.

4.3.3.2 Where practicable, addendum to the document is generated and the change is identified in the document or the appropriate attachments.

4.3.3.3 Where amendment of documents is done by hand, pending the re-issue of the documents, the QA Manager or the Laboratory Director authorizes the change and the EMAX Browser copy is updated accordingly. Amendments are clearly marked, initialed and dated. Revised documents are re-issued as soon as practicable.

4.3.3.4 Changes in documents maintained in computerized systems are controlled by the QA Department. Procedures for such changes are detailed in EMAX-DM02.

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4.4 Review of Requests, Tenders and Contracts

4.4.1 EMAX Project Management SOP (EMAX-QA01) describes the procedures for the review of requests, tenders and contracts. The policies and procedures of this SOP includes:

a) Project Specific Requirements (PSR), including the methods to be used, quality control procedures, reporting formats, deliverables and other requirements to fulfill contract agreement.

b) A process to ensure that the laboratory has the capability and resources to meet the PSR;

Where new methods are to be developed or additional analytes are required by a project, the Operations Manager is consulted purposely to review capability that the laboratory possesses the necessary physical, personnel and information resources, and that the laboratory's personnel have the skills and expertise necessary for the performance of the environmental tests in question. The review process includes demonstration of capability, successful participation of proficiency testing (PT) and/or the running of trial environmental test programs using samples or items of known value in order to determine uncertainties of measurement, detection limits, confidence limits, or other essential quality control requirements. The Project Manager (PM) where applicable, reviews current accreditation status of the laboratory and informs the client of the results of this review if it indicates any potential conflict, deficiency, lack of appropriate accreditation status, or inability on the laboratory's part to complete the client's work.

c) Appropriate selection of environmental test method to meet the PSR.

Any differences between the request or tender and the contract are resolved before any work commences. Each contract shall be acceptable both to the laboratory and the client.

A contract may be any written or oral agreement to provide a client with environmental testing services. Oral agreements are followed by written statement (i.e., email, fax or letter) clarifying the agreement.

4.4.2 Records of reviews, including any significant changes, are maintained by the Project Managers. Discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract are maintained. Phone conversations providing instructions and/or changes are followed by a written statement (i.e., email, fax or letter) to demonstrate a clear understanding on how to proceed with the project.

Changes are initiated by the designated PM, and are initialed and dated. Where changes impact generation of deliverables (e.g. analyses, report forms, EDDs, etc.), the PM is required to discuss the matter with the Laboratory Director and the Operations Manager.

4.4.3 Where part of the project is subcontracted, the PM is responsible for the review of contract requirement and make sure that the sub-tier lab is capable of providing the requirements of the project.

4.4.4 The PM is responsible for informing the client of any deviation from the contract.

4.4.5 If a contract needs to be amended after work has commenced, PM performs the same contract review process and communicates any amendments to all affected personnel. The PM informs the client when suspension of accreditation, revocation of accreditation, or voluntary withdrawal of accreditation occurs.

4.5 Subcontracting of Environmental Tests

4.5.1 When work is subcontracted, this work is placed with an accredited laboratory that meets applicable statutory and regulatory requirements for performing the tests and submitting the results of tests performed. Where project requirement include NELAP accreditation, specific DoD Component laboratory approval process, or other program acceptance process is required, the laboratory performing the subcontracted work is indicated in

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the final report and non-NELAP accredited work is clearly identified. Where on-site assessment is required, the PM arranges a schedule with the QA Manager, the client and the subcontractor representative.

4.5.2 The PM obtains project-specific approval from the client before work is subcontracted, preferably in writing. In the event that oral approval was provided, the PM shall send a written statement (i.e., email, fax or letter) confirming the verbal approval.

4.5.3 EMAX is responsible to the client for the subcontractor's work, except in the case where the client or a regulatory authority specifies which subcontractor is to be used.

4.5.4 A register of all subcontractors that EMAX uses for environmental tests and a record of the evidence of compliance are maintained by the designated PM.

4.6 Purchasing Services and Supplies

4.6.1 Purchasing SOP (EMAX-QA09) describes the policies and procedures for the selection and purchasing of services and supplies EMAX uses. This SOP includes the purchase, reception and storage of reagents and laboratory consumable materials relevant for the environmental tests.

4.6.2 Purchased supplies, reagents and consumable materials that affect the quality of environmental tests are not used until they have been inspected or otherwise verified as complying with standard specifications or requirements defined in the methods for the environmental tests concerned. Chemical QC SOP details the policies and procedures for acceptance/rejection of chemicals prior to its use. These services and supplies used are established and implemented to comply with specified requirements. Records of actions taken to check compliance are endorsed and maintained by the QA Department.

4.6.3 Purchase orders for items affecting the quality of laboratory output contain description of the services and supplies ordered. These purchasing documents are reviewed and approved for technical content prior to release.

These documents include date of receipt, expiration date (where applicable); source (i.e., provider or supplier), lot number, and calibration and verification records and certifications for whatever services and supplies may affect the quality of associated test results.

4.6.4 The Operations Manager evaluates suppliers of critical consumables, supplies and services which affect the quality of environmental testing, and maintains records of these evaluations and list those approved.

4.7 Service to the Client

A PM is designated for each project to clarify the client's request and to monitor the laboratory's performance in relation to the work performed. Where multi-projects are assigned to a PM, confidentiality to other clients is mandatory.

This service is also expected to provide proactive engagement. Client notification is observed when the following situations are encountered:

- Use of alternative method, technique, and/or monitoring analytes (e.g., surrogate standard, Internal Standard, etc.) other than specified by the project.
- The need to optimize methods to ensure achievement of QAPP (e.g. difficult matrix, poor performing analyte)
- Lack of project guidance documents, such as the QAPP, or the need for clarification of requirements in the document (e.g. action levels, detection and quantitation capabilities)

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- Problems with samples or analysis that may impact results (e.g. sample preservation, holding time, turn-around-time)

4.8 Complaints

EMAX treats customer satisfaction with high priority. All customer complaints are entertained and assessed appropriately. The designated PM serves as an interface between the customer and EMAX. The PM is responsible in making sure that issues are resolved from the time sampling supplies are ordered to the time the data deliverables are delivered. The PM is also responsible for responding to future questions that may arise from submitted data, hard copy and/or electronic.

Corrective Action SOP (EMAX-QA08) includes policy and procedure for the resolution of complaints received from clients or other parties. Complaints are treated on a case by case basis. Lessons learned from these incidents are incorporated in the improvement process, where new policies may be implemented to prevent recurrence. Records are maintained of all complaints and of the investigations and corrective actions taken by the laboratory.

4.9 Control of Non-conforming Environmental Testing Work

4.9.1 When discrepancies or any aspect of the environmental testing work, or the results of this work, do not conform to its own procedures or the agreed requirements of the client occur, the following steps are implemented:

a) The Operations Manager informs the Project Manager of the nonconforming event with recommendation(s) on how to resolve the issue. Where data quality is affected, the QA Manager is also involved to provide guidance on how to proceed. Where necessary, work may be temporarily halted until issue of concern is resolved.

b) An evaluation of the significance of the nonconforming work is assessed.

c) Corrective action is taken in a timely manner

d) Where data quality is or may be impacted, the PM notifies the client.

e) When work was halted, resumption of work is authorized by the official that ordered it or the QA Manager.

4.9.2 Where the evaluation by either of the involved parties (The PM, The QA, and/or Operations) indicates that the non-conforming work could recur or that there is doubt about the compliance to policies and procedures launch corrective action as described in Section 4.10.

4.10 Corrective Action

4.10.1 General

When established corrective action policies and procedures do not rectify the non-conforming event or departures from the policies and procedures in the quality system or technical operations have been identified, a case study is initiated by the QA Manager.

4.10.2 Cause Analysis

The purpose of cause analysis is to explore and understand the root and/or rationale behind the noncompliant event.

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4.10.3 Selection and Implementation of Corrective Actions

The cause analysis is expected to identify potential corrective actions. Selection of corrective action is based on the effectiveness to eliminate the problem and to prevent recurrence.

The extent of corrective actions is bounded to a degree appropriate to the magnitude and the risk of the problem.

The QA Manager maintains documentation of the entire case study and to include summary of the findings and any required changes resulting from corrective action investigations.

4.10.4 Monitoring of Corrective Actions

The Operations Manager is responsible for monitoring the implementation and effectiveness of the corrective action. In the event that corrective action implemented is unsuccessful, the Operations Manager confers with the QA Manager to revisit the issues of concern and find measures to resolve the issue.

4.10.5 Additional Audits

Where the identification of non-conformance or departures casts doubts on the laboratory's compliance with established policies and procedures or on its compliance with this manual, the QA Manager conducts an audit on appropriate areas of activity in accordance with Section 4.13 of this manual as soon as possible.

4.10.6 Technical Corrective Action

a) Analytical Quality Control Procedure (QCP) is incorporated in every work order. The QCP includes corrective action for quality control parameters. In the event that other anomalies occur or corrective action in the QCP does not resolve the problem, the Supervisor is informed and non-conformance report is initiated. This process is an integral part of Corrective Action SOP (EMAX-QA08) and it includes:

   1) Event description; corrective action recommendation (CAR) corrective action taken (CAT). The event description is initiated by the person that discovered the non-conforming event and informs the Supervisor or the responsible person for initiating CAR (e.g., the PM, if it requires client notification, the QA if it concerns data quality, PT). The CAR is initiated by the Supervisor or the responsible party. The CAT is initiated by the person responsible for implementing the CAR.

   2) The Supervisor is responsible in making sure that actions are taken in a timely manner as well as the acceptability of course of action. Where data quality is or maybe jeopardize, the PM is informed so that the client is notified.

   3) These non-conformance events are logged in a database maintained by the QA Department.

   4) The QA Manager performs a periodic review to check for appropriateness of the CAT and trending analysis or recurring problems. Where the QA Manager observes inappropriate CAT, trending or recurring events, the issue is brought to the Operations Manager and when necessary with the Laboratory Director for verification, evaluation and discuss probable cure to the existing concern.

b) To the extent possible, samples are reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure are reported with the appropriate project specific defined data qualifier(s). Refer to appendices for specific program qualifiers.

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4.11 Preventive Action

EMAX has established pro-active processes where identified potential sources of non-conformances or probable cause of problems may occur. These processes include but not limited to the following:

4.11.1 Standard Operating Procedures are established so that proper course of action is followed across the board.

4.11.2 Chemicals used are passed through quality control prior to its use to prevent accidental use of underrated or adulterated chemicals.

4.11.3 Operations capacity is verified prior to accepting work and turning down work when project specifications are not within EMAX capability.

4.11.4 Appropriate personnel training and adequacy of commissioned equipment.

4.11.5 Continuous quality systems improvement obtained from technical experience, customer satisfaction, and participation of performance testing, and internal and external assessments.

4.12 Control of Records

Laboratory logbooks are controlled and issued by the QA Department. These logbooks are uniquely identified, paginated, and bound with a seal. They are designed to suit particular laboratory activities and comply with any applicable regulation. They are primarily used to record original observations, calculations and derived data calibration records. These records are expected to produce unequivocal and accurate data. All of these laboratory records and copies of test reports are maintained for a minimum period of five years.

Sample custody documentations are based on client project specification. In the event that a new project specifies other than EMAX current Sample Management SOPs, addendum to the existing SOP or a new SOP shall be generated to comply with the requirement.

4.12.1 General

4.12.1.1 Every data package generated archives with it all pertinent information necessary for the entire data generation process. This data archive includes but not limited to a copy of the chain of custody, PSR for the work order, relevant logbook pages, calibrations, raw data, test reports, non-conformance report (if any), and review records, These records are identified by EMAX Control Number (ECN) and are chronologically archived and indexed according to the ECN. These documents are controlled and maintained by the Data Management Department. A logbook is used to record archiving, access and disposal of these records. Quality records are maintained by the QA Department. These records include reports from internal audits and management reviews as well as records of corrective and preventive actions.

4.12.1.2 All records are expected to be legible. They are stored and retained in such a way that they are readily retrievable in a suitable environment to prevent damage or deterioration and to prevent loss. These records are retained for a minimum period of five years.

4.12.1.3 Access to these records is limited to authorized personnel only. The records warehouse is held secured and in confidence.

4.12.1.4 Likewise, access controls to electronic records are established for LIMS and administrative files. All users of Company data must be authorized to access the appropriate systems and their resources. Access is controlled and monitored in accordance with Company policy. Copies of data, regardless of location, have the same data security and access control requirements as operational data. The elements involved in controlling and

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monitoring this access include identification, authentication, and authorization. Access levels are determined by the user's or user group's data access privileges. Access is granted by means of a computer account, which serves as identification. A computer account is created based on an approved request for network account.

All critical LIMS and administrative data are backed up on a regular basis. Files stored in servers are backed up daily. Workstation data are backed up at a frequency established by the user who generates the data. This frequency is influenced by the rate of generation of new data, the rate with which the data changes and the effort required to recreate information, if it is lost. Backup and archival methods shall be defined for all data files. Backup data shall be used to recover data when files have been destroyed. Archived data shall be kept for future reference. Retention times shall be defined for archived data. Provisions shall be made for off-site storage of daily and archival back ups.

4.12.1.5 All laboratory activities are recorded to allow historical reconstruction of how the resultant sample analytical data was produced. Laboratory logbooks or forms related to the laboratory activity are integrated with the specific SOP. Internal chain of custody records the history of inter-laboratory transfers of samples and/or extracts. These records include:

a) The identity of personnel involved in sample endorsement/receipt, preparation, or testing.

b) Equipment identification, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification.

c) Data file names, electronic data location to facilitate the retrieval of all working files and archived records for inspection and verification purposes.

d) All changes to records signed or initialed by responsible staff clearly identifying the reason for the signature or initials, e.g. "prepared by," or "reviewed by."

e) All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent ink.

f) Entries in records are not be obliterated by methods such as erasures, overwritten files or markings. All corrections to record-keeping errors are made by one line marked through the error. The individual making the correction signs (or initials) and dates the correction. These criteria also shall apply to electronically maintained records where applicable.

g) Refer to 5.4.7.2 for Computer and Electronic Data.

4.12.2 Technical Records

4.12.2.1 Records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each test report issued, are retained for a defined period. The records for each environmental test contain sufficient information to facilitate identification of factors affecting the uncertainty and to enable the environmental test to be repeated under conditions as close as possible to the original. The records include the identity of personnel responsible for the sample preparation, performance of each environmental test and checking of results.

4.12.2.2 Observations, data and calculations are recorded at the time they are made and are identifiable to the specific task.

4.12.2.3 When mistakes occur in records, each mistake are crossed out, not erased, made illegible or deleted, and the correct value entered alongside. All such alterations to records are signed or initialed by the person making the correction. In the case of records stored electronically, equivalent measures are taken, e.g., changes are noted in the laboratory logbook to avoid loss or change of original data.

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When corrections are due to reasons other than transcription errors, the reasons for the correction are documented.

4.12.2.4 Records Management and Storage

a) All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. These records are available to the accrediting authority.

b) All records, including those specified in 4.12.2.5 are retained for a minimum of five years from generation of the last entry in the records. All information necessary for the historical reconstruction of data are maintained by EMAX. Records which are stored only on electronic media are supported by the hardware and software necessary for their retrieval.

c) Records that are stored or generated by computers or personal computers have hard copy or write-protected backup copies.

d) Record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting is integrated in SOPs relevant to the activity.

e) Access to archived information is documented with an access log. These records are protected against fire, theft, loss, environmental deterioration, vermin and, in the case of electronic records, electronic or magnetic sources.

f) In the event that EMAX transfers ownership or goes out of business, all records shall be transferred according to the client's instructions or as specified in Section 4.1.8.e of the NELAC Standard. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records shall be followed.

4.12.2.5 Laboratory Sample Tracking

4.12.2.5.1 Sample Handling

Sample Management SOPs details procedures of how samples are received, stored, maintained and disposed. These processes include but are not limited to all records pertaining to:

a) sample preservation including appropriateness of sample container and compliance with holding time requirement;

b) sample identification, receipt, acceptance or rejection and log-in;

c) sample storage and tracking including shipping receipts, sample transmittal forms (chain of custody form); and

d) procedures are documented for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

4.12.2.5.2 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained:

a) all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);

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b) a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;

c) copies of final reports;

d) archived SOPs;

e) correspondence relating to laboratory activities for a specific project;

f) all corrective action reports, audits and audit responses;

g) proficiency test results and raw data; and

h) results of data review, verification, and crosschecking procedures.

4.12.2.5.3 Analytical Records

The essential information associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, shall include:

a) EMAX sample =identification convention;

b) date and time of analysis and time of analysis or other critical steps that are essential to the validity of test results, e.g., extractions, and incubations;

c) instrumentation identification and instrument operating conditions/parameters (or reference to such data);

d) analysis type;

e) all manual calculations, e.g., manual integrations;

f) analyst's or operator's initials/signature;

g) sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;

h) sample analysis;

i) standard and reagent origin, receipt, preparation, and use;

j) calibration criteria, frequency and acceptance criteria;

k) data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;

l) quality control protocols and assessment;

m) electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and

n) method performance criteria including expected quality control requirements.

4.12.2.5.4 Administrative Records

The following records are maintained:

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a) personnel qualifications, experience and training records;

b) records of demonstration of capability for each analyst; and

c) a log of names, initials and signatures for all individuals who are responsible for signing or initialing any laboratory record.

4.13 Internal Audits

4.13.1 Internal audits include both technical and systems audits. Technical audits verify compliance with method-specific requirements, as well as operations related to the analytical process, data reduction, and data review. The process includes all actions related to data generation and the assurance of its quality. Systems audits verify compliance with the laboratory's quality system, based on the NELAC Quality System, DOD Quality System, and regulatory systems required to accomplish existing projects. Part of the systems audit would be a review of the policies and procedures for Quality Assurance, Quality Control, Sample Management, Data Management, Project Management, and Information Systems.

The QA Manager or a designee arranges internal audits to verify that EMAX operations continue to comply with the requirements of the laboratory's quality system. It is the responsibility of the QA Manager to plan and organize audits not only as required by a predetermined schedule but also as requested by management. Such audits shall be carried out by the QA Manager or qualified personnel who are, wherever resources permit, independent of the activity to be audited. Personnel shall not audit their own activities except when it can be demonstrated that an effective audit will be carried out.

Personnel performing an internal audit shall complete the audit under the direction of the quality manager, however named. To be considered "trained and qualified," the internal auditor shall be trained and qualified in conducting the type of audit under review

An audit schedule shall be established such that all elements/areas of the laboratory are reviewed over the course of one year.

4.13.2 Where the audit findings cast doubt on the correctness or validity of the laboratory's calibrations or test results, the laboratory shall take immediate corrective action and immediately notify in writing any client whose work may have been affected.

4.13.3 The area of activity audited, the audit findings, and corrective actions that arise from them are recorded. Refer to Internal Assessment SOP (EMAX-QA07) for procedures in documenting internal audit. The Operations Manager and the Laboratory Director receive a copy of the Internal assessment report. The Operations Manager is responsible that the corrective actions are discharged within the agreed time frame as indicated in the report. Time frame for corrective actions is based on the magnitude of the finding and its impact on the defensibility and use of data.

4.13.4 It is the responsibility of the QA Manager to follow-up, verify, and record the implementation and effectiveness of the corrective action taken. Where resolution or timeliness of the implementation of corrective actions is in question, the Operations Manager must inform the QA Manager and the Laboratory Director for re-evaluation and/or redirection.

4.14 Management Reviews

4.14.1 In preparation of management review, the members of executive management submit their annual report to the QA Manager. The QA Manager consolidates the annual management review and submits to the Laboratory Director. The Laboratory Director or a designee arranges an executive meeting to review the laboratory's

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quality system and environmental testing activities, their continuing suitability and effectiveness, and to introduce necessary changes or improvements. The review shall take account of:

a) the suitability of policies and procedures;

b) reports from managerial and supervisory personnel;

c) the outcome of recent internal audits;

d) corrective and preventive actions;

e) assessments by external bodies;

f) the results of inter-laboratory comparisons or proficiency tests;

g) changes in the volume and type of the work;

h) client feedback;

i) complaints; and

j) other relevant factors, such as quality control activities, resources, and staff training.

4.14.2 Findings from management reviews and the actions that arise from them are included in the report.

The Laboratory Director presides the executive meeting and directs course of action where changes are necessary.

The Operations Manager is responsible to ensure that identified action items concerning operations (e.g., initiate hiring or reshuffling of personnel, purchase or repair of equipments, facility improvement or maintenance, and other action items related to operations) are carried out within an appropriate and agreed timescale.

The QA Manager is responsible to ensure that identified action items concerning quality systems (e.g., policies and procedures, trainings, quality controls, and other action items related to quality systems improvement) are carried out within an appropriate and agreed timescale.

4.14.3 As part of their overall internal auditing program, the management review is conducted with respect to any evidence of inappropriate actions or vulnerabilities related to data integrity.

Discovery of potential issues shall be handled in a confidential manner until such time as a follow up evaluation, full investigation, or other appropriate actions have been completed and the issues clarified.

All investigations that result in finding of inappropriate activity shall be documented and shall include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients. All documentation of these investigation and actions taken shall be maintained for at least five years.

5.0 TECHNICAL REQUIREMENTS

5.1 General

5.1.1 Factors affecting correctness and reliability of environmental tests results.

a) human factors (5.2);

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b) accommodation and environmental conditions (5.3);

c) environmental test methods and method validation (5.4);

d) equipment (5.5);

e) measurement traceability (5.6);

f) sampling (5.7); and

g) handling of samples (5.8).

5.1.2 The extent to which the factors contribute to the total uncertainty of measurement differs considerably between (types of) environmental tests. To minimize disparity of test results, EMAX established environmental test methods and procedures, standardized training, and qualification of personnel, and in conjunction to daily equipment check, subscribe to service contracts for major equipment. EMAX designed its facility considering factors that may effect stability of equipment, minimize probable sources of contamination, health and safety of its workers, and ease for maintaining tidiness and cleanliness.

5.2 Personnel

5.2.1 All of EMAX technical staff undergo training regardless of its educational attainment and/or experience. All who operate specific equipment, perform environmental tests, evaluate results, and sign test reports shall demonstrate competence prior to working on their own. Staff on training may participate in sample analysis, as long as appropriate supervision is provided. Personnel performing specific tasks are qualified on the basis of appropriate education, training, experience and/or demonstrated skills as required.

EMAX employs sufficient personnel with the necessary education, training, technical knowledge, and experience for their assigned functions.

All personnel are trained to be responsible for complying with all quality assurance/quality control requirements that pertain to their function may it be technical or non-technical. Each technical staff member is positioned to have a combination of experience and education to adequately demonstrate a specific knowledge of his or her particular function and a general knowledge of laboratory operations, test methods, quality assurance/quality control procedures, and records management.

Employed Technical Directors are qualified in accordance to the specification of the NELAC Standard[1] as well as the DoD QSM[2] (Grey box 26).

5.2.2 Training SOP (EMAX-QA05) details the general process of conducting training. The Supervisor formulates the goals with respect to the education, training and skills of the personnel and conducts the training or assigns a mentor. The Supervisor also identifies the SOPs needed for the training as well as all the necessary training needs to successfully execute and complete the training. In general, the training program is geared relevant to the present and anticipated tasks of the laboratory.

5.2.3 Most of EMAX personnel are employed fulltime. Where contracted and additional technical and key support personnel are used, they undergo the same training, supervision and qualification process as the fulltime employees and must work in accordance with the laboratory's quality system.

5.2.4 Current job descriptions for all personnel who manage, perform, or verify work affecting the quality of the environmental tests are maintained and evaluated periodically.

[1] Based On NELAC Voted Revision – 5 June 2003
[2] DoD Quality Systems Manual – Version 3 Final

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5.2.5 Training records are forwarded to the QA Department for evaluation and certification to authorize specific personnel to perform particular types of environmental testing. The certification qualifies them to conduct the first level of review on test results, give opinions, and interpretations to test results, and to operate equipment specific to the test performed. The certification is approved by the Laboratory Director and the QA Manager.

Training records are maintained by the QA Department. These records include relevant authorization(s), competence, educational and professional qualifications, training, skills, and experience. This information shall be readily available and shall include the date on which authorization and/or competence is confirmed.

5.2.6 The management is responsible for:

a) hiring personnel to meet the defined minimum level of qualification, experience, and skills necessary for all positions in the laboratory. In addition to education and/or experience, basic laboratory skills such as using a balance, micropipette, thermometers, qualitative and quantitative techniques are considered;

b) ensuring that all technical laboratory staff have demonstrated capability in the activities for which they are responsible. Such demonstration is documented and maintained in their training files.

Note: Where a sample process (e.g. preparation, extraction, and analysis) is to be completed by a group of individuals to perform a method, otherwise known as a "work cell", each individual is certified to perform his or her specific task in order for the group working as a unit meets the above criteria. This demonstration of capability is documented in the individual training file.

c) ensuring that the training of each member of the technical staff is kept up-to-date as described in EMAX-QA05 where:

1) Evidence must be on file that demonstrates that each employee has read, understood, and is using the latest version of the laboratory's in-house quality documentation, which relates to his/her job responsibilities.

2) Training courses or workshops on specific equipment, analytical techniques or laboratory procedures are included in the training files.

3) Analyst training is considered up to date if an employee training file contains a certification that the technical personnel has read, understood, and agreed to perform the most recent version of the test method (the approved method or standard operating procedure as defined by the document control system, 4.2.3.d) and documentation of continued proficiency by at least one of the following per year:

   i. acceptable performance of a blind sample (single blind to the analyst). Note: successful analysis of a blind performance sample on a similar test method using the same technology (e.g., GC/MS volatiles by purge and trap for Methods 524.2, 624 or 5030/8260) would only require documentation for one of the test methods. The laboratory must determine the acceptable limits of the blind performance sample prior to analysis;

   ii. an initial measurement system evaluation or another demonstration of capability;

   iii. at least four consecutive laboratory control samples with acceptable levels of precision and accuracy. The laboratory must determine the acceptable limits for precision and accuracy prior to analysis; or

   iv. if i-iii cannot be performed, analysis of authentic samples with results statistically indistinguishable from those obtained by another trained analyst.

d) documenting all analytical and operational activities of the laboratory;

e) supervising all personnel employed by the laboratory;

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f) ensuring that all sample acceptance criteria (Section 5.8) are verified and that samples are logged into the sample tracking system and properly labeled and stored; and

g) documenting the quality of all data reported by the laboratory;

5.2.7 Data integrity training is provided as a formal part of new employee orientation and provided on an annual basis for all current employees. Ethics Program SOP (EMAX-QA10) details EMAX business ethics, its policies and procedures, the critical need for honesty and full disclosure of analytical results, how and when to report data integrity issues, as well as record keeping. Employees are required to understand their obligations related to data integrity, that any infractions of the laboratory data integrity procedures will result in a detailed investigation that could lead to disciplinary action including immediate termination or be brought in the court of law. Data integrity trainings are authenticated by the participant's dated signature. Senior managers acknowledge their support of these procedures by 1) upholding the spirit and intent of the organization's data integrity procedures and 2) effectively implementing the specific requirements of the procedures.

Training shall include discussion regarding all data integrity procedures, data integrity training documentation, in-depth data monitoring, and data integrity procedure documentation.

Other relevant ethics training materials (e.g. examples of breaches of ethical behavior should be discussed including improper data manipulations, adjustments of instrument time clocks, and inappropriate changes in concentrations of standards) are developed by the QA Department to augment the Ethics Program SOP.

5.3 Accommodation and Environmental Conditions

5.3.1 Significance of every facet of the laboratory was taken into consideration when EMAX designed its facilities. Its energy sources, lighting and environmental conditions, are planned and constructed to facilitate correct performance of the environmental tests.

To ensure that environmental conditions do not invalidate the results or adversely affect the required quality of any measurement, controls are established and monitored. Fume hoods are adequately provided so that particular care when sub-sampling and environmental testing are undertaken. Technical requirements for accommodation and environmental conditions that can affect the results of environmental tests are monitored and documented.

5.3.2 All environmental conditions that require control are monitored and documented in accordance with the relevant specifications, methods and procedures or where they influence the quality of the results. Due attention are paid as appropriate to the technical activities concerned (e.g. Leaching requires controlled temperature, DoE lab requires frisking, etc.). Environmental tests shall be stopped when the environmental conditions jeopardize the results of the environmental tests.

In instances where monitoring or controls of any of the above-mentioned items are specified in a test method or by regulation, a course of action is included in the SOP relevant to the activity being performed to meet and document adherence to the laboratory facility requirements.

5.3.3 The laboratories were constructed to have effective separation between neighboring areas in which there are incompatible activities. Volatiles Laboratory is located farthest from the extraction lab and has independent mechanical controls; laboratories for DoE samples are isolated with independent mechanical controls and restricted entries.

All foreseen measures are taken to prevent cross-contamination. Sample storage for Volatiles is located in the Volatiles Laboratory. Samples from DoE sights that are identified as restricted samples are stored in the DoE Laboratory.

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5.3.4 Access to and use of areas affecting the quality of the environmental tests are controlled. Specific areas in the lab can only be accessed by authorized personnel.

5.3.5 Measures are taken to ensure good housekeeping in the laboratory. The Supervisors are responsible to make sure that their work areas are properly maintained to prevent cross-contamination and/or health hazard to staff members.

5.3.6 Workspaces are available and workers assigned to specific areas are responsible to clear their respective work areas. Maintenance of work areas are enumerated below:

a) access and entryways to the laboratory are maintained clear by the Facilities Manager;

b) sample receipt areas are maintained by the Sample Management Department;

c) sample storage areas are maintained by the Sample Management Department;

d) chemical and waste storage areas are maintained by the Waste Management Unit.

e) data handling and storage areas are maintained by the Data Management Department.

5.4 Environmental Test Methods and Method Validation

5.4.1 General

EMAX has established appropriate methods and procedures for all environmental tests within its capability. These include handling, transport, storage, and preparation of samples, and, where appropriate, an estimation of the measurement uncertainty as well as statistical techniques for analysis of environmental test data.

Analytical SOPs have instructions on the use and operation of all relevant equipment, and on the handling and preparation of samples where the absence of such instructions could jeopardize the results of environmental tests. All instructions, standards, manuals and reference data relevant to the work of the laboratory are kept up to date and are readily available to personnel (see 4.3). Deviation from environmental test methods occur only if the deviation has been documented, technically justified, authorized, and accepted by the client. All SOPs are reviewed for accuracy and adequacy at least annually and whenever procedural method changes occur, they are updated as appropriate

5.4.1.1 Standard Operating Procedures (SOPs)

EMAX maintains SOPs that accurately reflect all phases of current laboratory activities such as assessing data integrity, corrective actions, handling customer complaints, and all test methods.

a) These documents contain adequate details to allow qualified personnel, other than the analyst, to reproduce the procedures to generate the test result.

b) In the absence of internally written analytical SOPs, copies of published methods maybe used as long as any changes or selected options in the methods are documented and included in the methods manual (see 5.4.1.2). For DoD projects, where existing methods are specified, requirements contained within that method shall be followed. Any modifications to existing method requirements require project-specific approval by DoD project representative.

c) Copies of all SOPs are downloaded in the EMAX Browser and are accessible to all personnel.

d) The SOPs are organized indicative of their use. The Sample Management SOPs are policies and procedures describing how to handle samples from cradle to grave. The Data Management SOPs are policies on procedures detailing data collection from sample receiving to data packaging. The Quality Assurance SOPs

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and Quality Control SOPs are policies and procedures detailing execution and controls for the overall quality systems. The Information Systems SOPs are policies and procedures detailing handling and management of electronic media, from hardware and software administration to backup and restoration controls.

e) Each SOP clearly indicates the effective date of the document, the revision number and the signature(s) of the approving authority.

f) Analytical SOPs contain sufficient information to perform the tests. Any changes, including the use of a selected option must be documented and included in the specific analytical SOP in the form of an addendum. All SOPs shall be archived for historical reference in accordance to Section 4.12.

5.4.1.2 Laboratory Method Manual(s)

a) EMAX maintains laboratory method manuals referred to as analytical SOPs for each accredited analyte or test method.

b) The Analytical SOPs describe the process of producing analytical results from sub-sampling to data reduction and review. These SOPs are adaptations of referenced test methods. In cases where modifications to the published method have been made or where the referenced test method is ambiguous or provides insufficient detail, these changes or clarifications are clearly described. Each test method includes or reference where applicable:

1) identification of the test method;
2) applicable matrix or matrices;
3) detection limit;
4) scope and application, including components to be analyzed;
5) summary of the test method;
6) definitions;
7) interferences;
8) safety;
9) equipment and supplies;
10) reagents and standards;
11) sample collection, preservation, shipment and storage;
12) quality control;
13) calibration and standardization;
14) procedure;
15) data analysis and calculations;
16) method performance;
17) pollution prevention;
18) data assessment and acceptance criteria for quality control measures;
19) corrective actions for out of control data;
20) contingencies for handling out-of-control or unacceptable data;
21) waste management;
22) references; and

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23) any table, diagram, flowchart, and validation data.

5.4.2 Selection of Methods

Project Management SOP (EMAX-QA01) describes how methods for environmental testing, including methods for sample preparation, are dispense to meet the needs of the client and which are appropriate for the environmental tests it undertakes.

5.4.2.1 Sources of Methods

a) Methods published in international, regional or national standards are preferably be used. EMAX ensures that it uses the latest valid edition of a standard unless it is not appropriate or possible to do so. When necessary, the standard shall be supplemented with additional details to ensure consistent application.

b) When the use of specific methods for a sample analysis are mandated or requested, only those methods are used.

c) When the client does not specify the method to be used or where methods employed are not required, the methods are fully documented and validated (see 5.4.2.2, 5.4.5, and Appendix C), and shall be available to the client and other recipients of the relevant reports. It is of EMAX's best interest to select appropriate methods that have been published either in international, regional or national standards, or by reputable technical organizations, or in relevant scientific texts or journals, or as specified by the manufacturer of the equipment. Where no reference method has been established, EMAX may develop methods appropriate for the intended use. These methods shall be fully validated and shall only be put to use with client's consent.

d) EMAX shall inform the client when the method proposed by the client is considered to be inappropriate or out of date.

5.4.2.2 Demonstration of Capability

Capability to perform environmental tests requires demonstration to confirm that it can be properly executed. Where method changes occur, the confirmation is repeated.

a) Prior to acceptance and institution of any method, satisfactory demonstration of method capability is performed. (See Appendix C and 5.2.6.b) In general, this demonstration does not test the performance of the method in real world samples, but in the applicable and available clean quality system matrix sample (a quality system matrix in which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g., drinking water, solids and air. In addition, for analytes which do not lend themselves to spiking, the demonstration of capability may be performed using quality control samples. When available, demonstration of performance is determined using external source of information (e.g. published methods). In the absence of external source, EMAX shall use comparisons provided by the project sponsor or execute the process as specified by the project data quality objectives.

b) Thereafter, continuing demonstration of method performance, as per the quality control requirements in Appendix D (such as laboratory control samples) is performed.

   The initial and continuing demonstration of capability includes verification of method sensitivity checks (for example, through the use of quarterly method detection verification) and demonstrated measurements of accuracy and precision (such as the production and review of quality control charts). These requirements apply to each quality system matrix of concern.

c) For methods that were established before July 1999, and there have been no significant changes in instrument type, personnel or method, continuing demonstration of method performance and the analyst's documentation of continued proficiency is sufficient to demonstrate capability.

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d) In all cases, the appropriate forms such as the Certification Statement (Appendix C) must be completed. All associated supporting data necessary to reproduce the analytical results summarized in the Certification Statement must be retained and be available upon request. (See Appendix C for Certification Statement.)

e) A demonstration of capability must be completed each time there is a change in instrument type, personnel, method, or sample matrix that may affect the precision, accuracy, sensitivity, and selectivity of the output.

f) Specialized "work cell(s)" (a group consisting of analysts with specifically defined tasks that together perform the test method who see a sample through the complete process of preparation, extraction, and analysis), each member of the group is certified specifically for his/her function in the unit. Demonstration of capability is fully documented.

g) Since every individual that work in work cells are certified when there are changes in the members of the cell, the new employee(s) is assigned to work with experienced analyst(s) in that area of the work cell where they are employed and no disruption of the unit's capability to perform is expected. The new member of the work cell must demonstrate acceptable performance through the same process.

h) Currently EMAX does not certify work cell(s) as a unit but rather each member is certified individually. In the event that EMAX decides to certify work cells as a unit, the performance of the group shall be linked to the training record of the individual members of the work cell (see section 5.2.6). When there are changes in the members of the cell, the performance of the unit shall be monitored. Such performance must be documented and the four preparation batches following the change in personnel must not result in the failure of any batch acceptance criteria, e.g., method blank and laboratory control sample, or the demonstration of capability must be repeated. In addition, if the entire work cell is changed or replaced, the work cell must perform the demonstration of capability.

5.4.3 Laboratory-Developed Methods

Method Development SOP (EMAX-QA03) details the policies and procedures to guide the users in planning the activity for the study they are about to develop as well as the documentation required to complete the qualification of the method. This activity shall be assigned to qualified personnel equipped with adequate resources.

Plans are updated as development proceeds and shall be corroborated through effective communication amongst all personnel involved and the intellectual resources of EMAX.

5.4.4 Non-Standard Methods

Non-Standard Methods shall only be employed when mandated by the project. It shall include clear specification of the client's requirements as stated by the project quality objectives. The method developed shall have been validated appropriately before use.

5.4.5 Validation of Methods

5.4.5.1 EMAX validates its methods by assessing objective evidence ensuring that the particular requirements for a specific intended use are fulfilled.

5.4.5.2 Validation of non-standard methods, in-house-designed/developed methods, standard methods used outside their published scope, and amplifications and modifications of standard methods shall confirm that the methods are fit for the intended use. The validation shall be as extensive as is necessary to meet the needs of the given application or field of application. Records of results obtained, the procedure used for the validation, and a statement as to whether the method is fit for the intended use is retained. At a minimum, requirements shall be the initial test method evaluation requirements given in Appendix C.3.

5.4.5.3 Where project requirements are known, (e.g., DoD QSM, or as stated through Basic Ordering Agreements), when validating methods the range and accuracy of the values (e.g. the uncertainty of the results, detection

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limit, selectivity of the method, linearity, limit of repeatability and/or reproducibility, robustness against external influences and/or cross-sensitivity against interference from the matrix of the sample/test object), are assessed for the intended use and relevant to the clients' needs.

In cooperation of EMAX's clients, should the client elect to use EMAX as early as the planning phase of the project (QAPP preparation), EMAX shall ensure that the required methods are properly validated. Otherwise, the client shall be informed accordingly.

5.4.6 Estimation of Uncertainty of Measurement

5.4.6.1 Factors affecting measurement uncertainty is estimated based on the complexity of the process. Note that the analytical process is only a fraction of the total measurement uncertainty for a target analyte. Hence, EMAX can not make measurement uncertainty corrections on sample results.

Laboratory control samples (LCS) are subjected to all possible sources of measurement uncertainty, (e.g., sample sub-sampling, sample preparation, sensitivity of instrumentation, instrument calibrations, qualitative and quantitative evaluation). Hence, reasonable estimation of measurement uncertainty is revealed by the statistical evaluation of the LCS results and/or validation data.

In those cases where a well-recognized test method specifies limits to the values of the major sources of uncertainty of measurement and specifies the form of presentation of calculated results, it is considered to have established estimated measurement uncertainty.

5.4.6.2 When estimating the uncertainty of measurement is required by the project, EMAX shall secure guidance for estimating measurement uncertainty from the client to prevent misinterpretation of results.

5.4.7 Control of Data

5.4.7.1 Calculations and data transfers are subject to appropriate checks in a systematic manner. Data evaluation and review process is an integral part of every analytical SOP. In addition Data flow and Review SOP (EMAX-DM01) describes the general process of how data are generated and reviewed. These SOPs include policies and procedures:

a) to ensure that the reported data are free from transcription, omissions, mistakes and qualitative and quantitative identification errors.

b) to ensure that all quality control measures are reviewed, and evaluated before data are reported.

c) for manual calculations including manual integrations.

d) to ensure consistency with project-specific requirements (e.g., method requirements, calibration requirements, quality control procedures, project limits, etc.)

e) to generate case narrative that includes accurate explanation when anomalous results are encountered, the corrective actions taken and that affected data are flagged according to project specification.

5.4.7.2 Where EMAX uses computers, automated equipment, or microprocessors for the acquisition, processing, recording, reporting, storage or retrieval of environmental test data, controls are in place so that original electronic data acquired are retained. EMAX also developed Information Systems SOPs.

a) For computer software developed in-house, EMAX has established policies and procedures to ensure sufficient details for documentation and control. These SOPs include:

Software Documentation (EMAX-IS01)

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Software Development Methodologies (EMAX-IS02)

Software Testing and Quality Assurance (EMAX-IS03)

Software Maintenance (EMAX-IS04)

b) Data Security SOP (EMAX-IS08) details the policies and procedures for protecting laboratory programs and electronic data. Furthermore, EMAX has developed Ethics Program (EMAX-Q10) to uphold integrity and confidentiality of data entry or collection, data storage, data transmission and data processing.

c) Hardware Maintenance SOP (EMAX-IS10) details computers attached to automated equipment are maintained to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of environmental test data; and

d) Access controls, backup and archival, and routine disaster recovery are established and maintained by the Network Administrator to maintain security of data. Only unauthorized personnel can amend computer records.

Commercial off-the-shelf software (e.g. word processing, database and statistical programs) in general use within their designed application range is considered to be sufficiently validated. However, laboratory software configuration or modifications must be validated as in 5.4.7.2a.

5.5 Equipment

5.5.1 EMAX has all instrumentation and support equipment for the environmental tests it performs (including sub-sampling, preparation of samples, processing and analysis of environmental test data). These instruments are obtained and maintained to achieve the accuracy, precision, sensitivity, and selectivity required for the intended use of the generated data. Procedures for setup, maintenance, and adjustments to instrument operating parameters as well as documentation process are integrated with the SOPs where these instruments are used.

5.5.2 Equipment and its software (where applicable) are verified to comply with specifications relevant to the environmental tests requirements before being placed into service. Procedures for calibration and calibration verifications are imbedded with the SOPs where these instruments are utilized.

Calibration requirements are divided into two parts: (1) requirements for analytical support equipment, and 2) requirements for instrument calibration. In addition, the requirements for instrument calibration are divided into initial instrument calibration and continuing instrument calibration verification.

5.5.2.1 Support Equipment

Support equipments are devices that are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices, sample preparation devices, and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume.

a) All support equipments are maintained in proper working order. The records of all repair and maintenance activities including service calls are kept.

b) All support equipments are calibrated or verified at least annually, using NIST traceable references when available, over the entire range of use. The results of such calibration or verification shall be within the specifications required of the application for which this equipment is used or:

1) the equipment is removed from service until repaired; or

2) maintain records of established correction factors to correct all measurements.

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c) Raw data records are retained to document equipment performance.

d) Prior to use on each working day, balances, ovens, refrigerators, freezers, and water baths are checked in the expected use range, with NIST traceable references where commercially available. The acceptability for use or continued use shall be according to the needs of the analysis or application for which the equipment is being used.

e) Mechanical volumetric dispensing devices including burettes (except Class A glassware) are checked for accuracy on at least a quarterly use basis. Glass microliter syringes are to be considered in the same manner as Class A glassware, but must come with a certificate attesting to established accuracy otherwise, initial demonstration of accuracy is required.

5.5.2.2 Instrument Calibration

The essential elements that define the procedures and documentation for initial instrument calibration and continuing instrument calibration verification must ensure that the data is of known quality and appropriate for a given regulation or decision.

5.5.2.2.1 Initial Instrument Calibration

The following items are essential elements of initial instrument calibration:

a) Calibration procedures, how they are done, evaluated and use. These procedures are included in every EMAX Analytical SOP. These procedures shall only be superseded when other specifications are required by the project or mandated by regulation. Where instrument calibration are complex (e.g. calibration for multi-analytes analyzed by GC/MS, GC, or HPLC) a secondary review is required prior to its use. Initial calibration verification is also performed when applicable.

b) Raw data records. These records are retained to permit reconstruction of the initial instrument calibration, e.g., calibration date, test method, instrument, analysis date, each analyte name, analyst's initials or signature; concentration and response, calibration curve or response factor; or unique equation or coefficient used to reduce instrument responses to concentration.

When manual integrations are performed, the original and the manually integrated raw data records are retained and documented as described in Data Flow and Review SOP (EMAX-DM01). Where software of data acquisition permits, electronic data also includes complete audit trail for the manually integrated peaks.

c) Quantitation Technique. Sample result quantitation is based from the initial instrument calibration, unless otherwise required by regulation, method, program, or project.

d) Initial calibrations verification. Initial instrument calibration is verified with a standard obtained from a second manufacturer. The use of a standard from a second lot is acceptable when only one manufacturer of the calibration standard exists. Where commercially available, EMAX shall purchase standards that are certified and traceable to a national standard.

When method specific guidance does not exist, concentration of second source standard shall be at or near the middle of the calibration range.

Where stability of the standard has not been established, assessment of standard solution as well as degradation rate shall be observed from the standard preparation date when evaluating for its suitability for use.

e) Acceptance Criteria. Initial instrument calibration acceptance criteria are based on the method requirement, or project specific requirement e.g., correlation coefficient or relative standard deviation. The criteria used must be appropriate to the calibration technique employed.

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Exclusion of initial calibration points without technical justification is not allowed.

Where problem analytes are known, deviation to acceptance criteria mandates EMAX to seek for client approval.

f) Limit of Quantitation (LOQ). LOQ is dependent on the sensitivity of the instrument. Where applicable, the lowest calibration standard determines the lowest concentration for which quantitative data are reported. For other instruments (e.g. pH meters), the reporting limit is based on the sensitivity of the instrument. Any data reported below the lower limit of quantitation is considered to have an increased quantitative uncertainty and shall be reported only when it is required by the project using defined qualifiers or flags as specified by the project or explained in the case narrative.

The reporting limit shall lie within the calibration range, at or above the LOQ. If the client requires a reporting limit that lies below the lowest standard of the calibration curve and below the LOQ, then method modification is required. For methods that require only one standard (i.e., lower limit of curve is the origin), the reporting limit shall be no lower than a low-level check standard, designed to verify the integrity of the curve at the lower limits

g) Quantitation Range. Where applicable, the highest calibration standard determines the highest concentration for which quantitative data are reported. Any data reported above this highest standard should be considered to have an increased quantitative uncertainty and shall be reported only when allowed by the project using defined qualifiers or flags specified by the project or explained in the case narrative.

The range of the accepted initial calibration curve reflects the quantitation range of the samples (i.e., only those sample results with concentrations contained within the range of the calibration curve are considered to be quantitative). Any data reported outside the calibration range shall be qualified as an estimated value (i.e., by a data qualifier “flag”) and explained in the case narrative.

When sample concentrations exceed the upper limit of the calibration curve, samples shall be diluted and re-analyzed (if possible) to bring them within the calibration curve. When sample concentrations exceed the upper limit of the calibration curve or fall below the lower limit of the calibration curve, the resulting data shall be qualified as having estimated values and shall be flagged.

h) Limit of Detection (LOD). The lowest calibration standard must be above the limit of detection. Noted exception: The following shall occur for instrument technology (such as ICP or ICP/MS) with validated techniques from manufacturers or methods employing standardization with a zero point and a single point calibration standard:

1) Linear Range is established as described in EMAX-6010 or EMAX-6020.

2) A two-point calibration (zero point and single point calibration standard) is analyzed with each analytical batch.

3) A standard corresponding to the limit of quantitation is analyzed with each analytical batch and evaluated to meet established acceptance criteria.

4) The linearity is verified at a frequency established by the method and/or the manufacturer.

i) Corrective Action. If the initial instrument calibration results are outside established acceptance criteria, corrective actions must be performed and all associated samples re-analyzed. If re-analysis of the samples is not possible, data associated with an unacceptable initial instrument calibration shall be reported with appropriate data qualifiers.

j) If a reference or mandated method does not specify the number of calibration standards, the minimum number is five contiguous calibration points for organics and three contiguous calibration points for inorganics (one of

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which must be at the limit of quantitation), not including blanks or a zero standard with the noted exception of instrument technology for which it has been established by methodologies and procedures that a zero and a single point standard are appropriate for calibrations (see 5.5.2.2.1.h).

All reported target analytes and surrogates are included in the initial calibration. For multi-component analytes (e.g. PCBs, toxaphene), a separate initial calibration is performed.

5.5.3 Equipment are operated and maintained by authorized personnel only. Up-to-date instructions on the use and maintenance of equipment (including any relevant manuals provided by the manufacturer of the equipment) are readily available for use by the appropriate laboratory personnel.

All equipment are routinely maintained, inspected, and cleaned. Maintenance procedures are included in the specific SOPs where the instrument is used and performed maintenance is recorded in the instrument maintenance logbook.

5.5.4 Instruments and data acquired from each instrument are uniquely identified.

5.5.5 Major item of equipment and its software significant to the environmental tests performed is maintained. Records include the following:

a) Instrument ID and data acquisition software;

b) manufacturer's name, type identification, and serial number or other unique identification;

c) checks that equipment complies with the specification (see 5.5.2);

d) current location;

e) manufacturer's instructions, if available, or reference to their location;

f) dates, results and copies of reports and certificates of all calibrations, adjustments, acceptance criteria, and the due date of next calibration;

g) maintenance plan, where appropriate, and maintenance carried out to date; documentation on all routine and non-routine maintenance activities and reference material verifications.

h) any damage, malfunction, modification or repair to the equipment;

i) date received and date placed in service (if available); and

j) if available, condition when received (e.g., new, used, reconditioned);

5.5.6 Procedures for safe handling, transport, storage, use and planned maintenance of measuring equipment to ensure proper functioning and in order to prevent contamination or deterioration. Refer to specific SOPs where instruments are used.

5.5.7 Where equipment has been subjected to overloading or mishandling, gives suspect results, or has shown defective or non-compliant to requirements, it is taken out of service. It is either isolated to prevent its use or clearly labeled or marked as being out of service, until it has been repaired and shown by calibration or test to perform correctly. The laboratory shall examine the effect of the defect or departure from specified limits on previous environmental tests and shall institute the "Control of nonconforming work" procedure (see 4.9).

5.5.8 Support equipment requiring calibration are labeled and identified to indicate the status of calibration, the calibration reference (traceable to the equipment calibration record) and the next calibration due date.

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Analytical instruments calibrations are performed as described in the analytical SOPs.

5.5.9 When, for whatever reason, equipment goes out-of-control, the instrument shall only be put back in use when its function and calibration status are verified to be in control.

5.5.10 Where applicable, validity of initial calibration is verified as specified by the analytical SOP or as required by the project. Analytical SOPs include:

a) The details of the continuing instrument calibration procedure, calculations and associated statistics.

b) Target analytes in the continuing instrument calibration verification. Multi-component analytes such as, Total Petroleum Hydrocarbons, or Toxaphene, a separate continuing calibration standard is analyzed. For Aroclors, a representative chemical related substance (e.g. 1016 and 1260) is used.

c) Frequency of Instrument calibration verification:

a. Where internal standards are employed, calibration verification is done at the beginning of each analytical run otherwise, calibration verification brackets the analytical sequence at the frequency that the method requires or as specified by the project. When the methods specify that calibration verification shall run at specific sample intervals (for example, every 10 samples), the count of these samples shall be of field samples only.

In the absence of method or project requirement, at a minimum, calibration verification is performed at beginning and end of each analytical batch;

b. Perform calibration verification whenever it is expected that the analytical system may be out of calibration or might not meet the verification acceptance criteria;

c. Perform calibration verification if the time period for calibration or the most previous calibration verification has expired (e.g. 12-hour analytical cycle or every 20 field samples); or

d. Perform calibration verification for all analytical systems that contain a calibration verification requirement.

d) Retention of Records. Sufficient raw data records are retained to permit reconstruction of the continuing instrument calibration verification, e.g., test method, instrument, analysis date, each analyte name, concentration and response, calibration curve or response factor, or unique equations or coefficients used to convert instrument responses into concentrations, analyst name. Continuing calibration verification records are uniquely identified to link with the initial instrument calibration identification. Refer to Analytical and QC Labeling SOP (EMAX-SM04) for details. Corrections to any of these records include a complete audit trail for those manipulations.

e) Acceptance Criteria. Continuing calibration verification (CCV) is evaluated in accordance to the method requirement or as required by the project data quality objectives. Where no method requirements exist, CCV standards are analyzed at or below the middle of the calibration range using the same source as the initial calibration and acceptance criteria is modeled on similar analytical technology.

When CCV is non-compliant, a second consecutive (immediate) calibration verification may be considered if the result is indicative that it is not due to instrumentation problem. When this option is exercised, refer to the project requirements for CCV concentration level (DoD QSM requires different levels within the original calibration curve). If the CCV still fails or a second attempt is not considered, execute the corrective actions suggested on the specific analytical SOP.

If routine corrective action procedures fail to meet the acceptance criteria, further instrument evaluation and/or maintenance is undertaken to the extent necessary to correct the problem. When the instrument's condition is restored to normal status, a new initial instrument calibration is established and validated. Samples affected by the non-compliant

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CCVs are re-analyzed. Where re-analysis is not possible and results must be reported, data associated with non-compliant CCVs data are reported as specified by the project, otherwise the following conditions are implemented:

1) when the acceptance criteria for the continuing calibration verification exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise the samples affected by the unacceptable calibration verification are flagged and explained in the case narrative

2) when the acceptance criteria for the continuing calibration verification exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable verification are flagged and explained in the case narrative.

5.5.11 Where calibrations give rise to a set of correction factors, new instrument parameter settings are posted with the affected instrumentation (e.g., in computer software) where it is routinely used as checklist for instrument parameter check prior to sample analysis.

5.5.12 Limited access to laboratories is instituted so that test equipment, including both hardware and software, are safeguarded from adjustments when authorized instrument users are not around.

5.6 Measurement Traceability

5.6.1 General

All equipment used for environmental tests, including equipment for subsidiary measurements (e.g., for environmental conditions) having a significant effect on the accuracy or validity of the result of the environmental test or sampling are calibrated before being put into service and on a continuing basis.

Quality control procedures are established systems for selecting, using, calibrating, checking controlling, and maintaining support equipment as well as the calibration standards, (e.g. standard weights, standard thermometers). The laboratory shall have an established program and procedure for the calibration of its equipment. Calibration procedures for analytical instruments are detailed in the analytical SOPs.

5.6.2 Analytical Laboratories

5.6.2.1 Equipment measurement accuracy is dependent on its sensitivity. Every measuring device has uncertainty of measurement and is derived from its deviation from expected value.

a) To ensure that measurements are traceable to national standards of measurement, analytical calibration standards used at EMAX are purchased traceable to NIST, calibration weights and calibration thermometers are sent to NIST calibration laboratories (or equivalent).

5.6.2.2 Where traceability of measurements to SI units is not possible and/or not relevant, the same requirements for traceability to, for example, certified reference materials, agreed methods and/or consensus standards, are used. To provide satisfactory evidence of correlation of results, EMAX participates in proficiency testing, or independent analysis.

5.6.3 Reference Standards and Reference Materials

5.6.3.1 Reference Standards

Reference standards (e.g., balance weights, traceable thermometers) are purchased traceable to national standard of measurement. These standards are calibrated by a NIST certified calibration laboratory (or equivalent) at least once a year. These standards are used for calibration purposes only.

5.6.3.2 Reference Materials

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Where commercially available, all reference materials used at EMAX are purchased certified traceable to SI units of measurement, or to certified reference materials. Where possible, traceability shall be to national or international standards of measurement or to national or international standard reference materials. Internal reference materials are checked as far as is technically and economically practicable.

5.6.3.3 Intermediate Checks

Checks needed to maintain confidence in the status of reference, primary, transfer or working standards and reference materials are carried out according to defined procedures and schedules.

5.6.3.4 Transport and Storage

Procedures for safe handling, transport, storage, and use of reference standards and materials in order to prevent contamination or deterioration and in order to protect their integrity are also included in the relevant SOPs. Refer to QC procedures for details.

5.6.4 Documentation and Labeling of Standards, Reagents, and Reference Materials

SOP for Purchasing (EMAX-QA09) describes the procedures for the purchase, reception, and storage of consumable materials used for the technical operations.

a) Records are retained for all standards, reagents, reference materials, and media including the manufacturer/vendor, the manufacturer's Certificate of Analysis or purity (if supplied), the date of receipt, recommended storage conditions, and an expiration date after which the material shall not be used unless its reliability is verified by the user.

b) Original containers (such as provided by the manufacturer or vendor) are labeled with an expiration date.

c) Standards preparation logbooks are used to record standard and reference material preparation. These records are traceable to certificates of analysis from manufacturers indicating traceability to purchased stocks or neat compounds, reference to the method of preparation, lot numbers for the standard, date of preparation, expiration date and preparer's initials.

d) All containers of prepared standards and reference materials bear a unique identifier and expiration date and linked to the documentation requirements in 5.6.4.c above.

e) Analytical SOPs include the procedures for preparing reagents to meet the requirements of the test method. The source of reagents shall comply with 5.9.2a) 6) and D.1.4b).

f) All containers of prepared reagents bear identification a preparation date, expiration date, and the initials of the reagent preparer.

5.7 Sampling

5.7.1 Obtaining sample aliquots from a submitted sample is carried out as part of the test method. Procedures and appropriate techniques to obtain representative sub-samples are detailed in the analytical SOPs.

5.7.2 Where the client requires deviations, additions, or exclusions from the documented sub-sampling procedure, these are recorded referencing the source of instruction included in all documents containing environmental test results. These instructions are included in the work order distributed in the laboratory as part of the project specific requirement, and shall be communicated to the appropriate personnel.

5.7.3 Sub-sampling activities are documented in the appropriate laboratory logbook. Samples taken from the sample control room for sub-sampling are recorded in the internal chain of custody (ICOC). Aliquots taken are

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recorded in the appropriate sample preparation or analytical log. The records also include the date and initials of the personnel that executed the sub-sampling.

5.8 Handling of Samples

To ensure the validity of EMAX's data the following procedures are established.

5.8.1 Sample Management SOPs. These procedures describe transportation, receipt, handling, protection, storage, retention and/or disposal of samples, including all provisions necessary to protect the integrity of the sample, and to protect the interests of EMAX, the community it serves and its clients.

5.8.2 EMAX-SM01 describes the system for identifying samples. The identification is retained throughout the life of the sample in the laboratory. The system is designed and operated so that each container is uniquely identified, and a storage address is provided as to ensure that samples cannot be confused physically or when referred to in records or other documents.

The sample storage system is designed for ease of storing and locating samples.

a) Sample Management SOPs also include a system for storing samples to ensure that there can be no confusion regarding the identity of such samples at any time. This system includes identification for all samples, sub-samples and subsequent extracts and/or digestates. Samples are labeled with a unique identification (ID) code for each sample container received in the laboratory.

b) This laboratory code is an unequivocal link with the unique field ID code assigned each container.

c) The laboratory ID code is placed on the sample container as a durable label.

d) The laboratory ID code is used in the laboratory records (see 5.8.3.1.d) as internal identification in sample transfers, sample preparation, sample analysis, sample disposal and other related laboratory activities. This identification is linked to the field sample ID through the electronic sample login. Reports shall bear the laboratory identification and the field sample ID.

e) In cases where the laboratory pre-assigns numbers to sample containers, the laboratory ID code may be the same as the field ID code.

5.8.3 SOP for sample receiving is detailed in EMAX-SM02. Upon receipt of the samples, the condition, including any abnormalities or departures from normal or specified conditions as described in the environmental test method, are recorded. When there is doubt as to the suitability of a sample for environmental test, or when a sample does not conform to the description provided, or the environmental test required is not specified in sufficient detail, the Project Manager is informed immediately so that the sample condition is communicated to the client for further instructions before proceeding. Discrepancies and instructions on how to proceed is recorded in the sample receipt form and/or attached documents to sample receipt forms.

5.8.3.1 Sample Receipt Protocols

a) All items specified in 5.8.3.2 below are checked.

1) All samples which require thermal preservation is considered acceptable if the arrival temperature is either within 2°C of the required temperature or the method specified range.

For samples with a specified temperature of 4°C, samples with a temperature ranging from just above the freezing temperature of water to 6°C shall be acceptable. Samples that are hand delivered to the laboratory on the same day that they are collected not meeting the thermal preservation requirement shall be considered acceptable if there is evidence that the chilling process has begun such as arrival on ice.

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Temperature measurement, when provided, shall be verified through temperature blanks are included in the sample coolers.

2) Chemical preservation is checked using readily available techniques, such as pH or chlorine, during sample receiving. When sample chemical preservation cannot be checked (e.g., volatile samples) preservation is checked during analysis.

b) The results of all checks are recorded.

c) If the sample does not meet the sample receipt acceptance criteria listed in this standard, the laboratory shall either:

1) retain correspondence and/or records of conversations concerning the final disposition of rejected samples; or

2) fully document any decision to proceed with the analysis of samples not meeting acceptance criteria.

i. The conditions of these samples, at a minimum, are noted in the sample receipt forms or as specified in the project requirement.

ii. Records of instruction on how to proceed shall be retained and final report shall include these documentations when required by the project.

Where there is doubt as to the sample's suitability for testing, where the sample does not conform to the description provided, or where the test required is not fully specified, the client is consulted by the Project Manager at a timely manner for further instruction before proceeding.

d) Permanent chronological record such as a logbook and electronic login system is used to document receipt of all sample containers. Electronic data systems shall meet the requirements specified in Section 5.4.7.2.

1) The sample receipt form (SRF) includes but not limited to:

i. client/project name,

ii. date and time of laboratory receipt,

iii. unique laboratory ID code (see 5.8.2), and

iv. signature or initials of the person making the entries.

2) Samples are logged in such a way that all pertinent information linked to the sample is traceable. All the records generated during sample receiving become permanent records, easily retrievable upon request and readily available to individuals who will process the sample. The EMAX sample control number is linked to the following:

i. The field ID code which identifies each container

ii. The date and time of sample collection linked to the sample container to the date and time of receipt

iii. The requested analyses (including applicable approved test method numbers)

iv. Any comments resulting from inspection for sample rejection

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e) All documentation, such as memos or transmittal forms, that are transmitted to the laboratory by the sample transmitter are retained in the master folder that contains all pertinent records related to a sample delivery batch.

f) The original chain of custody record form (Sections 4.12.2.5 and Appendix E), is included in the master folder. Internal chain of custody is recorded and maintained with the laboratory logbooks.

5.8.3.2 Sample Acceptance Policy

Prior to project commencement, capabilities to accept new samples are confirmed with the Operations. When additional project requirements concerning sample acceptance (e.g., safety caution, samples needs to be filtered and preserved, etc.), implementation process are discussed with the Operations by the Project Manger.

Policies and procedures for sample acceptance policy are detailed in EMAX-SM02. This SOP clearly outlines the circumstances under which samples are accepted or rejected. Data from any samples which do not meet the following criteria are noted in the sample receipt form (SRF) clearly defining the nature and substance of the discrepancy. This SOP is also made available to sample receiving personnel who are also trained to properly implement this SOP. Training includes, but is not limited to, the following areas of concern:

a) proper, full, and complete documentation, which shall include sample identification, the location, date and time of collection, collector's name, preservation type, sample type and any special remarks concerning the sample;

b) proper sample labeling to include unique identification and a labeling system for the samples with requirements concerning the durability of the labels (water resistant) use of indelible ink and laboratory label does not obscure field identification;

c) use of appropriate sample containers;

d) adherence to specified holding times;

e) adequate sample volume. Sufficient sample volume must be available to perform the necessary tests; and

f) course of action when samples show signs of damage, contamination, or inadequate preservation.

5.8.4 Samples received at EMAX are stored as specified by the method and/or project requirement. To prevent deterioration, contamination, loss or damage to the sample during storage, handling, preparation and testing, policies and procedures are established. Monitoring of sample storage is detailed in MEAX-QC03. Sample Handling for Highly Contaminated Samples is detailed in EMAX-QC08. In the event that special handling instructions are provided by the client, these instructions are incorporated as part of the work-order instructions. When samples have to be stored or conditioned under specified environmental conditions, these conditions are maintained, monitored and recorded.

All samples received at EMAX are held secured in the sample control room that protects the condition and integrity of the secured samples.

a) Samples are stored according to the conditions specified in EMAX-SM01:

1) Samples which require thermal preservation are stored under refrigeration which is +/-2 of the specified preservation temperature unless method specific criteria exist. For samples with a specified storage temperature of 4°C, samples are stored at a temperature above the freezing point of water to 6°C.

To ensure that samples remain within acceptable thermal preservation, temperature and sample storage are monitored twice a day, seven days a week.

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2) Sample control room contains environmental field samples only. To prevent cross-contamination, pure products, PT samples or samples that are known to have high concentrations and/or highly contaminated are segregated from the regular samples.

b) Sample fractions, extracts, leachates and other sample preparation products are stored according to 5.8.4.a above or according to specifications in the test method.

1) Sample disposal for residual samples, digestates, leachates and extracts or other sample preparation products is detailed in EAMX-SM03. This SOP is in conformance with Federal, State and local regulations.

5.9 Assuring the Quality of Environmental Test and Calibration Results

5.9.1 General

Quality control procedures for monitoring the validity of environmental tests undertaken are included in the analytical SOPs. Quality control results are collected and evaluated according to EMAX-QA06, Control Chart SOP. Data is collected and appended on a database where a control chart can be plotted specific to inclusive dates. The resulting data is used to analyze for possible trends and statistical techniques are applied to review the results. Monitoring includes evaluation of the following:

a) Laboratory Control Samples;

b) Results of PT samples.

c) Replicate tests results from the same or different methods;

d) Retesting of retained samples;

e) Correlation of results for different characteristics of a sample (for example, total phosphate should be greater than or equal to orthophosphate).

Every work order includes project QC requirement. In the absence of project QC requirement, EMAX quality control procedures are applied. These requirements are monitored and evaluated on time while samples are analyzed to evaluate the quality and usability of data. Where QC requirement is not met and prescribed corrective action does not resolve the problem, the Supervisor and the PM are informed for further instruction. Where necessary, non-conformance report is generated. Supplemental review of these checks is performed during annual internal assessment.

5.9.2 Essential Quality Control Procedures

These general quality control principles are applied, where appropriate. The manner in which they are implemented is dependent on the types of tests performed (refer to Appendix D). Quality control actions should be both batch-specific and time-based (i.e., those required to be conducted at specific time periods, such as for tunes and detection limit verification. Batch-specific quality control actions include sample-specific quality control actions such as surrogate spikes, LCS, duplicate samples.

The standards for any given test type shall assure that the applicable principles are addressed:

a) Monitoring of basic quality controls to include:

1) positive and negative controls to monitor tests such as blanks, spikes, reference materials;

2) tests to define the variability and/or repeatability of the laboratory results such as replicates;

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3) measures to assure the accuracy of the test method including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures;

4) measures to evaluate test method capability, such as limit of detection and limit of quantitation or range of applicability such as linearity;

5) selection of appropriate formulae to reduce raw data to final results such as regression analysis, comparison to internal/external standard calculations, and statistical analyses;

6) selection and use of reagents and standards of appropriate quality;

7) measures to assure the selectivity of the test for its intended purpose; and

8) measures to assure constant and consistent test conditions (both instrumental and environmental) where required by the test method such as temperature, humidity, light, or specific instrument conditions.

b) On-going assessment and evaluation quality control measures and application of quality control acceptance criteria to determine the usability of the data.

c) Establish procedures for the development of acceptance/rejection criteria where no method or regulatory criteria exist. (See 5.8.3.2, Sample Acceptance Policy.)

d) Proper implementation of established quality control protocols specified in analytical SOPs (5.4.1.2). Essential standards outlined in Appendix D or mandated methods or regulations (whichever are more stringent) are incorporated in analytical SOPs. When it is not apparent which is more stringent the QC in the mandated method or regulations is followed. Project specific requirement other than specified in analytical SOPs are incorporated through project management.

The essential quality control measures for testing are found in Appendix D.

5.10 Reporting the Results

5.10.1 General

The results of each environmental test performed at EMAX are reported accurately, clearly, unambiguously and objectively, and in accordance with any specific instructions in the environmental test and project specific requirement.

EMAX data reporting system is designed to include all pertinent information. Deliverables include all of the information required by the project necessary for the interpretation of the environmental test results and all information required by the method used. For standard requirements, refer to 5.10.2 and 5.10.3.

Where the project requires simplified deliverables, EMAX delivers what is required and archives all information on how the environmental test is carried out readily available.

Where regulatory reporting requirements or formats are required, EMAX shall provide all the required information to their client use in preparing such regulatory reports.

5.10.2 Test Reports

Each test report includes at least the following information, unless there are valid reasons for not doing so:

a) a title – on EMAX data report submittal cover letter, it reads, Subject: “Laboratory Report “

b) EMAX name and address: EMAX Laboratories, Inc., 1835 W. 205th St., Torrance, CA 90501;

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c) EMAX Batch Number as unique identification of the test report , and on each page an identification in order to ensure that the page is recognized as a part of the test report, and a clear identification of the end of the test report;

1) This requirement is presented as stated below:

i. A table of contents is created identifying the sub-sections and corresponding pages of the contents of the report.

ii. Each page is paginated as the table of contents specified.

d) the name and address of the client and project name if applicable;

e) identification of the method used;

f) a description and condition of, and unambiguous identification of the sample(s), including the client identification code;

g) the date of receipt of the sample(s) where this is critical to the validity and application of the results, date and time of sample collection, the date(s) and time of performance of the environmental test, date and time of sample preparation;

h) reference to procedures used by the laboratory relevant to the validity or application of the results;

i) the environmental test results with, where appropriate, the units of measurement, and any failures identified; identify whether data are calculated on a dry weight or wet weight basis; identify the reporting units such as µg/l or mg/kg;

j) the name(s), function(s), and signature(s) or equivalent electronic identification of person(s) authorizing the test report, and date of issue;

k) a statement to the effect that the results relate only to the samples;

l) the report cover letter includes the following statement:

"This report is confidential and intended solely for the use of the individual or entity to whom it is addressed. This report shall not be reproduced except in full or without the written approval of EMAX."

m) The report cover letter also include the following statement:

"EMAX certifies that the test results included in this report meet all NELAC requirements unless noted in the Case Narrative."

5.10.3 Supplemental Information for Test Reports

5.10.3.1 In addition to the requirements listed in 5.10.2, test reports, where necessary for the interpretation of the test results, include the following:

a) deviations from (such as failed quality control), additions to, or exclusions from the test method, and information on specific test conditions, such as environmental conditions and any non-standard conditions that may have affected the quality of results, including the use and definitions of data qualifiers;

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b) where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications, including identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature;

c) where applicable, a statement on the estimated uncertainty of measurement; information on uncertainty is needed, when a client's instruction so requires;

d) where appropriate and needed, opinions and interpretations (see 5.10.4);

e) additional information which may be required by specific methods, clients or groups of clients;

f) qualification of numerical results with values outside the working range.

5.10.3.2 In addition to the requirements listed in 5.10.2 and 5.10.3.1, when required, the Chain-of-Custody (COC) received with the samples is included as part of the report. In general the COC contains the following information which may be necessary for the interpretation of test results:

a) the date of sampling;

b) unambiguous identification of the substance, material or product sampled

c) the location of sampling, including depths when applicable;

d) safety precautions for sample handling

e) details of any environmental conditions during sampling that may affect the interpretation of the test results;

f) any standard or other specification or procedure, and deviations, additions to or exclusions from the specification that the lab needs to perform to satisfy the data quality objective of the delivered samples.

5.10.4 Opinions and Interpretations

When opinions and interpretations are included, the case narrative includes discussion of the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly explained as such in a test report.

5.10.5 Environmental Testing Obtained from Subcontractors

When the test report contains results of tests performed by subcontractors, these results are reported as delivered in EMAX where it clearly identifies where the report came from. The subcontractor is required to report the results in writing or electronically as required by the project. EMAX retains a copy of the subcontractor’s report and stores it using EMAX archival system.

5.10.6 Electronic Transmission of Results

Where transmission of environmental test results is by facsimile, email or other electronic or electromagnetic means, the Standards set forth by this manual is applied and all reasonable steps are taken to preserve confidentiality (refer to Section 5.4.7).

5.10.7 Format of Reports

The format for each environmental test is designed to accommodate information on traceability, how the analysis is carried out, and to minimize the possibility of misunderstanding or misuse.

5.10.8 Amendments to Test Reports

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Where amendments to a test report after issue are made the subject of the cover letter reads:

"Supplement to Test Report, [EMAX batch number]".

Where a part of the report is to replace a particular page, that page is numbered with the same number as the previous report stamped with "Revised Report". Where a page(s) is inadvertently missed and is to be added in the previous report, the table of contents is revised to include the missed page(s). The table of contents is stamped with "Revised Report" and the additional pages will be numbered according to the table of contents.

When it is necessary to issue a complete new test report, it must contain a unique identification referencing to the original that it replaces unless otherwise specified by the client.

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APPENDICES

Appendix A

References

Appendix B

Glossary

Appendix C

Demonstration of Capability

Appendix D

Essential Quality Control Requirements

Appendix E

EMAX Appendices

APPENDIX

A

REFERENCES

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APPENDIX

B

GLOSSARY

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GLOSSARY

The following definitions are used in the text of Quality Systems. In writing this document, the following hierarchy of definition references was used: ISO 8402, ANSI/ASQC E-4, EPA's Quality Assurance Division Glossary of Terms, and finally definitions developed by NELAC. The source of each definition, unless otherwise identified, is the Quality Systems Committee.

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority: The Territorial, State, or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation. (NELAC) [1.4.2.3]

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Aliquot: A discrete, measured, representative portion of a sample taken for analysis. (DoD, EPA QAD Glossary)

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Quality Systems Definitions: The Quality Systems Committee is the NELAC-appointed group that created and continues to modify NELAC Chapter 5 (Quality Systems). Terms not included in the NELAC Glossary, but defined by DoD, are included in gray text boxes throughout this Appendix.

Analyte: The specific chemicals or components for which a sample is analyzed; may be a group of chemicals that belong to the same chemical family, and which are analyzed together. (EPA Risk Assessment Guide for Superfund; OSHA Glossary)

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Audit: A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch: Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates, or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage, or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

Blind Sample: A sub-sample for analysis with a composition known to the submitter. The analyst/ laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibration: Set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (VIM: 6.11)

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1) In calibration of support equipment the values realized by standards are established through the use of Reference Standards that are traceable to the International System of Units (SI).

2) In calibration according to test methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve: The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method: A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard: A substance or reference material used to calibrate an instrument. (QAMS)

Certified Reference Material (CRM): A reference material whose one or more property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation and which is issued by a certifying body. (ISO Guide 30 - 2.2)

Chain of Custody Form: A record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses. (NELAC)

Chemical: Any element, compound, or mixture of elements and/or compounds. Frequently, chemical substances are classified by the CAS rules of nomenclature for the purposes of identification for a hazard evaluation. (OSHA Glossary)

Client: The party that has agreed to pay the bill for services rendered by the laboratory, and with whom the laboratory has a contractual relationship for that project. For a laboratory, this is typically the prime contractor who originally hires the laboratory for the project, and who signs the contract as the receiver of services and resulting data. In cases where the laboratory has a direct contractual relationship with DoD, the client shall be the Government's authorized contracting officer. The contracting officer, as the client, shall consult with the Government's authorized technical representative when dealing with laboratory technical issues. It is understood that typically other "Clients" are present at other levels of the project, but they may be removed from the day-to-day decision-making (for example, installation representatives, service center representatives, and other Government officials). Specific circumstances may require the direct notification of these other clients, in addition to the prime contractor or DoD representative; these circumstances shall be included as part of specific project requirements. (DoD)

Compound: A unique combination of chemical elements, existing in combination to form a single chemical entity. (DoD)

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

• Second column confirmation;

• Alternate wavelength;

• Derivatization;

• Mass spectral interpretation;

• Alternative detectors; or

• Additional cleanup procedures. (NELAC)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ ASQC E4-1994)

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

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Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction: The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate acceptable accuracy. (NELAC)

Detection Limit: The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed. (ASQC)

Environmental Program: An organized effort that assesses environmental concerns and leads to the collection of data, either in the field or through laboratory analysis. (Variation on EPA QAD Glossary for Terms: Environmentally related measurement, environmental sample)

Consensus Standards: A protocol established by a recognized authority (for example, American Society for Testing and Materials [ASTM], American National Standards Institute [ANSI], or the Institute for Electrical and Electronic Engineers [IEEE]).

Definitive Data: Data that are generated using rigorous analytical methods, such as approved EPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data in the form of paper printouts or electronic files. Data shall satisfy QA/QC requirements. For data to be definitive, either analytical or total measurement error shall be determined and documented. (Data Quality Objectives Process for Superfund)

Finding: An assessment conclusion referenced to a NELAC Standard and supported by objective evidence that identifies a deviation from a NELAC requirement.

Holding Times (Maximum Allowable Holding Times): The maximum times that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR Part 136)

Inspection: An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ASQC E4-1994)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method. (NELAC)

International System of Units (SI): The coherent system of units adopted and recommended by the General Conference on Weights and Measures. (CCGPM) (VIM 1.12)

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Laboratory: A body that calibrates and/or tests. (ISO 25)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system. (NELAC).

Laboratory Duplicate: Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

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Limit of Detection (LOD): An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte-and-matrix-specific and may be laboratory-dependent.

Limits of Quantitation (LOQ): The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.

Key Staff: At a minimum, the following managerial and supervisory staff (however named) – executive staff (for example, Chief Executive Officer, Chief Operating Officer, laboratory director, technical director); technical directors/supervisors (for example, section supervisors for organics and inorganics); quality assurance systems directors/supervisors (for example, quality manager, quality auditors); and support systems directors/supervisors (for example, information systems supervisor, purchasing director, project manager).

Holding Times (DoD Clarification): The time elapsed from the time of sampling to the time of extraction or analysis, as appropriate.

Limit of Quantitation (DoD Clarification): For DoD, the lowest standard of the calibration establishes the LOQ, but it must be greater than or equal to 3 times the LOD.

Manager (however named): The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Matrix: The substrate of a test sample

Field of Accreditation Matrix: These matrix definitions shall be used when accrediting a laboratory.

- Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.
- Non-Potable Water: Any aqueous sample excluded from the definition of Drinking Water matrix. Includes surface water, groundwater, effluents, water treatment chemicals, and TCLP or other extracts.
- Solid and Chemical Materials: Includes soils, sediments, sludges, products and by-products of an industrial process that results in a matrix not previously defined.
- Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- Air and Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device. (NELAC)

Quality System Matrix: These matrix definitions are an expansion of the field of accreditation matrices and shall be used for purposes of batch and quality control requirements (see Appendix D). These matrix distinctions shall be used:

- Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
- Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.
- Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.
- Non-aqueous Liquid: Any organic liquid with <15% settleable solids.
- Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- Solids: Includes soils, sediments, sludges and other matrices with > 15% settleable solids.
- Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.

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- Air and Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample): A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (QAMS)

May: Denotes permitted action, but not required action. (NELAC)

Measurement Quality Objectives (MQOs): The desired sensitivity, range, precision, and bias of a measurement.

Measurement System: A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).

Method: 1. See Test Method. 2. Logical sequence of operations, described generically, used in the performance of measurements. (VIM 2.4)

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit: One way to establish a Limit of Detection defined as the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Must: Denotes a requirement that must be met. (Random House College Dictionary)

National Accreditation Database: The publicly accessible database listing the accreditation status of all laboratories participating in NELAP. (NELAC)

National Environmental Laboratory Accreditation Conference (NELAC): A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP): The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

Nonconformance: An indication or judgment that a product or service has not met the requirements of the relevant specifications, contract or regulation; also the state of failing to meet the requirements.

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

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Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Oversight Body/Proficiency Testing Provider Accreditor (PTOB/PTPA): An organization with technical expertise, administrative capacity, and financial resources sufficient to implement and operate a national program of PT provider evaluation and oversight that meets the responsibilities and requirements established by NELAC standards. (NELAC)

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results, and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Testing Study Provider: Any person, private party, or government entity that meets stringent criteria to produce and distribute NELAC PT samples, evaluate study results against published performance criteria and report the results to the laboratories, primary accrediting authorities, PTOB/PTPA, and NELAP. (NELAC)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Protocol: A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed. (EPA-QAD)

Quality Assurance: An integrated system of activities involving planning, quality control, quality assessment, reporting, and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance (Project) Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EPA-QAD)

Quality Control: The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. QC samples may be Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking.

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ASQC E-4 1994)

Quantitation Range: DoD is concerned with both the upper and lower limits of quantitation. The quantitation range is defined by the low and high calibration standards.

Raw Data: Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted. (EPA-QAD)

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Reagent Blank (method reagent blank): A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Reference Material: A material or substance of which one or more of its properties are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Standard: A standard, generally of the highest metrological quality, available at a given location, and from which measurements made at that location are derived. (VIM-6.08)

Reference Toxicant: The toxicant used in performing toxicity tests to indicate the sensitivity of a test organism and to demonstrate the laboratory's ability to perform the test correctly and obtain consistent results (see Appendix D, Section 2.1.f). (NELAC)

Replicate Analyses: The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Reporting Limit: A data value specified by the client based on sensitivity requirements from project specific action levels. If initially set by the client below the laboratory's LOQ, method modification is required or the client will be required to accept the laboratory's LOQ as the lowest technically valid value that can be provided by the laboratory. For methods that require only one standard and a blank, a low level check standard shall be required to establish the LOQ. The reporting limit shall be no lower than this value. Note: There may be numbers reported to the client that are below the reporting limit. These numbers must be flagged appropriately. When the analysis demonstrates a non-detect at the LOD, the data shall be flagged with a "U." The value reported to the client is the LOD, adjusted by any dilution factor used in the analysis. When an analyte is detected between the LOQ and the LOD, the data shall be flagged with a "J." The value reported is an estimation.

Requirement: Denotes a mandatory specification; often designated by the term "shall". (NELAC)

Sample: Portion of material collected for analysis, identified by a single, unique alpha-numeric code. A sample may consist of portions in multiple containers, if a single sample is submitted for multiple or repetitive analysis.

Selectivity: (Analytical chemistry) The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Shall: Denotes a requirement that is mandatory, whenever the criterion for conformance with the specification requires, there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)

Should: Denotes a guideline or recommendation, whenever non-compliance with the specification, is permissible. (ANSI)

Spike: A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes. (NELAC)

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard Method: A test method issued by an organization generally recognized as competent to do so.

Standard Operating Procedure (SOP): A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

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Standardized Reference Material (SRM): A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named): The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties, and ascertaining that technical employees have the required balance of education, training, and experience to perform the required analyses. (NELAC)

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes. (QAMS)

Technical Director: Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Test: A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method: An adoption of a scientific technique for performing a specific measurement as documented in a laboratory SOP or as published by a recognized authority.

Testing Laboratory: A laboratory that performs tests. (ISO/ IEC Guide 2-12.4)

Test Sensitivity/Power: The minimum significant difference (MSD) between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the selected significance level, and the type of statistical analysis (see Appendix D, Section 2.4.a). (NELAC)

Tolerance Chart: A chart in which the plotted quality control data is assessed via a tolerance level (e.g., +/- 10% of a mean) based on the precision level judged acceptable to meet overall quality/data use requirements instead of a statistical acceptance criteria (e.g., +/- 3 sigma) (applies to radiobioassay laboratories). (ANSI)

Traceability: The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM - 6.12)

Tune: An injected standard required by the method as a check on instrument performance for mass spectrometry.

Target Analytes: 1) Analytes specifically named by a client (also called project-specific analytes) or 2) if no project-specific analytes are provided, the target analytes will be the list found in Appendix DoD-C.

Validation: The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

Verification: Confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell: A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

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APPENDIX

C

DEMONSTRATION OF CAPABILITY

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DEMONSTRATION OF CAPABILITY

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DEMONSTRATION OF CAPABILITY

C.1 PROCEDURE FOR DEMONSTRATION OF CAPABILITY

A demonstration of capability (DOC) must be made prior to using any test method, and at any time there is a change in instrument type, personnel or test method (see 5.4.2.2). Procedures for DOC are detailed in EMAX-QA05.

Capability – Change: "Change" refers to any change in personnel, instrumentation, test method, or sample matrix that potentially impacts the precision, accuracy, sensitivity, and selectivity of the output (for example, a change in the detector, column, or other components of the sample analytical system, or a method revision). All new analysts, regardless of experience on that instrument in another laboratory, shall complete a demonstration of capability.

Although in some areas of the laboratory, a group of individuals are needed to complete the entire analytical process, EMAX certifies its technical staff individually. Each member of the group demonstrates capability in his/her area of responsibility in the sequence.

Since majority of EMAX's field samples are aqueous and soil matrices, lab control sample (LCS) or PT samples are used for demonstration of capability. In addition, for analytes which do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples.

All demonstrations are documented through the use of the form in this appendix. All data applicable to the demonstration are retained on a personnel file. When an analyte not currently found on the laboratory's list of accredited analytes is added to an existing accredited test method, an initial evaluation must be performed for that analyte.

General guidelines for demonstration of capability:

a) Where commercially available, quality samples used for demonstration of capability is obtained from a secondary source as certified solutions. If not available, the QC samples are prepared in-house using stock standards that are prepared independently from those used in instrument calibration.

b) The analyte(s) are spiked in a volume of clean quality system matrix sufficient to prepare four aliquots at the LCS concentration level, or if unspecified, to a concentration of 1-4 times the limit of quantitation.

c) At least four aliquots are prepared and analyzed according to the test method either concurrently or over a period of days.

d) The mean recovery and standard deviation of results are evaluated. When it is not possible to determine mean and standard deviations, such as for presence/absence and logarithmic values, the performance is assessed against the established and documented criteria.

   In the case where a new method is developed, acceptance criteria is determined using external source of information when available (e.g., published method). In the absence of external source of information, EMAX shall request from the project sponsor (e.g., DoD or DoE) for comparisons or guidance for acceptance criteria.

e) Results are accepted based on the acceptance criteria for precision and accuracy in the test method (if applicable) or the generated control limits (in the absence of established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin. If any one of the parameters does not meet the acceptance criteria, the performance is unacceptable for that parameter.

f) When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must :

   1) Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with c) above; or

   2) Beginning with c) above, repeat the test for all parameters that failed to meet criteria.

   Repeated failure, however, confirms a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with c).

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C.2 CERTIFICATION STATEMENT

The following certification statement is used to document the completion of each demonstration of capability. A copy of the certification statement is retained in the personnel records of each affected employee (see 5.2.5 and 4.12.2.5.4.b).

All repeated incidences of testing to meet a demonstration of capability is documented and included in the submittal of demonstration of capability.

Refer to EMAX-QA05 Figure 5 for DOC Certification Statement.

This certification form is completed each time a demonstration of capability study is completed with proof that it is:

True: Consistent with supporting data.

Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.

Complete: Includes the results of all supporting performance testing.

Self-Explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation**.**

C.3 INITIAL TEST METHOD EVALUATION

For all test methods apply C.3.1 and C.3.2. For the evaluation of precision and bias (C.3.3), the requirements of C.3.3(a) apply to standard methods. The requirements of C.3.3(b) apply to the methods referenced therein.

C.3.1 Limit of Detection (LOD)

a) Where quantitation is derived from multi-calibration points and the analyte can be qualitatively identified at a concentration level of the lowest calibration point, the LOD is determined set at half of the lowest calibration point. All sample-processing steps of the analytical method are performed when verifying the LOD.

b) The validity of the LOD is confirmed by qualitative identification of the analyte(s) in a QC sample in each quality system matrix containing the analyte at no more than 2-3X the LOD for single analyte tests and 1-4X the LOD for multiple analyte tests. This verification is performed on every instrument that is to be used for analysis of samples and reporting of data. Qualitative identification is performed as specified in the analytical SOP.

c) Where an LOD study is not performed (any analyte for which spiking solutions or quality control samples are not available such as temperature, pH) or, when test results are not to be reported to the LOD, determination of LOD is not required.

C.3.2 Limit of Quantitation (LOQ)

a) Where quantitation is derived from multi-calibration points, the LOQ for each analyte of concern is the lowest calibration point. Otherwise, it is determined by the sensitivity of the analytical instrument.

b) The LOQ study is not required for any component or property for which spiking solutions or quality control samples are not commercially available or otherwise inappropriate (e.g., pH).

c) The validity of the LOQ is confirmed by successful analysis of a QC sample containing the analytes of concern in each quality system matrix 1-2 times the claimed LOQ. A successful analysis is one where the recovery of each analyte is within the established test method acceptance criteria or client data quality objectives for accuracy. This single analysis is not required if the bias and precision of the measurement system is evaluated at the LOQ.

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C.3.3 Evaluation of Precision and Bias

a) Standard methods – precision and bias of a standard method for each analyte of concern for each quality system matrix is established by evaluating a single-concentration of four-replicate recovery study, or LCS data collected over a period of time (e.g. a year or minimum of 20 data points).

b) Non-standard methods – precision and bias is established as defined at 5.4.3 and 5.4.4. Where the method is developed for a certain project, precision and bias is defined as guided by the project the data quality objectives of the project, with the criteria established by the client, or the criteria given in the reference method.

Precision and bias measurements are evaluated across the analytical calibration range of the method using the relevant quality system matrices and process the samples through the entire measurement system for each analyte of interest.

The mean percent recovery and standard deviation for the LCS for non-standard methods are calculated and compared to the project sponsor published LCS mean percent recovery and standard deviation (e.g. DoD-Appendix D). In the absence of project sponsor published LCS, the in-house generated limits should be used. In either case, the calculated mean and standard deviation must be at least as good as the DoD published limits, where they exist, or as good or better than the published limits for similar methods or technologies. In no case should the lower LCS control limit be less than 10%.

Guidelines for evaluating precision and bias:

Analyze QC samples in triplicate containing the analytes of concern at or near the limit of quantitation, at the upper-range of the calibration (upper 20%) and at a mid-range concentration.

Process these samples on different days as three sets of samples through the entire measurement system for each analyte of interest. Each day one QC sample at each concentration is analyzed. A separate method blank shall be subjected to the analytical method along with the QC samples on each of the three days. (Note that the three samples at the LOQ concentration can demonstrate sensitivity as well.) For each analyte, calculate the mean recovery for each day, for each level over days, and for all nine samples. Calculate the relative standard deviation for each of the separate means obtained. Compare the standard deviations for the different days and the standard deviations for the different concentrations. If the different standard deviations are all statistically insignificant (e.g., F-test), then compare the overall mean and standard deviation with the established criteria from above.

A validation protocol such as the Tier I, Tier II, and Tier III requirements in US EPA Office of Water's Alternate Test Procedure (ATP) approval process.

C.3.4 Evaluation of Selectivity

Evaluate selectivity by following the checks established within the method, which may include mass spectral tuning, second column confirmation, ICP inter-element interference checks, chromatography retention time windows, sample blanks, spectrochemical absorption or fluorescence profiles, co-precipitation evaluations, and electrode response factors.

New Matrix: Prior to initial analysis of a new or unknown sample matrix, a minimum of 3 MS/MSD samples in said matrix must be analyzed. The spike concentration should be within a range of 1-4 times the estimated concentration of the environmental samples, if known, otherwise, at the regulatory limit or mid-point of the calibration range, whichever is lower. The percent mean recoveries and standard deviations for each analyte recovered in the new matrix must be compared to the project LCS means and control limits generated for clean matrices and should be at least as good as those published by the project sponsor.

Selectivity for Non-Standard Methods: When a historic selectivity check has not been identified, the most common selectivity check for a similar method or what is most typically used for the specific instrument or technology is applied.

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APPENDIX

D

ESSENTIAL QUALITY CONTROL REQUIREMENTS

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ESSENTIAL QUALITY CONTROL REQUIREMENTS

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ESSENTIAL QUALITY CONTROL REQUIREMENTS

The quality control protocols specified by the analytical SOPs (5.4.1.2) are applied unless otherwise a different requirement is specified by the project. Essential standards outlined in Appendix D are incorporated into the analytical SOPs.

All quality control measures are assessed and evaluated on an on-going basis and quality control acceptance criteria used to determine the validity of the data is distributed with every work order. Likewise, all procedures developed at EMAX shall have established acceptance/rejection criteria where no method or regulatory criteria exists.

The requirements from 5.9.2, apply to all types of testing. The specific manner in which they are implemented is detailed in each of the following section.

DoD Quality Control Requirements: Appendix DoD-D contains tables that consolidate DoD data quality requirements that apply to EPA's *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846). In addition, introductory material identifies definitions of QC checks and clarifies DoD's interpretation of method requirements. This appendix follows all the NELAC appendices.

D.1. CHEMICAL TESTING

D.1.1 Positive and Negative Controls

D.1.1.1 Negative Control - Method Performance

a) Purpose: The method blank is used to assess the preparation batch for possible contamination during the preparation and processing steps. The method blank is processed along with and under the same conditions as the associated samples to include all steps of the analytical procedure. Procedures are in place to determine if a method blank is contaminated. Any affected samples associated with a contaminated method blank are reprocessed for analysis or the results reported with appropriate data qualifying codes.

b) Frequency: The method blank is analyzed at a minimum of 1 per preparation batch. In those instances for which no separate preparation method is used (example: volatiles in water) the batch is defined as environmental samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

c) Composition: The method blank is a quality system matrix that is similar to the associated samples and is known to be free of the analytes of interest.

d) Evaluation Criteria and Corrective Action: While the goal is to have no detectable contaminants, each method blank must be critically evaluated as to the nature of the interference and the effect on the analysis of each sample within the batch. The concentration of a targeted analyte in the blank is at or above the reporting limit as established by the test method or by regulation, AND is greater than 1/10 of the amount measured in any sample.

For DoD sponsored projects, if the method blank contamination exceeds **one-half** the reporting limit, evaluate whether reprocessing of the samples is necessary based on the above criteria.

The concentrations of common laboratory contaminants shall not exceed the reporting limit.

Any sample associated with a blank that fail these criteria checks shall be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. The source of contamination shall be investigated and measures are taken to minimize or eliminate the problem and affected samples reprocessed or data shall be appropriately qualified if:

1) If no sample volume remains for reprocessing, the results shall be reported with appropriate data qualifying codes

2) The blank contamination otherwise affects the sample results as per the test method requirements or the individual project data quality objectives.

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ESSENTIAL QUALITY CONTROL REQUIREMENTS

3) When quality control measures fail the acceptance criteria, corrective action shall be taken based on project-specific requirements or project sponsor requirements and the magnitude of the problem. Where applicable, corrective actions may include:

- Determining the source of the problem
- Notifying the client,
- Reprocessing samples,
- Using data qualifiers to "flag" data, and
- Adding commentary in the case narrative.

D.1.1.2 Positive Control - Method Performance

D.1.1.2.1 Laboratory Control Sample (LCS)

a) Purpose: The LCS is used to evaluate the performance of the total analytical system, including all preparation and analysis steps. Results of the LCS are compared to established criteria. LCS found outside of these criteria indicates that the analytical system is "out of control". Any affected samples associated with an out of control LCS are reprocessed for re-analysis or the results are reported with appropriate data qualifying codes.

b) Frequency: The LCS is analyzed at a minimum of 1 per preparation batch. Exceptions would be for those analytes for which no spiking solutions are available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. In those instances for which no separate preparation method is used (example: volatiles in water) the batch shall be defined as environmental samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

c) Composition: The LCS is a quality system matrix, known to be free of analytes of interest, spiked with known and verified concentrations of analytes. NOTE: the matrix spike may be used in place of this control as long as the acceptance criteria are as stringent as for the LCS. Alternatively the LCS may consist of a media containing known and verified concentrations of analytes or as Certified Reference Material (CRM). All analyte concentrations shall be within the calibration range of the methods. The following shall be used in choosing components for the spike mixtures:

The components to be spiked are as specified by the mandated test method or other regulatory requirement or as requested by the client. In the absence of specified spiking components the laboratory shall spike per the following:

For those components that interfere with an accurate assessment such as spiking simultaneously with technical chlordane, toxaphene and PCBs, the spike should be chosen that represents the chemistries and elution patterns of the components to be reported.

For those test methods that have extremely long lists of analytes, a representative number may be chosen unless otherwise specified by the project. The analytes selected are representative of all analytes reported. The following criteria are used for determining the minimum number of analytes to be spiked.

1) For methods that include 1-10 targets, spike all components;

2) For methods that include 11-20 targets, spike at least 10 or 80%, whichever is greater;

3) For methods with more than 20 targets, spike at least 16 components.

To ensure that all targeted components are included in the spike mixture over a 2- year period, include all target analytes when performing PT samples.

Spiking Compounds for DoD sponsored projects:

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- All target analytes must be spiked in the LCS. Target analytes are defined by the project or in Appendix DoD-C. For evaluation and acceptance criteria see Appendices DoD-B and DoD-D.
- For multi-component analytes (e.g. PCBs), the LCS should be spiked with the same constituents as the calibration standard. Multiple samples may be necessary to avoid interference.
- The concentration of the spiked compounds shall be at or below the midpoint of the calibration range or at the appropriate level of concern.

d) Evaluation Criteria and Corrective Action: The results of the individual batch LCS are calculated in percent recovery unless otherwise specified by the project or the method. Calculations are documented and reported as specified by the project.

The individual LCS is compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory shall determine internal criteria and document the method used to establish the limits or utilize client specified assessment criteria.

DoD Laboratory Control Sample (LCS): The acceptability of LCS results within a preparatory batch shall be determined using project-specified limits or the DoD limits (refer to Appendix DoD-D) If DoD limits are not available for certain analytes, LCS acceptability shall be based on its in-house limits.

Control limits are evaluated at mean ± 3 times the standard deviation of LCS percent recovery. In addition, control charts are maintained and used to detect trends and prevent out of control conditions. Control limits are continually monitored for shifts in mean recovery, changes in standard deviation, and development of trends. Refer to EMAX-QA06 for generation and updating procedures of control limits and control chart evaluation.

A LCS that is determined to be within the criteria effectively establishes that the analytical system is in control and validates system performance for the samples in the associated batch. Samples analyzed along with a LCS determined to be “out of control” is considered questionable requiring the samples reprocessed and re-analyzed or the data reported with appropriate data qualifying codes.

e) Application of Marginal Exceedance Limits (ME): If a large number of analytes are in the LCS, it becomes statistically likely that a few will be outside control limits. This may not indicate that the system is out of control; therefore corrective action may not be necessary. Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. A ME is defined as being beyond the LCS control limit (3 standard deviations), but within the ME limits. ME limits is 4 standard deviations around the mean.

The number of allowable marginal exceedances is based on the number of analytes in the LCS.

If more analytes exceed the LCS control limits than is allowed, or if any one analyte exceeds the ME limits, the LCS fails and corrective action is necessary. This marginal exceedance approach is relevant for methods with long lists of analytes. It will not apply to target analyte lists with fewer than 11 analytes.

The number of allowable marginal exceedances is as follows:

1) >90 analytes in LCS, 5 analytes allowed in ME of the LCS control limit;
2) 71-90 analytes in LCS, 4 analytes allowed in ME of the LCS control limit;
3) 51-70 analytes in LCS, 3 analytes allowed in ME of the LCS control limit;
4) 31-50 analytes in LCS, 2 analytes allowed in ME of the LCS control limit;
5) 11-30 analytes in LCS, 1 analytes allowed in ME of the LCS control limit;
6) <11 analytes in LCS, no analytes allowed in ME of the LCS control limit;

For DoD sponsored projects, application of ME does not allow any project-specific analytes of concern to exceed its LCS control limits, even marginally. In addition, DoD does not feel it is appropriate to control batch acceptance on poor performing analytes.

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ESSENTIAL QUALITY CONTROL REQUIREMENTS

Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systemic problem. The source of the error must be located and corrective action taken. All LCS results are collected and monitored including those that fall within marginal exceedance allowance to ensure random behavior. However, the same analyte exceeding the LCS control limit 2 out of 3 consecutive LCS is considered indicative of non-random behavior.

D.1.1.3 Sample Specific Controls

Where applicable, the effect of the sample matrix on method performance is determined with the analytical batch. These procedures relate to the analyses of matrix specific Quality Control (QC) samples and are designed as data quality indicators for a specific sample using the designated test method.

Matrix specific QC include: Matrix Spike (MS); Matrix Spike Duplicate (MSD); sample duplicates; and surrogate spikes. Evaluation of matrix managing, and handling matrix specific QC criteria including spiking appropriate components at appropriate concentrations, calculating recoveries and relative percent difference, evaluating and reporting results based on performance of the QC samples.

D.1.1.3.1 Matrix Spike : Matrix Spike Duplicates

a) Purpose: Matrix specific QC samples indicate the effect of the sample matrix on the precision and accuracy of the results generated using the selected method. The information from these controls is sample/matrix specific and would not normally be used to determine the validity of the entire batch.

b) Frequency: The frequency of the analysis of matrix specific samples is dependent on the Data Quality Objectives of the project unless otherwise mandated by the test method. When sample amount is not adequate it shall be noted on the case narrative.

c) Composition: The components of the spike are specified in the analytical SOPs unless otherwise specified by the project. Any permit specified analytes, as specified by regulation or client requested analytes shall also be included.

For DoD projects all target analytes must be spiked in the project-specific MS and MSD.

For multi-component analytes (e.g., PCBs), the project-specific MS and MSD should be spiked with the same constituents as the calibration standard. Multiple samples may be necessary to avoid interference.

The concentration of the spiked compounds shall be at or below the midpoint of the calibration range or at the appropriate level of concern.

d) Evaluation Criteria and Corrective Action: The results from matrix spike/matrix spike duplicate are primarily designed to assess the precision and accuracy of analytical results in a given matrix and are expressed as percent recovery (%R), relative percent difference (RPD), or as specified by the project. Calculations for %R and RPD are detailed in the analytical SOPs.

Results are compared to project acceptance criteria. Where there are no established acceptance criteria, the in-house statistically generated MS/MSD control limits are applied.

Results and calculations are reviewed and data are archived with the data package. MS/MSD recoveries outside the project limits are discussed in the case narrative unless otherwise other corrective action is mandated by the project.

D.1.1.3.2 Matrix Duplicates

a) Purpose: Matrix duplicates are defined as replicate aliquots of the same sample taken through the entire analytical procedure. The results from this analysis indicate the precision of the results for the specific sample using the selected method. The matrix duplicate provides a usable measure of precision only when target analytes are found in the sample chosen for duplication.

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b) Frequency: The frequency of the analysis of matrix duplicates is also dependent on the Data Quality Objectives of the project unless otherwise mandated by the test method. Methods that do not require MS duplicate analysis should be performed at a minimum frequency of once per preparatory batch per matrix type. When sample amount is not adequate it shall be noted on the case narrative

c) Composition: Matrix duplicates are performed on replicate aliquots of actual samples. The composition is usually not known.

d) Evaluation Criteria and Corrective Action: The results from matrix duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD) or another statistical treatment (e.g., absolute differences). Calculations for RPD are detailed in the analytical SOPs.

Results are compared to the acceptance criteria specified in the analytical SOPs unless specified by the project.

Matrix duplicates results outside established criteria are discussed in the case narrative or as specified by the project.

D.1.1.3.3 Surrogate Spikes

a) Purpose: Surrogates are used most often in organic chromatography test methods and are chosen to reflect the chemistries of the targeted components of the method. Added prior to sample preparation/extraction, they provide a measure of recovery for every sample matrix.

b) Frequency: Except where the matrix precludes its use or when not commercially available, surrogate compounds must be added to all samples, standards, and blanks for all appropriate test methods.

c) Composition: Surrogate compounds chosen to represent the various chemistries of the target are specified in the analytical SOPs.

d) Evaluation Criteria and Corrective Action: The results are compared to project-specific acceptance criteria. Where there are no established criteria, the in-house statistically generated surrogate control limits are applied.

Surrogates outside the acceptance criteria are evaluated for the effect indicated for the individual sample results. The appropriate corrective action applied is guided by the data quality objectives or other site specific requirements. Results reported from analyses with surrogate recoveries outside the acceptance criteria are qualified per project requirement.

D.1.2 Limit of Detection and Limit of Quantitation

All documentation for generating and verifying LOD and LOQ are retained and reviewed by the Operations Manager. Documents shall include all supporting data, sample preparation information, raw data, calculations and reviews. These documents are also reviewed during internal assessment and shall be available for external assessment.

D.1.2.1 Limit of Detection (LOD)

LOD is established as described in C.3.1. For projects requiring Method Detection Limit Study, refer to EMAX-QA04. Where applicable, results are reported at LOD with appropriate data flagging.

Where analytes are identified by a recognizable pattern (for example, PCBs, toxaphene, technical-chlordane), the limit of detection is based on the concentration of the mixture at which the pattern becomes qualitatively identified.

D.1.2.2 Limit of Quantitation (LOQ)

a) Any established LOQ must be above the LOD.

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ESSENTIAL QUALITY CONTROL REQUIREMENTS

b) The LOQ is verified annually for each quality system matrix, method and analyte according to the procedure specified in C.3 or according to the frequency specified by the project.

D.1.3 Data Reduction

The procedures for data reduction, such as use of linear regression, are detailed in the analytical SOPs. In-house developed software for automated data processing are tested and validated. Refer to Software Testing and Quality Assurance SOP (EMAX-IS03) for details. This process involves a sample data test set test and verify the correct operation of these data reduction software that include data capture, manipulation, transfer, and reporting. This process is done every time the programming code is modified or otherwise manipulated.

D.1.4 Quality of Standards and Reagents

a) The source of standards shall comply with 5.6.2.2. Where available, standards are purchased as certified standard solutions traceable to NIST.

b) Analytical SOPs specifies the quality of reagents required for the analysis. In addition, reagent and water quality are checked prior to use.

1) Reagents – Reagents are purchased as reagent grade or better. Reagents undergo quality control testing prior to use. EMAX-QC01 details the process of quality control for chemicals. Chemicals/reagents that have passed the QC acceptance criteria shall bear a “QC PASSED” sticker, indicating the QC reference number traceable to the QC documentation. Reagents that do not pass the QC acceptance criteria shall be returned to the vendor.

2) Water - Reagent Water produced in-house is monitored daily as described in EMAX-QC01. A logbook is used to record the daily monitoring. Commercially purchased reagent water undergoes the same test as any chemical/reagent and shall conform to the method specified requirements.

3) Concentration of titrants is verified in accordance with specific analytical procedures.

D.1.5 Selectivity

a) Selectivity of qualitative determination for each target analytes is based on the requirement of the analytical method and instrument detector. Analyte identification is detailed in every analytical SOP.

Gas and liquid chromatography shall use peak absolute retention time as qualitative identification requiring tentatively identified analyte confirmation by another column or another detector. Both tentative and confirmation results shall be maintained and properly documented.

Retention time window study is based on three non-consecutive measurements of retention time for each analyte within a 72-hour period. The standard deviation (SD) and the mean retention time are calculated. The magnitude of retention time window is established by + 3 x SD.

New retention time study is established when new column is installed or when there is a major change in the instrument parameter setup.

b) Where test methods require confirmation, compound identification is confirmed through a second column or detector when positive results are detected on a sample. Such confirmations shall be performed on organic tests such as pesticides, herbicides, or acid extractable or when recommended by the analytical test method except when the analysis involves the use of a mass spectrometer.

Confirmation may be waived by the client in cases of periodic monitoring of well-characterized media. For data that are required to be confirmed, all results reported are confirmed or unconfirmed. If unconfirmed data are reported, they shall be identified separately in the report, with a narrative explaining why the data were not

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confirmed. Evaluation criteria for the confirmation of results shall be specified by the method, unless otherwise specified by the client. If method-specific requirements do not exist, EMAX shall develop and document acceptance criteria for the confirmation of results. Confirmation is required unless stipulated in writing by the client. All confirmation shall be documented.

c) When analyzing an analytes using chromatography equipped with mass spectrometry, confirmation shall be evaluated by comparing the sample mass spectrum with characteristic ions in the reference mass spectrum. Mass spectral tuning shall be performed prior to daily calibration. Acceptance criteria are specified in the related test method SOPs.

D.1.6 Constant and Consistent Test Conditions

a) To maintain constant and consistent test conditions, EMAX performs assessment and evaluation of all quality control measures on an on-going basis. Quality control acceptance criteria determine the usability of the data. Refer to Appendix 1 of analytical procedures list the Summary of Quality Control Procedures for the essential testing measures. These Quality Control Procedures are also detailed in each of the analytical SOP.

The quality control protocols are attached to every work order distributed in the laboratory in the absence of project specific requirement.

Analytical instruments undergo routine daily maintenance and calibration check prior to sample analysis. Instrument blanks are analyzed to rule-out and document probable environment and instrument contamination.

D.1.6.1.1 GC/MS Performance Check

Mass spectrometer performance is monitored every 12 hours of operation period by measuring the mass/ion distribution of BFB (volatiles) or DFTPP (semi-volatiles). The mass/ion distribution of these compounds has to fulfill the method project's specific requirements before analysis can start. Furthermore, mass assignments are checked periodically by using perfluorobutylamine to ensure that mass number is properly assigned.

D.1.6.1.2 Pesticide Performance Evaluation

Pesticide analysis is subjected to the following additional QC to ensure the quality of data. A mixture of DDT and Endrin is analyzed at the beginning of analysis and at a 12-hour interval. Individual breakdown and the combined breakdown of Endrin and DDT should be less than predetermined criteria for the system to be acceptable.

D.1.6.1.3 Temperature Controlled Analyses

Analyses dependent on temperature controlled environment (e.g., leaching procedures, GPC, etc.) are performed in work cells where temperature are controlled by a thermostat and temperature is recorded in the analytical log.

b) Glassware Cleaning. All reusable labwares are decontaminated prior to reuse. A copy of the SOP for glassware cleaning is posted in the glassware cleaning area.

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E

EMAX APPENDICES

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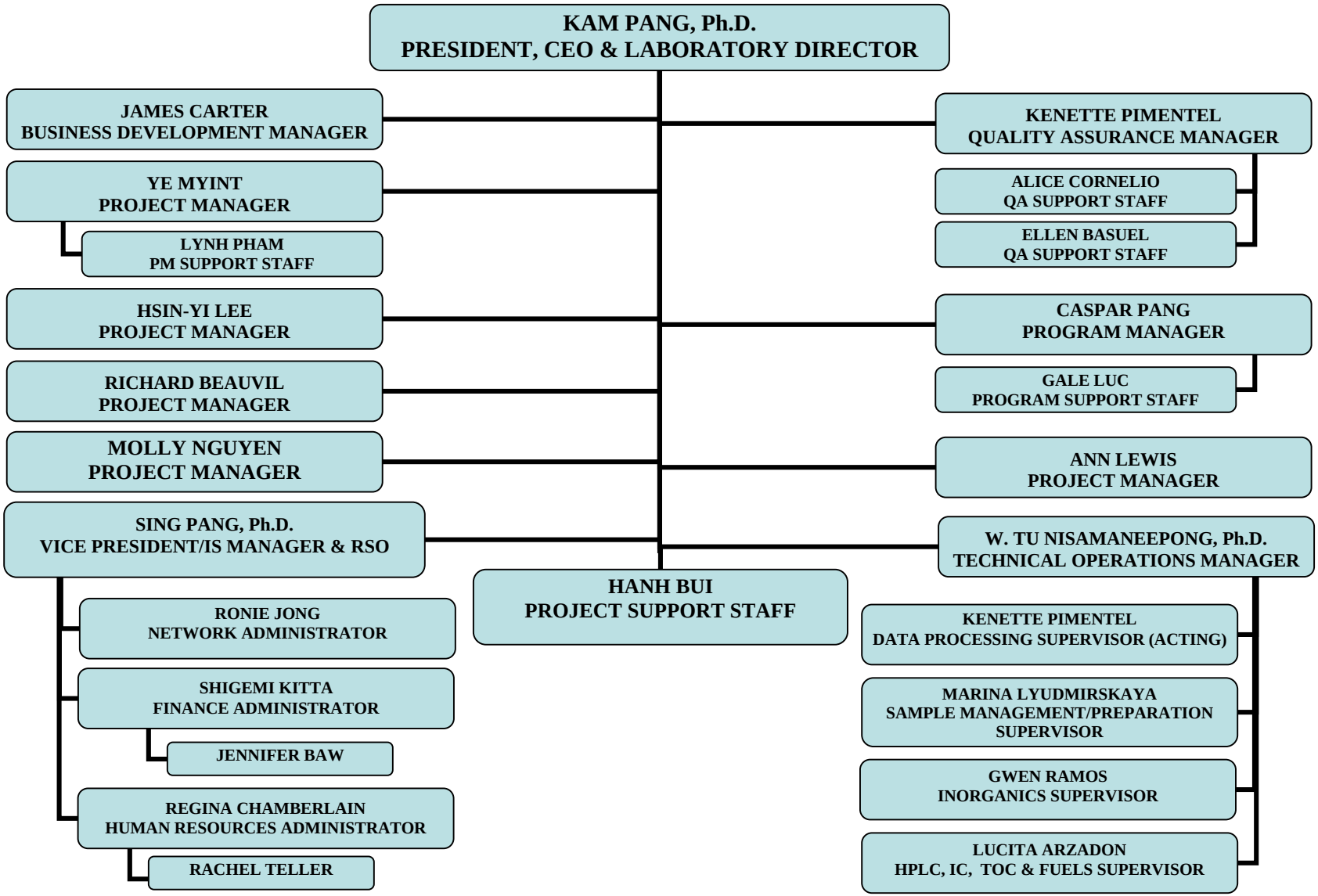
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E-1

EMAX ORGANIZATIONAL CHART & MINUMUM PERSONNEL QUALIFICATIONS

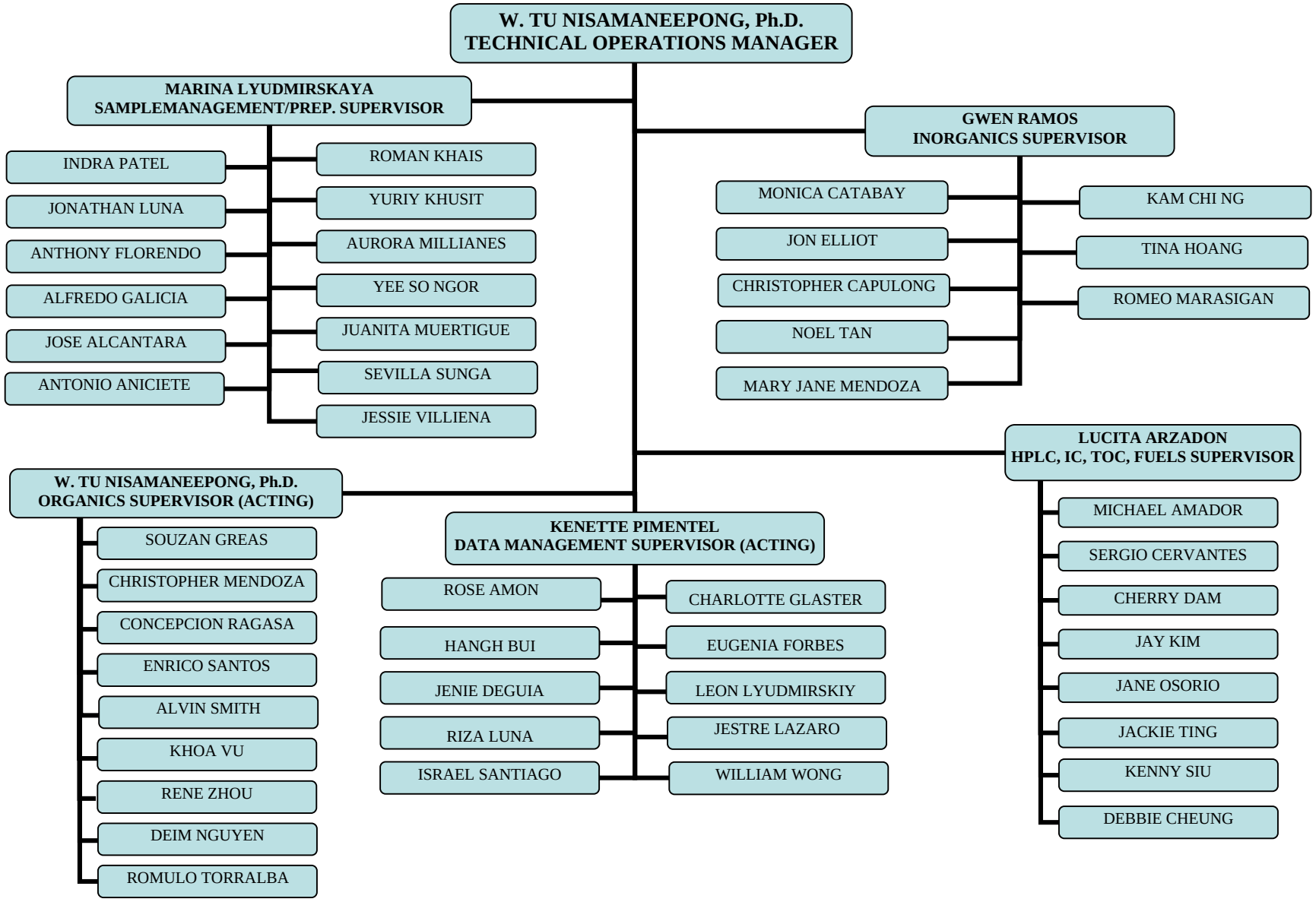
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EMAX ORGANIZATIONAL CHART



Approved: _____ Date: 11/4/16

EMAX LABORATORY STRUCTURE



Approved: _____ Date: 11/14/06

E-1. MINIMUM QUALIFICATIONS

E-1.1 TECHNICAL DIRECTOR

- Bachelor's degree in chemistry or any science/engineering discipline.
- Five years of laboratory experience directly related to environmental testing, including at least three years of supervisory experience.

E-1.2 TECHNICAL OPERATIONS MANAGER

- Bachelor's degree in chemistry or any science/engineering discipline.
- Five years of laboratory experience in analytical field, including at least three years of supervisory experience.

E-1.3 QA MANAGER

- Bachelor's degree in chemistry or any science/engineering discipline.
- Five years of laboratory experience, including at least one year of applied experience dealing with QA principles and practices in an analytical laboratory.

E-1.4 PROJECT MANAGER

- Bachelor's degree in chemistry or any science/engineering discipline.
- Three years of analytical laboratory experience including sample analysis, data validation, and QA activities.

E-1.5 DEPARTMENT SUPERVISORS

- Bachelor's degree in chemistry or any science/engineering discipline.
- Three years of analytical laboratory experience, including at least one year of supervisory experience.

E-1.6 ANALYSTS

- Bachelor's degree in chemistry or any science/engineering discipline or in lieu of minimum education requirement, two additional years experience in operating and maintenance in the related field of service.
- Two years experience in related field of service, such as GC/MS, GC, ICP, etc.

E-1.7 TECHNICIANS

- High school diploma and a college level course in general chemistry.
- One-year experience of laboratory work.

E-1.8 LABORATORY INFORMATION MANAGER

- Bachelor's degree with advanced training in programming, information management, database management systems, or systems requirements analysis.
- Three years experience in data or systems management or programming, including one year of experience in laboratory information management system operations.

E-1.9 DATA PROCESSING SUPERVISOR

- Bachelor's degree with course work in management and advanced training in computer software applications.
- Three years experience in data processing

E-1.10 ELECTRONIC DATA DELIVERABLES SUPERVISOR

- Bachelor's degree with advanced training in programming, information management, information systems, database management systems or systems requirements analysis.
- Two years experience in systems or applications programming, including one-year experience of data management and EDD generation.

E-1.11 SAMPLE MANAGEMENT SUPERVISOR

- Bachelor's degree in chemistry or any science/engineering discipline.
- Two years of laboratory experience in sample management and at least one year of supervisory experience.

E-1.12 HEALTH AND SAFETY OFFICER

- Bachelor's degree in chemistry or any science/engineering discipline, with 40-hour training on Hazardous Waste Management.
- One-year experience in administering health and safety regulations.

APPENDIX

E-2

EMAX FACILITIES

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E2 EMAX FACILITIES

E2-1 LABORATORIES

E2-1.1 VOLATILES LAB

The Volatiles Lab is in an area of about 3,200 square feet. This laboratory consists of the main Volatiles Lab, DOE Volatiles Lab, the Supervisor's room, and the volatiles sample storage room. This laboratory is isolated from the rest of EMAX's operations and has its own mechanical controls.





The main Volatiles Lab has a total of 104Lft. of workbench with two sinks, both equipped with a reagent water filtration system. There are two freezers dedicated for analytical standards.

The sample control room is furnished with nine sample storage refrigerators and a total of 18Lft of workbench, a fume hood and one analytical balance.

The DOE Volatiles lab has its own mechanical controls independent from the main Volatiles Lab. This lab has a total of 18Lft. of workbench with one sink equipped with reagent water filtration system. This lab houses its own sample storage refrigerator.

E2-1.2 MAIN LAB

The Main Lab is a separate area of about 6,000 square feet and includes three Supervisors' offices, the Project Managers' offices and a Standards Preparation room. This Lab has a total of 240Lft. of workbench with a possibility for an 80Lft expansion. This laboratory consists of the Semi-volatile Lab, Fuels & HPLC Lab, and General Chemistry laboratories.





The Standards Preparation room has three (3) fume hoods and three (3) standards storage refrigerators.

E2-1.3 METALS LAB

The Metals Laboratory is a separate area of about 1,100 square feet. This Lab is consists of a Digestion Lab, the Metals Analysis Lab and the Supervisor's Office.



The Digestion Lab has two acid resistant fume hoods with four hot plates and one fume hood for Standards preparation. The Metals Analysis Lab has two ICPs, one Mercury Analyzer and two GFAA instruments.



E2-1.4 EXTRACTION LAB



The Extraction Lab occupies an area of about 2,500 square feet. This Lab consists of the main Extraction Lab, the TCLP Lab and the Supervisor's office.

The main Extraction Lab has twelve (12) fume hoods, four (4) sonicators, six (6) concentrators, eighty (80) units of continuous liquid-liquid extractors, eighty (80) units of soxhlet extractors, and one reagent water system. The TCLP Lab has two (2) twelve-position TCLP extractors, three (3) GPC instruments, and one explosive extractor.





E2-1.5 DOE LAB



The DOE Lab is a separate area of about 1,200 square feet. This lab has its own mechanical controls independent from the rest of the laboratories. This room is designed to have negative pressure so that no air coming from this room migrates to the other labs. This lab has its own extraction lab, semi-volatile lab and metals lab. It has a total of 42Lft of workbench, three acid resistant hoods, one ASE extractor, eighteen (18) continuous liquid-liquid extractors, one concentrator, one sonicator, one GC/MS, one GC with dual ECD detectors, one GC with FID detector, one ICP and one Mercury Analyzer.

E2-2 SUPPORT FACILITIES

E2-2.1 DATA PROCESSING LAB

The Data Processing Lab occupies a space of about 850 square feet and includes a Supervisor's office. This lab has seven computers dedicated to data processing, one printer and two copiers.





E2-2.2 Sample Receipt, Sample Storage and Waste Storage Area

The Sample Receipt Area is about 500 square feet. It has a fume hood and cooler storage shelves.





The Sample Storage Area is about 1,000 square feet with one bottle preparation room and one office. It has eight sample storage refrigerators and 12Lft. of workbench.



The Waste Storage Area is an enclosed 200 square feet shed constructed outside the building.

E2-2.2.1 Data Storage Room

The data storage room is about 1,200 square feet. This room houses archived data packages, laboratory logbooks, and other documents related to the activities of EMAX.

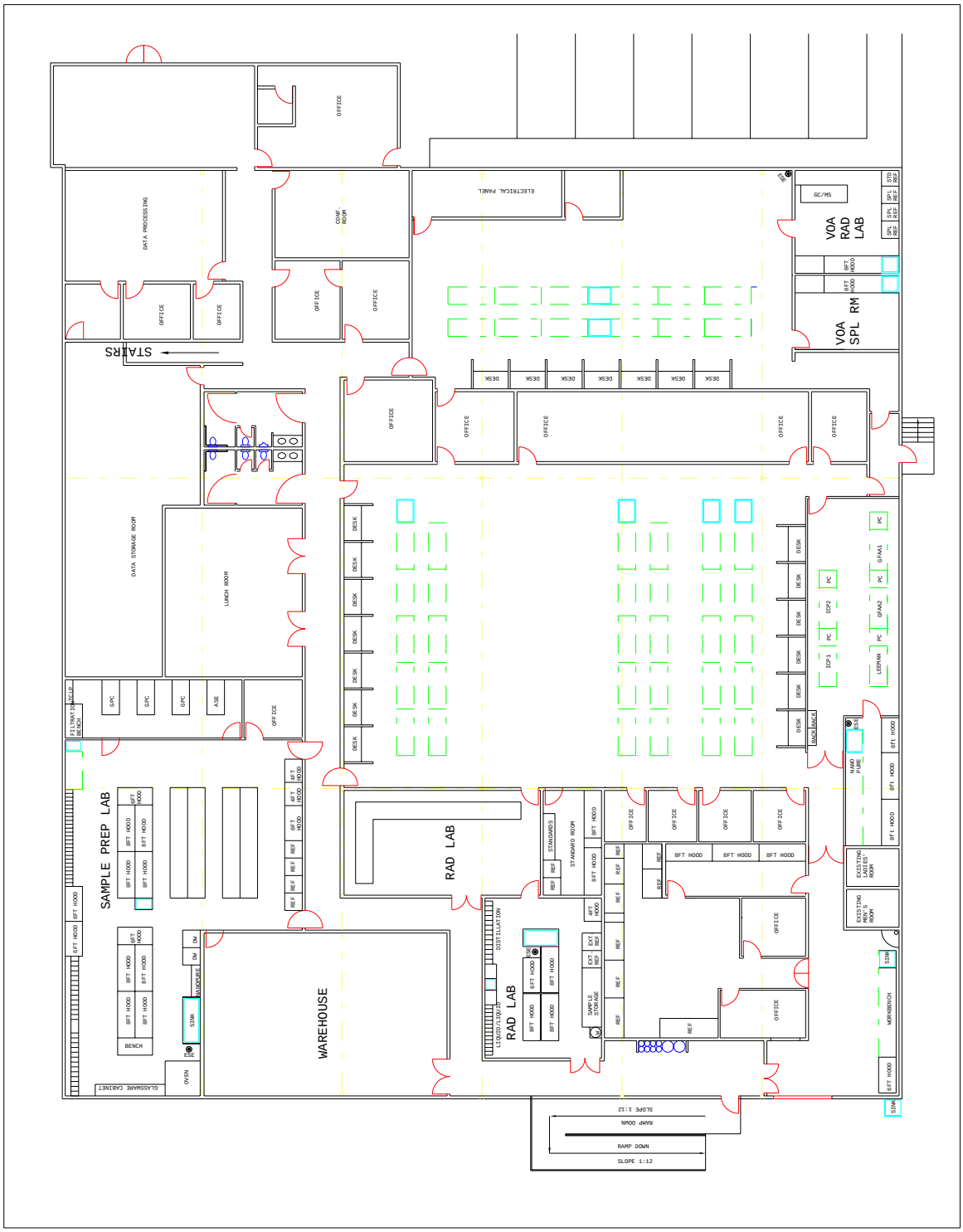


E2-2.2.2 Warehouse

The warehouse is about 1,200 square feet. The warehouse stores the laboratory supplies, solvents and reagents in appropriate cabinets.



E2-2.2.3 EMAX Floor Plan



APPENDIX

E-3

EMAX LIST OF MAJOR EQUIPMENT

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EMAX LABORATORIES, INC.

LIST OF MAJOR ANALYTICAL EQUIPMENT

No.	Type	Detector	Use	Manufacturer	Model	Location	Date Acquired
1	GC	MS	524 624 8260	Hewlett Packard	5890/5970	VOLATILES	6/1/1996
2	GC	MS	524 624 8260	Hewlett Packard	5890/5970	SEMIVOLATILES	6/1/1996
3	GC	MS	524 624 8260	Hewlett Packard	5890/5870	VOLATILES	6/1/1996
5	GC	MS	524 624 8260	Hewlett Packard	5890/5870	VOLATILES	6/1/1996
6	GC	MS	524 624 8260	Hewlett Packard	5890/5870	VOLATILES	6/1/1996
8	GC	Dual ECD	8081 8082	Hewlett Packard	5891 II	SEMIVOLATILES	6/1/1996
9	GC	Dual ECD	8151	Hewlett Packard	5892 II	SEMIVOLATILES	6/1/1996
10	GC	FID	RSK175	Varian	3400	HPLC & FUELS	6/1/1996
12	GC	NPD FPD	8141	Hewlett Packard	5890	SEMIVOLATILES	6/1/1996
13	GC	ELCD/ PID	8021	Hewlett Packard	5890	HPLC & FUELS	6/1/1996
16	GC	Dual ECD	8081 8082	Hewlett Packard	5890	SEMIVOLATILES	6/1/1996
17	HPLC	UV/F	8310 8330	Hewlett Packard	1050	HPLC & FUELS	6/1/1996
20	GFAA	GFAA	7000	Varian	Zeeman SpectAA 400	METALS	6/1/1996
24	ICP	Polychromator	6010	Thermo Jarell Ash	61E	METALS	6/1/1996
26	TOC Analyzer	IR	415.1 9060	Shimadzu	TOC-500	GENERAL CHEMISTRY	6/1/1996
28	Flash Point	Thermometer	1010	Pensky Martens	Semi-Automatic	GENERAL CHEMISTRY	6/1/1996
29	Conductivity	Conductivity	120.1	CSI	HYDAC	GENERAL CHEMISTRY	6/1/1996
30	Turbidimeter	NA	180.1	HF Scientific	DRT-153	GENERAL CHEMISTRY	6/1/1996
31	ICP	Polychromator	6010	Thermo Jarell Ash	Trace	METALS	6/1/1996
33	pH Meter	Conductivity	150.1 9040 9045	Hach One	N/A	GENERAL CHEMISTRY	6/1/1996
34	HPLC	UV/F	8310 8330	Waters	LC Module 1 Plus	HPLC & FUELS	6/1/1996
39	GC	FID/PID	8015G 8021(BTEXM)	Hewlett Packard	5890	HPLC & FUELS	6/1/1996
41	GC	MS	8270 625	Hewlett Packard	5890/5970		6/1/1996
42	GC	MS	524 624 8260	Hewlett Packard	5890/5970	SEMIVOLATILES	6/1/1996
43	GC	FID	8015B	Hewlett Packard	5890	HPLC & FUELS	6/1/1996
47	Mercury Analyzer	Cold Vapor	245.1 245.5 7470 7471	Leeman PS-200II	200II	METALS	10/26/1999
48	GC	MS	524 624 8260	Shimadzu	QP 5000 Ver. 2	SEMIVOLATILES	8/20/1999
50	GC	FID	8015B	Hewlett Packard	5890	HPLC & FUELS	6/1/1996

EMAX LABORATORIES, INC.

LIST OF MAJOR ANALYTICAL EQUIPMENT

No.	Type	Detector	Use	Manufacturer	Model	Location	Date Acquired
52	GC	MS	524 624 8260	Shimadzu	QP 5000 Ver. 2	SEMIVOLATILES	4/1/2000
53	pH Meter	Conductivity	150.1 9040 9045	Orion	420A	GENERAL CHEMISTRY	4/1/2000
55	GC	FID/PID	8015G	Hewlett Packard	5890	HPLC & FUELS	8/1/2000
56	Turbidimeter	NA	180.1	La Motte	2008	GENERAL CHEMISTRY	9/1/2000
57	IC	Conductivity	300.0	Dionex	LC25	GENERAL CHEMISTRY	9/28/2000
58	BOD Meter	Conductivity	405.1	Orion	N/A	GENERAL CHEMISTRY	9/1/2000
59	IC	AD25/M	218.6	Dionex	LC20	GENERAL CHEMISTRY	6/1/1996
61	TRPH	IR	413.2 418.1 1664	Buck Scientific	HC404	SEMIVOLATILES	6/1/1996
62	TOC Analyzer	IR	415.1 9060	Shimadzu	TOC-V-CSN	GENERAL CHEMISTRY	9/1/2001
63	pH Meter	Conductivity	150.1 9040 9045	CMS Labcraft	PH102	GENERAL CHEMISTRY	4/1/2001
64	pH Meter	Conductivity	150.1 9040 9045	VWR		GENERAL CHEMISTRY	6/1/1996
65	TRPH	IR	413.2 418.1 1664	Buck Scientific	HC404	SEMIVOLATILES	6/1/1996
67	GC	MS	524 624 8260	Hewlett Packard	5890 II/5971B	VOLATILES	9/1/2001
70	Spectrometer	IR	420.1 9014	Thermo Spectronic	Spectronic 20D	GENERAL CHEMISTRY	12/1/2001
71	GC	Dual ECD	8081 8082	Hewlett Packard	5890 II	DOE	12/18/2001
72	GC	FID	8015B	Hewlett Packard	5890 II	DOE	12/18/2001
73	ICP	Polychromator	6010	Thermo Jarell Ash	Trace II	DOE	12/1/2001
74	Mercury Analyzer	Cold Vapor	245.1 245.5 7470 7471	Leeman PS	HYDRA-AA	DOE	12/1/2001
81	HPLC	UV/F	8310 8330	Waters	717 Plus	HPLC & FUELS	6/7/2002
83	GC	MS	TO14	VARIAN	SATURN 2000	VOLATILES	9/25/2002
84	GC	FID	TO3	VARIAN	3800/3380	VOLATILES	9/25/2002
94	GC	MS	524 624 8260	Hewlett Packard	5890A	VOLATILES	3/24/2003
96	pH Meter	Conductivity	150.1 9040 9045	Thermo Ion	210A	GENERAL CHEMISTRY	6/7/2002
97	pH Meter	Conductivity	150.1 9040 9045	Thermo Ion	420A PLUS	GENERAL CHEMISTRY	7/10/2003
98	ICP	MS	6020A	Agilent	7500	METALS	9/15/2003
100	IC	Conductivity	300.0	Metrohm	761 Compact IC	GENERAL CHEMISTRY	4/11/2005
103	GC	MS	524 624 8260	AGILENT	5890 SII	VOLATILES	9/16/2005
104	Conductivity Meter	PLATIMUM	120.1 2510B	TRACEABLE	61161	GENERAL CHEMISTRY	1/2/2006

EMAX LABORATORIES, INC.

LIST OF MAJOR ANALYTICAL EQUIPMENT

No.	Type	Detector	Use	Manufacturer	Model	Location	Date Acquired
105	GC	FID	8015B	AGILENT	G1530N,G1540N	HPLC & FUELS	4/5/2006
106	IC	Conductivity and Absorbance	300.0/9056 218.6/7199	Dionex	ICS-1000 with AS50 Autosampler		5/8/2006
107	IC	Conductivity	300.0/300.0M	Metrohm		GENERAL CHEMISTRY	10/4/2006
108	ICP	AES	200.7 6010B	THERMO	ICAP 6500	METALS	12/1/2006

APPENDIX

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EMAX
LIST
OF
STANDARD
OPERATING
PROCEDURES

UNCONTROLLED WHEN PRINTED

EMAX STANDARD OPERATING PROCEDURES

ANALYTICAL

SOP #	TITLE	REV.#	Effective Date
EMAX-1010	IGNITABILITY	1	7/18/2002
EMAX-110.2	COLOR	1	6/26/2004
EMAX-120.1	SPECIFIC CONDUCTANCE	2	6/25/2004
EMAX-130.2	HARDNESS	2	4/5/2002
EMAX-150.1	pH	3	7/9/2002
EMAX-160.1	RESIDUE, FILTERABLE (TDS)	3	6/21/2004
EMAX-160.2	RESIDUE, NON-FILTERABLE (TSS)	2	6/28/2004
EMAX-160.3	RESIDUE, TOTAL	1	3/15/2002
EMAX-1664	OIL AND GREASE (HEM & SGT-HEM)	3	9/15/2004
EMAX-180.1	TURBIDITY BY NEPHELOMETRIC METHOD	3	10/9/2006
EMAX-200.7	DETERMINATION OF METALS AND TRACE ELEMENTS BY	0	7/16/2004
EMAX-200.8	DETERMINATION OF TRACE ELEMENTS IN WATER AND	0	8/4/2004
EMAX-2130B	TURBIDITY	1	7/15/2002
EMAX-218.6	HEXAVALENT CHROMIUM	3	7/1/2004
EMAX-2310B	ACIDITY	0	4/10/2002
EMAX-2320B	ALKALINITY	1	11/1/2004
EMAX-2340B	HARDNESS BY CALCULATION	1	4/11/2004
EMAX-2340C	HARDNESS (EDTA TITRATION METHOD)	1	4/8/2002
EMAX-245.2	MERCURY AUTOMATED COLD VAPOR	0	7/13/2004
EMAX-2510B	CONDUCTIVITY	0	4/11/2002
EMAX-2540C	RESIDUE, FILTERABLE (TDS)	1	7/11/2002
EMAX-2540D	RESIDUE, NONFILTERABLE (TSS)	0	4/8/2002
EMAX-300.0	ION CHROMATOGRAPHY ANALYSIS	4	6/24/2004
EMAX-300.0M	ION CHROMATOGRAPHY ANALYSIS FOR ORGANIC ACIDS	0	4/30/2004
EMAX-305.1	ACIDITY	0	4/4/2002
EMAX-310.1	ALKALINITY	3	11/1/2004
EMAX-314.0	ION CHROMATOGRAPHY ANALYIS	1	4/5/2002
EMAX-330.3	CHLORINE, TOTAL RESIDUAL	1	7/19/2004

EMAX STANDARD OPERATING PROCEDURES

ANALYTICAL

SOP #	TITLE	REV.#	Effective Date
EMAX-335.1	CYANIDE AMENABLE TO CHLORINATION	0	3/13/2002
EMAX-335.2	CYANIDE, TOTAL	2	6/15/2006
EMAX-340.2	FLUORIDE (ION SELECTIVE ELECTRODE)	1	9/19/2002
EMAX-350.2	AMMONIA-N	2	6/27/2002
EMAX-351.3	KJELDAHL NITROGEN	3	11/30/2006
EMAX-353.3	NITROGEN, NITRATE-NITRITE BY COPPER-CADMIUM RED	1	9/15/2004
EMAX-365.2	PHOSPHORUS (COLORIMETRIC), ALL FORMS	3	11/30/2006
EMAX-370.1	SILICA	1	11/15/2004
EMAX-375.4	SULFATE (TURBIDIMETRIC)	0	6/1/2005
EMAX-376.1	SULFIDE (TITRIMETRIC, IODINE)	2	8/10/2006
EMAX-376.2	SULFIDE (COLORIMETRY)	0	5/1/2003
EMAX-377.1	SULFITE (TITRIMETRIC, IODINE)	1	5/29/2002
EMAX-405.1	BIOCHEMICAL OXYGEN DEMAND (BOD)	2	7/15/2002
EMAX-410.4	CHEMICAL OXYGEN DEMAND (COD)	1	10/29/2002
EMAX-413.1	TOTAL RECOVERABLE OIL AND GREASE	2	7/12/2002
EMAX-413.2	OIL AND GREASE	0	6/18/2003
EMAX-413.2M	OIL AND GREASE	1	4/6/2002
EMAX-415.1	TOTAL ORGANIC CARBON (TOC)	1	4/3/2002
EMAX-418.1	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS	3	7/8/2002
EMAX-420.1	TOTAL PHENOLS BY SPECTROPHOTOMETRY	1	4/4/2002
EMAX-425.1	ORGANICS: METHYLENE BLUE ACTIVE SUBSTANCES (MBA	0	10/9/2002
EMAX-4500F	FLUORIDE (ION SELECTIVE ELECTRODE)	0	9/19/2002
EMAX-4500H	pH MEASUREMENT	0	4/11/2002
EMAX-504.1	EDB/DBCP	2	7/24/2002
EMAX-5210B	BIOCHEMICAL OXYGEN DEMAND (BOD)	1	7/15/2002
EMAX-5220B	CHEMICAL OXYGEN DEMAND (COD)	0	4/8/2002
EMAX-524.2	VOLATILE ORGANIC COMPOUNDS	3	9/20/2002
EMAX-5310B	DISSOLVED OXYGEN (DOC)	0	4/8/2002

EMAX STANDARD OPERATING PROCEDURES

ANALYTICAL

SOP #	TITLE	REV.#	Effective Date
EMAX-5520	OIL AND GREASE	0	4/8/2002
EMAX-6010	TRACE METALS BY ICP	5	6/15/2006
EMAX-6020	TRACE METALS BY ICP-MS	3	11/15/2006
EMAX-608	ORGANOCHLORINE PESTICIDES & PCBs	0	8/1/2005
EMAX-624	VOLATILE ORGANICS BY GCMS	1	5/30/2002
EMAX-625	SEMIVOLATILE ORGANICS BY GC/MS	0	8/1/2005
EMAX-7000	TRACE METALS BY GFAA	3	9/19/2002
EMAX-7196	CHROMIUM(VI)	2	7/9/2002
EMAX-7199	CHROMIUM(VI)	1	9/16/2003
EMAX-7470	MERCURY	3	1/8/2003
EMAX-7471	MERCURY	3	1/8/2003
EMAX-8011	EDB/DBCP	2	7/9/2002
EMAX-8015D	DIESEL RANGE ORGANICS (DRO)	3	4/1/2004
EMAX-8015G	GASOLINE RANGE ORGANICS (GRO)	1	11/1/2001
EMAX-8015G	PROPYLENE GLYCOL/ETHYLENE GLYCOL BY GC	0	6/7/2006
EMAX-8015O	ALCOHOLS BY GC	0	6/7/2006
EMAX-8015S	STODDARD SOLVENT	1	8/22/2001
EMAX-8081	ORGANOCHLORINE PESTICIDES BY GAS CHROMATOGRA	5	11/1/2006
EMAX-8082	POLYCHLORINATED BIPHENYLS(PCB) BY GAS CHROMAT	1	4/8/2002
EMAX-8141	ORGANOPHOSPHORUS COMPOUNDS BY GC	1	9/20/2002
EMAX-8151	CHLORINATED HERBICIDES	2	12/1/2003
EMAX-8260	VOLATILE ORGANIC COMPOUNDS BY GC/MS	3	11/16/2006
EMAX-8270	SEMIVOLATILE ORGANICS BY GC/MS	3	7/15/2006
EMAX-8270SI	SEMIVOLATILE ORGANICS BY GC/MS	1	11/15/2006
EMAX-8310	POLYNUCLEAR AROMATIC HYDROCARBONS	4	10/1/2003
EMAX-8330	NITROAROMATICS & NITAMINES BY HPLC	3	10/1/2003
EMAX-8332	NITROGLYCERINE & NITROGUANIDINE	0	8/1/2000
EMAX-9010	CYANIDE DISTILLATION	1	3/18/2002

EMAX STANDARD OPERATING PROCEDURES

ANALYTICAL

SOP #	TITLE	REV.#	Effective Date
EMAX-9014	CYANIDE, TOTAL	1	2/7/2002
EMAX-9030	ACID SOLUBLE AND ACID INSOLUBLE SULFIDES: DISTILL	0	3/15/2004
EMAX-9034	SULFIDES, TOTAL	0	3/15/2004
EMAX-9040	pH DETERMINATION – CORROSIVITY	3	7/9/2002
EMAX-9045	pH, SOLID AND WASTE SAMPLES	0	3/9/2001
EMAX-9056	ION CHROMATOGRAPHY ANALYSIS	2	7/9/2002
EMAX-9060	TOTAL ORGANIC CARBON (TOC)	1	4/5/2002
EMAX-9065	PHENOLICS BY SPECTROPHOTOMETRY, MANUAL 4-AAP W	1	9/15/2004
EMAX-9095	PAINT FILTER LIQUID TEST	0	4/9/2001
EMAX-9253	CHLORIDE (TITRIMETRIC SILVER NITRATE)	1	9/15/2004
EMAX-BTEX	AROMATIC VOLATILE ORGANICS BY GAS CHROMATOGRA	1	3/15/2002
EMAX-D1385	TEST METHOD FOR HYDRAZINE	0	7/13/2004
EMAX-LUFT	TOTAL VOLATILE PETROLEUM HYDROCARBON	1	1/15/2002
EMAX-LUFT	TOTAL PETROLEUM HYDROCARBON BY EXTRACTION	3	6/10/2004
EMAX-M8270	1,4-DIOXANE BY GC/MS, MODIFIED METHOD 8270SIM	1	5/10/2004
EMAX-MCD	MOISTURE CONTENT DETERMINATION	2	5/10/2006
EMAX-RCN	REACTIVE CYANIDE	0	10/8/2002
EMAX-RSE	REACTIVE SULFIDE	0	10/8/2002
EMAX-RSK17	DISSOLVED GASES	1	4/1/2004
EMAX-TO14	DETERMINATION VOLATILE ORGANIC COMPOUNDS IN A	0	5/16/2003
EMAX-TO15	DETERMINATION VOLATILE ORGANIC COMPOUNDS IN A	0	11/16/2003
EMAX-TOCW	TOTAL ORGANIC CARBON (TOC) BY WALKLEY BLACK ME	0	5/12/2003

EMAX STANDARD OPERATING PROCEDURES

DATA MANAGEMENT

SOP #	TITLE	REV.#	Effective Date
EMAX-DM01	DATA FLOW AND REVIEW	2	7/15/2002
EMAX-DM02	DOCUMENT CONTROL	1	12/5/2002
EMAX-DM03	DATA PACKAGE ASSEMBLY AND ARCHIVAL	2	1/12/2004
EMAX-DM04	MANAGEMENT OF LIMS RAW DATA	0	8/30/2002

EMAX STANDARD OPERATING PROCEDURES

INFORMATION SYSTEMS

SOP #	TITLE	REV.#	Effective Date
EMAX-IS01	SOFTWARE DOCUMENTATION	2	3/1/2004
EMAX-IS02	SOFTWARE DEVELOPMENT METHODOLOGY	1	9/24/2001
EMAX-IS03	SOFTWARE TESTING AND QUALITY ASSURANCE	0	9/24/2001
EMAX-IS04	SOFTWARE MAINTENANCE	1	3/1/2004
EMAX-IS05	EDD GENERATION AND VALIDATION	1	10/30/2001
EMAX-IS06	HISTORICAL FILE MAINTENANCE	0	3/1/2004
EMAX-IS07	ACQUISITION OF SOFTWARE PACKAGES	2	3/1/2004
EMAX-IS08	DATA SECURITY	3	5/17/2005
EMAX-IS09	BACKING UP FILES	2	5/17/2005
EMAX-IS10	VIRUS PROTECTION	2	5/17/2005
EMAX-IS11	PROJECT SUPPORT FILES	1	10/25/2002
EMAX-IS12	HARDWARE MAINTENANCE	0	2/20/2002

EMAX STANDARD OPERATING PROCEDURES

QUALITY ASSURANCE

SOP #	TITLE	REV.#	Effective Date
EMAX-QA00	WRITING STANDARD OPERATING PROCEDURES	1	12/8/2003
EMAX-QA01	PROJECT MANAGEMENT	3	1/15/2004
EMAX-QA02	UTILIZATION OF SUBCONTRACT LABORATORIES	1	6/5/2006
EMAX-QA03	METHOD DEVELOPMENT	1	11/15/2005
EMAX-QA04	METHOD DETECTION LIMIT STUDY	2	5/21/2004
EMAX-QA05	TRAINING	3	9/1/2006
EMAX-QA06	CONTROL CHART	3	11/1/2003
EMAX-QA07	INTERNAL ASSESSMENT	1	6/5/2006
EMAX-QA08	CORRECTIVE ACTION	2	9/16/2003
EMAX-QA09	PURCHASING	1	9/26/2002
EMAX-QA10	ETHICS PROGRAM	0	9/1/2006
EMAX-QS00	QUALITY SYSTEMS MANUAL	2	12/4/2006

EMAX STANDARD OPERATING PROCEDURES

QUALITY CONTROL

SOP #	TITLE	REV.#	Effective Date
EMAX-QC01	QUALITY CONTROL FOR CHEMICALS	1	5/2/2005
EMAX-QC02	ANALYTICAL STANDARD PREPARATION	1	5/2/2005
EMAX-QC03	REFRIGERATOR CONTROL	2	6/20/2004
EMAX-QC04	BALANCE CALIBRATION	1	9/17/2001
EMAX-QC05	THERMOMETER CALIBRATION	1	6/1/2004
EMAX-QC06	MICROPIPET CALIBRATION	1	9/17/2001
EMAX-QC07	GLASSWARE CLEANING	1	4/15/2005
EMAX-QC08	HANDLING HIGHLY CONTAMINATED SAMPLES	0	9/25/2002
EMAX-QC09	FUME HOOD INSPECTION PROGRAM	0	10/31/2004

EMAX STANDARD OPERATING PROCEDURES

SAMPLE MANAGEMENT

SOP #	TITLE	REV.#	Effective Date
EMAX-SM01	SAMPLE MANAGEMENT	3	1/15/2004
EMAX-SM02	SAMPLE RECEIVING	4	1/15/2004
EMAX-SM03	WASTE DISPOSAL	2	1/15/2004
EMAX-SM04	ANALYTICAL AND QC LABELING	0	3/12/2001
EMAX-SM05	SAMPLE CONTAINERS, HANDLING AND SHIPPING	0	1/12/2000
EMAX-SM06	TRIP BLANK PREPARATION	0	10/11/2000

EMAX STANDARD OPERATING PROCEDURES

SAMPLE PREPARATION

SOP #	TITLE	REV.#	Effective Date
EMAX-3005	ACID DIGESTION, TOTAL RECOVERABLE OR DISSOLVED	4	12/31/2005
EMAX-3010	ACID DIGESTION, TOTAL METALS FOR AQUEOUS	3	12/31/2005
EMAX-3020	ACID DIGESTION, TOTAL METALS FOR GFAA	3	12/31/2005
EMAX-3050	ACID DIGESTION, TOTAL METALS SOLIDS	3	9/7/2004
EMAX-3520	EXTRACTION, CONTINUOUS LIQUID LIQUID	2	11/15/2005
EMAX-3545	EXTRACTION, PRESSURIZED FLUID	1	3/26/2002
EMAX-3550	EXTRACTION, SONICATION	2	11/27/2006
EMAX-5030	PURGE & TRAP	1	3/14/2002
EMAX-5035	PURGE & TRAP, CLOSED SYSTEM	1	5/20/2002

APPENDIX

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EMAX ACCREDITATIONS

UNCONTROLLED WHEN PRINTED

Agency	Certificate Number	Expiration Date	Notes
State of Arizona	AZ0465	March 6, 2007	In good standing.
State of California	2168	August 31, 2007	In good standing.
State of Connecticut	PH-0239	March 31, 2007	In good standing.
State of Florida	970153	June 30, 2007	Renewal is dependent on NELAP accreditation.
State of Kansas	E-10272	October 31, 2007	Renewal is dependent on NELAP accreditation.
State of Massachusetts	M-CA291	June 30, 2007	In good standing.
State of South Carolina	87012	August 31, 2007	Renewal is dependent on Arizona and NELAP accreditation.
State of Utah	CKY1	August 31, 2007	Renewal is dependent on NELAP accreditation.
State of Washington	C227	August 13, 2007	In good standing
USACE	NA	NA	In good standing.
NFESC	NA	January 19, 2007	In good standing.
AFCEE	NA	Until Revoked	In good standing.
USDA Permit to Remove Soil	S-57253	June 30, 2007	In good standing.
City of Torrance Business License	5294 Miscellaneous Business Date Issued: 1/21/97	Until Revoked	Annual tax due January 1st of each year, delinquent if not paid by 31st. Void if there's a change in ownership or address.

UNCONTROLLED WHEN PRINTED

Arizona Department of Health Services

ENVIRONMENTAL LABORATORY LICENSE

Issued to:

Laboratory Director: **Kam Y. Pang, Ph.D**
Owner/Representative: **Kam Y. Pang, Ph.D.**

EMAX Laboratories, Inc.
AZ0465

is in compliance with Environmental Laboratory's applicable standards for the State of Arizona and maintains on file a List of Parameters for which the laboratory is certified to perform analysis.

PERIOD OF LICENSURE FROM: 03/07/2006 TO: 03/06/2007

Steven D. Baker, Chief
Office of Laboratory Services
Bureau of State Laboratory Services

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
250 North 17th Avenue, Phoenix, AZ 85007

Tuesday, January 24 2006

AZ License: AZ0465

Lab Director: Dr. Kam Y. Pang

Lab Name: Emax Laboratories, Inc.
Phone: (310) 618-8889
Fax: (310) 618-0818

Program HW

Parameter	EPA Method	Billing Code	Cert Date
Perchlorate	EPA 314.0	NIIIA1	02/18/04
1,2-Dibromoethane & 1,2-Dibromo-3-Chloropropane	EPA 8011	SOC5	02/18/04
Aluminum	EPA 6010B	MTL3	06/11/98
Aluminum	EPA 6020	MTL7	01/21/05
Antimony	EPA 6010B	MTL3	06/11/98
Antimony	EPA 6020	MTL7	01/05/51
Arsenic	EPA 6010B	MTL3	06/11/98
Arsenic	EPA 6020	MTL7	01/21/05
Arsenic	EPA 7060A	MTL2	03/11/98
Barium	EPA 6010B	MTL3	06/11/98
Barium	EPA 6020	MTL7	01/21/05
Beryllium	EPA 6010B	MTL3	06/11/98
Beryllium	EPA 6020	MTL7	01/21/05
Boron	EPA 6010B	MTL3	02/18/04
Bromide	EPA 9056	NIIIA1	02/18/04
C10-C32 Hydrocarbons	8015AZ	VOC4	05/29/98
Cadmium	EPA 6010B	MTL3	06/11/98
Cadmium	EPA 6020	MTL7	01/21/05
Calcium	EPA 6010B	MTL3	06/11/98
Chloride	EPA 9056	NIIIA1	02/18/04
Chlorinated Herbicides	EPA 8151A	SOC3	06/11/98
Chromium Total	EPA 6010B	MTL3	06/11/98
Chromium, Hexavalent	EPA 7196A	MTL4	02/10/95
Chromium, Hexavalent	EPA 7199	MISC24	02/18/04
Cobalt	EPA 6010B	MTL3	06/11/98
Cobalt	EPA 6020	MTL7	01/21/05
Continuous Liquid-Liquid Extraction	EPA 3520C	*	02/18/04
Copper	EPA 6010B	MTL3	06/11/98
Copper	EPA 6020	MTL7	01/21/05
Corrosivity Ph Determination	EPA 9040B	NIA6	12/06/02
Cyanide	EPA 9010B	MISC7	06/11/98
Cyanide	EPA 9014	MISC7	04/08/03
Fluoride	EPA 9056	NIIIA1	02/18/04
Gel-Permeation Cleanup	EPA 3640A	*	02/15/00
Hydrogen Ion (Ph)	EPA 9040B	NIA6	03/11/98
Hydrogen Ion (Ph)	EPA 9045C	NIA6	02/18/04
Ignitability (Flash Point)	EPA 1010	HAZ2	02/02/94
Iron	EPA 6010B	MTL3	06/11/98
Lead	EPA 6010B	MTL3	06/11/98

AZ License: AZ0465 **Lab Name: Emax Laboratories, Inc.**

Program HW

Parameter	EPA Method	Billing Code	Cert Date
Lead	EPA 6020	MTL7	01/21/05
Magnesium	EPA 6010B	MTL3	06/11/98
Manganese	EPA 6010B	MTL3	06/11/98
Manganese	EPA 6020	MTL7	01/21/05
Mercury	EPA 7470A	MTL5	02/02/94
Mercury	EPA 7471A	MTL5	02/10/95
Molybdenum	EPA 6010B	MTL3	06/11/98
Nickel	EPA 6010B	MTL3	06/11/98
Nickel	EPA 6020	MTL7	01/21/05
Nitrate	EPA 9056	NIIIA1	02/18/04
Nitrite	EPA 9056	NIIIA1	02/18/04
Nitroaromatics And Nitramines	EPA 8330	SOC7	03/11/99
Oil And Grease	EPA 1664A	MISC6	02/18/04
Organochlorine Pesticides	EPA 8081A	SOC9	06/11/98
Organophosphorus Pesticides	EPA 8141A	SOC10	03/11/98
Ortho-Phosphate	EPA 9056	NIIIA1	02/18/04
Phosphorous	EPA 365.3	MISC24	01/21/05
Phosphorus	EPA 6010B	MTL3	02/18/04
Polychlorinated Biphenyls	EPA 8082	SOC9	04/08/98
Polynuclear Aromatic Hydrocarbons	EPA 8310	SOC13	02/02/94
Potassium	EPA 6010B	MTL3	06/11/98
Purge And Trap	EPA 5030B	*	06/11/98
Purge And Trap	EPA 5035	*	02/18/04
Reactivity	REACTIVITY	HAZ3	02/02/94
Sediments, Sludges And Soils	EPA 3050B	*	02/18/04
Selenium	EPA 6010B	MTL3	06/11/98
Semivolatile Organics	EPA 8270C	SOC16	06/11/98
Silver	EPA 6010B	MTL3	06/11/98
Silver	EPA 6020	MTL7	01/21/05
Sodium	EPA 6010B	MTL3	06/11/98
Sonication Extraction	EPA 3550B	*	06/11/98
Strontium	EPA 6010B	MTL3	06/11/98
Sulfate	EPA 9056	NIIIA1	02/18/04
Sulfide	EPA 9030B	MISC11	06/11/98
Sulfide	EPA 9034	MISC11	04/08/03
Sulfur Cleanup	EPA 3660B	*	02/18/04
Sulfuric Acid/Permanganate Cleanup	EPA 3665A	*	01/21/05
Synthetic Precipitation Leaching Procedure (Splp)	EPA 1312	HAZ6	03/11/98
Thallium	EPA 6010B	MTL3	06/11/98
Thallium	EPA 6020	MTL7	01/21/05
Tin	EPA 6010B	MTL3	02/18/04

AZ License: AZ0465 **Lab Name: Emax Laboratories, Inc.**

Program HW

Parameter	EPA Method	Billing Code	Cert Date
Titanium	EPA 6010B	MTL3	02/18/04
Total Metals	EPA 3010A	*	02/15/00
Total Organic Carbon	EPA 9060	MISC1	02/02/94
Total Petroleum Hydrocarbons In Soil	418.1AZ	MISC5	04/08/98
Toxicity Characteristics Leaching Procedure	EPA 1311	HAZ5	02/02/94
Vanadium	EPA 6010B	MTL3	06/11/98
Volatile Organics	EPA 8260B	VOC8	06/11/98
Waste Dilution	EPA 3580A	*	02/18/04
Zinc	EPA 6010B	MTL3	06/11/98
Zinc	EPA 6020	MTL7	01/21/05

Total Licensed Parameters in this Program: 90

Program SDW

Parameter	EPA Method	Billing Code	Cert Date
Bromate	EPA 300.1	NIIIA1	03/10/05
Perchlorate	EPA 314.0	MISC24	02/18/04

Total Licensed Parameters in this Program: 2

Program WW

Parameter	EPA Method	Billing Code	Cert Date
Aluminum	EPA 200.7	MTL3	01/21/05
Antimony	EPA 200.7	MTL3	01/21/05
Arsenic	EPA 200.7	MTL3	01/21/05
Barium	EPA 200.7	MTL3	01/21/05
Beryllium	EPA 200.7	MTL3	01/21/05
Cadmium	EPA 200.7	MTL3	01/21/05
Chloride	EPA 300.0	NIIIA1	03/07/96
Chromium Total	EPA 200.7	MTL3	01/21/05
Cobalt	EPA 200.7	MTL3	01/21/05
Copper	EPA 200.7	MTL3	01/21/05
Cyanide, Total	EPA 335.2	MISC7	02/02/94
Fluoride	EPA 300.0	NIIIA1	02/18/04
Hardness	EPA 130.1	NIA5	02/02/94
Hardness	EPA 130.2	NIA5	02/18/04
Hydrogen Ion (Ph)	EPA 150.1	NIA6	02/02/94
Hydrogen Ion (Ph)	SM 4500-H B	NIA6	02/18/04
Iron	EPA 200.7	MTL3	01/21/05
Iron	SM 3500-FE D	MTL4	01/24/06
Kjeldahl Nitrogen	EPA 351.3	NIIB3	03/11/98
Lead	EPA 200.7	MTL3	01/21/05
Magnesium	EPA 200.7	MTL3	01/21/05

AZ License: AZ0465 **Lab Name: Emax Laboratories, Inc.**

Program WW

Parameter	EPA Method	Billing Code	Cert Date
Manganese	EPA 200.7	MTL3	01/21/05
Mercury	EPA 245.1	MTL5	02/18/04
Mercury	EPA 245.2	MTL5	02/18/04
Molybdenum	EPA 200.7	MTL3	01/21/05
Nickel	EPA 200.7	MTL3	01/21/05
Nitrate	EPA 300.0	NIIIA1	02/02/94
Nitrate	EPA 353.3	NIB1	02/18/04
Nitrite	EPA 300.0	NIIIA1	02/02/94
Oil And Grease	EPA 1664	MISC6	02/18/04
Oil And Grease	EPA 413.1	MISC6	02/02/94
Organic Carbon, Total	EPA 415.1	MISC1	02/02/94
Ortho-Phosphate	EPA 300.0	NIIIA1	02/18/04
Ortho-Phosphate	EPA 365.2	NIIB5	03/11/98
Phenols	EPA 420.1	MISC8	02/18/04
Residue Filterable	EPA 160.1	NIA8	02/02/94
Residue Nonfilterable	EPA 160.2	NIIA5	02/02/94
Selenium	EPA 200.7	MTL3	01/21/05
Silver	EPA 200.7	MTL3	01/21/05
Specific Conductance	EPA 120.1	NIA7	02/02/94
Sulfate	EPA 300.0	NIIIA1	02/02/94
Sulfide	EPA 376.1	MISC11	03/11/98
Thallium	EPA 200.7	MTL3	01/21/05
Total Organic Carbon	SM 5310B	MISC1	02/18/04
Vanadium	EPA 200.7	MTL3	01/21/05
Zinc	EPA 200.7	MTL3	01/21/05

Total Licensed Parameters in this Program: 46

Instruments	Quantity	Date
GAS CHROMATOGRAPH	2	02/15/00
GAS CHROMATOGRAPH/MASS SPECTROMETER	2	02/10/03
ATOMIC ABSORPTION SPECTROPHOTOMETER	1	02/10/03
HIGH PERFORMANCE LIQUID CHROMATOGRAPH	1	02/15/00
ION CHROMATOGRAPH	1	03/07/96
INDUCTIVELY COUPLED PLASMA SPECTROMETER	1	02/10/03
MERCURY ANALYZER	1	02/10/03
INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETER	1	01/21/05

Softwares
EZ CHROM - GC
ENVIROQUANT - GCMS

AZ License: AZ0465 **Lab Name: Emax Laboratories, Inc.**

EZ CHROM - HPLC
EZ CHROM - IC
VARIAN - AA
PS 200 SOFTWARE - MERCURY ANALYZER
THERMOSPEC VERSION 6.20 - ICP
AGILENT - ICP/MS

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

NELAP - RECOGNIZED

ACCREDITATION

Is hereby granted to

EMAX LABORATORIES, INC.

1835 WEST 205th STREET

TORRANCE, CA 90501

Scope of accreditation is limited to the
"NELAP Fields of Accreditation"
which accompanies this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **02116CA**

Expiration Date: **08/31/2007**

Effective Date: **08/31/2006**

Richmond, California
subject to forfeiture or revocation

George C. Kulasingam, Ph.D.
Program Chief
Environmental Laboratory Accreditation Program

CALIFORNIA DEPARTMENT OF HEALTH SERVICES

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM - NELAP RECOGNIZED

Fields of Accreditation

EMAX LABORATORIES, INC.

Lab Phone (310) 618-8889

1835 WEST 205th STREET
TORRANCE, CA 90501

Certificate No: 02116CA Renew Date: 08/31/2007

102 - Inorganic Chemistry of Drinking Water			
102.030	001	EPA 300.0	Bromide
102.030	002	EPA 300.0	Chlorate
102.030	003	EPA 300.0	Chloride
102.030	005	EPA 300.0	Fluoride
102.030	006	EPA 300.0	Nitrate
102.030	007	EPA 300.0	Nitrite
102.030	008	EPA 300.0	Phosphate, Ortho
102.030	010	EPA 300.0	Sulfate
102.040	004	EPA 300.1	Bromate
102.045	001	EPA 314.0	Perchlorate
102.100	001	SM2320B	Alkalinity
102.120	001	SM2340B	Hardness
102.121	001	SM2340C	Hardness
102.130	001	SM2510B	Conductivity
102.140	001	SM2540C	Total Dissolved Solids
102.145	001	EPA 160.1	Total Dissolved Solids
102.150	001	SM4110B	Chloride
102.150	002	SM4110B	Fluoride
102.150	003	SM4110B	Nitrate
102.150	004	SM4110B	Nitrite
102.150	005	SM4110B	Phosphate, Ortho
102.150	006	SM4110B	Sulfate
102.200	001	SM4500-F C	Fluoride
102.260	001	SM5310B	Total Organic Carbon
102.261	001	SM5310B	DOC
102.270	001	SM5540C	Surfactants
102.520	001	EPA 200.7	Calcium
102.520	002	EPA 200.7	Magnesium
102.520	003	EPA 200.7	Potassium
102.520	004	EPA 200.7	Silica
102.520	005	EPA 200.7	Sodium
103 - Toxic Chemical Elements of Drinking Water			
103.130	001	EPA 200.7	Aluminum

As of 09/20/2006, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

103.130	003	EPA 200.7	Barium
103.130	004	EPA 200.7	Beryllium
103.130	005	EPA 200.7	Cadmium
103.130	007	EPA 200.7	Chromium
103.130	008	EPA 200.7	Copper
103.130	009	EPA 200.7	Iron
103.130	011	EPA 200.7	Manganese
103.130	012	EPA 200.7	Nickel
103.130	015	EPA 200.7	Silver
103.130	017	EPA 200.7	Zinc
103.140	001	EPA 200.8	Aluminum
103.140	002	EPA 200.8	Antimony
103.140	003	EPA 200.8	Arsenic
103.140	004	EPA 200.8	Barium
103.140	005	EPA 200.8	Beryllium
103.140	006	EPA 200.8	Cadmium
103.140	007	EPA 200.8	Chromium
103.140	008	EPA 200.8	Copper
103.140	009	EPA 200.8	Lead
103.140	010	EPA 200.8	Manganese
103.140	011	EPA 200.8	Mercury
103.140	012	EPA 200.8	Nickel
103.140	013	EPA 200.8	Selenium
103.140	014	EPA 200.8	Silver
103.140	015	EPA 200.8	Thallium
103.140	016	EPA 200.8	Zinc
103.161	001	EPA 245.2	Mercury

104 - Volatile Organic Chemistry of Drinking Water

104.030	001	EPA 504.1	1,2-Dibromoethane
104.030	002	EPA 504.1	1,2-Dibromo-3-chloropropane
104.040	000	EPA 524.2	Volatile Organic Compounds
104.040	001	EPA 524.2	Benzene
104.040	002	EPA 524.2	Bromobenzene
104.040	003	EPA 524.2	Bromochloromethane
104.040	006	EPA 524.2	Bromomethane
104.040	007	EPA 524.2	n-Butylbenzene
104.040	008	EPA 524.2	sec-Butylbenzene
104.040	009	EPA 524.2	tert-Butylbenzene
104.040	010	EPA 524.2	Carbon Tetrachloride
104.040	011	EPA 524.2	Chlorobenzene
104.040	012	EPA 524.2	Chloroethane

104.040	014	EPA 524.2	Chloromethane
104.040	015	EPA 524.2	2-Chlorotoluene
104.040	016	EPA 524.2	4-Chlorotoluene
104.040	018	EPA 524.2	Dibromomethane
104.040	019	EPA 524.2	1,3-Dichlorobenzene
104.040	020	EPA 524.2	1,2-Dichlorobenzene
104.040	021	EPA 524.2	1,4-Dichlorobenzene
104.040	022	EPA 524.2	Dichlorodifluoromethane
104.040	023	EPA 524.2	1,1-Dichloroethane
104.040	024	EPA 524.2	1,2-Dichloroethane
104.040	025	EPA 524.2	1,1-Dichloroethene
104.040	026	EPA 524.2	cis-1,2-Dichloroethene
104.040	027	EPA 524.2	trans-1,2-Dichloroethene
104.040	028	EPA 524.2	Dichloromethane
104.040	029	EPA 524.2	1,2-Dichloropropane
104.040	030	EPA 524.2	1,3-Dichloropropane
104.040	031	EPA 524.2	2,2-Dichloropropane
104.040	032	EPA 524.2	1,1-Dichloropropene
104.040	033	EPA 524.2	cis-1,3-Dichloropropene
104.040	034	EPA 524.2	trans-1,3-Dichloropropene
104.040	035	EPA 524.2	Ethylbenzene
104.040	036	EPA 524.2	Hexachlorobutadiene
104.040	037	EPA 524.2	Isopropylbenzene
104.040	038	EPA 524.2	4-Isopropyltoluene
104.040	039	EPA 524.2	Naphthalene
104.040	040	EPA 524.2	Nitrobenzene
104.040	041	EPA 524.2	N-propylbenzene
104.040	042	EPA 524.2	Styrene
104.040	043	EPA 524.2	1,1,1,2-Tetrachloroethane
104.040	044	EPA 524.2	1,1,2,2-Tetrachloroethane
104.040	045	EPA 524.2	Tetrachloroethene
104.040	046	EPA 524.2	Toluene
104.040	047	EPA 524.2	1,2,3-Trichlorobenzene
104.040	048	EPA 524.2	1,2,4-Trichlorobenzene
104.040	049	EPA 524.2	1,1,1-Trichloroethane
104.040	050	EPA 524.2	1,1,2-Trichloroethane
104.040	051	EPA 524.2	Trichloroethene
104.040	052	EPA 524.2	Trichlorofluoromethane
104.040	053	EPA 524.2	1,2,3-Trichloropropane
104.040	054	EPA 524.2	1,2,4-Trimethylbenzene
104.040	055	EPA 524.2	1,3,5-Trimethylbenzene

104.040	056	EPA 524.2	Vinyl Chloride
104.040	057	EPA 524.2	Xylenes, Total
104.045	001	EPA 524.2	Bromodichloromethane
104.045	002	EPA 524.2	Bromoform
104.045	003	EPA 524.2	Chloroform
104.045	004	EPA 524.2	Dibromochloromethane
104.045	005	EPA 524.2	Trihalomethanes
104.050	002	EPA 524.2	Methyl tert-butyl Ether (MTBE)
104.050	004	EPA 524.2	tert-Amyl Methyl Ether (TAME)
104.050	005	EPA 524.2	Ethyl tert-butyl Ether (ETBE)
104.050	006	EPA 524.2	Trichlorotrifluoroethane

108 - Inorganic Chemistry of Wastewater

108.016	001	EPA 110.2	Color
108.020	001	EPA 120.1	Conductivity
108.030	001	EPA 130.1	Hardness
108.040	001	EPA 130.2	Hardness
108.050	001	EPA 150.1	pH
108.060	001	EPA 160.1	Residue, Filterable
108.070	001	EPA 160.2	Residue, Non-filterable
108.080	001	EPA 160.3	Residue, Total
108.090	001	EPA 160.4	Residue, Volatile
108.100	001	EPA 160.5	Residue, Settleable
108.110	001	EPA 180.1	Turbidity
108.112	001	EPA 200.7	Boron
108.112	002	EPA 200.7	Calcium
108.112	004	EPA 200.7	Magnesium
108.112	005	EPA 200.7	Potassium
108.112	006	EPA 200.7	Silica
108.112	007	EPA 200.7	Sodium
108.120	001	EPA 300.0	Bromide
108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite, Total
108.120	007	EPA 300.0	Phosphate, Ortho
108.120	008	EPA 300.0	Sulfate
108.130	001	EPA 305.1	Acidity
108.140	001	EPA 310.1	Alkalinity
108.172	001	EPA 330.3	Chlorine Residual, Total
108.181	001	EPA 335.2	Cyanide, Total

108.191	001	EPA 340.2	Fluoride
108.201	001	EPA 350.2	Ammonia
108.212	001	EPA 351.3	Kjeldahl Nitrogen
108.234	001	EPA 353.3	Nitrate-nitrite, Total
108.235	001	EPA 353.3	Nitrate calc.
108.262	001	EPA 365.2	Phosphate, Ortho
108.263	001	EPA 365.2	Phosphorus, Total
108.270	001	EPA 370.1	Dissolved Silica
108.290	001	EPA 376.1	Sulfide
108.291	001	EPA 376.2	Sulfide
108.300	001	EPA 377.1	Sulfite
108.310	001	EPA 405.1	Biochemical Oxygen Demand
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.330	001	EPA 413.1	Oil and Grease
108.340	001	EPA 415.1	Total Organic Carbon
108.350	001	EPA 418.1	Total Recoverable Petroleum Hydrocarbons
108.360	001	EPA 420.1	Phenols, Total
108.370	001	EPA 425.1	Surfactants
108.380	001	EPA 1664	Oil and Grease
108.390	001	SM2130B	Turbidity
108.400	001	SM2310B	Acidity
108.410	001	SM2320B	Alkalinity
108.420	001	SM2340B	Hardness (calc.)
108.421	001	SM2340C	Hardness
108.430	001	SM2510B	Conductivity
108.440	001	SM2540B	Residue, Total
108.441	001	SM2540C	Residue, Filterable
108.442	001	SM2540D	Residue, Non-filterable
108.443	001	SM2540F	Residue, Settleable
108.480	001	SM4500-F C	Fluoride
108.490	001	SM4500-H+ B	pH
108.590	001	SM5210B	Biochemical Oxygen Demand
108.602	001	SM5220D	Chemical Oxygen Demand
108.610	001	SM5310B	Total Organic Carbon
108.630	001	SM5520B	Oil and Grease

109 - Toxic Chemical Elements of Wastewater

109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	003	EPA 200.7	Arsenic
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium

109.010	007	EPA 200.7	Cadmium
109.010	009	EPA 200.7	Chromium
109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	019	EPA 200.7	Selenium
109.010	021	EPA 200.7	Silver
109.010	023	EPA 200.7	Thallium
109.010	024	EPA 200.7	Tin
109.010	025	EPA 200.7	Titanium
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium
109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc
109.104	001	EPA 218.6	Chromium (VI)

110 - Volatile Organic Chemistry of Wastewater

110.040	001	EPA 624	Benzene
110.040	002	EPA 624	Bromodichloromethane
110.040	003	EPA 624	Bromoform
110.040	004	EPA 624	Bromomethane
110.040	005	EPA 624	Carbon Tetrachloride

110.040	006	EPA 624	Chlorobenzene
110.040	007	EPA 624	Chloroethane
110.040	008	EPA 624	2-Chloroethyl Vinyl Ether
110.040	009	EPA 624	Chloroform
110.040	010	EPA 624	Chloromethane
110.040	011	EPA 624	Dibromochloromethane
110.040	012	EPA 624	1,2-Dichlorobenzene
110.040	013	EPA 624	1,3-Dichlorobenzene
110.040	014	EPA 624	1,4-Dichlorobenzene
110.040	015	EPA 624	1,1-Dichloroethane
110.040	016	EPA 624	1,2-Dichloroethane
110.040	017	EPA 624	1,1-Dichloroethene
110.040	018	EPA 624	trans-1,2-Dichloroethene
110.040	019	EPA 624	1,2-Dichloropropane
110.040	020	EPA 624	cis-1,3-Dichloropropene
110.040	021	EPA 624	trans-1,3-Dichloropropene
110.040	022	EPA 624	Ethylbenzene
110.040	023	EPA 624	Methylene Chloride
110.040	024	EPA 624	1,1,2,2-Tetrachloroethane
110.040	025	EPA 624	Tetrachloroethene
110.040	026	EPA 624	Toluene
110.040	027	EPA 624	1,1,1-Trichloroethane
110.040	028	EPA 624	1,1,2-Trichloroethane
110.040	029	EPA 624	Trichloroethene
110.040	030	EPA 624	Trichlorofluoromethane
110.040	031	EPA 624	Vinyl Chloride
110.040	042	EPA 624	Oxygenates

111 - Semi-volatile Organic Chemistry of Wastewater

111.100	001	EPA 625	Acenaphthene
111.100	002	EPA 625	Acenaphthylene
111.100	003	EPA 625	Anthracene
111.100	004	EPA 625	Benzidine
111.100	005	EPA 625	Benz(a)anthracene
111.100	006	EPA 625	Benzo(b)fluoranthene
111.100	007	EPA 625	Benzo(k)fluoranthene
111.100	008	EPA 625	Benzo(g,h,i)perylene
111.100	009	EPA 625	Benzo(a)pyrene
111.100	010	EPA 625	Benzyl Butyl Phthalate
111.100	011	EPA 625	Bis(2-chloroethoxy)methane
111.100	012	EPA 625	Bis(2-chloroethyl) Ether
111.100	013	EPA 625	Bis(2-chloroisopropyl) Ether

111.100	014	EPA 625	Di(2-ethylhexyl) Phthalate
111.100	015	EPA 625	4-Bromophenyl Phenyl Ether
111.100	016	EPA 625	4-Chloro-3-methylphenol
111.100	017	EPA 625	2-Chloronaphthalene
111.100	018	EPA 625	2-Chlorophenol
111.100	019	EPA 625	4-Chlorophenyl Phenyl Ether
111.100	020	EPA 625	Chrysene
111.100	021	EPA 625	Dibenz(a,h)anthracene
111.100	022	EPA 625	1,2-Dichlorobenzene
111.100	023	EPA 625	1,3-Dichlorobenzene
111.100	024	EPA 625	1,4-Dichlorobenzene
111.100	025	EPA 625	3,3'-Dichlorobenzidine
111.100	026	EPA 625	2,4-Dichlorophenol
111.100	027	EPA 625	Diethyl Phthalate
111.100	028	EPA 625	2,4-Dimethylphenol
111.100	029	EPA 625	Dimethyl Phthalate
111.100	030	EPA 625	Di-n-butyl phthalate
111.100	031	EPA 625	Di-n-octyl phthalate
111.100	032	EPA 625	2,4-Dinitrophenol
111.100	033	EPA 625	2,4-Dinitrotoluene
111.100	034	EPA 625	2,6-Dinitrotoluene
111.100	035	EPA 625	Fluoranthene
111.100	036	EPA 625	Fluorene
111.100	037	EPA 625	Hexachlorobenzene
111.100	038	EPA 625	Hexachlorobutadiene
111.100	039	EPA 625	Hexachlorocyclopentadiene
111.100	040	EPA 625	Hexachloroethane
111.100	041	EPA 625	Indeno(1,2,3-c,d)pyrene
111.100	042	EPA 625	Isophorone
111.100	043	EPA 625	2-Methyl-4,6-dinitrophenol
111.100	044	EPA 625	Naphthalene
111.100	045	EPA 625	Nitrobenzene
111.100	046	EPA 625	2-Nitrophenol
111.100	047	EPA 625	4-Nitrophenol
111.100	048	EPA 625	N-nitrosodimethylamine
111.100	049	EPA 625	N-nitrosodi-n-propylamine
111.100	050	EPA 625	N-nitrosodiphenylamine
111.100	051	EPA 625	Pentachlorophenol
111.100	052	EPA 625	Phenanthrene
111.100	053	EPA 625	Phenol
111.100	054	EPA 625	Pyrene

111.100	055	EPA 625	1,2,4-Trichlorobenzene
111.100	056	EPA 625	2,4,6-Trichlorophenol
111.170	001	EPA 608	Aldrin
111.170	002	EPA 608	a-BHC
111.170	003	EPA 608	b-BHC
111.170	004	EPA 608	d-BHC
111.170	005	EPA 608	g-BHC (Lindane)
111.170	006	EPA 608	Chlordane
111.170	007	EPA 608	4,4'-DDD
111.170	008	EPA 608	4,4'-DDE
111.170	009	EPA 608	4,4'-DDT
111.170	010	EPA 608	Dieldrin
111.170	011	EPA 608	Endosulfan I
111.170	012	EPA 608	Endosulfan II
111.170	013	EPA 608	Endosulfan Sulfate
111.170	014	EPA 608	Endrin
111.170	015	EPA 608	Endrin Aldehyde
111.170	016	EPA 608	Heptachlor
111.170	017	EPA 608	Heptachlor Epoxide
111.170	018	EPA 608	Toxaphene
111.170	019	EPA 608	PCB-1016
111.170	020	EPA 608	PCB-1221
111.170	021	EPA 608	PCB-1232
111.170	022	EPA 608	PCB-1242
111.170	023	EPA 608	PCB-1248
111.170	024	EPA 608	PCB-1254
111.170	025	EPA 608	PCB-1260
111.170	031	EPA 608	PCBs

114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium

114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.103	001	EPA 7196A	Chromium (VI)
114.106	001	EPA 7199	Chromium (VI)
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury
114.222	001	EPA 9014	Cyanide
114.230	001	EPA 9034	Sulfides, Total
114.240	001	EPA 9040B	Corrosivity - pH Determination
114.241	001	EPA 9045C	Corrosivity - pH Determination
114.250	001	EPA 9056	Fluoride
115 - Extraction Test of Hazardous Waste			
115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
115.030	001	CCR Chapter11, Article 5, Appendix II	Waste Extraction Test (WET)
115.040	001	EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)
116 - Volatile Organic Chemistry of Hazardous Waste			
116.010	001	EPA 8011	1,2-Dibromoethane
116.010	002	EPA 8011	Dibromochloropropane
116.020	011	EPA 8015B	Ethylene Glycol
116.030	001	EPA 8015B	Gasoline-range Organics
116.040	002	EPA 8021B	Benzene
116.040	039	EPA 8021B	Ethylbenzene
116.040	041	EPA 8021B	Methyl tert-butyl Ether (MTBE)

116.040	047	EPA 8021B	Toluene
116.040	056	EPA 8021B	Xylenes, Total
116.080	001	EPA 8260B	Acetone
116.080	002	EPA 8260B	Acetonitrile
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	005	EPA 8260B	Allyl Alcohol
116.080	006	EPA 8260B	Allyl Chloride
116.080	007	EPA 8260B	Benzene
116.080	009	EPA 8260B	Bromoacetone
116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform
116.080	013	EPA 8260B	Bromomethane
116.080	014	EPA 8260B	n-Butyl Alcohol
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform
116.080	022	EPA 8260B	Chloromethane
116.080	023	EPA 8260B	Chloroprene
116.080	024	EPA 8260B	3-Chloropropionitrile
116.080	025	EPA 8260B	Crotonaldehyde
116.080	026	EPA 8260B	Dibromochloromethane
116.080	027	EPA 8260B	Dibromochloropropane
116.080	028	EPA 8260B	1,2-Dibromoethane
116.080	030	EPA 8260B	Dibromomethane
116.080	031	EPA 8260B	1,2-Dichlorobenzene
116.080	032	EPA 8260B	1,3-Dichlorobenzene
116.080	033	EPA 8260B	1,4-Dichlorobenzene
116.080	034	EPA 8260B	cis-1,4-Dichloro-2-butene
116.080	035	EPA 8260B	trans-1,4-Dichloro-2-butene
116.080	036	EPA 8260B	Dichlorodifluoromethane
116.080	037	EPA 8260B	1,1-Dichloroethane
116.080	038	EPA 8260B	1,2-Dichloroethane
116.080	039	EPA 8260B	1,1-Dichloroethene
116.080	040	EPA 8260B	trans-1,2-Dichloroethene
116.080	041	EPA 8260B	cis-1,2-Dichloroethene
116.080	042	EPA 8260B	1,2-Dichloropropane

116.080	043	EPA 8260B	1,3-Dichloropropane
116.080	044	EPA 8260B	2,2-Dichloropropane
116.080	045	EPA 8260B	1,1-Dichloropropene
116.080	046	EPA 8260B	cis-1,3-Dichloropropene
116.080	047	EPA 8260B	trans-1,3-Dichloropropene
116.080	048	EPA 8260B	1,3-Dichloro-2-propanol
116.080	049	EPA 8260B	1,2,3,4-Diepoxybutane
116.080	050	EPA 8260B	1,4-Dioxane
116.080	053	EPA 8260B	Ethylbenzene
116.080	055	EPA 8260B	Ethyl Methacrylate
116.080	056	EPA 8260B	Hexachlorobutadiene
116.080	058	EPA 8260B	2-Hexanone (MBK)
116.080	059	EPA 8260B	Iodomethane
116.080	060	EPA 8260B	Isobutyl Alcohol
116.080	061	EPA 8260B	Malononitrile
116.080	062	EPA 8260B	Methacrylonitrile
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)
116.080	065	EPA 8260B	Methylene Chloride
116.080	066	EPA 8260B	Methyl Ethyl Ketone
116.080	067	EPA 8260B	Methyl Methacrylate
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)
116.080	069	EPA 8260B	Naphthalene
116.080	070	EPA 8260B	Nitrobenzene
116.080	072	EPA 8260B	N-nitrosodi-n-butylamine
116.080	074	EPA 8260B	Pentachloroethane
116.080	075	EPA 8260B	Pentafluorobenzene
116.080	076	EPA 8260B	2-Picoline
116.080	078	EPA 8260B	Propionitrile
116.080	079	EPA 8260B	N-propylamine
116.080	080	EPA 8260B	Pyridine
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene
116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane

116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total
116.080	096	EPA 8260B	tert-Amyl Methyl Ether (TAME)
116.080	097	EPA 8260B	tert-Butyl Alcohol (TBA)
116.080	098	EPA 8260B	Ethyl tert-butyl Ether (ETBE)
116.080	099	EPA 8260B	Bromobenzene
116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2-Chlorotoluene
116.080	104	EPA 8260B	4-Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene

117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.015	001	LUFT GC/MS	Diesel-range Total Petroleum Hydrocarbons
117.016	001	LUFT	Diesel-range Total Petroleum Hydrocarbons
117.017	001	EPA 418.1	TRPH Screening
117.110	001	EPA 8270C	Acenaphthene
117.110	002	EPA 8270C	Acenaphthylene
117.110	003	EPA 8270C	Acetophenone
117.110	004	EPA 8270C	2-Acetylaminofluorene
117.110	005	EPA 8270C	1-Acetyl-2-thiourea
117.110	006	EPA 8270C	4-Aminobiphenyl
117.110	007	EPA 8270C	Aniline
117.110	008	EPA 8270C	Anthracene
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	017	EPA 8270C	p-Benzoquinone
117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate
117.110	020	EPA 8270C	Bis(2-chloroethoxy)methane

117.110	021	EPA 8270C	Bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Di(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	025	EPA 8270C	Carbazole
117.110	026	EPA 8270C	4-Chloroaniline
117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether
117.110	032	EPA 8270C	Chrysene
117.110	033	EPA 8270C	2-Cyclohexyl-4,6-dinitrophenol
117.110	034	EPA 8270C	2,4-Diaminotoluene
117.110	036	EPA 8270C	Dibenz(a,h)anthracene
117.110	037	EPA 8270C	Dibenzofuran
117.110	038	EPA 8270C	Dibenzo(a,e)pyrene
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	044	EPA 8270C	2,6-Dichlorophenol
117.110	045	EPA 8270C	Diethyl Phthalate
117.110	050	EPA 8270C	p-Dimethylaminoazobenzene
117.110	051	EPA 8270C	7,12-Dimethylbenz(a)anthracene
117.110	052	EPA 8270C	a,a-Dimethylphenethylamine
117.110	053	EPA 8270C	2,4-Dimethylphenol
117.110	054	EPA 8270C	Dimethyl Phthalate
117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	056	EPA 8270C	Di-n-octyl phthalate
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	063	EPA 8270C	Diphenylamine
117.110	064	EPA 8270C	1,2-Diphenylhydrazine
117.110	066	EPA 8270C	Ethyl Methanesulfonate
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene

117.110	072	EPA 8270C	Hexachloroethane
117.110	073	EPA 8270C	Hexachlorophene
117.110	074	EPA 8270C	Hexachloropropene
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	077	EPA 8270C	Isosafrole
117.110	078	EPA 8270C	Maleic Anhydride
117.110	079	EPA 8270C	3-Methylcholanthrene
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	082	EPA 8270C	Methyl Methanesulfonate
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	085	EPA 8270C	3-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	087	EPA 8270C	Naphthalene
117.110	088	EPA 8270C	1,4-Naphthoquinone
117.110	089	EPA 8270C	1-Naphthylamine
117.110	090	EPA 8270C	2-Naphthylamine
117.110	091	EPA 8270C	Nicotine
117.110	092	EPA 8270C	2-Nitroaniline
117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol
117.110	098	EPA 8270C	N-nitrosodi-n-butylamine
117.110	099	EPA 8270C	N-nitrosodiethylamine
117.110	100	EPA 8270C	N-nitrosodimethylamine
117.110	101	EPA 8270C	N-nitrosodi-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine
117.110	103	EPA 8270C	N-nitrosomethylethylamine
117.110	104	EPA 8270C	N-nitrosomorpholine
117.110	105	EPA 8270C	N-nitrosopiperidine
117.110	106	EPA 8270C	N-nitrosopyrrolidine
117.110	107	EPA 8270C	5-Nitro-o-toluidine
117.110	108	EPA 8270C	Pentachlorobenzene
117.110	109	EPA 8270C	Pentachloronitrobenzene
117.110	110	EPA 8270C	Pentachlorophenol
117.110	111	EPA 8270C	Phenacetin
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol

117.110	116	EPA 8270C	2-Picoline
117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	122	EPA 8270C	Safrole
117.110	124	EPA 8270C	1,2,4,5-Tetrachlorobenzene
117.110	125	EPA 8270C	2,3,4,6-Tetrachlorophenol
117.110	128	EPA 8270C	o-Toluidine
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.110	132	EPA 8270C	1,3,5-Trinitrobenzene
117.111	025	EPA 8270C	Dimethoate
117.111	026	EPA 8270C	Dinoseb
117.111	036	EPA 8270C	Famphur
117.111	039	EPA 8270C	Isodrin
117.111	040	EPA 8270C	Kepone
117.111	054	EPA 8270C	Parathion Ethyl
117.111	055	EPA 8270C	Parathion Methyl
117.111	056	EPA 8270C	Phorate
117.111	058	EPA 8270C	Sulfotepp
117.111	061	EPA 8270C	O,O,O-triethyl Phosphorothioate
117.140	001	EPA 8310	Acenaphthene
117.140	002	EPA 8310	Acenaphthylene
117.140	003	EPA 8310	Anthracene
117.140	004	EPA 8310	Benz(a)anthracene
117.140	005	EPA 8310	Benzo(a)pyrene
117.140	006	EPA 8310	Benzo(b)fluoranthene
117.140	007	EPA 8310	Benzo(k)fluoranthene
117.140	008	EPA 8310	Benzo(g,h,i)perylene
117.140	009	EPA 8310	Chrysene
117.140	010	EPA 8310	Dibenz(a,h)anthracene
117.140	011	EPA 8310	Fluoranthene
117.140	012	EPA 8310	Fluorene
117.140	013	EPA 8310	Indeno(1,2,3-c,d)pyrene
117.140	014	EPA 8310	Naphthalene
117.140	015	EPA 8310	Phenanthrene
117.140	016	EPA 8310	Pyrene
117.170	001	EPA 8330	4-Amino-2,6-dinitrotoluene
117.170	002	EPA 8330	2-Amino-4,6-dinitrotoluene
117.170	003	EPA 8330	1,3-Dinitrobenzene
117.170	004	EPA 8330	2,4-Dinitrotoluene

117.170	005	EPA 8330	2,6-Dinitrotoluene
117.170	006	EPA 8330	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
117.170	007	EPA 8330	Methyl-2,4,6-trinitrophenylnitramine
117.170	008	EPA 8330	Nitrobenzene
117.170	009	EPA 8330	2-Nitrotoluene
117.170	010	EPA 8330	3-Nitrotoluene
117.170	011	EPA 8330	4-Nitrotoluene
117.170	012	EPA 8330	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
117.170	013	EPA 8330	1,3,5-Trinitrobenzene
117.170	014	EPA 8330	2,4,6-Trinitrotoluene
117.190	001	EPA 8332	Nitroglycerine
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC
117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)
117.210	010	EPA 8081A	Chlorobenzilate
117.210	011	EPA 8081A	Chloroneb
117.210	012	EPA 8081A	Chlorothalonil
117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT
117.210	016	EPA 8081A	Diallate
117.210	020	EPA 8081A	Dieldrin
117.210	021	EPA 8081A	Endosulfan I
117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate
117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	029	EPA 8081A	Hexachlorobenzene
117.210	033	EPA 8081A	Methoxychlor
117.210	039	EPA 8081A	Toxaphene
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232

117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260
117.220	008	EPA 8082	2-Chlorobiphenyl
117.220	009	EPA 8082	2,3-Dichlorobiphenyl
117.220	010	EPA 8082	2,2',5-Trichlorobiphenyl
117.220	011	EPA 8082	2,4',5-Trichlorobiphenyl
117.220	012	EPA 8082	2,2',3,5'-Tetrachlorobiphenyl
117.220	013	EPA 8082	2,2',5,5'-Tetrachlorobiphenyl
117.220	014	EPA 8082	2,3',4,4'-Tetrachlorobiphenyl
117.220	015	EPA 8082	2,2',3,4,5'-Pentachlorobiphenyl
117.220	016	EPA 8082	2,2',4,5,5'-Pentachlorobiphenyl
117.220	017	EPA 8082	2,3,3',4',6-Pentachlorobiphenyl
117.220	018	EPA 8082	2,2',3,4,4',5'-Hexachlorobiphenyl
117.220	019	EPA 8082	2,2',3,4,5,5'-Hexachlorobiphenyl
117.220	020	EPA 8082	2,2',3,5,5',6-Hexachlorobiphenyl
117.220	021	EPA 8082	2,2',4,4',5,5'-Hexachlorobiphenyl
117.220	022	EPA 8082	2,2',3,3',4,4',5-Heptachlorobiphenyl
117.220	023	EPA 8082	2,2',3,4,4',5,5'-Heptachlorobiphenyl
117.220	024	EPA 8082	2,2',3,4,4',5',6-Heptachlorobiphenyl
117.220	025	EPA 8082	2,2',3,4',5,5',6-Heptachlorobiphenyl
117.220	026	EPA 8082	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl
117.240	001	EPA 8141A	Atrazine
117.240	002	EPA 8141A	Azinphos Methyl
117.240	004	EPA 8141A	Chlorfenvinphos
117.240	005	EPA 8141A	Chlorpyrifos
117.240	006	EPA 8141A	Chlorpyrifos Methyl
117.240	007	EPA 8141A	Demeton-O
117.240	008	EPA 8141A	Demeton-S
117.240	009	EPA 8141A	Diazinon
117.240	010	EPA 8141A	Dimethoate
117.240	012	EPA 8141A	EPN
117.240	013	EPA 8141A	Ethion
117.240	014	EPA 8141A	Famphur
117.240	015	EPA 8141A	Malathion
117.240	016	EPA 8141A	Mevinphos
117.240	017	EPA 8141A	Naled
117.240	018	EPA 8141A	Parathion Ethyl
117.240	019	EPA 8141A	Parathion Methyl
117.240	020	EPA 8141A	Phorate

117.240	022	EPA 8141A	Ronnel
117.240	024	EPA 8141A	Sulfotepp
117.240	026	EPA 8141A	Thionazin
117.250	001	EPA 8151A	2,4-D
117.250	002	EPA 8151A	2,4-DB
117.250	003	EPA 8151A	2,4,5-T
117.250	004	EPA 8151A	2,4,5-TP
117.250	006	EPA 8151A	Dalapon
117.250	007	EPA 8151A	Dichlorprop
117.250	008	EPA 8151A	Dinoseb
117.250	009	EPA 8151A	MCPA
117.250	010	EPA 8151A	MCPP
117.250	011	EPA 8151A	4-Nitrophenol
117.250	012	EPA 8151A	Pentachlorophenol
117.250	013	EPA 8151A	Picloram
117.250	014	EPA 8151A	Dicamba
117.250	015	EPA 8151A	3,5-Dichlorobenzoic Acid
117.250	016	EPA 8151A	Acifluorfen
117.250	017	EPA 8151A	Bentazon
117.250	018	EPA 8151A	Chloramben
117.250	019	EPA 8151A	DCPA

120 - Physical Properties of Hazardous Waste

120.010	001	EPA 1010	Ignitability
120.040	001	Section 7.3 SW-846	Reactive Cyanide
120.050	001	Section 7.3 SW-846	Reactive Sulfide
120.070	001	EPA 9040B	Corrosivity - pH Determination
120.080	001	EPA 9045C	Corrosivity - pH Determination

State of Connecticut, Department of Public Health

Approved Environmental Laboratory

THIS IS TO CERTIFY THAT THE LABORATORY DESCRIBED BELOW HAS BEEN APPROVED BY THE STATE DEPARTMENT OF PUBLIC HEALTH PURSUANT TO APPLICABLE PROVISIONS OF THE PUBLIC HEALTH CODE AND GENERAL STATUTES OF CONNECTICUT, FOR MAKING THE EXAMINATIONS, DETERMINATIONS OR TESTS SPECIFIED BELOW WHICH HAVE BEEN AUTHORIZED IN WRITING BY THAT DEPARTMENT.

EMAX LABORATORIES, INC.

LOCATED AT 1835 West 205th Street IN Torrance, CA 90501

AND REGISTERED IN THE NAME OF KAM Y. PANG, PH.D.

THIS CERTIFICATE IS ISSUED IN THE NAME OF KAM Y. PANG, PH.D WHO HAS BEEN DESIGNATED

BY THE REGISTRANT TO BE IN CHARGE OF THE LABORATORY WORK COVERED BY THIS CERTIFICATE OF APPROVAL AS FOLLOWS:

DRINKING WATER, NON-POTABLE WATER/WASTEWATER, SOIL/SOLID WASTE
Examination for:
INORGANIC CHEMICALS
ORGANIC CHEMICALS

SEE COMPUTER PRINT-OUT FOR SPECIFIC TESTS APPROVED

THIS CERTIFICATE EXPIRES March 31, 2007 AND IS REVOCABLE FOR CAUSE BY THE STATE DEPARTMENT OF PUBLIC HEALTH

DATED AT HARTFORD, CONNECTICUT, THIS 7th DAY OF April 2005

Registration No.

PH-0239

Ellen J. Blaschinski

DIRECTOR, DIVISION OF ENVIRONMENTAL HEALTH

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

DIVISION OF ENVIRONMENTAL HEALTH
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

APPROVED ANALYTES REPORT

FOR ALL MATRICES

EMAX Laboratories, Inc.

CT-APP-NUM PH-0239

LOCATION

1835 W. 205TH STREET

Torrance CA 90501-

PHONE (310)-618-8889

REGISTERED OWNER/
AUTHORIZED AGENT Kam Y. Pang, Ph.D.

DIRECTOR Kam Y. Pang, Ph.D.

CO DIRECTOR(S)

APPROVED BY Jeffrey C. Curran

DATE 04/07/2005 10:52:58 AM

LABORATORY APPROVAL EXPIRATION DATE 03/31/2007

LABORATORY STATUS **APPROVED**

ANY QUESTIONS CONCERNING THIS DOCUMENT SHOULD BE ADDRESSED TO
THE ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM AT (860) 509-7389

DRINKING WATER (SDWA)

STATUS REPORTED ON 04/07/2005

SOC: REGULATED SYNTHETIC ORGANIC CHEMICAL
WITH MINIMUM MDL REQUIREMENTS

ANALYTE NAME

PHYSICALS

PH

TURBIDITY

CONDUCTIVITY

MINERALS

ALKALINITY

CHLORIDE

FLUORIDE

HARDNESS, TOTAL

SULFATE

NUTRIENTS

NITRATE

NITRITE

METALS

ALUMINUM

ANTIMONY

ARSENIC

BARIUM

BERYLLIUM

CADMIUM

CHROMIUM

COPPER

IRON

LEAD

MANGANESE

MERCURY

NICKEL

SELENIUM

SILVER

THALLIUM

ZINC

RESIDUE

TOTAL DISSOLVED SOLIDS

DEMANDS

TOTAL ORGANIC CARBON

MISCELLANEOUS

FOAMING AGENTS (MBAS)

INORGANIC DISINFECTION BY-PRODUCTS

BROMATE

BROMIDE

CHLORATE

PERCHLORATE

THMs & VOCs

VOLATILE ORGANICS - 524.2 (SOC)

1,2 - DIBROMO-3-CHLOROPROPANE (DBCP) (SOC)

TOTAL TRIHALOMETHANES 524.2 (SOC)

ETHYLENE DIBROMIDE (EDB) (SOC)

NON-POTABLE WATER/ WASTEWATER

STATUS REPORTED ON 04/07/2005

ANALYTE NAME

PHYSICALS

COLOR

PH

TURBIDITY

CONDUCTIVITY

MINERALS

ACIDITY

ALKALINITY

CHLORIDE

CHLORINE, TOTAL & FREE RESIDUAL

CHLORINE, FREE RESIDUAL

FLUORIDE

HARDNESS, TOTAL

SILICA

SULFATE

SULFIDE

SULFITE

NUTRIENTS

AMMONIA

KJELDAHL NITROGEN

NITRATE

NITRITE

O-PHOSPHATE

TOTAL PHOSPHOROUS

METALS

CALCIUM

CHROMIUM - Hexavalent

MAGNESIUM

POTASSIUM

SODIUM

RESIDUE

TOTAL RESIDUE (SOLIDS)

TOTAL DISSOLVED SOLIDS

TOTAL SUSPENDED SOLIDS (non-filterable)

DEMANDS

BOD

COD

TOTAL ORGANIC CARBON

MISCELLANEOUS

CYANIDE (TOTAL)

PHENOLICS

FOAMING AGENTS (MBAS)

INORGANIC DISINFECTION BY-PRODUCTS

BROMIDE

SOLVENTS

OIL AND GREASE

TOTAL PETROLEUM HYDROCARBONS

NON-POTABLE WATER\WASTEWATER ORG.

VOLATILE ORGANICS (ALL)

SOLID WASTE/SOIL

STATUS REPORTED ON 04/07/2005

ANALYTE NAME

PHYSICALS

PH

MINERALS

SULFIDE

METALS

ANTIMONY
ARSENIC
BARIUM
BERYLLIUM
CADMIUM
CHROMIUM
CHROMIUM - Hexavalent
COBALT
COPPER
LEAD
MERCURY
MOLYBDENUM
NICKEL
SELENIUM
SILVER
THALLIUM
VANADIUM
ZINC

MISCELLANEOUS

CYANIDE (TOTAL)
IGNITABILITY
CORROSIVITY
TCLP LEACH (1311)
SPLP LEACH (1312)
REACTIVITY

PCBs

AROCLOR 1016/1242
AROCLOR 1221
AROCLOR 1232
AROCLOR 1248
AROCLOR 1254
AROCLOR 1260
PCB IN OIL

HERBICIDES

DALAPON
DICAMBA
DINOSEB
PENTACHLOROPHENOL
2,4-D
2,4-DB
2,4,5-T
2,4,5- TP (SILVEX)
DICHLOROPROP
MCPA
MCPP
4-NITROPHENOL

SOLID WASTE ORGANICS

VOLATILE ORGANICS (SW)
ACID EXTRACTABLES (PHENOLS) (SW)
BENZIDINES (SW)
PHTHALATES (SW)
NITROSOAMINES (SW)
ORGANOCHLORINE PESTICIDES (SW)
NITROAROMATICS & CYCLIC KETONES (SW)
PAH's (SW)
HALOETHERS (SW)
CHLORINATED HYDROCARBONS (SW)
CARBAZOLE (SW)
DIBENZOFURAN (SW)

END OF SECTION FOR EMAX Laboratories, Inc.

REPORT PROFILE

Report Printed on:	04/07/2005 10:52:58 AM
Report Name:	APPROVED TESTS_ALT_NEW
Printed by:	jeff
Report published from:	CERTIFICATION REPORTS screen #3

lab code = ID1105P
test code = *
matrix code = *
matrix selection = ALL OR SOME MATRICES SELECTED
certifications approved or provisional on 04/07/2005

THIS IS THE LAST PAGE OF THE REPORT

FLORIDA DEPARTMENT OF HEALTH

State of Florida
Department of Health, Bureau of Laboratories

This is to certify that

E87825
EMAX LABORATORIES, INC.
1835 W. 205TH STREET
TORRANCE, CA 90501

has complied with Florida Administrative Code 64E-1,
for the examination of Environmental samples in the following categories

DRINKING WATER - GROUP II UNREGULATED CONTAMINANTS, DRINKING WATER - OTHER REGULATED CONTAMINANTS, DRINKING WATER - PRIMARY INORGANIC CONTAMINANTS, DRINKING WATER - SECONDARY INORGANIC CONTAMINANTS, DRINKING WATER - SYNTHETIC ORGANIC CONTAMINANTS, NON-POTABLE WATER - GENERAL CHEMISTRY, SOLID AND CHEMICAL MATERIALS - EXTRACTABLE ORGANICS, SOLID AND CHEMICAL MATERIALS - PESTICIDES-HERBICIDES-PCB'S, SOLID AND CHEMICAL MATERIALS - GENERAL CHEMISTRY, SOLID AND CHEMICAL MATERIALS - METALS, SOLID AND CHEMICAL MATERIALS - VOLATILE ORGANICS

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

EFFECTIVE July 01, 2006 THROUGH June 30, 2007

Dian Sharma, Ph.D.
Acting Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1697, 7/04
NON-TRANSFERABLE E87825-02-7/1/2006

Laboratory Scope of Accreditation

Attachment to Certificate #: E87825-02, expiration date June 30, 2007. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87825 **EPA Lab Code: CA00029** **(310) 618-8889**

E87825
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
1,1,1-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
1,1,2,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
1,1,2-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
1,1-Dichloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
1,1-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
1,1-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
1,2,3-Trichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
1,2,3-Trichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
1,2,4-Trichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
1,2,4-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	12/4/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1	Synthetic Organic Contaminants	NELAP	1/2/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1	Synthetic Organic Contaminants	NELAP	1/2/2003
1,2-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
1,2-Dichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
1,2-Dichloropropane	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
1,3,5-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
1,3-Dichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
1,3-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
1,4-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
2,2-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
2-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
4-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
4-Isopropyltoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Benzene	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
Bromate	EPA 300.1	Primary Inorganic Contaminants	NELAP	12/4/2003
Bromobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Bromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Bromodichloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Bromoform	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Carbon tetrachloride	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
Chlorate	EPA 300.0	Secondary Inorganic Contaminants	NELAP	12/4/2003
Chloride	EPA 300.0	Secondary Inorganic Contaminants	NELAP	1/2/2003
Chloride	SM 4110 B	Secondary Inorganic Contaminants	NELAP	1/2/2003
Chlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
Chloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87825-02, expiration date June 30, 2007. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87825 **EPA Lab Code: CA00029** **(310) 618-8889**

E87825
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chloroform	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
cis-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	12/4/2003
cis-1,3-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Conductivity	SM 2510 B	Primary Inorganic Contaminants	NELAP	1/2/2003
Dibromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Dibromomethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Dichlorodifluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Dichloromethane (DCM, Methylene chloride)	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
Ethylbenzene	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
Fluoride	EPA 300.0	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	1/2/2003
Fluoride	SM 4110 B	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	1/2/2003
Hexachlorobutadiene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Isopropylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Methyl bromide (Bromomethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Methyl chloride (Chloromethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Methyl tert-butyl ether (MTBE)	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Naphthalene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
n-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Nitrate	SM 4110 B	Primary Inorganic Contaminants	NELAP	1/2/2003
Nitrate as N	EPA 300.0	Primary Inorganic Contaminants	NELAP	1/2/2003
Nitrite	SM 4110 B	Primary Inorganic Contaminants	NELAP	1/2/2003
Nitrite as N	EPA 300.0	Primary Inorganic Contaminants	NELAP	1/2/2003
Nitrobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
n-Propylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Perchlorate	EPA 300.0	Secondary Inorganic Contaminants	NELAP	1/2/2003
Perchlorate	EPA 314.0	Secondary Inorganic Contaminants	NELAP	12/4/2003
pH	SM 4500-H B	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	1/2/2003
Residue-filterable (TDS)	SM 2540 C	Secondary Inorganic Contaminants	NELAP	1/2/2003
sec-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Styrene	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
Sulfate	EPA 300.0	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	1/2/2003

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State Laboratory ID: E87825 **EPA Lab Code: CA00029** **(310) 618-8889**

E87825
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
tert-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Tetrachloroethylene (Perchloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
Toluene	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
Total nitrate-nitrite	EPA 300.0	Primary Inorganic Contaminants	NELAP	1/2/2003
Total nitrate-nitrite	SM 4110 B	Primary Inorganic Contaminants	NELAP	1/2/2003
Total trihalomethanes	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
trans-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
trans-1,3-Dichloropropylene	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Trichloroethene (Trichloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
Trichlorofluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	1/2/2003
Turbidity	EPA 180.1	Secondary Inorganic Contaminants	NELAP	1/2/2003
Vinyl chloride	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003
Xylene (total)	EPA 524.2	Other Regulated Contaminants	NELAP	1/2/2003

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State Laboratory ID: E87825 **EPA Lab Code: CA00029** **(310) 618-8889**

E87825
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Acidity, as CaCO3	EPA 305.1	General Chemistry	NELAP	1/2/2003
Acidity, as CaCO3	SM 2310 B (4A)	General Chemistry	NELAP	1/2/2003
Alkalinity as CaCO3	EPA 310.1	General Chemistry	NELAP	1/2/2003
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	1/2/2003
Amenable cyanide	EPA 335.1	General Chemistry	NELAP	12/4/2003
Ammonia as N	EPA 350.2	General Chemistry	NELAP	1/2/2003
Biochemical oxygen demand	EPA 405.1	General Chemistry	NELAP	1/2/2003
Bromide	EPA 300.0	General Chemistry	NELAP	1/2/2003
Chemical oxygen demand	EPA 410.4	General Chemistry	NELAP	1/2/2003
Chloride	EPA 300.0	General Chemistry	NELAP	1/2/2003
Chromium VI	EPA 218.6	General Chemistry	NELAP	12/4/2003
Color	EPA 110.2	General Chemistry	NELAP	12/4/2003
Conductivity	EPA 120.1	General Chemistry	NELAP	1/2/2003
Conductivity	SM 2510 B	General Chemistry	NELAP	1/2/2003
Fluoride	EPA 300.0	General Chemistry	NELAP	1/2/2003
Hardness	EPA 130.1	General Chemistry	NELAP	1/2/2003
Hardness	SM 2340 B	General Chemistry	NELAP	1/2/2003
Hardness	SM 2340 C	General Chemistry	NELAP	1/2/2003
Kjeldahl nitrogen - total	EPA 351.3	General Chemistry	NELAP	1/2/2003
Nitrate as N	EPA 300.0	General Chemistry	NELAP	1/2/2003
Nitrite as N	EPA 300.0	General Chemistry	NELAP	1/2/2003
Oil & Grease	EPA 1664	General Chemistry	NELAP	1/2/2003
Oil & Grease	EPA 413.1	General Chemistry	NELAP	1/2/2003
Orthophosphate as P	EPA 300.0	General Chemistry	NELAP	1/2/2003
Orthophosphate as P	EPA 365.2	General Chemistry	NELAP	1/2/2003
pH	EPA 150.1	General Chemistry	NELAP	1/2/2003
pH	SM 4500-H B	General Chemistry	NELAP	1/2/2003
Phosphorus, total	EPA 365.2	General Chemistry	NELAP	1/2/2003
Residue-filterable (TDS)	EPA 160.1	General Chemistry	NELAP	1/2/2003
Residue-filterable (TDS)	SM 2540 C	General Chemistry	NELAP	1/2/2003
Residue-nonfilterable (TSS)	EPA 160.2	General Chemistry	NELAP	1/2/2003
Residue-nonfilterable (TSS)	SM 2540 D	General Chemistry	NELAP	1/2/2003
Residue-settleable	SM 2540 F	General Chemistry	NELAP	1/2/2003
Residue-total	EPA 160.3	General Chemistry	NELAP	1/2/2003
Residue-total	SM 2540 B	General Chemistry	NELAP	1/2/2003
Silica-dissolved	EPA 370.1	General Chemistry	NELAP	1/2/2003

Laboratory Scope of Accreditation

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State Laboratory ID: E87825 **EPA Lab Code:** CA00029 **(310) 618-8889**

E87825
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Sulfate	EPA 300.0	General Chemistry	NELAP	1/2/2003
Sulfide	EPA 376.2	General Chemistry	NELAP	12/4/2003
Sulfite-SO3	EPA 377.1	General Chemistry	NELAP	12/4/2003
Surfactants - MBAS	EPA 425.1	General Chemistry	NELAP	12/4/2003
Total cyanide	EPA 335.2	General Chemistry	NELAP	12/4/2003
Total nitrate-nitrite	EPA 300.0	General Chemistry	NELAP	1/2/2003
Total organic carbon	EPA 415.1	General Chemistry	NELAP	1/2/2003
Total phenolics	EPA 420.1	General Chemistry	NELAP	12/4/2003
Total recoverable petroleum hydrocarbons (TRPH)	EPA 418.1	General Chemistry	NELAP	1/2/2003
Total residual chlorine	EPA 330.3	General Chemistry	NELAP	1/2/2003
Turbidity	EPA 180.1	General Chemistry	NELAP	1/2/2003
Turbidity	SM 2130 B	General Chemistry	NELAP	1/2/2003

Laboratory Scope of Accreditation

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State Laboratory ID: E87825 **EPA Lab Code: CA00029** **(310) 618-8889**

E87825
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	1/2/2003
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	1/2/2003
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	12/4/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8011	Volatile Organics	NELAP	1/2/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8011	Volatile Organics	NELAP	1/2/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	1/2/2003
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	1/2/2003
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	12/4/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	1/2/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	1/2/2003
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	1/2/2003
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	1/2/2003
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	1/2/2003
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	1/2/2003
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	1/2/2003
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	1/2/2003
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003

Laboratory Scope of Accreditation

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State Laboratory ID: E87825 **EPA Lab Code: CA00029** **(310) 618-8889**

E87825
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	1/2/2003
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
2,3-Dichlorobiphenyl (BZ 5)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	1/2/2003
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	1/2/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	1/2/2003
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	1/2/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	1/2/2003
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	1/2/2003
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	1/2/2003
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	1/2/2003
2-Chlorobiphenyl (BZ 1)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	1/2/2003

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E87825
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	1/2/2003
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	12/4/2003
2-Hexanone	EPA 8260	Volatile Organics	NELAP	1/2/2003
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	1/2/2003
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	1/2/2003
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	1/2/2003
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	1/2/2003
2-Picoline (2-Methylpyridine)	EPA 8260	Volatile Organics	NELAP	1/2/2003
3,5-Dichlorobenzoic acid	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	12/4/2003
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	1/2/2003
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	1/2/2003
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	1/2/2003
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	1/2/2003
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	1/2/2003
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	1/2/2003
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	1/2/2003
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	1/2/2003
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	1/2/2003
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	12/4/2003
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	1/2/2003
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	1/2/2003
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	1/2/2003
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	1/2/2003
4-Nitrophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	12/4/2003
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	1/2/2003
5-Hydroxydicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	1/2/2003
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	1/2/2003

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	1/2/2003
Acenaphthene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Acenaphthene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Acetone	EPA 8260	Volatile Organics	NELAP	1/2/2003
Acetonitrile	EPA 8260	Volatile Organics	NELAP	1/2/2003
Acetophenone	EPA 8270	Extractable Organics	NELAP	1/2/2003
Acifluorfen	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	12/4/2003
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	1/2/2003
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	1/2/2003
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	1/2/2003
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Aniline	EPA 8270	Extractable Organics	NELAP	1/2/2003
Anthracene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Anthracene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Antimony	EPA 6010	Metals	NELAP	1/2/2003
Antimony	EPA 7041	Metals	NELAP	1/2/2003
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Arsenic	EPA 6010	Metals	NELAP	1/2/2003
Arsenic	EPA 7060	Metals	NELAP	1/2/2003
Atrazine	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	12/4/2003
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Barium	EPA 6010	Metals	NELAP	1/2/2003
Bentazon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	12/4/2003
Benzene	EPA 8021	Volatile Organics	NELAP	1/2/2003
Benzene	EPA 8260	Volatile Organics	NELAP	1/2/2003
Benzidine	EPA 8270	Extractable Organics	NELAP	12/4/2003

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Benzoic acid	EPA 8270	Extractable Organics	NELAP	1/2/2003
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	1/2/2003
Beryllium	EPA 6010	Metals	NELAP	1/2/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
beta-Naphthylamine	EPA 8270	Extractable Organics	NELAP	1/2/2003
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	1/2/2003
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	1/2/2003
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	1/2/2003
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	1/2/2003
Bromoacetone	EPA 8260	Volatile Organics	NELAP	1/2/2003
Bromobenzene	EPA 8260	Volatile Organics	NELAP	12/4/2003
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
Bromoform	EPA 8260	Volatile Organics	NELAP	1/2/2003
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	1/2/2003
Cadmium	EPA 6010	Metals	NELAP	1/2/2003
Cadmium	EPA 7131	Metals	NELAP	1/2/2003
Carbazole	EPA 8270	Extractable Organics	NELAP	1/2/2003
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	1/2/2003
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	1/2/2003
Chloramben	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	12/4/2003
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Chlorfenvinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	1/2/2003
Chloroethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
Chloroform	EPA 8260	Volatile Organics	NELAP	1/2/2003

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Chloroprene	EPA 8260	Volatile Organics	NELAP	1/2/2003
Chlorpyrifos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Chlorpyrifos methyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Chromium	EPA 6010	Metals	NELAP	1/2/2003
Chromium VI	EPA 7196	General Chemistry	NELAP	1/2/2003
Chromium VI	EPA 7199	Metals	NELAP	1/2/2003
Chrysene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Chrysene	EPA 8310	Extractable Organics	NELAP	1/2/2003
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	1/2/2003
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	1/2/2003
cis-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	1/2/2003
Cobalt	EPA 6010	Metals	NELAP	1/2/2003
Copper	EPA 6010	Metals	NELAP	1/2/2003
Copper	EPA 7211	Metals	NELAP	1/2/2003
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Demeton-o	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Demeton-s	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Dibenz(a,h) anthracene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Dibenz(a,h) anthracene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Dibenzo(a,e) pyrene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	1/2/2003
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
Dibromomethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	12/4/2003
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	1/2/2003
Dimethoate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	1/2/2003
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	1/2/2003
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	1/2/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
EPN	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Ethion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	1/2/2003
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	1/2/2003
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	1/2/2003
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	1/2/2003
Famphur	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Fluoranthene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Fluoranthene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Fluorene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Fluorene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Fluoride	EPA 9056	General Chemistry	NELAP	1/2/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Hexachlorobenzene	EPA 8270	Extractable Organics,Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	1/2/2003
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics,Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	1/2/2003
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Ignitability	EPA 1010	General Chemistry	NELAP	1/2/2003
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	1/2/2003
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	1/2/2003
Isophorone	EPA 8270	Extractable Organics	NELAP	1/2/2003

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	12/4/2003
Isosafrole	EPA 8270	Extractable Organics	NELAP	1/2/2003
Lead	EPA 6010	Metals	NELAP	1/2/2003
Lead	EPA 7421	Metals	NELAP	1/2/2003
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Mercury	EPA 7470	Metals	NELAP	1/2/2003
Mercury	EPA 7471	Metals	NELAP	1/2/2003
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	1/2/2003
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	1/2/2003
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	1/2/2003
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	1/2/2003
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	1/2/2003
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Methyl tert-butyl ether (MTBE)	EPA 8021	Volatile Organics	NELAP	1/2/2003
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	1/2/2003
Methylene chloride	EPA 8260	Volatile Organics	NELAP	1/2/2003
Mevinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Molybdenum	EPA 6010	Metals	NELAP	1/2/2003
Naled	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Naphthalene	EPA 8260	Volatile Organics	NELAP	1/2/2003
Naphthalene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Naphthalene	EPA 8310	Extractable Organics	NELAP	1/2/2003
n-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	1/2/2003
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	12/4/2003
Nickel	EPA 6010	Metals	NELAP	1/2/2003
Nitrobenzene	EPA 8260	Volatile Organics	NELAP	1/2/2003
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	1/2/2003
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	1/2/2003
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	1/2/2003
n-Nitroso-di-n-butylamine	EPA 8260	Volatile Organics	NELAP	1/2/2003
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	1/2/2003
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	1/2/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87825-02, expiration date June 30, 2007. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87825 **EPA Lab Code: CA00029** **(310) 618-8889**

E87825
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	1/2/2003
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	1/2/2003
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	1/2/2003
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	1/2/2003
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	1/2/2003
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	12/4/2003
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	12/4/2003
o-Toluidine	EPA 8270	Extractable Organics	NELAP	1/2/2003
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Pentachloroethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
Pentachloronitrobenzene	EPA 8270	Extractable Organics,Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Pentachlorophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	12/4/2003
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
pH	EPA 9040	General Chemistry	NELAP	1/2/2003
pH	EPA 9045	General Chemistry	NELAP	1/2/2003
Phenacetin	EPA 8270	Extractable Organics	NELAP	1/2/2003
Phenanthrene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Phenanthrene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Phenol	EPA 8270	Extractable Organics	NELAP	1/2/2003
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Picloram	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	12/4/2003
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	1/2/2003
Pyrene	EPA 8270	Extractable Organics	NELAP	1/2/2003
Pyrene	EPA 8310	Extractable Organics	NELAP	1/2/2003
Pyridine	EPA 8260	Volatile Organics	NELAP	1/2/2003
Pyridine	EPA 8270	Extractable Organics	NELAP	1/2/2003
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	1/2/2003
Reactive cyanide	EPA 7.3.3.2	General Chemistry	NELAP	1/2/2003
Reactive sulfide	EPA 7.3.4.2	General Chemistry	NELAP	1/2/2003
Ronnel	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Safrole	EPA 8270	Extractable Organics	NELAP	1/2/2003
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	12/4/2003
Selenium	EPA 6010	Metals	NELAP	1/2/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87825-02, expiration date June 30, 2007. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87825 **EPA Lab Code: CA00029** **(310) 618-8889**

E87825
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Selenium	EPA 7740	Metals	NELAP	1/2/2003
Silver	EPA 6010	Metals	NELAP	1/2/2003
Silver	EPA 7761	Metals	NELAP	1/2/2003
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Styrene	EPA 8260	Volatile Organics	NELAP	12/4/2003
Sulfotepp	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Synthetic Precipitation Leaching Procedure	EPA 1312	General Chemistry	NELAP	1/2/2003
tert-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	12/4/2003
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	12/4/2003
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	1/2/2003
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	1/2/2003
Thallium	EPA 6010	Metals	NELAP	1/2/2003
Thallium	EPA 7841	Metals	NELAP	1/2/2003
Thionazin (Zinophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Toluene	EPA 8021	Volatile Organics	NELAP	1/2/2003
Toluene	EPA 8260	Volatile Organics	NELAP	1/2/2003
Total cyanide	EPA 9010	General Chemistry	NELAP	1/2/2003
Total cyanide	EPA 9010/9014	General Chemistry	NELAP	12/4/2003
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	1/2/2003
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	1/2/2003
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	1/2/2003
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	1/2/2003
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	1/2/2003
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	1/2/2003
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	1/2/2003
Vanadium	EPA 6010	Metals	NELAP	1/2/2003
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	1/2/2003
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	1/2/2003
Xylene (total)	EPA 8021	Volatile Organics	NELAP	1/2/2003
Xylene (total)	EPA 8260	Volatile Organics	NELAP	1/2/2003
Zinc	EPA 6010	Metals	NELAP	1/2/2003

STATE OF KANSAS

DEPARTMENT OF HEALTH AND ENVIRONMENT

CERTIFICATE

This is to certify that Certificate No. E-10272

EMAX Laboratories, Inc.
1835 W 205th Street
Torrance, CA 90501

has been accredited in accordance with K.S.A. 65-1,109a for performing environmental analyses for the parameters listed on the attached form. Continuous accreditation depends on successful, ongoing participation in the program. Clients are urged to verify with this agency the laboratory's certification status for particular methods and analytes.

EFFECTIVE DATE: 11/01/2006 EXPIRATION DATE: 10/31/2007

Secretary
Department of Health and Environment

Environmental Laboratory Certification Officers

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KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
ENVIRONMENTAL LABORATORY CERTIFICATION
DRINKING WATER CERTIFICATION - PARAMETER LIST

This certificate supersedes all previous certificates

EMAX Laboratories, Inc.
1835 W 205th Street
Torrance, CA 90501

Certificate Number: E-10272
Effective Date: 11/01/2006
Expiration Date: 10/31/2007
Reciprocity: CA

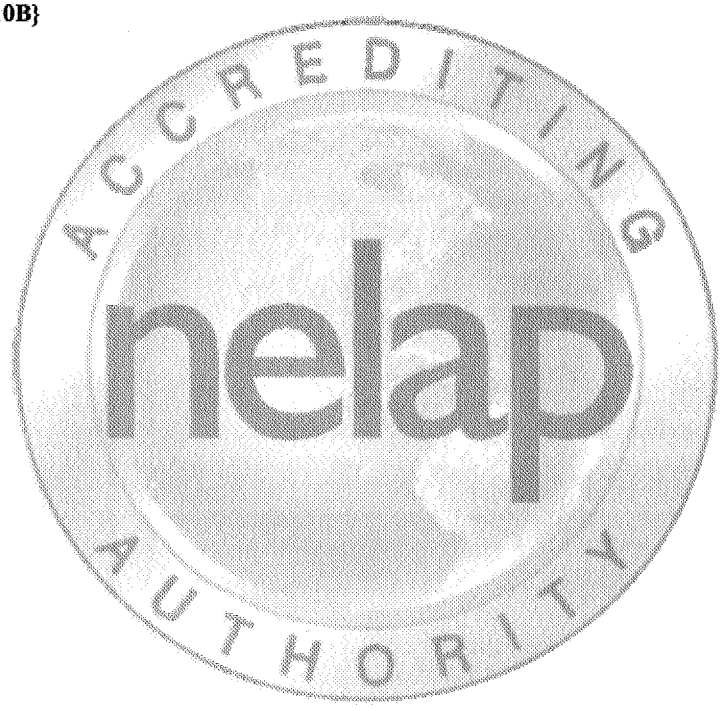
The laboratory listed above is hereby approved for environmental laboratory certification in accordance with K.S.A. 65-1,109a for performing drinking water analysis for the following parameters:

****DEMANDS**
Dissolved Organic Carbon {SM 5310B}
Total Organic Carbon {SM 5310B}

****INORGANIC**
Phosphate, Ortho {EPA 300.0}
Phosphate, Ortho {SM 4110B}

****METALS**
Aluminum {EPA 200.7}
Aluminum {EPA 200.8}
Antimony {EPA 200.8}
Arsenic {EPA 200.8}
Barium {EPA 200.7}
Barium {EPA 200.8}
Beryllium {EPA 200.7}
Beryllium {EPA 200.8}
Cadmium {EPA 200.7}
Cadmium {EPA 200.8}
Calcium {EPA 200.7}
Chromium {EPA 200.7}
Chromium {EPA 200.8}
Copper {EPA 200.7}
Copper {EPA 200.8}
Iron {EPA 200.7}
Lead {EPA 200.8}
Manganese {EPA 200.7}
Manganese {EPA 200.8}
Mercury {EPA 200.8}
Mercury {EPA 245.2}
Nickel {EPA 200.7}
Nickel {EPA 200.8}
Selenium {EPA 200.8}
Silica {EPA 200.7}
Silver {EPA 200.7}
Silver {EPA 200.8}
Sodium {EPA 200.7}
Thallium {EPA 200.8}
Zinc {EPA 200.7}
Zinc {EPA 200.8}

****MINERALS**
Alkalinity {SM 2320B}
Chloride {EPA 300.0}
Chloride {SM 4110B}
Fluoride {EPA 300.0}
Fluoride {SM 4110B}
Fluoride {SM 4500-F C}
Hardness {SM 2340B}
Hardness {SM 2340C}



NELAP-Recognized

Sulfate {EPA 300.0}
Sulfate {SM 4110B}

**MISCELLANEOUS
Bromate {EPA 300.1}
Bromide {EPA 300.0}
Chlorate {EPA 300.0}
Specific Conductance {SM 2510B}
Surfactants (MBAS) {SM 5540C}

**NUTRIENTS
Nitrate {EPA 300.0}
Nitrate {SM 4110B}
Nitrite {EPA 300.0}
Nitrite {SM 4110B}

**ORGANIC CHEMISTRY DBCP/EDB
{EPA 504.1} 1,2-Dibromo-3-Chloropropane (DBCP)
{EPA 504.1} 1,2-Dibromoethane (EDB, Ethylene dibromide)

**ORGANIC CHEMISTRY VOLATILES
{EPA 524.2} 1,1-Dichloroethylene
{EPA 524.2} 1,1,1-Trichloroethane
{EPA 524.2} 1,1,2-Trichloroethane
{EPA 524.2} 1,2-Dichlorobenzene
{EPA 524.2} 1,2-Dichloroethane
{EPA 524.2} 1,2-Dichloropropane
{EPA 524.2} 1,2,4-Trichlorobenzene
{EPA 524.2} 1,4-Dichlorobenzene
{EPA 524.2} Benzene
{EPA 524.2} Carbon Tetrachloride
{EPA 524.2} Chlorobenzene
{EPA 524.2} cis-1,2-Dichloroethylene
{EPA 524.2} Dichloromethane (Methylene chloride)
{EPA 524.2} Ethylbenzene
{EPA 524.2} Styrene
{EPA 524.2} Tetrachloroethylene
{EPA 524.2} Toluene
{EPA 524.2} trans-1,2-Dichloroethylene
{EPA 524.2} Trichloroethylene
{EPA 524.2} Vinyl Chloride
{EPA 524.2} Xylene

ACCREDITING nelap AUTHORITY
NELAP-Recognized

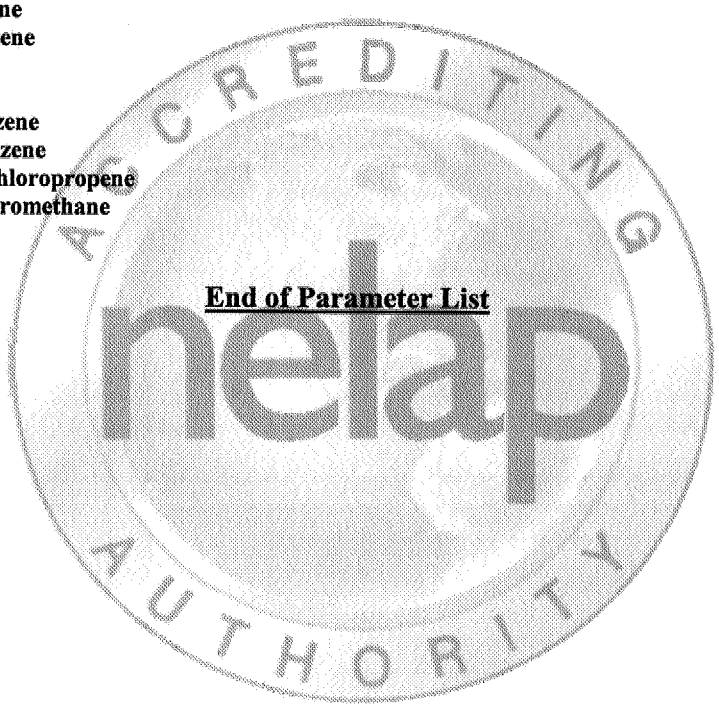
**RESIDUES
Residue, Filterable (TDS) {SM 2540C}

**TRIHALOMETHANES
{EPA 524.2} Bromodichloromethane
{EPA 524.2} Bromoform
{EPA 524.2} Chloroform
{EPA 524.2} Dibromochloromethane

**UNREGULATED ORGANIC COMPOUNDS
{EPA 524.2} 1,1-Dichloroethane
{EPA 524.2} 1,1-Dichloropropene
{EPA 524.2} 1,1,1,2-Tetrachloroethane
{EPA 524.2} 1,1,2,2-Tetrachloroethane
{EPA 524.2} 1,2,3-Trichlorobenzene
{EPA 524.2} 1,2,3-Trichloropropane
{EPA 524.2} 1,2,4-Trimethylbenzene
{EPA 524.2} 1,3-Dichlorobenzene

{EPA 524.2} 1,3-Dichloropropane
{EPA 524.2} 1,3,5-Trimethylbenzene
{EPA 524.2} 2-Chlorotoluene
{EPA 524.2} 2,2-Dichloropropane
{EPA 524.2} 4-Chlorotoluene
{EPA 524.2} 4-Isopropyltoluene
{EPA 524.2} Bromobenzene
{EPA 524.2} Bromochloromethane
{EPA 524.2} Bromomethane
{EPA 524.2} Chloroethane
{EPA 524.2} Chloromethane
{EPA 524.2} cis-1,3-Dichloropropene
{EPA 524.2} Dibromomethane
{EPA 524.2} Dichlorodifluoromethane
{EPA 524.2} Hexachlorobutadiene
{EPA 524.2} Isopropylbenzene
{EPA 524.2} Methyl-t-butyl ether
{EPA 524.2} n-Butylbenzene
{EPA 524.2} n-Propylbenzene
{EPA 524.2} Naphthalene
{EPA 524.2} Nitrobenzene
{EPA 524.2} sec-Butylbenzene
{EPA 524.2} tert-Butylbenzene
{EPA 524.2} trans-1,3-Dichloropropene
{EPA 524.2} Trichlorofluoromethane

End of Parameter List



NELAP-Recognized

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
ENVIRONMENTAL LABORATORY CERTIFICATION
WASTE WATER CERTIFICATION - PARAMETER LIST

This certificate supersedes all previous certificates

EMAX Laboratories, Inc.
1835 W 205th Street
Torrance, CA 90501

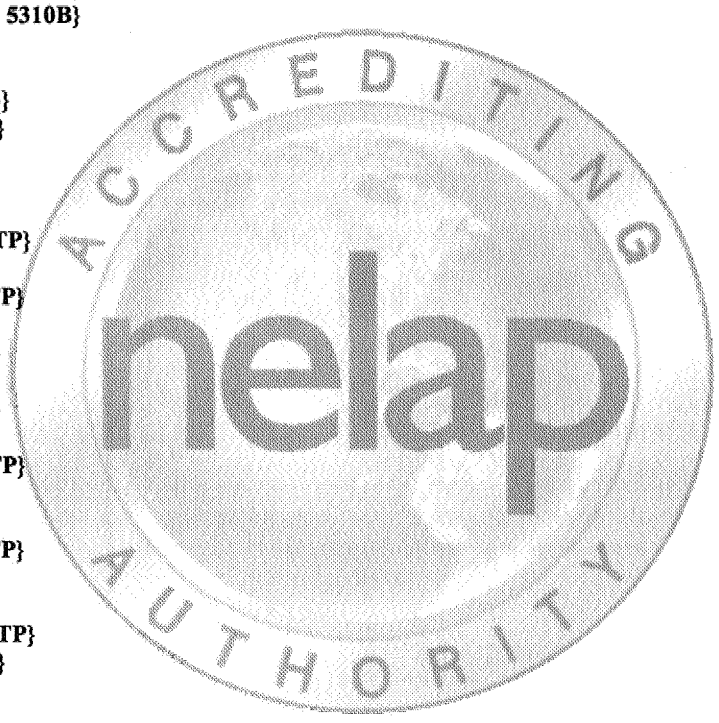
Certificate Number: E-10272
Effective Date: 11/01/2006
Expiration Date: 10/31/2007
Reciprocity: CA

The laboratory listed above is hereby approved for environmental laboratory certification in accordance with K.S.A. 65-1,109a for performing waste water analysis for the following parameters:

****DEMANDS**
BOD {EPA 405.1}
BOD {SM 5210B}
COD {EPA 410.4}
COD {SM 5220D}
Total Organic Carbon {EPA 415.1}
Total Organic Carbon {SM 5310B}

****INORGANIC**
Chlorine - total {EPA 330.3}
Cyanide, Total {EPA 335.2}

****METALS**
Aluminum {EPA 200.7}
Aluminum {EPA 200.8 - ATP}
Antimony {EPA 200.7}
Antimony {EPA 200.8 - ATP}
Arsenic {EPA 200.7}
Arsenic {EPA 200.8 - ATP}
Barium {EPA 200.7}
Barium {EPA 200.8 - ATP}
Beryllium {EPA 200.7}
Beryllium {EPA 200.8 - ATP}
Boron {EPA 200.7}
Cadmium {EPA 200.7}
Cadmium {EPA 200.8 - ATP}
Calcium {EPA 200.7}
Chromium {EPA 200.7}
Chromium {EPA 200.8 - ATP}
Chromium, VI {EPA 218.6}
Cobalt {EPA 200.7}
Cobalt {EPA 200.8 - ATP}
Copper {EPA 200.7}
Iron {EPA 200.7}
Lead {EPA 200.7}
Lead {EPA 200.8 - ATP}
Magnesium {EPA 200.7}
Manganese {EPA 200.7}
Manganese {EPA 200.8 - ATP}
Molybdenum {EPA 200.7}
Molybdenum {EPA 200.8 - ATP}
Nickel {EPA 200.7}
Nickel {EPA 200.8 - ATP}
Potassium {EPA 200.7}
Selenium {EPA 200.7}
Selenium {EPA 200.8 - ATP}
Silica {EPA 200.7}
Silica {EPA 370.1}
Silver {EPA 200.7}
Silver {EPA 200.8 - ATP}



NELAP-Recognized

Sodium {EPA 200.7}
Thallium {EPA 200.7}
Thallium {EPA 200.8 - ATP}
Tin {EPA 200.7}
Titanium {EPA 200.7-ATP}
Vanadium {EPA 200.7}
Vanadium {EPA 200.8 - ATP}
Zinc {EPA 200.7}
Zinc {EPA 200.8 - ATP}

**METALS - 503 Regs
Arsenic {EPA 6010B}
Arsenic {EPA 6020}
Cadmium {EPA 6010B}
Cadmium {EPA 6020}
Chromium, Total {EPA 6010B}
Chromium, Total {EPA 6020}
Copper {EPA 6010B}
Copper {EPA 6020}
Lead {EPA 6010B}
Lead {EPA 6020}
Mercury {EPA 7470}
Mercury {EPA 7471}
Molybdenum {EPA 6010B}
Molybdenum {EPA 6020}
Nickel {EPA 6010B}
Nickel {EPA 6020}
Selenium {EPA 6010B}
Selenium {EPA 6020}
Zinc {EPA 6010B}
Zinc {EPA 6020}

**MINERALS
Acidity {EPA 305.1}
Acidity {SM 2310B}
Alkalinity {EPA 310.1}
Alkalinity {SM 2320B}
Chloride {EPA 300.0}
Fluoride {EPA 300.0}
Fluoride {EPA 340.2}
Fluoride {SM 4500-F C}
Hardness {EPA 130.1}
Hardness {EPA 130.2}
Hardness {SM 2340B}
Hardness {SM 2340C}
Sulfate {EPA 300.0}
Sulfide {EPA 376.1}
Sulfide {EPA 376.2}
Sulfite {EPA 377.1}

**MISCELLANEOUS
Bromide {EPA 300.0}
Color {EPA 110.2}
Hydrogen Ion (pH) {EPA 150.1}
Hydrogen Ion (pH) {SM 4500-H+ B}
Oil & Grease {EPA 1664}
Oil & Grease {EPA 413.1}
Oil & Grease {SM 5520B}
Phenolics {EPA 420.1}
Specific Conductance {EPA 120.1}
Specific Conductance {SM 2510B}

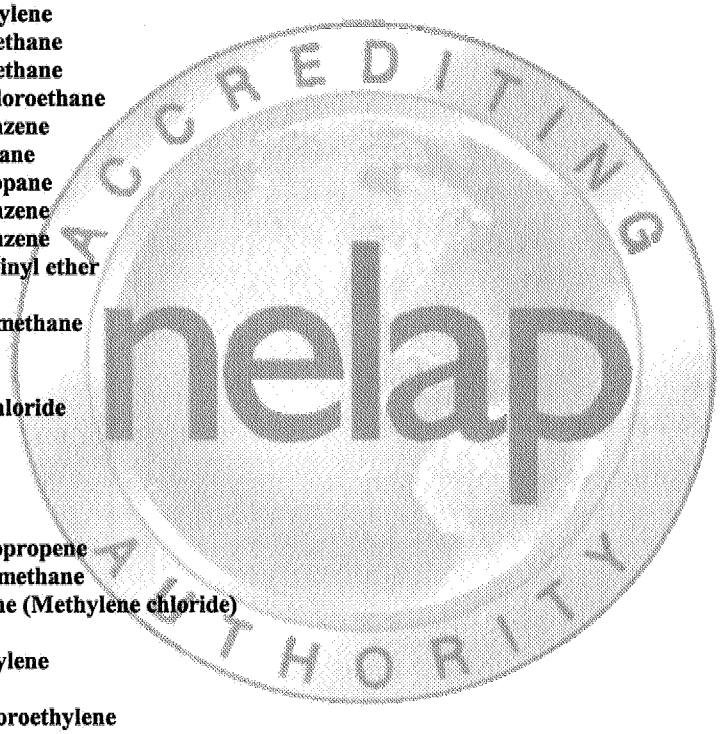


NELAP-Recognized

Surfactants (MBAS) {EPA 425.1}
Turbidity {EPA 180.1}
Turbidity {SM 2130B}

**NUTRIENTS
Ammonia {EPA 350.2}
K Nitrogen {EPA 351.3}
Nitrate-Nitrite {EPA 300.0}
Nitrate-Nitrite {EPA 353.3}
Nitrate {EPA 300.0}
Nitrate {EPA 353.3}
Nitrite {EPA 300.0}
O-Phosphate {EPA 300.0}
O-Phosphate {EPA 365.2}

**ORGANIC CHEMISTRY VOLATILES (MEASUREMENT BY GC/MS)
{EPA 624} 1,1-Dichloroethane
{EPA 624} 1,1-Dichloroethylene
{EPA 624} 1,1,1-Trichloroethane
{EPA 624} 1,1,2-Trichloroethane
{EPA 624} 1,1,2,2-Tetrachloroethane
{EPA 624} 1,2-Dichlorobenzene
{EPA 624} 1,2-Dichloroethane
{EPA 624} 1,2-Dichloropropane
{EPA 624} 1,3-Dichlorobenzene
{EPA 624} 1,4-Dichlorobenzene
{EPA 624} 2-Chloroethyl vinyl ether
{EPA 624} Benzene
{EPA 624} Bromodichloromethane
{EPA 624} Bromoform
{EPA 624} Bromomethane
{EPA 624} Carbon Tetrachloride
{EPA 624} Chlorobenzene
{EPA 624} Chloroethane
{EPA 624} Chloroform
{EPA 624} Chloromethane
{EPA 624} cis-1,3-Dichloropropene
{EPA 624} Dibromochloromethane
{EPA 624} Dichloromethane (Methylene chloride)
{EPA 624} Ethylbenzene
{EPA 624} Tetrachloroethylene
{EPA 624} Toluene
{EPA 624} trans-1,2-Dichloroethylene
{EPA 624} trans-1,3-Dichloropropene
{EPA 624} Trichloroethylene
{EPA 624} Trichlorofluoromethane
{EPA 624} Vinyl Chloride

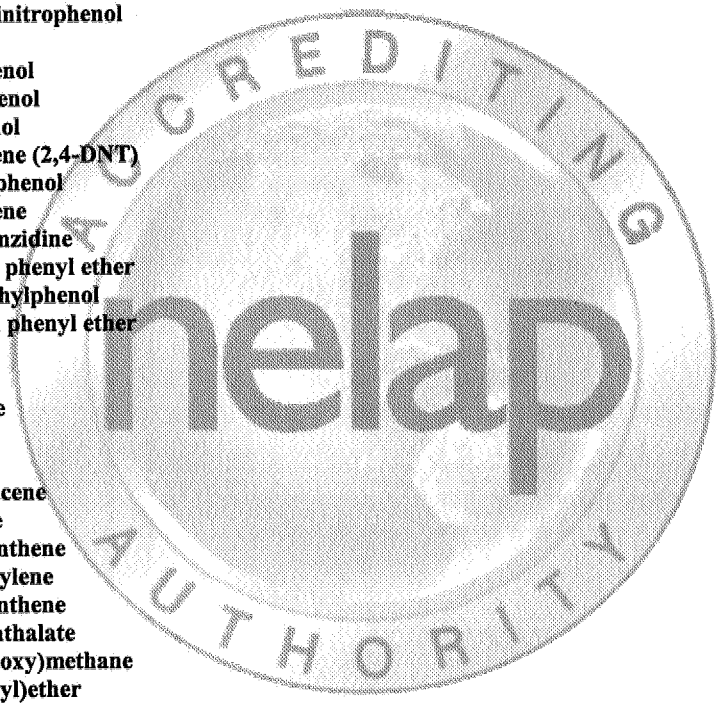


NELAP-Recognized

**ORGANIC CHEMISTRY (MEASUREMENT BY GC)
{EPA 608} alpha-BHC (alpha-Hexachlorocyclohexane)
{EPA 608} beta-BHC (beta-Hexachlorocyclohexane)
{EPA 608} Chlordane
{EPA 608} delta-BHC
{EPA 608} Dieldrin
{EPA 608} Endosulfan I
{EPA 608} Endosulfan II
{EPA 608} Endosulfan Sulfate
{EPA 608} Endrin
{EPA 608} Endrin aldehyde
{EPA 608} gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)
{EPA 608} Heptachlor

{EPA 608} Heptachlor epoxide
{EPA 608} PCB-1016
{EPA 608} PCB-1221
{EPA 608} PCB-1232
{EPA 608} PCB-1242
{EPA 608} PCB-1248
{EPA 608} PCB-1254
{EPA 608} PCB-1260
{EPA 608} Toxaphene (Chlorinated camphene)

**ORGANIC CHEMISTRY (MEASUREMENT BY GC/MS)
{EPA 625} 1,2-Dichlorobenzene
{EPA 625} 1,2,4-Trichlorobenzene
{EPA 625} 1,3-Dichlorobenzene
{EPA 625} 1,4-Dichlorobenzene
{EPA 625} 2-Chloronaphthalene
{EPA 625} 2-Chlorophenol
{EPA 625} 2-Methyl-4,6-Dinitrophenol
{EPA 625} 2-Nitrophenol
{EPA 625} 2,4-Dichlorophenol
{EPA 625} 2,4-Dimethylphenol
{EPA 625} 2,4-Dinitrophenol
{EPA 625} 2,4-Dinitrotoluene (2,4-DNT)
{EPA 625} 2,4,6-Trichlorophenol
{EPA 625} 2,6-Dinitrotoluene
{EPA 625} 3,3'-Dichlorobenzidine
{EPA 625} 4-Bromophenyl phenyl ether
{EPA 625} 4-Chloro-3-methylphenol
{EPA 625} 4-Chlorophenyl phenyl ether
{EPA 625} 4-Nitrophenol
{EPA 625} Acenaphthene
{EPA 625} Acenaphthylene
{EPA 625} Anthracene
{EPA 625} Benzidine
{EPA 625} Benzo(a)anthracene
{EPA 625} Benzo(a)pyrene
{EPA 625} Benzo(b)fluoranthene
{EPA 625} Benzo(g,h,i)perylene
{EPA 625} Benzo(k)fluoranthene
{EPA 625} Benzyl butyl phthalate
{EPA 625} Bis(2-chloroethoxy)methane
{EPA 625} Bis(2-chloroethyl)ether
{EPA 625} bis(2-Chloroisopropyl)ether
{EPA 625} Bis(2-ethylhexyl)phthalate
{EPA 625} Chrysene
{EPA 625} Di-n-butyl phthalate
{EPA 625} Di-n-octyl phthalate
{EPA 625} Dibenzo(a,h)anthracene
{EPA 625} Diethyl phthalate
{EPA 625} Dimethyl phthalate
{EPA 625} Fluoranthene
{EPA 625} Fluorene
{EPA 625} Hexachlorobenzene
{EPA 625} Hexachlorobutadiene
{EPA 625} Hexachlorocyclopentadiene
{EPA 625} Hexachloroethane
{EPA 625} Indeno(1,2,3-c,d)pyrene
{EPA 625} Isophorone
{EPA 625} N-Nitrosodi-n-propylamine
{EPA 625} N-Nitrosodimethylamine
{EPA 625} N-Nitrosodiphenylamine



NELAP-Recognized

{EPA 625} Naphthalene
{EPA 625} Nitrobenzene
{EPA 625} Pentachlorophenol
{EPA 625} Phenanthrene
{EPA 625} Phenol
{EPA 625} Pyrene

****RESIDUES**
Residue, Filterable (TDS) {EPA 160.1}
Residue, Filterable (TDS) {SM 2540C}
Residue, Non Filterable (TSS) {EPA 160.2}
Residue, Non Filterable (TSS) {SM 2540D}
Residue, Settleable {EPA 160.5}
Residue, Settleable {SM 2540F}
Residue, Total {EPA 160.3}
Residue, Total {SM 2540B}
Residue, Volatile {EPA 160.4}

End of Parameter List

NELAP-Recognized

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
ENVIRONMENTAL LABORATORY CERTIFICATION
SOLID/HAZARDOUS WASTE CERTIFICATION - PARAMETER LIST

This certificate supersedes all previous certificates

EMAX Laboratories, Inc.
1835 W 205th Street
Torrance, CA 90501

Certificate Number: E-10272
Effective Date: 11/01/2006
Expiration Date: 10/31/2007
Reciprocity: CA

The laboratory listed above is hereby approved for environmental laboratory certification in accordance with K.S.A. 65-1,109a for performing solids and/or hazardous waste analysis for the following parameters:

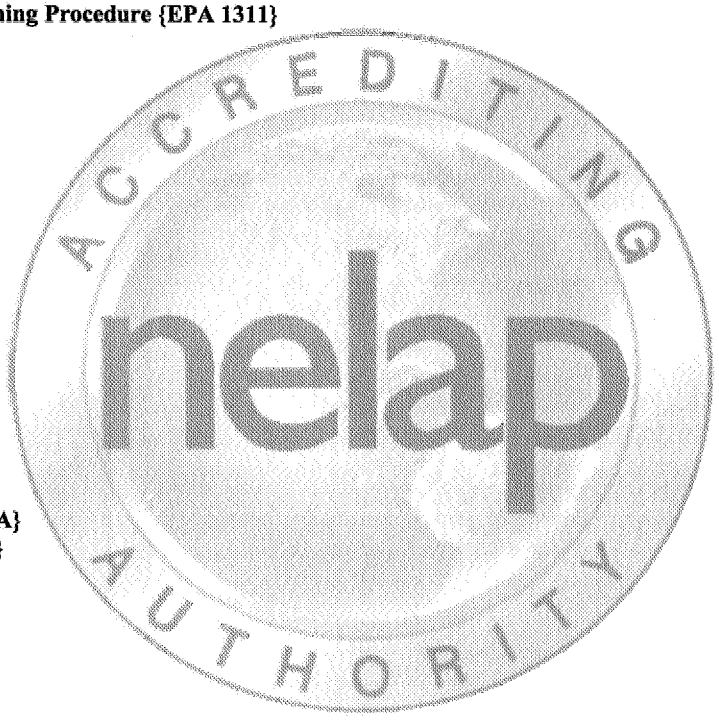
****CHARACTERISTICS**
Ignitability {EPA 1010}
Reactive Cyanide {CHAP 7, SEC. 7.3}
Reactive Sulfide {CHAP 7, SEC. 7.3}
Synthetic Precipitation Leaching Procedure {EPA 1312}
Toxic Characteristic Leaching Procedure {EPA 1311}

****INORGANIC**
Cyanide {EPA 9014}

****METALS**
Antimony {EPA 6010B}
Antimony {EPA 6020}
Arsenic {EPA 6010B}
Arsenic {EPA 6020}
Barium {EPA 6010B}
Barium {EPA 6020}
Beryllium {EPA 6010B}
Beryllium {EPA 6020}
Cadmium {EPA 6010B}
Cadmium {EPA 6020}
Chromium {EPA 6010B}
Chromium {EPA 6020}
Chromium, VI {EPA 7196A}
Chromium, VI {EPA 7199}
Cobalt {EPA 6010B}
Cobalt {EPA 6020}
Copper {EPA 6010B}
Copper {EPA 6020}
Lead {EPA 6010B}
Lead {EPA 6020}
Mercury {EPA 7470A}
Mercury {EPA 7471A}
Molybdenum {EPA 6010B}
Nickel {EPA 6010B}
Nickel {EPA 6020}
Selenium {EPA 6010B}
Silver {EPA 6010B}
Thallium {EPA 6010B}
Thallium {EPA 6020}
Vanadium {EPA 6010B}
Zinc {EPA 6010B}
Zinc {EPA 6020}

****MINERALS**
Fluoride {EPA 9056}
Sulfide {EPA 9034}

****MISCELLANEOUS**



NELAP-Recognized

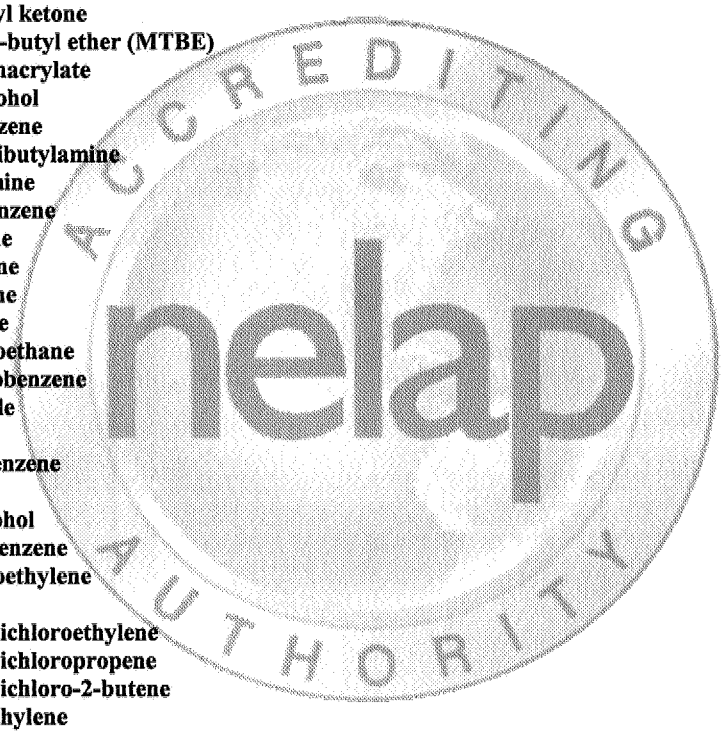
Hydrogen Ion (pH) {EPA 9040B}
Hydrogen Ion (pH) {EPA 9045C}

****ORGANIC CHEMISTRY VOLATILES (MEASUREMENT BY GC)**
{EPA 8015B} Ethylene glycol
{EPA 8021B} Benzene
{EPA 8021B} Ethylbenzene
{EPA 8021B} meta-Xylene
{EPA 8021B} ortho-Xylene
{EPA 8021B} para-Xylene
{EPA 8021B} Toluene

****ORGANIC CHEMISTRY VOLATILES (MEASUREMENT BY GC/MS)**
{EPA 8260B} 1,1-Dichloroethane
{EPA 8260B} 1,1-Dichloroethylene
{EPA 8260B} 1,1-Dichloropropene
{EPA 8260B} 1,1,1-Trichloroethane
{EPA 8260B} 1,1,1,2-Tetrachloroethane
{EPA 8260B} 1,1,2-Trichloroethane
{EPA 8260B} 1,1,2,2-Tetrachloroethane
{EPA 8260B} 1,2-Dibromoethane (EDB, Ethylene dibromide)
{EPA 8260B} 1,2-Dichlorobenzene
{EPA 8260B} 1,2-Dichloropropane
{EPA 8260B} 1,2,3-Trichlorobenzene
{EPA 8260B} 1,2,3-Trichloropropane
{EPA 8260B} 1,2,3,4-Diepoxybutane
{EPA 8260B} 1,2,4-Trichlorobenzene
{EPA 8260B} 1,2,4-Trimethylbenzene
{EPA 8260B} 1,3-Dichloro-2-propanol
{EPA 8260B} 1,3-Dichlorobenzene
{EPA 8260B} 1,3-Dichloropropane
{EPA 8260B} 1,3,5-Trimethylbenzene
{EPA 8260B} 1,4-Dichlorobenzene
{EPA 8260B} 1,4-Dioxane
{EPA 8260B} 2-Chloroethyl vinyl ether
{EPA 8260B} 2-Chlorotoluene
{EPA 8260B} 2-Hexanone
{EPA 8260B} 2-Picoline
{EPA 8260B} 2,2-Dichloropropane
{EPA 8260B} 3-Chloropropionitrile
{EPA 8260B} 4-Chlorotoluene
{EPA 8260B} 4-Methyl-2-Pentanone (MIBK)
{EPA 8260B} Acetone
{EPA 8260B} Acetonitrile
{EPA 8260B} Acrolein
{EPA 8260B} Acrylonitrile
{EPA 8260B} Allyl alcohol
{EPA 8260B} Allyl Chloride
{EPA 8260B} Benzene
{EPA 8260B} Bromoacetone
{EPA 8260B} Bromobenzene
{EPA 8260B} Bromochloromethane
{EPA 8260B} Bromodichloromethane
{EPA 8260B} Bromoform
{EPA 8260B} Bromomethane
{EPA 8260B} Carbon disulfide
{EPA 8260B} Carbon Tetrachloride
{EPA 8260B} Chlorobenzene
{EPA 8260B} Chloroethane
{EPA 8260B} Chloroform
{EPA 8260B} Chloromethane

ACCREDITING AUTHORITY nelap
NELAP-Recognized

{EPA 8260B} cis-1,2-Dichloroethylene
{EPA 8260B} cis-1,3-Dichloropropene
{EPA 8260B} Crotonaldehyde
{EPA 8260B} Dibromochloromethane
{EPA 8260B} Dibromochloropropane
{EPA 8260B} Dibromomethane
{EPA 8260B} Dichlorodifluoromethane
{EPA 8260B} Dichloromethane (Methylene chloride)
{EPA 8260B} Ethyl methacrylate
{EPA 8260B} Ethylbenzene
{EPA 8260B} Hexachlorobutadiene
{EPA 8260B} Iodomethane
{EPA 8260B} Isobutyl Alcohol
{EPA 8260B} Isopropylbenzene
{EPA 8260B} Malononitrile
{EPA 8260B} meta-Xylene
{EPA 8260B} Methacrylonitrile
{EPA 8260B} Methyl ethyl ketone
{EPA 8260B} Methyl tert-butyl ether (MTBE)
{EPA 8260B} Methylmethacrylate
{EPA 8260B} n-Butyl alcohol
{EPA 8260B} n-Butylbenzene
{EPA 8260B} N-Nitrosodibutylamine
{EPA 8260B} n-Propylamine
{EPA 8260B} n-Propylbenzene
{EPA 8260B} Naphthalene
{EPA 8260B} Nitrobenzene
{EPA 8260B} ortho-Xylene
{EPA 8260B} para-Xylene
{EPA 8260B} Pentachloroethane
{EPA 8260B} Pentafluorobenzene
{EPA 8260B} Propionitrile
{EPA 8260B} Pyridine
{EPA 8260B} sec-Butylbenzene
{EPA 8260B} Styrene
{EPA 8260B} t-Butyl alcohol
{EPA 8260B} tert-Butylbenzene
{EPA 8260B} Tetrachloroethylene
{EPA 8260B} Toluene
{EPA 8260B} trans-1,2-Dichloroethylene
{EPA 8260B} trans-1,3-Dichloropropene
{EPA 8260B} trans-1,4-Dichloro-2-butene
{EPA 8260B} Trichloroethylene
{EPA 8260B} Trichlorofluoromethane
{EPA 8260B} Vinyl Acetate
{EPA 8260B} Vinyl Chloride



NELAP-Recognized

**ORGANIC CHEMISTRY (MEASUREMENT BY GC)
{EPA 8011} 1,2-Dibromoethane (EDB, Ethylene dibromide)
{EPA 8011} Dibromochloropropane
{EPA 8081A} 4,4'-DDD
{EPA 8081A} 4,4'-DDE
{EPA 8081A} 4,4'-DDT
{EPA 8081A} Aldrin
{EPA 8081A} alpha-BHC (alpha-Hexachlorocyclohexane)
{EPA 8081A} alpha-Chlordane
{EPA 8081A} beta-BHC (beta-Hexachlorocyclohexane)
{EPA 8081A} Chlordane (Tech)
{EPA 8081A} Chlorobenzilate
{EPA 8081A} Chloroneb
{EPA 8081A} Chlorothalonil

{EPA 8081A} delta-BHC
{EPA 8081A} Diallate
{EPA 8081A} Dieldrin
{EPA 8081A} Endosulfan I
{EPA 8081A} Endosulfan II
{EPA 8081A} Endosulfan Sulfate
{EPA 8081A} Endrin
{EPA 8081A} Endrin aldehyde
{EPA 8081A} Endrin ketone
{EPA 8081A} g-Chlordane
{EPA 8081A} gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)
{EPA 8081A} Heptachlor
{EPA 8081A} Heptachlor Epoxide
{EPA 8081A} Hexachlorobenzene
{EPA 8081A} Methoxychlor
{EPA 8081A} Toxaphene (Chlorinated camphene)
{EPA 8082} 2-Chlorobiphenyl
{EPA 8082} 2,2',3,3',4,4',5-Heptachlorobiphenyl
{EPA 8082} 2,2',3,3',4,4',5,5',6-Nonachlorobipheny
{EPA 8082} 2,2',3,4',5,5',6-Heptachlorobiphenyl
{EPA 8082} 2,2',3,4,4',5'-Hexachlorobiphenyl
{EPA 8082} 2,2',3,4,4',5',6-Heptachlorobiphenyl
{EPA 8082} 2,2',3,4,4',5,5'-Heptachlorobiphenyl
{EPA 8082} 2,2',3,4,5'-Pentachlorobiphenyl
{EPA 8082} 2,2',3,4,5,5'-Hexachlorobiphenyl
{EPA 8082} 2,2',3,5'-Tetrachlorobiphenyl
{EPA 8082} 2,2',3,5,5',6-Hexachlorobiphenyl
{EPA 8082} 2,2',4,4',5,5'-Hexachlorobiphenyl
{EPA 8082} 2,2',4,5,5'-Pentachlorobiphenyl
{EPA 8082} 2,2',5-Trichlorobiphenyl
{EPA 8082} 2,2',5,5'-Tetrachlorobiphenyl
{EPA 8082} 2,3',4,4'-Tetrachlorobiphenyl
{EPA 8082} 2,3-Dichlorobiphenyl
{EPA 8082} 2,3,3',4',6-Pentachlorobiphenyl
{EPA 8082} 2,4',5-Trichlorobiphenyl
{EPA 8082} PCB-1016
{EPA 8082} PCB-1221
{EPA 8082} PCB-1232
{EPA 8082} PCB-1242
{EPA 8082} PCB-1248
{EPA 8082} PCB-1254
{EPA 8082} PCB-1260
{EPA 8141A} Atrazine
{EPA 8141A} Azinphos-methyl (Guthion)
{EPA 8141A} Chlorfenvinphos
{EPA 8141A} Chlorpyrifos
{EPA 8141A} Chlorpyrifos methyl
{EPA 8141A} Demeton-o
{EPA 8141A} Demeton-s
{EPA 8141A} Diazinon
{EPA 8141A} Dimethoate
{EPA 8141A} EPN
{EPA 8141A} Ethion
{EPA 8141A} Famphur
{EPA 8141A} Malathion
{EPA 8141A} Mevinphos
{EPA 8141A} Naled
{EPA 8141A} Parathion ethyl
{EPA 8141A} Parathion methyl
{EPA 8141A} Phorate
{EPA 8141A} Ronnel

ACCREDITING AUTHORITY
nelap
NELAP-Recognized

{EPA 8141A} Thionazine
{EPA 8151A} 2,4-D
{EPA 8151A} 2,4-DB
{EPA 8151A} 2,4,5-T
{EPA 8151A} 2,4,5-TP
{EPA 8151A} 3,5-Dichlorobenzoic acid
{EPA 8151A} 4-Nitrophenol
{EPA 8151A} Aciflurofen
{EPA 8151A} Bentazon
{EPA 8151A} Chloramben
{EPA 8151A} Dalapon
{EPA 8151A} DCPA Di-Acid
{EPA 8151A} Dicamba
{EPA 8151A} Dichlorprop
{EPA 8151A} Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
{EPA 8151A} MCPA
{EPA 8151A} MCPP
{EPA 8151A} Pentachlorophenol
{EPA 8151A} Picloram

**ORGANIC CHEMISTRY (MEASUREMENT BY GC/MS)
{EPA 8270C} 1-Acetyl-2-thiourea
{EPA 8270C} 1-Naphthylamine
{EPA 8270C} 1,2-Dichlorobenzene
{EPA 8270C} 1,2-Diphenylhydrazine
{EPA 8270C} 1,2,4-Trichlorobenzene
{EPA 8270C} 1,2,4,5-Tetrachlorobenzene
{EPA 8270C} 1,3-Dichlorobenzene
{EPA 8270C} 1,3,5-Trinitrobenzene
{EPA 8270C} 1,4-Dichlorobenzene
{EPA 8270C} 1,4-Naphthoquinone
{EPA 8270C} 2-Acetylaminofluorene
{EPA 8270C} 2-Chloronaphthalene
{EPA 8270C} 2-Chlorophenol
{EPA 8270C} 2-Cyclohexyl-4,6-dinitrophenol
{EPA 8270C} 2-Methyl-4,6-Dinitrophenol
{EPA 8270C} 2-Methylnaphthalene
{EPA 8270C} 2-Methylphenol (o-Cresol)
{EPA 8270C} 2-Naphthylamine
{EPA 8270C} 2-Nitroaniline
{EPA 8270C} 2-Nitrophenol
{EPA 8270C} 2-Picoline
{EPA 8270C} 2,3,4,6-Tetrachlorophenol
{EPA 8270C} 2,4-Diamininotoluene
{EPA 8270C} 2,4-Dichlorophenol
{EPA 8270C} 2,4-Dimethylphenol
{EPA 8270C} 2,4-Dinitrophenol
{EPA 8270C} 2,4-Dinitrotoluene (2,4-DNT)
{EPA 8270C} 2,4,5-Trichlorophenol
{EPA 8270C} 2,4,6-Trichlorophenol
{EPA 8270C} 2,6-Dichlorophenol
{EPA 8270C} 2,6-Dinitrotoluene
{EPA 8270C} 3-Methylcholanthrene
{EPA 8270C} 3-Methylphenol (m-Cresol)
{EPA 8270C} 3-Nitroaniline
{EPA 8270C} 3,3'-Dichlorobenzidine
{EPA 8270C} 4-Aminobiphenyl
{EPA 8270C} 4-Bromophenyl phenyl ether
{EPA 8270C} 4-Chloro-3-methylphenol
{EPA 8270C} 4-Chloroaniline
{EPA 8270C} 4-Chlorophenyl phenyl ether

ACCREDITING AUTHORITY nelap
NELAP-Recognized

{EPA 8270C} 4-Methylphenol (p-Cresol)
{EPA 8270C} 4-Nitroaniline
{EPA 8270C} 4-Nitrophenol
{EPA 8270C} 5-Nitro-o-toluidine
{EPA 8270C} 7,12-Dimethylbenz(a)anthracene
{EPA 8270C} Acenaphthene
{EPA 8270C} Acenaphthylene
{EPA 8270C} Acetophenone
{EPA 8270C} alpha-alpha-Dimethylphenethylamine
{EPA 8270C} Aniline
{EPA 8270C} Anthracene
{EPA 8270C} Benzidine
{EPA 8270C} Benzoic acid
{EPA 8270C} Benzo(a)anthracene
{EPA 8270C} Benzo(a)pyrene
{EPA 8270C} Benzo(b)fluoranthene
{EPA 8270C} Benzo(g,h,i)perylene
{EPA 8270C} Benzo(k)fluoranthene
{EPA 8270C} Benzyl alcohol
{EPA 8270C} Bis(2-chloroethoxy)methane
{EPA 8270C} Bis(2-chloroethyl)ether
{EPA 8270C} Bis(2-chloroisopropyl)ether
{EPA 8270C} Butyl benzyl phthalate
{EPA 8270C} Chrysene
{EPA 8270C} Di-n-butyl phthalate
{EPA 8270C} Di-n-octyl phthalate
{EPA 8270C} Dibenzofuran
{EPA 8270C} Dibenzo(a,e)pyrene
{EPA 8270C} Dibenzo(a,h)anthracene
{EPA 8270C} Diethyl phthalate
{EPA 8270C} Dimethoate
{EPA 8270C} Dimethyl phthalate
{EPA 8270C} Dimethylaminoazobenzene
{EPA 8270C} Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
{EPA 8270C} Diphenylamine
{EPA 8270C} Ethyl methanesulfonate
{EPA 8270C} Famphur
{EPA 8270C} Fluoranthene
{EPA 8270C} Fluorene
{EPA 8270C} Hexachlorobenzene
{EPA 8270C} Hexachlorobutadiene
{EPA 8270C} Hexachlorocyclopentadiene
{EPA 8270C} Hexachloroethane
{EPA 8270C} Hexachlorophene
{EPA 8270C} Hexachloropropene
{EPA 8270C} Indeno(1,2,3-c,d)pyrene
{EPA 8270C} Isodrin
{EPA 8270C} Isophorone
{EPA 8270C} Isosafrole
{EPA 8270C} Kepone
{EPA 8270C} Malic anhydride
{EPA 8270C} Methylmethanesulfonate
{EPA 8270C} N-Nitrosodi-n-butylamine
{EPA 8270C} N-Nitrosodi-n-propylamine
{EPA 8270C} N-Nitrosodiethylamine
{EPA 8270C} N-Nitrosodimethylamine
{EPA 8270C} N-Nitrosodiphenylamine
{EPA 8270C} N-Nitrosomethylethylamine
{EPA 8270C} N-Nitrosomorpholine
{EPA 8270C} N-Nitrosopiperidine
{EPA 8270C} N-Nitrosopyrrolidine

ACCREDITING AUTHORITY nelap
NELAP-Recognized

{EPA 8270C} Naphthalene
{EPA 8270C} o-Toluidine
{EPA 8270C} O,O,O-Triethylphosphorothioate
{EPA 8270C} p-Benzoquinone
{EPA 8270C} Parathion ethyl
{EPA 8270C} Parathion methyl
{EPA 8270C} Pentachlorobenzene
{EPA 8270C} Pentachloronitrobenzene
{EPA 8270C} Pentachlorophenol
{EPA 8270C} Phenacetin
{EPA 8270C} Phenanthrene
{EPA 8270C} Phenol
{EPA 8270C} Phorate
{EPA 8270C} Pyrene
{EPA 8270C} Pyridine
{EPA 8270C} Safrole
{EPA 8270C} Tetraethyl dithiopyrophosphate (Sulfotepp)

**ORGANIC CHEMISTRY (MEASUREMENT BY HPLC)
{EPA 8310} Acenaphthene
{EPA 8310} Acenaphthylene
{EPA 8310} Benzo(a)anthracene
{EPA 8310} Benzo(a)pyrene
{EPA 8310} Benzo(b)fluoranthene
{EPA 8310} Benzo(g,h,i)perylene
{EPA 8310} Benzo(k)fluoranthene
{EPA 8310} Chrysene
{EPA 8310} Dibenzo(a,h)anthracene
{EPA 8310} Fluoranthene
{EPA 8310} Fluorene
{EPA 8310} Indeno(1,2,3-c,d)pyrene
{EPA 8310} Naphthalene
{EPA 8310} Phenanthrene
{EPA 8310} Pyrene
{EPA 8330} 1,3-Dinitrobenzene
{EPA 8330} 1,3,5-Trinitrobenzene
{EPA 8330} 2-Amino-4,6-dinitrotoluene
{EPA 8330} 2,4-Dinitrotoluene (2,4-DNT)
{EPA 8330} 2,4,6-Trinitrotoluene
{EPA 8330} 2,6-Dinitrotoluene
{EPA 8330} 4-Amino-2,6-dinitrotoluene
{EPA 8330} HMX
{EPA 8330} meta-Nitrotoluene
{EPA 8330} Methyl-2,4,6-trinitrophenylnitramine
{EPA 8330} Nitrobenzene
{EPA 8330} ortho-Nitrotoluene
{EPA 8330} para-Nitrotoluene
{EPA 8330} RDX
{EPA 8332} Nitroglycerine

**TOTAL PETROLEUM HYDROCARBONS
{EPA 8015B} GRO

ACCREDITING AUTHORITY nelap NELAP-Recognized

End of Parameter List

KANSAS
DEPARTMENT OF HEALTH & ENVIRONMENT
KATHLEEN SEBELIUS, GOVERNOR
Roderick L. Bremby, Secretary

NELAP-Recognized

MEMORANDUM

DATE: December 4, 2006

TO: Kennette Pimentel
Emax Laboratories, Inc.
1835 West 205th Street
Torrance, CA 90501

FROM: Jack R. McKenzie and Aurora Shields
Laboratory Improvement Specialists

Enclosed please find your updated parameter list(s). Please check parameters and methodology for accuracy.

If there are any questions concerning the parameters listed, contact this office at (785) 296-1639-Jack or (785) 296-6198-Aurora. If there are any changes, please notify this office in writing.

Enclosure/s

JRM/APS/gnm

Division of Health and Environmental Laboratories
Forbes Field, Bldg. 740; Topeka, KS 66620-0001
http://www.kdhe.state.ks.us/lipo

Telephone: Jack McKenzie (785) 296-1639
Aurora Shields (785) 296-6198
FAX (785) 296-1638

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The Commonwealth of Massachusetts

Department of Environmental Protection

Division of Environmental Analysis
Senator William X. Wall Experiment Station

certifies

M-CA291

EMAX LABORATORIES INC
1835 205TH ST
TORRANCE, CA 90501-0000

Laboratory Director: **Kam Y. PANG, PH.D.**

for the analysis of **POTABLE WATER (CHEMISTRY)**
NON POTABLE WATER (CHEMISTRY)

pursuant to 310 CMR 42.00

This certificate supersedes all previous Massachusetts certificates issued to this laboratory. The laboratory is regulated by and shall be responsible for being in compliance with Massachusetts regulations at 310 CMR 42.00.

This certificate is valid only when accompanied by the latest dated Certified Parameter List as issued by the Massachusetts D.E.P. Contact the Division of Environmental Analysis to verify the current certification status of the laboratory.

Certification is no guarantee of the validity of the data. This certification is subject to unannounced laboratory inspections.

Issued: **01 JUL 2006**

Expires: **30 JUN 2007**

Oscar C. Parcells

Director, Division of Environmental Analysis

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Certified Parameter List as of: 01 JUL 2006

M-CA291 EMAX LABORATORIES INC
TORRANCE CA

NON POTABLE WATER (CHEMISTRY) **Effective Date** **01 JUL 2006** **Expiration Date** **30 JUN 2007**

Analytes	Methods
PH	EPA 150.1
SPECIFIC CONDUCTIVITY	EPA 120.1
TOTAL DISSOLVED SOLIDS	EPA 160.1
HARDNESS (CACO3), TOTAL	SM 2340B
ALKALINITY, TOTAL	EPA 310.1
CHLORIDE	EPA 300.0
SULFATE	EPA 300.0
AMMONIA-N	EPA 350.2
NITRATE-N	EPA 300.0
ORTHOPHOSPHATE	EPA 365.2
ORTHOPHOSPHATE	EPA 300.0
PHOSPHORUS, TOTAL	EPA 365.2
BIOCHEMICAL OXYGEN DEMAND	EPA 405.1
TOTAL ORGANIC CARBON	EPA 415.1
NON-FILTERABLE RESIDUE	EPA 160.2
OIL AND GREASE	EPA 413.1
OIL AND GREASE	EPA 1664
VOLATILE HALOCARBONS	EPA 624
VOLATILE AROMATICS	EPA 624

POTABLE WATER (CHEMISTRY) **Effective Date** **01 JUL 2006** **Expiration Date** **30 JUN 2007**

Analytes	Methods
NITRITE-N	EPA 300.0
FLUORIDE	EPA 300.0
SULFATE	EPA 300.0
VOLATILE ORGANIC COMPOUNDS	EPA 524.2
1,2-DIBROMOETHANE	EPA 504.1
1,2-DIBROMO-3-CHLOROPROPANE	EPA 504.1

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

Environmental Laboratory Certification Program

In accordance with the provisions of Regulation 61 - 81, entitled "State Environmental Laboratory Certification Regulation,"

EMAX LABORATORIES INC
1835 W 205TH ST
TORRANCE, CALIFORNIA 90501-1510

is hereby certified to perform analyses as documented on the attached parameter list(s). This certification does not guarantee validity of data generated, but indicates the laboratory's adherence to prescribed methodology, quality control, records keeping, and reporting procedures. This certificate is the property of S.C. DHEC and must be surrendered upon demand. This certificate is non-transferable and is valid only for the parameters and methodology listed on the attached parameter list(s).

Laboratory Director: KAM Y PANG PH D
Certifying Authority: CA
Date of Issue: September 14, 2006
Date of Expiration: August 31, 2007
Certificate Number: 87012001

Carl T. Smith

Director
Office of Environmental Laboratory Certification

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

EMAX LABORATORIES INC (Laboratory ID 87012)
Laboratory Director: KAM Y PANG PH D
Certifying Authority: CA
Certificate Number: 87012001

Date of Issue: September 14, 2006
Expiration Date: August 31, 2007

CLEAN WATER ACT

INORGANIC - DEMAND

BIOCHEMICAL OXYGEN DEMAND(BOD)	EPA 405.1
TOTAL ORGANIC CARBON (TOC)	EPA 415.1

INORGANIC - MINERAL

ACIDITY	EPA 305.1
ALKALINITY	EPA 310.1
CHLORIDE	EPA 300.0
HYDROGEN-ION CONC. (PH)	EPA 150.1
SPECIFIC CONDUCTANCE	EPA 120.1
SULFATE	EPA 300.0

INORGANIC - MISCELLANEOUS

BROMIDE	EPA 300.0
OIL & GREASE	EPA 413.1
SULFIDE	EPA 376.1
TURBIDITY	EPA 180.1

INORGANIC - NUTRIENT

AMMONIA-NITROGEN	EPA 350.2
KJELDAHL-NITROGEN	EPA 351.3
NITRATE-NITRITE (N02&N03)	EPA 300.0
NITRATE-NITROGEN	EPA 300.0
NITRITE-NITROGEN	EPA 300.0
ORTHOPHOSPHATE	EPA 300.0
PHOSPHORUS	EPA 365.2

SAFE DRINKING WATER ACT

INORGANIC - MINERAL

CHLORIDE	EPA 300.0
SULFATE	EPA 300.0

INORGANIC - MISCELLANEOUS

SURFACTANTS (MBAS)	SM 5540C

INORGANIC - NUTRIENT

NITRATE-NITROGEN	EPA 300.0
NITRITE-NITROGEN	EPA 300.0

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

EMAX LABORATORIES INC (Laboratory ID 87012)
Laboratory Director: KAM Y PANG PH D
Certifying Authority: CA
Certificate Number: 87012001

Date of Issue: September 14, 2006
Expiration Date: August 31, 2007

SAFE DRINKING WATER ACT

INORGANIC - RESIDUE

RESIDUE, FILTERABLE (TDS)	SM 2540C

D H E C
PROMOTE PROTECT PROSPER

C. Earl Hunter, Commissioner

Promoting and protecting the health of the public and the environment.

September 14, 2006

KAM Y PANG PH D
EMAX LABORATORIES INC
1835 W 205TH ST
TORRANCE, CALIFORNIA 90501-1510

Laboratory I. D. 87012

Dear Kam Y Pang Ph D:

Your amended certificate and associated parameter list(s) are enclosed. These documents now represent the certificate of record for your laboratory. Any certificate(s) and associated parameter list(s) received prior to your receipt of these documents are now null and void and should be destroyed. Please be reminded that all environmental data submitted to the Department is reviewed to ensure that the reporting laboratory possesses the necessary certification. Data reported by laboratories without the proper certification will be addressed by the affected enforcement programs.

If you have any questions, or problems are detected concerning your certificate, please contact this office within ten (10) working days.

Sincerely,

Carol F. Smith

Carol F. Smith, Director
Office of Environmental Laboratory Certification
Bureau of Environmental Services

CFS:ic

Enclosures

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

Environmental Laboratory Certification Program

In accordance with the provisions of Regulation 61 - 81, entitled "State Environmental Laboratory Certification Regulation,"

EMAX LABORATORIES INC
1835 W 205TH ST
TORRANCE, CALIFORNIA 90501-1510

is hereby certified to perform analyses as documented on the attached parameter list(s). This certification does not guarantee validity of data generated, but indicates the laboratory's adherence to prescribed methodology, quality control, records keeping, and reporting procedures. This certificate is the property of S.C. DHEC and must be surrendered upon demand. This certificate is non-transferable and is valid only for the parameters and methodology listed on the attached parameter list(s).

Laboratory Director: KAM Y PANG PH D
Certifying Authority: AZ
Date of Issue: June 02, 2006
Date of Expiration: March 06, 2007
Certificate Number: 87012002

Carol F. Smith

Director
Office of Environmental Laboratory Certification

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

EMAX LABORATORIES INC (Laboratory ID 87012)
Laboratory Director: KAM Y PANG PH D
Certifying Authority: AZ
Certificate Number: 87012002

Date of Issue: June 02, 2006
Expiration Date: March 06, 2007

SOLID & HAZARDOUS WASTES

INORGANIC - HAZARDOUS WASTE CHARACTERISTICS

IGNITABILITY (PENSKY MARTENS)	EPA 1010	
TCLP - BOTTLE EXTRACTION	EPA 1311	
TCLP - ZERO HEADSPACE	EPA 1311	

INORGANIC - MISCELLANEOUS

CYANIDE DISTILLATION	EPA 9010B	
SULFIDE DISTILLATION	EPA 9030B	

INORGANIC - TRACE METAL

ANTIMONY	EPA 6010B	
ARSENIC	EPA 6010B	
CADMIUM	EPA 6010B	
CHROMIUM, HEXAVALENT	EPA 7196A	
COPPER	EPA 6010B	
LEAD	EPA 6010B	
MERCURY	EPA 7470A	
MERCURY	EPA 7471A	
SELENIUM	EPA 6010B	
SILVER	EPA 6010B	
THALLIUM	EPA 6010B	

PCBS AND PESTICIDES

ORGANOCHLORINE PESTICIDES BY GC: CAP.COL.	EPA 8081A	EPA 3520C
ORGANOCHLORINE PESTICIDES BY GC: CAP.COL.	EPA 8081A	EPA 3550B
POLYCHLORINATED BIPHENYLS BY GC	EPA 8082	EPA 3520C
POLYCHLORINATED BIPHENYLS BY GC	EPA 8082	EPA 3550B

SEMI-VOLATILES

POLYNUCLEAR AROMATIC HYDROCARBONS BY HPLC	EPA 8310	EPA 3550B
SEMIVOLATILE ORGANICS BY GC/MS:CAP. COL.	EPA 8270C	EPA 3550B

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

EMAX LABORATORIES INC (Laboratory ID 87012)
Certifying Authority: AZ **Date of Issue: June 02, 2006**
Certificate Number: 87012002 **Expiration Date: March 06, 2007**

SOLID & HAZARDOUS WASTES

--------PCBS AND PESTICIDES--------

EPA 8081A
EPA 3520C

4,4'-DDD
4,4'-DDE
4,4'-DDT
ALDRIN
ALPHA-BHC
ALPHA-CHLORDANE
BETA-BHC
DELTA-BHC
DIELDRIN
ENDOSULFAN I
ENDOSULFAN II
ENDOSULFAN SULFATE
ENDRIN
ENDRIN ALDEHYDE
ENDRIN KETONE
GAMMA-BHC (LINDANE)
GAMMA-CHLORDANE
HEPTACHLOR
HEPTACHLOR EPOXIDE
HEXACHLOROBENZENE
METHOXYCHLOR
TOXAPHENE

EPA 8081A
EPA 3550B

4,4'-DDD
4,4'-DDE
4,4'-DDT
ALDRIN
ALPHA-BHC
ALPHA-CHLORDANE
BETA-BHC
DELTA-BHC
DIELDRIN
ENDOSULFAN I
ENDOSULFAN II
ENDOSULFAN SULFATE
ENDRIN
ENDRIN ALDEHYDE
ENDRIN KETONE
GAMMA-BHC (LINDANE)
GAMMA-CHLORDANE

EPA 8081A
EPA 3550B

HEPTACHLOR
HEPTACHLOR EPOXIDE
HEXACHLOROBENZENE
METHOXYCHLOR
TOXAPHENE

EPA 8082
EPA 3520C

PCB-1016 (AROCLOR-1016)
PCB-1221 (AROCLOR-1221)
PCB-1232 (AROCLOR-1232)
PCB-1242 (AROCLOR-1242)
PCB-1248 (AROCLOR-1248)
PCB-1254 (AROCLOR-1254)
PCB-1260 (AROCLOR-1260)

EPA 8082
EPA 3550B

PCB-1016 (AROCLOR-1016)
PCB-1221 (AROCLOR-1221)
PCB-1232 (AROCLOR-1232)
PCB-1242 (AROCLOR-1242)
PCB-1248 (AROCLOR-1248)
PCB-1254 (AROCLOR-1254)
PCB-1260 (AROCLOR-1260)

----------SEMI-VOLATILES----------

EPA 8270C
EPA 3550B

1,2,4-TRICHLOROBENZENE
1,2-DICHLOROBENZENE
1,2-DIPHENYLHYDRAZINE
1,3-DICHLOROBENZENE
1,4-DICHLOROBENZENE
1-CHLORONAPHTHALENE
2,4,5-TRICHLOROPHENOL
2,4,6-TRICHLOROPHENOL
2,4-DICHLOROPHENOL
2,4-DIMETHYLPHENOL
2,4-DINITROPHENOL
2,4-DINITROTOLUENE (2,4-DNT)

EPA 8270C
EPA 3550B

2,6-DINITROTOLUENE (2,6-DNT)
2-CHLORONAPHTHALENE
2-CHLOROPHENOL
2-METHYLNAPHTHALENE
2-METHYLPHENOL
2-NITROANILINE
2-NITROPHENOL
3,3-DICHLOROBENZIDINE
3-NITROANILINE
4,6-DINITRO-2-METHYLPHENOL
4-BROMOPHENYLPHENYL ETHER
4-CHLORO-3-METHYLPHENOL
4-CHLOROANILINE
4-CHLOROPHENYL PHENYL ETHER
4-METHYLPHENOL
4-NITROANILINE
4-NITROPHENOL
ACENAPHTHENE
ACENAPHTHYLENE
ANILINE
ANTHRACENE
BENZIDINE
BENZO(A)ANTHRACENE
BENZO(A)PYRENE
BENZO(B)FLUORANTHENE
BENZO(G,H,I)PERYLENE
BENZO(K)FLUORANTHENE
BENZOIC ACID
BENZYL ALCOHOL
BIS(2-CHLOROETHOXY)METHANE
BIS(2-CHLOROETHYL)ETHER
BIS(2-CHLOROISOPROPYL)ETHER
BIS(2-ETHYLHEXYL)PHTHALATE
BUTYL BENZYL PHTHALATE
CHRYSENE
DI-N-BUTYL PHTHALATE
DI-N-OCTYL PHTHALATE
DIBENZO(A,H)ANTHRACENE
DIBENZOFURAN
DIETHYL PHTHALATE
DIMETHYL PHTHALATE
FLUORANTHENE
FLUORENE
HEXACHLOROBENZENE
HEXACHLOROBUTADIENE

EPA 8270C
EPA 3550B

HEXACHLOROCYCLOPENTADIENE
HEXACHLOROETHANE
ISOPHORONE
N-NITROSODI-N-PROPYLAMINE
N-NITROSODIMETHYLAMINE
N-NITROSODIPHENYLAMINE
NAPHTHALENE
NITROBENZENE (NB)
PENTACHLOROPHENOL
PHENANTHRENE
PHENOL
PYRENE
PYRIDINE

EPA 8310
EPA 3550B

ACENAPHTHENE
ACENAPHTHYLENE
ANTHRACENE
BENZO(A)ANTHRACENE
BENZO(A)PYRENE
BENZO(B)FLUORANTHENE
BENZO(G,H,I)PERYLENE
BENZO(K)FLUORANTHENE
CHRYSENE
DIBENZO(A,H)ANTHRACENE
FLUORANTHENE
FLUORENE
INDENO(1,2,3-CD)PYRENE
NAPHTHALENE
PHENANTHRENE
PYRENE

State of Utah
#
Governor
GARY HERBERT
Lieutenant Governor

Utah Department of Health
David N. Sundwall, MD
Executive Director

Epidemiology and Laboratory Services
Patrick F. Luedtke, MD, MPH.
Director of Public Health Laboratories

Bureau of Laboratory Improvement
David B Mendenhall, MPA, MT (ASCP)
Bureau Director

NELAP Recognized

9/20/2006

EMAX Laboratories Incorporated
Kam Pang, Ph.D
1835 W. 205th St.
Torrance CA 90501

ID # CKY1
Account # 3106188889

Director,

In recognition of your NELAP accreditation and in compliance with the ELCP requirements, the laboratory listed is certified for environmental monitoring under the Clean Water Act and authorized to perform the following methods, for the analytes and matrix listed:

Non-Potable Water

Inorganics and Metals

110.2 [1971]	Color (Colorimetric-Platinum-Cobalt)
120.1 [1982]	Conductance (Specific Conductance, umhos at 25-C)
130.1 [1982]	Hardness, Total (mg/L as CaCO3) (Colorimetric, Automated EDTA)
130.2 [1971]	Hardness, Total (mg/L as CaCO3) (Titrimetric, EDTA)
150.1 [1982]	pH (Electometric)
160.1 [1971]	Residue, Filterable (Gravimetric, Dried at 180-C)
160.2 [1971]	Residue, Non-Filterable (Gravimetric, Dried at 103-105-C)
160.3 [1971]	Residue, Total (Gravimetric, Dried at 103-105-C)
160.4 [1971]	Residue, Volatile (Gravimetric, Ignition at 550-C)
160.5 [1974]	Settleable Matter (Volumetric, Imhoff Cone)
1664 A [1999]	Oil & Grease and Total Petroleum Hydrocarbons
180.1 [1993]	Turbidity
200.7 [1994]	Metals and Trace Elements in Water
200.7 [1994]	Aluminum
200.7 [1994]	Antimony
200.7 [1994]	Arsenic
200.7 [1994]	Barium
200.7 [1994]	Beryllium
200.7 [1994]	Boron
200.7 [1994]	Cadmium
200.7 [1994]	Calcium
200.7 [1994]	Chromium, Total
200.7 [1994]	Cobalt
200.7 [1994]	Copper
200.7 [1994]	Iron
200.7 [1994]	Lead

The expiration for the laboratory's certification is 8/31/2007. The Utah Environmental Laboratory Certification Program (ELCP) encourages clients and data users to verify the most current certification letter for the authorized method. For further assistance please call Lorna Ward 801-584-8469.

Inorganics and Metals

200.7 [1994]	Magnesium
200.7 [1994]	Manganese
200.7 [1994]	Molybdenum
200.7 [1994]	Nickel
200.7 [1994]	Potassium
200.7 [1994]	Selenium
200.7 [1994]	Silica
200.7 [1994]	Silver
200.7 [1994]	Sodium
200.7 [1994]	Thallium
200.7 [1994]	Tin
200.7 [1994]	Titanium
200.7 [1994]	Vanadium
200.7 [1994]	Zinc
200.8 [1994]	Metals And Trace Elements In Water and Wastes
200.8 [1994]	Aluminum
200.8 [1994]	Antimony
200.8 [1994]	Arsenic
200.8 [1994]	Barium
200.8 [1994]	Beryllium
200.8 [1994]	Cadmium
200.8 [1994]	Chromium
200.8 [1994]	Cobalt
200.8 [1994]	Lead
200.8 [1994]	Manganese
200.8 [1994]	Molybdenum
200.8 [1994]	Nickel
200.8 [1994]	Selenium
200.8 [1994]	Silver
200.8 [1994]	Thallium
200.8 [1994]	Vanadium
200.8 [1994]	Zinc
2130 B	Turbidity (Nephelometric)
2310 B	Acidity (Nephelometric)
2320 B	Alkalinity (Titration)
2340 B	Hardness (Calculation)
2340 C	Hardness (Titrimetric, EDTA)
2510 B	Conductivity (Laboratory)
2540 B	Total Solids Dried at 103-105-C
2540 C	Total Dissolved Solids Dried at 180-C
2540 D	Total Suspended Solids Dried at 103-105-C
2540 F	Settleable Solids
300.0 [1993]	Inorganic Anions In Water By Ion Chromatography
300.0 [1993]	Bromide
300.0 [1993]	Chloride
300.0 [1993]	Fluoride
300.0 [1993]	Nitrate
300.0 [1993]	Nitrite
300.0 [1993]	ortho-Phosphate
300.0 [1993]	Sulfate
305.1 [1974]	Acidity
310.1 [1978]	Alkalinity
330.3 [1978]	Chlorine, Total Residual
335.2 [1980]	Cyanide, Total

Inorganics and Metals

340.2 [1974]	Fluoride
350.2 [1974]	Nitrogen, Ammonia
351.3 [1978]	Nitrogen, Total Kjeldahl
353.3 [1974]	Nitrogen, Nitrate-Nitrite
365.2 [1971]	Phosphorous, Total
370.1	Silica, Dissolved
376.1 [1978]	Sulfide
376.2 [1978]	Sulfide
377.1 [1978]	Sulfite
405.1 [1974]	Biochemical Oxygen Demand
410.4 [1993]	Chemical Oxygen Demand
413.1 [1978]	Oil And Grease
415.1 [1974]	Organic Carbon, Total
418.1 [1978]	Petroleum Hydrocarbons
420.1 [1978]	Phenolics
425.1 [1971]	Methylene Blue Active Substances (MBAS)
4500 (F-) C	Fluoride (Ion-Selective Electrode)
4500 (H+) B	pH (Electrometric)
5210 B	Carboneous Biochemical Oxygen Demand (CBOD)
5220 D	Chemical Oxygen Demand (Colorimetric, Closed Reflux))
5310 B	Total Organic Carbon (Combustion-Infrared)
5520 B	Oil and Grease (Partition-Gravimetric)

Organics

624	Purgeables
624	Benzene
624	Bromodichloromethane
624	Bromoform
624	Bromomethane
624	Carbon Tetrachloride
624	Chlorobenzene
624	Chloroethane
624	2-Chloroethylvinyl Ether
624	Chloroform
624	Chloromethane
624	Dibromochloromethane
624	1,2-Dichlorobenzene
624	1,3-Dichlorobenzene
624	1,4-Dichlorobenzene
624	1,1-Dichloroethane
624	1,2-Dichloroethane
624	1,1-Dichloroethene
624	trans-1,2-Dichloroethene
624	1,2-Dichloropropane
624	cis-1,3-Dichloropropene
624	trans-1,3-Dichloropropene
624	Ethylbenzene
624	Methylene Chloride
624	1,1,2,2-Tetrachloroethane
624	Tetrachloroethylene
624	Toluene
624	1,1,1-Trichloroethane
624	1,1,2-Trichloroethane
624	Trichloroethene
624	Trichlorofluoromethane

Organics

624	Vinyl Chloride
625	Base/Neutrals and Acids
625	Acenaphthene
625	Acenaphthylene
625	Anthracene
625	Benzidine
625	Benzo(a)anthracene
625	Benzo(b)fluoranthene
625	Benzo(k)fluoranthene
625	Benzo(g,h,i)perylene
625	Benzo(a)pyrene
625	Benzyl Butyl Phthalate
625	bis(2-Chloroethyl)ether
625	bis(2-Chloroethoxy)methane
625	bis(2-Ethylhexyl)phthalate
625	bis(2-Chloroisopropyl)ether
625	4-Bromophenyl Phenyl Ether
625	2-Chloronaphthalene
625	4-Chlorophenyl Phenyl Ether
625	Chrysene
625	Dibenz(a,h)anthracene
625	Di-n-butylphthalate
625	1,2-Dichlorobenzene
625	1,3-Dichlorobenzene
625	1,4-Dichlorobenzene
625	3,3'-Dichlorobenzidine
625	Diethyl phthalate
625	Dimethyl phthalate
625	2,4-Dinitrotoluene
625	2,6-Dinitrotoluene
625	Di-n-octylphthalate
625	Fluoranthene
625	Fluorene
625	Hexachlorobenzene
625	Hexachlorobutadiene
625	Hexachlorocyclopentadiene
625	Hexachloroethane
625	Indeno(1,2,3-cd)pyrene
625	Isophorone
625	Naphthalene
625	Nitrobenzene
625	N-Nitrosodimethylamine
625	N-Nitrosodi-n-propylamine
625	N-Nitrosodiphenylamine
625	Phenanthrene
625	Pyrene
625	1,2,4-Trichlorobenzene
625	4-Chloro-3-methylphenol
625	2-Chlorophenol
625	2,4-Dichlorophenol
625	2,4-Dimethylphenol
625	2,4-Dinitrophenol
625	2-Methyl- 4,6-dinitrophenol
625	2-Nitrophenol

Organics	
625	4-Nitrophenol
625	Pentachlorophenol
625	Phenol
625	2,4,6-Trichlorophenol

The effective date of this certificate letter is: 9/1/2006.

The analytes by method which a laboratory is authorized to perform at any given time will be those indicated in the most recent certificate letter. The most recent certification letter supersedes all previous certification or authorization letters. It is the certified laboratory's responsibility to review this letter for discrepancies. The certified laboratory must document any discrepancies in this letter and send notice to this bureau within 15 days of receipt. This certificate letter will be recalled in the event your laboratory's certification is revoked.

Respectfully,

Patrick F. Luedtke, MD, MPH.
Director of Public Health Laboratories
Deputy Director of Epidemiology and Laboratory Services

State of Utah
#
Governor
GARY HERBERT
Lieutenant Governor

Utah Department of Health
David N. Sundwall, MD
Executive Director

Epidemiology and Laboratory Services
Patrick F. Luedtke, MD, MPH.
Director of Public Health Laboratories

Bureau of Laboratory Improvement
David B Mendenhall, MPA, MT (ASCP)
Bureau Director

NELAP Recognized

9/20/2006

EMAX Laboratories Incorporated
Kam Pang, Ph.D
1835 W. 205th St.
Torrance CA 90501

ID # CKY1
Account # 3106188889

Director,

On the basis of your most recent assessment, Proficiency Testing results and continuing compliance with the ELCP requirements, the laboratory listed is certified for environmental monitoring under the Resource Conservation and Recovery Act and authorized to perform the following methods, for the analytes and matrix listed:I

Characteristics

	Solid	Non-Potable Water	
1010	☐	☑	Ignitability
1311	☑	☑	Toxicity Characteristic Leaching Procedure Metals
1311	☑	☑	Toxicity Characteristic Leaching Procedure Semi-Volatiles
1311	☑	☑	Toxicity Characteristic Leaching Procedure Volatiles
1312	☑	☑	Synthetic Precipitation Leaching Procedure (TCLP Approval)

Inorganics

	Solid	Non-Potable Water	
9014	☑	☑	Cyanide
9034	☑	☑	Acid-Soluble and Acid-Insoluble Sulfides
9040 B	☐	☑	pH
9045	☑	☐	Soil and Waste pH
9056 [1994]	☑	☑	Fluoride

Metal Digestion

	Solid	Non-Potable Water	
3005 A	☐	☑	Acid Digestion Total Recoverable or Dissolved Metals
3010 A	☐	☑	Acid Digestion for Total Metals
3020 A	☐	☑	Acid Digestion for Total Metals
3050 B	☑	☐	Acid Digestion of Sediments, Sludges and Soils

Metals

	Solid	Non-Potable Water	
6010 B	☑	☑	Antimony
6010 B	☑	☑	Arsenic
6010 B	☑	☑	Barium
6010 B	☑	☑	Beryllium

The expiration for the laboratory's certification is 8/31/2007. The Utah Environmental Laboratory Certification Program (ELCP) encourages clients and data users to verify the most current certification letter for the authorized method. For further assistance please call Lorna Ward 801-584-8469.

Metals

	Solid	Non-Potable Water	
6010 B	☑	☑	Cadmium
6010 B	☑	☑	Chromium
6010 B	☑	☑	Cobalt
6010 B	☑	☑	Copper
6010 B	☑	☑	Lead
6010 B	☑	☑	Molybdenum
6010 B	☑	☑	Nickel
6010 B	☑	☑	Selenium
6010 B	☑	☑	Silver
6010 B	☑	☑	Thallium
6010 B	☑	☑	Vanadium
6010 B	☑	☑	Zinc
6020 [1994]	☑	☑	Antimony
6020 [1994]	☑	☑	Arsenic
6020 [1994]	☑	☑	Barium
6020 [1994]	☑	☑	Beryllium
6020 [1994]	☑	☑	Cadmium
6020 [1994]	☑	☑	Chromium
6020 [1994]	☑	☑	Cobalt
6020 [1994]	☑	☑	Copper
6020 [1994]	☑	☑	Lead
6020 [1994]	☑	☑	Molybdenum
6020 [1994]	☑	☑	Nickel
6020 [1994]	☑	☑	Selenium
6020 [1994]	☑	☑	Silver
6020 [1994]	☑	☑	Thallium
6020 [1994]	☑	☑	Vanadium
6020 [1994]	☑	☑	Zinc
7196 A	☑	☑	Chromium, Hexavalent
7199	☐	☑	Chromium, Hexavalent
7470 A	☑	☑	Mercury
7471 A	☑	☐	Mercury

Organic Cleanup

	Solid	Non-Potable Water	
3620 B	☑	☑	Florisil Cleanup
3640 A	☑	☑	Gel Permeation Cleanup
3660	☑	☑	Sulfur Cleanup

Organic Extraction

	Solid	Non-Potable Water	
3510 C	☐	☑	Separatory Funnel Liquid-Liquid Extractions
3520 C	☐	☑	Continuous Liquid-Liquid Extraction
3540 C	☑	☐	Soxhlet Extraction
3550 B	☑	☐	Ultrasonic Extraction
3580 A	☑	☐	Waste Dilution

Organic Instrumentation

	Solid	Non-Potable Water	
8011	☐	☑	1,2-Dibromoethane (EDB, Ethylene dibromide)

Organic Instrumentation

	Solid	Non-Potable Water	
8011	☐	☑	EDB and DBCP by Microextraction and Gas Chromatography
8015 B	☑	☑	Diesel Range Organics (DROs)
8015 B	☑	☑	Ethylene Glycol
8015 B	☑	☑	Gasoline Range Organics (GROs)
8015 B	☑	☑	Nonhalogenated Organics Using GC/FID
8021 B	☑	☑	Aromatic and Halogenated Volatiles
8021 B	☑	☑	Benzene
8021 B	☑	☑	Ethylbenzene
8021 B	☑	☑	meta-Xylene
8021 B	☑	☑	Methyl-t-Butyl Ether (MTBE)
8021 B	☑	☑	ortho-Xylene
8021 B	☑	☑	para-Xylene
8021 B	☑	☑	Toluene
8021 B	☑	☑	Xylenes, Total
8081 A	☑	☑	4,4'-DDD
8081 A	☑	☑	4,4'-DDE
8081 A	☑	☑	4,4'-DDT
8081 A	☑	☑	Aldrin
8081 A	☑	☑	alpha-BHC(alpha-hexachlorocyclohexane)
8081 A	☑	☑	alpha-Chlordane
8081 A	☑	☑	beta-BHC(beta-hexachlorocyclohexane)
8081 A	☑	☑	Chlorobenzilate
8081 A	☑	☑	Chloroneb
8081 A	☑	☑	Chlorothalonil
8081 A	☑	☑	delta-BHC(delta-hexachlorocyclohexane)
8081 A	☑	☑	Diallate
8081 A	☑	☑	Dieldrin
8081 A	☑	☑	Endosulfan I
8081 A	☑	☑	Endosulfan II
8081 A	☑	☑	Endosulfan sulfate
8081 A	☑	☑	Endrin
8081 A	☑	☑	Endrin Aldehyde
8081 A	☑	☑	Endrin Ketone
8081 A	☑	☑	gamma-BHC (Lindane, gamma-hexachlorocyclohexane)
8081 A	☑	☑	gamma-Chlordane
8081 A	☑	☑	Heptachlor
8081 A	☑	☑	Heptachlor Epoxide
8081 A	☑	☑	Hexachlorobenzene
8081 A	☑	☑	Methoxychlor
8081 A	☑	☑	Organochlorine Pesticides
8081 A	☑	☑	Toxaphene [Chlorinated camphene]
8082	☑	☑	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl
8082	☑	☑	2,2',3,3',4,4',5-Heptachlorobiphenyl
8082	☑	☑	2,2',3,4',5,5',6-Heptachlorobiphenyl
8082	☑	☑	2,2',3,4,4',5',6-Heptachlorobiphenyl
8082	☑	☑	2,2',3,4,4',5'-Hexachlorobiphenyl
8082	☑	☑	2,2',3,4,4',5,5'-Heptachlorobiphenyl
8082	☑	☑	2,2',3,4,5'-Pentachlorobiphenyl
8082	☑	☑	2,2',3,4,5,5'-Hexachlorobiphenyl
8082	☑	☑	2,2',3,5'-Tetrachlorobiphenyl
8082	☑	☑	2,2',3,5,5',6-Hexachlorobiphenyl

Organic Instrumentation

	Solid	Non-Potable Water	
8082	☑	☑	2,2',4,4',5,5'-Hexachlorobiphenyl
8082	☑	☑	2,2',4,5,5'-Pentachlorobiphenyl
8082	☑	☑	2,2',5,5'-Tetrachlorobiphenyl
8082	☑	☑	2,2',5-Trichlorobiphenyl
8082	☑	☑	2,3',4,4'-Tetrachlorobiphenyl
8082	☑	☑	2,3,3',4',6-Pentachlorobiphenyl
8082	☑	☑	2,3-Dichlorobiphenyl
8082	☑	☑	2,4',5-Trichlorobiphenyl
8082	☑	☑	2-Chlorobiphenyl
8082	☑	☑	Aroclor-1016 [PCB-1016]
8082	☑	☑	Aroclor-1221 PCB-1221]
8082	☑	☑	Aroclor-1232 [PCB-1232]
8082	☑	☑	Aroclor-1242 [PCB-1242]
8082	☑	☑	Aroclor-1248 [PCB-1248]
8082	☑	☑	Aroclor-1254 [PCB-1254]
8082	☑	☑	Aroclor-1260 [PCB-1260]
8082	☑	☑	PCBs
8141 A	☑	☑	Atrazine
8141 A	☑	☑	Azinphos methyl (Guthion)
8141 A	☑	☑	Chlorfenvinphos
8141 A	☑	☑	Chlorpyrifos
8141 A	☑	☑	Chlorpyrifos Methyl
8141 A	☑	☑	Demeton-o
8141 A	☑	☑	Demeton-s
8141 A	☑	☑	Diazinon
8141 A	☑	☑	Dimethoate
8141 A	☑	☑	EPN
8141 A	☑	☑	Ethinon
8141 A	☑	☑	Famphur
8141 A	☑	☑	Malathion
8141 A	☑	☑	Mevinphos
8141 A	☑	☑	Naled
8141 A	☑	☑	Organophosphorus Compounds
8141 A	☑	☑	Parathion, ethyl
8141 A	☑	☑	Parathion, methyl
8141 A	☑	☑	Phorate
8141 A	☑	☑	Ronnel
8141 A	☑	☑	Sulfotepp
8141 A	☑	☑	Thionazin [Zinophos]
8151 A	☑	☑	2,4,5-T
8151 A	☑	☑	2,4,5-TP (Silvex)
8151 A	☑	☑	2,4-D
8151 A	☑	☑	2,4-DB
8151 A	☑	☑	3,5-Dichlorobenzoic Acid
8151 A	☑	☑	4-Nitrophenol
8151 A	☑	☑	Acifluorfen
8151 A	☑	☑	Bentazon
8151 A	☑	☑	Chloramben
8151 A	☑	☑	Chlorinated Herbicides
8151 A	☑	☑	Dalapon
8151 A	☑	☑	DCPA [di acid degradate]

Organic Instrumentation

	Solid	Non-Potable Water	
8151 A	☑	☑	Dicamba
8151 A	☑	☑	Dichlorprop(Dichloroprop)
8151 A	☑	☑	Dinoseb (DNBP, 2-sec-butyl-4,6-dinitrophenol)
8151 A	☑	☑	MCPA
8151 A	☑	☑	MCPP
8151 A	☑	☑	Pentachlorophenol
8151 A	☑	☑	Picloram
8260 B	☑	☑	1,1,1,2-Tetrachloroethane
8260 B	☑	☑	1,1,1-Trichloroethane
8260 B	☑	☑	1,1,2,2-Tetrachloroethane
8260 B	☑	☑	1,1,2-Trichloroethane
8260 B	☑	☑	1,1-Dichloroethane
8260 B	☑	☑	1,1-Dichloroethylene (-ethene)
8260 B	☑	☑	1,1-Dichloropropene
8260 B	☑	☑	1,2,3,4-Diepoxybutane
8260 B	☑	☑	1,2,3-Trichlorobenzene
8260 B	☑	☑	1,2,3-Trichloropropane
8260 B	☑	☑	1,2,4-Trichlorobenzene
8260 B	☑	☑	1,2,4-Trimethylbenzene
8260 B	☑	☑	1,2-Dibromoethane (EDB, Ethylene dibromide)
8260 B	☑	☑	1,2-Dichlorobenzene
8260 B	☑	☑	1,2-Dichloroethane
8260 B	☑	☑	1,2-Dichloropropane
8260 B	☑	☑	1,3,5-Trimethylbenzene
8260 B	☑	☑	1,3-Dichloro-2-propanol
8260 B	☑	☑	1,3-Dichlorobenzene
8260 B	☑	☑	1,3-Dichloropropane
8260 B	☑	☑	1,4-Dichlorobenzene
8260 B	☑	☑	1,4-Dioxane (1,3-Diethyleneoxide)
8260 B	☑	☑	2,2-Dichloropropane
8260 B	☑	☑	2-Chloroethyl Vinyl Ether
8260 B	☑	☑	2-Chlorotoluene
8260 B	☑	☑	2-Hexanone
8260 B	☑	☑	2-Picoline (2-Methylpyridine)
8260 B	☑	☑	3-Chloropropionitrile
8260 B	☑	☑	4-Chlorotoluene
8260 B	☑	☑	4-Methyl-2-pentanone (MIBK, Isopropylacetone, Hexone)
8260 B	☑	☑	Acetone
8260 B	☑	☑	Acetonitrile
8260 B	☑	☑	Acrolein (Propenal)
8260 B	☑	☑	Acrylonitrile
8260 B	☑	☑	Allyl Alcohol
8260 B	☑	☑	Allyl Chloride (3-Chloropropene)
8260 B	☑	☑	Benzene
8260 B	☑	☑	Bromoacetone
8260 B	☑	☑	Bromobenzene
8260 B	☑	☑	Bromochloromethane
8260 B	☑	☑	Bromodichloromethane
8260 B	☑	☑	Bromoform
8260 B	☑	☑	Carbon Disulfide
8260 B	☑	☑	Carbon Tetrachloride

Organic Instrumentation

	Solid	Non-Potable Water	
8260 B	☑	☑	Chlorobenzene
8260 B	☑	☑	Chlorodibromomethane [Dibromochloromethane]
8260 B	☑	☑	Chloroethane
8260 B	☑	☑	Chloroform
8260 B	☑	☑	Chloroprene
8260 B	☑	☑	cis-1,2-Dichloroethene (-ethylene)
8260 B	☑	☑	cis-1,3-dichloropropene
8260 B	☑	☑	cis-1,4-dichloro-2-butene
8260 B	☑	☑	Crotonaldehyde
8260 B	☑	☑	Dibromomethane
8260 B	☑	☑	Dichlorodifluoromethane
8260 B	☑	☑	Ethyl Methacrylate
8260 B	☑	☑	Ethylbenzene
8260 B	☑	☑	Hexachlorobutadiene
8260 B	☑	☑	Iodomethane (Methyl iodide)
8260 B	☑	☑	Isobutyl Alcohol (2-Methyl-1-propanol)
8260 B	☑	☑	Isopropylbenzene
8260 B	☑	☑	Malononitrile
8260 B	☑	☑	meta-Xylene
8260 B	☑	☑	Methacrylonitrile
8260 B	☑	☑	Methyl bromide [Bromomethane]
8260 B	☑	☑	Methyl chloride [Chloromethane]
8260 B	☑	☑	Methyl Ethyl Ketone (MEK, 2-Butanone)
8260 B	☑	☑	Methyl Methacrylate
8260 B	☑	☑	Methyl-t-Butyl Ether (MTBE)
8260 B	☑	☑	Methylene Chloride
8260 B	☑	☑	n-Butylbenzene
8260 B	☑	☑	n-Nitroso-di-n-Butylamine
8260 B	☑	☑	n-Propylamine
8260 B	☑	☑	n-Propylbenzene
8260 B	☑	☑	Naphthalene
8260 B	☑	☑	Nitrobenzene
8260 B	☑	☑	ortho-Xylene
8260 B	☑	☑	para-Xylene
8260 B	☑	☑	Pentachloroethane
8260 B	☑	☑	Pentafluorobenzene
8260 B	☑	☑	Propionitrile (Ethyl cyanide)
8260 B	☑	☑	Pyridine
8260 B	☑	☑	sec-Butylbenzene
8260 B	☑	☑	Styrene
8260 B	☑	☑	tert-Butyl Alcohol
8260 B	☑	☑	tert-Butylbenzene
8260 B	☑	☑	Tetrachloroethylene (Perchloroethylene -ethene)
8260 B	☑	☑	Toluene
8260 B	☑	☑	trans-1,2-Dichloroethylene (-ethene)
8260 B	☑	☑	trans-1,3-Dichloropropylene (-propene)
8260 B	☑	☑	trans-1,4-dichloro-2-butene
8260 B	☑	☑	Trichloroethene (Trichloroethylene)
8260 B	☑	☑	Trichlorofluoromethane
8260 B	☑	☑	Vinyl Acetate
8260 B	☑	☑	Vinyl Chloride

Organic Instrumentation

	Solid	Non-Potable Water	
8260 B	☑	☑	Volatile Organic Compounds
8260 B	☑	☑	Xylenes, Total
8270 C	☑	☑	1,2,4,5-Tetrachlorobenzene
8270 C	☑	☑	1,2,4-Trichlorobenzene
8270 C	☑	☑	1,2-Dichlorobenzene
8270 C	☑	☑	1,2-Diphenylhydrazine
8270 C	☑	☑	1,3,5-Trinitrobenzene (1,3,5-TNB)
8270 C	☑	☑	1,3-Dichlorobenzene
8270 C	☑	☑	1,4-Dichlorobenzene
8270 C	☑	☑	1,4-Naphthoquinone
8270 C	☑	☑	1-Naphthylamine
8270 C	☑	☑	2,3,4,6-Tetrachlorophenol
8270 C	☑	☑	2,4,5-Trichlorophenol
8270 C	☑	☑	2,4,6-Trichlorophenol
8270 C	☑	☑	2,4-Diaminotoluene
8270 C	☑	☑	2,4-Dichlorophenol
8270 C	☑	☑	2,4-Dimethylphenol
8270 C	☑	☑	2,4-Dinitrophenol
8270 C	☑	☑	2,4-Dinitrotoluene (2,4-DNT)
8270 C	☑	☑	2,6-Dichlorophenol
8270 C	☑	☑	2,6-Dinitrotoluene (2,6-DNT)
8270 C	☑	☑	2-Acetylaminofluorene
8270 C	☑	☑	2-Chloronaphthalene
8270 C	☑	☑	2-Chlorophenol
8270 C	☑	☑	2-Cyclohexyl-4,6-dinitrophenol
8270 C	☑	☑	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
8270 C	☑	☑	2-Methylnaphthalene
8270 C	☑	☑	2-Methylphenol (o-cresol, 2-Hydroxytoluene)
8270 C	☑	☑	2-Naphthylamine
8270 C	☑	☑	2-Nitroaniline
8270 C	☑	☑	2-Nitrophenol
8270 C	☑	☑	2-Picoline (2-Methylpyridine)
8270 C	☑	☑	3,3'-Dichlorobenzidine
8270 C	☑	☑	3-Methylcholanthrene
8270 C	☑	☑	3-Methylphenol (m-cresol, 3-Hydroxytoluene)
8270 C	☑	☑	3-Nitroaniline
8270 C	☑	☑	4-Aminobiphenyl
8270 C	☑	☑	4-Bromophenyl Phenyl Ether
8270 C	☑	☑	4-Chloro-3-methylphenol
8270 C	☑	☑	4-Chloroaniline
8270 C	☑	☑	4-Chlorophenyl Phenyl Ether
8270 C	☑	☑	4-Methylphenol (p-cresol, 4-Hydroxytoluene)
8270 C	☑	☑	4-Nitroaniline
8270 C	☑	☑	4-Nitrophenol
8270 C	☑	☑	5-Nitro-o-toluidine
8270 C	☑	☑	7,12-Dimethylbenz(a)anthracene
8270 C	☑	☑	Acenaphthene
8270 C	☑	☑	Acenaphthylene
8270 C	☑	☑	Acetophenone
8270 C	☑	☑	Alpha,alpha-dimethylphene-thylamine
8270 C	☑	☑	Aniline

Organic Instrumentation

	Solid	Non-Potable Water	
8270 C	☑	☑	Anthracene
8270 C	☑	☑	Benzidine
8270 C	☑	☑	Benzo(a)anthracene
8270 C	☑	☑	Benzo(a)pyrene
8270 C	☑	☑	Benzo(b)fluoranthene
8270 C	☑	☑	Benzo(g,h,i)perylene
8270 C	☑	☑	Benzo(k)fluoranthene
8270 C	☑	☑	Benzoic Acid
8270 C	☑	☑	Benzyl alcohol
8270 C	☑	☑	bis(2-chloroethoxy)methane
8270 C	☑	☑	bis(2-Chloroethyl)ether
8270 C	☑	☑	bis(2-chloroisopropyl)ether
8270 C	☑	☑	bis(2-Ethylhexyl) phthalate (DEHP)
8270 C	☑	☑	Butyl Benzyl Phthalate
8270 C	☑	☑	Carbazole
8270 C	☑	☑	Chrysene
8270 C	☑	☑	Di-n-butyl phthalate
8270 C	☑	☑	Di-n-octyl Phthalate
8270 C	☑	☑	Dibenzo(a,e)pyrene
8270 C	☑	☑	Dibenzo(a,h)anthracene
8270 C	☑	☑	Dibenzofuran
8270 C	☑	☑	Diethyl Phthalate
8270 C	☑	☑	Dimethoate
8270 C	☑	☑	Dimethyl Phthalate
8270 C	☑	☑	Dinoseb (DNBP, 2-sec-butyl-4,6-dinitrophenol)
8270 C	☑	☑	Diphenylamine
8270 C	☑	☑	Ethyl Methanesulfonate
8270 C	☑	☑	Famphur
8270 C	☑	☑	Fluoranthene
8270 C	☑	☑	Fluorene
8270 C	☑	☑	Hexachlorobenzene
8270 C	☑	☑	Hexachlorobutadiene
8270 C	☑	☑	Hexachlorocyclopentadiene
8270 C	☑	☑	Hexachloroethane
8270 C	☑	☑	Hexachlorophene
8270 C	☑	☑	Hexachloropropene
8270 C	☑	☑	Indeno(1,2,3-cd)pyrene
8270 C	☑	☑	Isodrin
8270 C	☑	☑	Isophorone
8270 C	☑	☑	Isosafrole
8270 C	☑	☑	Kepone
8270 C	☑	☑	Maleic Anhydride
8270 C	☑	☑	Methyl methanesulfonate
8270 C	☑	☑	n-Nitroso-di-n-Propylamine
8270 C	☑	☑	N-Nitrosodibutylamine
8270 C	☑	☑	N-Nitrosodiethylamine
8270 C	☑	☑	n-Nitrosodimethylamine
8270 C	☑	☑	n-Nitrosodiphenylamine
8270 C	☑	☑	N-Nitrosomethylethylamine
8270 C	☑	☑	N-Nitrosomorpholine
8270 C	☑	☑	N-Nitrosopiperidine

Organic Instrumentation

	Solid	Non-Potable Water	
8270 C	☑	☑	N-Nitrosopyrrolidine
8270 C	☑	☑	Naphthalene
8270 C	☑	☑	Nitrobenzene
8270 C	☑	☑	o,o,o-Triethyl phosphorothioate
8270 C	☑	☑	ortho-Toluidine
8270 C	☑	☑	p-Dimethylaminoazobenzene
8270 C	☑	☑	Parathion
8270 C	☑	☑	Parathion, methyl
8270 C	☑	☑	Pentachlorobenzene
8270 C	☑	☑	Pentachloronitrobenzene
8270 C	☑	☑	Pentachlorophenol
8270 C	☑	☑	Phenacetin
8270 C	☑	☑	Phenanthrene
8270 C	☑	☑	Phenol
8270 C	☑	☑	Phorate
8270 C	☑	☑	Pyrene
8270 C	☑	☑	Pyridine
8270 C	☑	☑	Safrole
8270 C	☑	☑	Semivolatile Organic Compounds
8270 C	☑	☑	Sulfotepp
8310	☑	☑	Acenaphthene
8310	☑	☑	Acenaphthylene
8310	☑	☑	Anthracene
8310	☑	☑	Benzo(a)anthracene
8310	☑	☑	Benzo(a)pyrene
8310	☑	☑	Benzo(b)fluoranthene
8310	☑	☑	Benzo(g,h,i)perylene
8310	☑	☑	Benzo(k)fluoranthene
8310	☑	☑	Chrysene
8310	☑	☑	Dibenzo(a,h)anthracene
8310	☑	☑	Fluoranthene
8310	☑	☑	Fluorene
8310	☑	☑	Indeno(1,2,3-c,d)pyrene
8310	☑	☑	Naphthalene
8310	☑	☑	Phenanthrene
8310	☑	☑	Polynuclear Aromatic Hydrocarbons
8310	☑	☑	Pyrene
8330	☑	☑	1,3,5-Trinitrobenzene (1,3,5-TNB)
8330	☑	☑	1,3-Dinitrobenzene (1,3-DNB)
8330	☑	☑	2,4,6-Trinitrotoluene (2,4,6-TNT)
8330	☑	☑	2,4-Dinitrotoluene (2,4-DNT)
8330	☑	☑	2,6-Dinitrotoluene (2,6-DNT)
8330	☑	☑	2-Amino-4,6-Dinitrotoluene (2-Am-DNT)
8330	☑	☑	2-Nitrotoluene (2-NT)
8330	☑	☑	3-Nitrotoluene (3-NT)
8330	☑	☑	4-Amino-2,6-Dinitrotoluene (4-Am-DNT)
8330	☑	☑	4-Nitrotoluene (4-NT)
8330	☑	☑	Hexahydro-1, 3, 5-tritro-1, 3, 5-triazine (RDX)
8330	☑	☑	Methyl-2,4,6-Trinitrophenylnitramine (TETRYL)
8330	☑	☑	Nirtoaromatics and Nitramines
8330	☑	☑	Nitrobenzene

Organic Instrumentation

	Solid	Non-Potable Water	
8330	☑	☑	Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine (HMX)

Volatile Organic Preparation

	Solid	Non-Potable Water	
5030 B	☐	☑	Purge-and-Trap for Aqueous Samples
5035	☑	☐	Purge-and-Trap and Extraction for Volatile Organics

The effective date of this certificate letter is: 9/1/2006.

The analytes by method which a laboratory is authorized to perform at any given time will be those indicated in the most recent certificate letter. The most recent certification letter supersedes all previous certification or authorization letters. It is the certified laboratory's responsibility to review this letter for discrepancies. The certified laboratory must document any discrepancies in this letter and send notice to this bureau within 15 days of receipt. This certificate letter will be recalled in the event your laboratory's certification is revoked.

Respectfully,

Patrick F. Luedtke

Patrick F. Luedtke, MD, MPH.
Director of Public Health Laboratories
Deputy Director of Epidemiology and Laboratory Services

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SERVICE CENTER
1100 23RD AVE
PORT HUENEME CA 93043-4370

IN REPLY REFER TO:

NFESC 413
November 16, 2006

Ms. Kenette Pimentel
Quality Assurance Manager
EMAX Laboratories, Inc.
1835 205th Street
Torrance, CA 90503

Dear Ms. Pimentel,

This correspondence addresses the status of EMAX Laboratories, Inc (EMAX) of Torrance, CA in the Navy Installation Restoration (IR) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

Your laboratory is accepted to perform sample analysis for the methods listed in Table 1. The period of acceptance expires January 19, 2007. This acceptance does not guarantee the delivery of any analytical samples. Acceptance is facility specific and can not be transferred to an affiliated or subcontract laboratory.

The Navy's review included a review of the laboratory's QA manual, selected standard operating procedures (SOPs) and SOP master list, list of major analytical instrumentation, performance test (PT) results and NELAC onsite audit documentation[1].

The Navy reserves the right to conduct additional laboratory assessments or to suspend or revoke acceptance status for any or all of the listed parameters if deemed necessary.

Table 1

300 series	Anions Chloride, Fluoride, Sulfate, nitrate, Nitrite, and Ortho-phosphate	Water
8021B	Aromatic Volatile Organics	Water
9010B/9012A	Cyanide	Water
9013	Cyanide	Solids
8330	Explosives	Water/solids
8151A	Herbicides	Water/solids
8081A	Organochlorine Pesticides	Water/Solids
8082	Polychlorinated Biphenyls	Water/Solids
8310	Polynuclear Aromatic Hydrocarbons	Water/Solids

[1] State of California Health and Human Services Agency, Department of Health Services conducted an on-site assessment under National Environmental Laboratory Accreditation Conference (NELAC) requirements on November 17-19, 2004.

NFESC 413
November 16, 2006

8270C	Semivolatile Organics	Water/Solids
SW-846	TAL Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium and Zinc	Water/Solids
Mod 8015	Total Petroleum Hydrocarbons-GRO	Water/Solids
Mod 8015	Total Petroleum Hydrocarbons-DRO	Water/Solids
8260B	Volatile Organics	Water/ Solids

Acceptance for use for parameters not identified on the table will be determined by Navy project personnel.

The laboratory should notify NFESC if there are parameters not presented on Table 1 that the laboratory expects to run on a routine basis in support of Navy installation restoration projects. In these circumstances the laboratory's capability to run the tests will be reviewed and the table will be modified accordingly.

Questions concerning the information provided should be directed to the NFESC IR QA Program coordinator, Ms. Patricia Moreno at (805) 982-1659, or via email at pati.moreno@navy.mil

Sincerely,

FOR Robert J. Kratzke
Supervisor, Consultation/Information
Management Branch

Sent By: USDA APHIS PPQ; 909 937 8667; Sep-10-02 13:28; Page 1/1

Soil Permit

Permit Number: S-57253

COPY

UNITED STATES DEPARTMENT OF AGRICULTURE

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

Issued To: Emax Laboratories, Inc.
(Dr. Kam Pang)
1835 205th Street
Torrance, California 90501

TELEPHONE: (310) 618-8889

Under the authority of the Federal Plant Pest Act of May 23, 1957, permission is hereby granted to the facility/individual named above subject to the following conditions:

1. Valid for shipments of soil not heat treated at the port of entry, only if a compliance agreement (PPQ Form 519) has been completed and signed. Compliance Agreements and Soil permits are non-transferable. If you hold a Soil Permit and you leave your present employer or company, you must notify your local USDA office promptly.
2. To be shipped in sturdy, leakproof, containers and released without treatment at the port of entry.
3. To be used only for analysis, and only in the facility of the permittee at COMPANY located in CITY, STATE.
4. No use of soil for growing purposes is authorized, including the isolation or culture of organisms imported in soil.
5. All unconsumed soil, containers, and effluent is to be autoclaved, incinerated, or heat treated by the permittee at the conclusion of the project as approved and prescribed by PPQ.
6. This permit authorizes shipments from all foreign sources, including Guam, Hawaii, Puerto Rico, and the U.S. Virgin Islands through any U.S. port of entry staffed by Plant Protection and Quarantine.
7. The permittee must notify the office of the Los Angeles County Agricultural Commissioner upon arrival of shipment(s) at Area Code (526) 940-7803.

JUNE 30, 2007
Expiration Date

Deborah M. Knott
Approving Official : DEBORAH M. KNOTT

PPQ FORM 525B (8/94)

PART 3 - PPQ FIELD

APPENDIX

A

REFERENCES

REFERENCES

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APPENDIX

B

GLOSSARY

GLOSSARY

The following definitions are used in the text of Quality Systems. In writing this document, the following hierarchy of definition references was used: ISO 8402, ANSI/ASQC E-4, EPA's Quality Assurance Division Glossary of Terms, and finally definitions developed by NELAC. The source of each definition, unless otherwise identified, is the Quality Systems Committee.

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority: The Territorial, State, or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation. (NELAC) [1.4.2.3]

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Aliquot: A discrete, measured, representative portion of a sample taken for analysis. (DoD, EPA QAD Glossary)

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Quality Systems Definitions: The Quality Systems Committee is the NELAC-appointed group that created and continues to modify NELAC Chapter 5 (Quality Systems). Terms not included in the NELAC Glossary, but defined by DoD, are included in gray text boxes throughout this Appendix.

Analyte: The specific chemicals or components for which a sample is analyzed; may be a group of chemicals that belong to the same chemical family, and which are analyzed together. (EPA Risk Assessment Guide for Superfund; OSHA Glossary)

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Audit: A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch: Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates, or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage, or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

Blind Sample: A sub-sample for analysis with a composition known to the submitter. The analyst/ laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibration: Set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (VIM: 6.11)

GLOSSARY

1) In calibration of support equipment the values realized by standards are established through the use of Reference Standards that are traceable to the International System of Units (SI).

2) In calibration according to test methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve: The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method: A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard: A substance or reference material used to calibrate an instrument. (QAMS)

Certified Reference Material (CRM): A reference material whose one or more property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation and which is issued by a certifying body. (ISO Guide 30 - 2.2)

Chain of Custody Form: A record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses. (NELAC)

Chemical: Any element, compound, or mixture of elements and/or compounds. Frequently, chemical substances are classified by the CAS rules of nomenclature for the purposes of identification for a hazard evaluation. (OSHA Glossary)

Client: The party that has agreed to pay the bill for services rendered by the laboratory, and with whom the laboratory has a contractual relationship for that project. For a laboratory, this is typically the prime contractor who originally hires the laboratory for the project, and who signs the contract as the receiver of services and resulting data. In cases where the laboratory has a direct contractual relationship with DoD, the client shall be the Government's authorized contracting officer. The contracting officer, as the client, shall consult with the Government's authorized technical representative when dealing with laboratory technical issues. It is understood that typically other "Clients" are present at other levels of the project, but they may be removed from the day-to-day decision-making (for example, installation representatives, service center representatives, and other Government officials). Specific circumstances may require the direct notification of these other clients, in addition to the prime contractor or DoD representative; these circumstances shall be included as part of specific project requirements. (DoD)

Compound: A unique combination of chemical elements, existing in combination to form a single chemical entity. (DoD)

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

• Second column confirmation;

• Alternate wavelength;

• Derivatization;

• Mass spectral interpretation;

• Alternative detectors; or

• Additional cleanup procedures. (NELAC)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ ASQC E4-1994)

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

GLOSSARY

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction: The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Demonstration of Capability: A procedure to establish the ability of the analyst to generate acceptable accuracy. (NELAC)

Detection Limit: The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed. (ASQC)

Environmental Program: An organized effort that assesses environmental concerns and leads to the collection of data, either in the field or through laboratory analysis. (Variation on EPA QAD Glossary for Terms: Environmentally related measurement, environmental sample)

Consensus Standards: A protocol established by a recognized authority (for example, American Society for Testing and Materials [ASTM], American National Standards Institute [ANSI], or the Institute for Electrical and Electronic Engineers [IEEE]).

Definitive Data: Data that are generated using rigorous analytical methods, such as approved EPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data in the form of paper printouts or electronic files. Data shall satisfy QA/QC requirements. For data to be definitive, either analytical or total measurement error shall be determined and documented. (Data Quality Objectives Process for Superfund)

Finding: An assessment conclusion referenced to a NELAC Standard and supported by objective evidence that identifies a deviation from a NELAC requirement.

Holding Times (Maximum Allowable Holding Times): The maximum times that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR Part 136)

Inspection: An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ASQC E4-1994)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method. (NELAC)

International System of Units (SI): The coherent system of units adopted and recommended by the General Conference on Weights and Measures. (CCGPM) (VIM 1.12)

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Laboratory: A body that calibrates and/or tests. (ISO 25)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system. (NELAC).

Laboratory Duplicate: Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

GLOSSARY

Limit of Detection (LOD): An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte-and-matrix-specific and may be laboratory-dependent.

Limits of Quantitation (LOQ): The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.

Key Staff: At a minimum, the following managerial and supervisory staff (however named) – executive staff (for example, Chief Executive Officer, Chief Operating Officer, laboratory director, technical director); technical directors/supervisors (for example, section supervisors for organics and inorganics); quality assurance systems directors/supervisors (for example, quality manager, quality auditors); and support systems directors/supervisors (for example, information systems supervisor, purchasing director, project manager).

Holding Times (DoD Clarification): The time elapsed from the time of sampling to the time of extraction or analysis, as appropriate.

Limit of Quantitation (DoD Clarification): For DoD, the lowest standard of the calibration establishes the LOQ, but it must be greater than or equal to 3 times the LOD.

Manager (however named): The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Matrix: The substrate of a test sample

Field of Accreditation Matrix: These matrix definitions shall be used when accrediting a laboratory.

- Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.
- Non-Potable Water: Any aqueous sample excluded from the definition of Drinking Water matrix. Includes surface water, groundwater, effluents, water treatment chemicals, and TCLP or other extracts.
- Solid and Chemical Materials: Includes soils, sediments, sludges, products and by-products of an industrial process that results in a matrix not previously defined.
- Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- Air and Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device. (NELAC)

Quality System Matrix: These matrix definitions are an expansion of the field of accreditation matrices and shall be used for purposes of batch and quality control requirements (see Appendix D). These matrix distinctions shall be used:

- Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
- Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.
- Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.
- Non-aqueous Liquid: Any organic liquid with <15% settleable solids.
- Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- Solids: Includes soils, sediments, sludges and other matrices with > 15% settleable solids.
- Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.

GLOSSARY

- Air and Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample): A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (QAMS)

May: Denotes permitted action, but not required action. (NELAC)

Measurement Quality Objectives (MQOs): The desired sensitivity, range, precision, and bias of a measurement.

Measurement System: A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).

Method: 1. See Test Method. 2. Logical sequence of operations, described generically, used in the performance of measurements. (VIM 2.4)

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit: One way to establish a Limit of Detection defined as the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Must: Denotes a requirement that must be met. (Random House College Dictionary)

National Accreditation Database: The publicly accessible database listing the accreditation status of all laboratories participating in NELAP. (NELAC)

National Environmental Laboratory Accreditation Conference (NELAC): A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP): The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

Nonconformance: An indication or judgment that a product or service has not met the requirements of the relevant specifications, contract or regulation; also the state of failing to meet the requirements.

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation: Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

GLOSSARY

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Oversight Body/Proficiency Testing Provider Accreditor (PTOB/PTPA): An organization with technical expertise, administrative capacity, and financial resources sufficient to implement and operate a national program of PT provider evaluation and oversight that meets the responsibilities and requirements established by NELAC standards. (NELAC)

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results, and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Testing Study Provider: Any person, private party, or government entity that meets stringent criteria to produce and distribute NELAC PT samples, evaluate study results against published performance criteria and report the results to the laboratories, primary accrediting authorities, PTOB/PTPA, and NELAP. (NELAC)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Protocol: A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed. (EPA-QAD)

Quality Assurance: An integrated system of activities involving planning, quality control, quality assessment, reporting, and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance (Project) Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EPA-QAD)

Quality Control: The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. QC samples may be Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking.

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ASQC E-4 1994)

Quantitation Range: DoD is concerned with both the upper and lower limits of quantitation. The quantitation range is defined by the low and high calibration standards.

Raw Data: Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted. (EPA-QAD)

GLOSSARY

Reagent Blank (method reagent blank): A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Reference Material: A material or substance of which one or more of its properties are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Standard: A standard, generally of the highest metrological quality, available at a given location, and from which measurements made at that location are derived. (VIM-6.08)

Reference Toxicant: The toxicant used in performing toxicity tests to indicate the sensitivity of a test organism and to demonstrate the laboratory's ability to perform the test correctly and obtain consistent results (see Appendix D, Section 2.1.f). (NELAC)

Replicate Analyses: The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Reporting Limit: A data value specified by the client based on sensitivity requirements from project specific action levels. If initially set by the client below the laboratory's LOQ, method modification is required or the client will be required to accept the laboratory's LOQ as the lowest technically valid value that can be provided by the laboratory. For methods that require only one standard and a blank, a low level check standard shall be required to establish the LOQ. The reporting limit shall be no lower than this value. Note: There may be numbers reported to the client that are below the reporting limit. These numbers must be flagged appropriately. When the analysis demonstrates a non-detect at the LOD, the data shall be flagged with a "U." The value reported to the client is the LOD, adjusted by any dilution factor used in the analysis. When an analyte is detected between the LOQ and the LOD, the data shall be flagged with a "J." The value reported is an estimation.

Requirement: Denotes a mandatory specification; often designated by the term "shall". (NELAC)

Sample: Portion of material collected for analysis, identified by a single, unique alpha-numeric code. A sample may consist of portions in multiple containers, if a single sample is submitted for multiple or repetitive analysis.

Selectivity: (Analytical chemistry) The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Shall: Denotes a requirement that is mandatory, whenever the criterion for conformance with the specification requires, there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)

Should: Denotes a guideline or recommendation, whenever non-compliance with the specification, is permissible. (ANSI)

Spike: A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes. (NELAC)

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard Method: A test method issued by an organization generally recognized as competent to do so.

Standard Operating Procedure (SOP): A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

GLOSSARY

Standardized Reference Material (SRM): A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named): The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties, and ascertaining that technical employees have the required balance of education, training, and experience to perform the required analyses. (NELAC)

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes. (QAMS)

Technical Director: Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Test: A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method: An adoption of a scientific technique for performing a specific measurement as documented in a laboratory SOP or as published by a recognized authority.

Testing Laboratory: A laboratory that performs tests. (ISO/ IEC Guide 2-12.4)

Test Sensitivity/Power: The minimum significant difference (MSD) between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the selected significance level, and the type of statistical analysis (see Appendix D, Section 2.4.a). (NELAC)

Tolerance Chart: A chart in which the plotted quality control data is assessed via a tolerance level (e.g., +/- 10% of a mean) based on the precision level judged acceptable to meet overall quality/data use requirements instead of a statistical acceptance criteria (e.g., +/- 3 sigma) (applies to radiobioassay laboratories). (ANSI)

Traceability: The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM - 6.12)

Tune: An injected standard required by the method as a check on instrument performance for mass spectrometry.

Target Analytes: 1) Analytes specifically named by a client (also called project-specific analytes) or 2) if no project-specific analytes are provided, the target analytes will be the list found in Appendix DoD-C.

Validation: The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

Verification: Confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell: A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

Sources:

GLOSSARY

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APPENDIX

C

DEMONSTRATION OF CAPABILITY

DEMONSTRATION OF CAPABILITY

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DEMONSTRATION OF CAPABILITY

C.1 PROCEDURE FOR DEMONSTRATION OF CAPABILITY

A demonstration of capability (DOC) must be made prior to using any test method, and at any time there is a change in instrument type, personnel or test method (see 5.4.2.2). Procedures for DOC are detailed in EMAX-QA05.

Capability – Change: "Change" refers to any change in personnel, instrumentation, test method, or sample matrix that potentially impacts the precision, accuracy, sensitivity, and selectivity of the output (for example, a change in the detector, column, or other components of the sample analytical system, or a method revision). All new analysts, regardless of experience on that instrument in another laboratory, shall complete a demonstration of capability.

Although in some areas of the laboratory, a group of individuals are needed to complete the entire analytical process, EMAX certifies its technical staff individually. Each member of the group demonstrates capability in his/her area of responsibility in the sequence.

Since majority of EMAX's field samples are aqueous and soil matrices, lab control sample (LCS) or PT samples are used for demonstration of capability. In addition, for analytes which do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples.

All demonstrations are documented through the use of the form in this appendix. All data applicable to the demonstration are retained on a personnel file. When an analyte not currently found on the laboratory's list of accredited analytes is added to an existing accredited test method, an initial evaluation must be performed for that analyte.

General guidelines for demonstration of capability:

a) Where commercially available, quality samples used for demonstration of capability is obtained from a secondary source as certified solutions. If not available, the QC samples are prepared in-house using stock standards that are prepared independently from those used in instrument calibration.

b) The analyte(s) are spiked in a volume of clean quality system matrix sufficient to prepare four aliquots at the LCS concentration level, or if unspecified, to a concentration of 1-4 times the limit of quantitation.

c) At least four aliquots are prepared and analyzed according to the test method either concurrently or over a period of days.

d) The mean recovery and standard deviation of results are evaluated. When it is not possible to determine mean and standard deviations, such as for presence/absence and logarithmic values, the performance is assessed against the established and documented criteria.

   In the case where a new method is developed, acceptance criteria is determined using external source of information when available (e.g., published method). In the absence of external source of information, EMAX shall request from the project sponsor (e.g., DoD or DoE) for comparisons or guidance for acceptance criteria.

e) Results are accepted based on the acceptance criteria for precision and accuracy in the test method (if applicable) or the generated control limits (in the absence of established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin. If any one of the parameters does not meet the acceptance criteria, the performance is unacceptable for that parameter.

f) When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must :

   1) Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with c) above; or

   2) Beginning with c) above, repeat the test for all parameters that failed to meet criteria.

   Repeated failure, however, confirms a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with c).

DEMONSTRATION OF CAPABILITY

C.2 CERTIFICATION STATEMENT

The following certification statement is used to document the completion of each demonstration of capability. A copy of the certification statement is retained in the personnel records of each affected employee (see 5.2.5 and 4.12.2.5.4.b).

All repeated incidences of testing to meet a demonstration of capability is documented and included in the submittal of demonstration of capability.

Refer to EMAX-QA05 Figure 5 for DOC Certification Statement.

This certification form is completed each time a demonstration of capability study is completed with proof that it is:

True: Consistent with supporting data.

Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.

Complete: Includes the results of all supporting performance testing.

Self-Explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation**.**

C.3 INITIAL TEST METHOD EVALUATION

For all test methods apply C.3.1 and C.3.2. For the evaluation of precision and bias (C.3.3), the requirements of C.3.3(a) apply to standard methods. The requirements of C.3.3(b) apply to the methods referenced therein.

C.3.1 Limit of Detection (LOD)

a) Where quantitation is derived from multi-calibration points and the analyte can be qualitatively identified at a concentration level of the lowest calibration point, the LOD is determined set at half of the lowest calibration point. All sample-processing steps of the analytical method are performed when verifying the LOD.

b) The validity of the LOD is confirmed by qualitative identification of the analyte(s) in a QC sample in each quality system matrix containing the analyte at no more than 2-3X the LOD for single analyte tests and 1-4X the LOD for multiple analyte tests. This verification is performed on every instrument that is to be used for analysis of samples and reporting of data. Qualitative identification is performed as specified in the analytical SOP.

c) Where an LOD study is not performed (any analyte for which spiking solutions or quality control samples are not available such as temperature, pH) or, when test results are not to be reported to the LOD, determination of LOD is not required.

C.3.2 Limit of Quantitation (LOQ)

a) Where quantitation is derived from multi-calibration points, the LOQ for each analyte of concern is the lowest calibration point. Otherwise, it is determined by the sensitivity of the analytical instrument.

b) The LOQ study is not required for any component or property for which spiking solutions or quality control samples are not commercially available or otherwise inappropriate (e.g., pH).

c) The validity of the LOQ is confirmed by successful analysis of a QC sample containing the analytes of concern in each quality system matrix 1-2 times the claimed LOQ. A successful analysis is one where the recovery of each analyte is within the established test method acceptance criteria or client data quality objectives for accuracy. This single analysis is not required if the bias and precision of the measurement system is evaluated at the LOQ.

DEMONSTRATION OF CAPABILITY

C.3.3 Evaluation of Precision and Bias

a) Standard methods – precision and bias of a standard method for each analyte of concern for each quality system matrix is established by evaluating a single-concentration of four-replicate recovery study, or LCS data collected over a period of time (e.g. a year or minimum of 20 data points).

b) Non-standard methods – precision and bias is established as defined at 5.4.3 and 5.4.4. Where the method is developed for a certain project, precision and bias is defined as guided by the project the data quality objectives of the project, with the criteria established by the client, or the criteria given in the reference method.

Precision and bias measurements are evaluated across the analytical calibration range of the method using the relevant quality system matrices and process the samples through the entire measurement system for each analyte of interest.

The mean percent recovery and standard deviation for the LCS for non-standard methods are calculated and compared to the project sponsor published LCS mean percent recovery and standard deviation (e.g. DoD-Appendix D). In the absence of project sponsor published LCS, the in-house generated limits should be used. In either case, the calculated mean and standard deviation must be at least as good as the DoD published limits, where they exist, or as good or better than the published limits for similar methods or technologies. In no case should the lower LCS control limit be less than 10%.

Guidelines for evaluating precision and bias:

Analyze QC samples in triplicate containing the analytes of concern at or near the limit of quantitation, at the upper-range of the calibration (upper 20%) and at a mid-range concentration.

Process these samples on different days as three sets of samples through the entire measurement system for each analyte of interest. Each day one QC sample at each concentration is analyzed. A separate method blank shall be subjected to the analytical method along with the QC samples on each of the three days. (Note that the three samples at the LOQ concentration can demonstrate sensitivity as well.) For each analyte, calculate the mean recovery for each day, for each level over days, and for all nine samples. Calculate the relative standard deviation for each of the separate means obtained. Compare the standard deviations for the different days and the standard deviations for the different concentrations. If the different standard deviations are all statistically insignificant (e.g., F-test), then compare the overall mean and standard deviation with the established criteria from above.

A validation protocol such as the Tier I, Tier II, and Tier III requirements in US EPA Office of Water's Alternate Test Procedure (ATP) approval process.

C.3.4 Evaluation of Selectivity

Evaluate selectivity by following the checks established within the method, which may include mass spectral tuning, second column confirmation, ICP inter-element interference checks, chromatography retention time windows, sample blanks, spectrochemical absorption or fluorescence profiles, co-precipitation evaluations, and electrode response factors.

New Matrix: Prior to initial analysis of a new or unknown sample matrix, a minimum of 3 MS/MSD samples in said matrix must be analyzed. The spike concentration should be within a range of 1-4 times the estimated concentration of the environmental samples, if known, otherwise, at the regulatory limit or mid-point of the calibration range, whichever is lower. The percent mean recoveries and standard deviations for each analyte recovered in the new matrix must be compared to the project LCS means and control limits generated for clean matrices and should be at least as good as those published by the project sponsor.

Selectivity for Non-Standard Methods: When a historic selectivity check has not been identified, the most common selectivity check for a similar method or what is most typically used for the specific instrument or technology is applied.

APPENDIX

D

ESSENTIAL QUALITY CONTROL REQUIREMENTS

ESSENTIAL QUALITY CONTROL REQUIREMENTS

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ESSENTIAL QUALITY CONTROL REQUIREMENTS

The quality control protocols specified by the analytical SOPs (5.4.1.2) are applied unless otherwise a different requirement is specified by the project. Essential standards outlined in Appendix D are incorporated into the analytical SOPs.

All quality control measures are assessed and evaluated on an on-going basis and quality control acceptance criteria used to determine the validity of the data is distributed with every work order. Likewise, all procedures developed at EMAX shall have established acceptance/rejection criteria where no method or regulatory criteria exists.

The requirements from 5.9.2, apply to all types of testing. The specific manner in which they are implemented is detailed in each of the following section.

DoD Quality Control Requirements: Appendix DoD-D contains tables that consolidate DoD data quality requirements that apply to EPA's *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846). In addition, introductory material identifies definitions of QC checks and clarifies DoD's interpretation of method requirements. This appendix follows all the NELAC appendices.

D.1. CHEMICAL TESTING

D.1.1 Positive and Negative Controls

D.1.1.1 Negative Control - Method Performance

a) Purpose: The method blank is used to assess the preparation batch for possible contamination during the preparation and processing steps. The method blank is processed along with and under the same conditions as the associated samples to include all steps of the analytical procedure. Procedures are in place to determine if a method blank is contaminated. Any affected samples associated with a contaminated method blank are reprocessed for analysis or the results reported with appropriate data qualifying codes.

b) Frequency: The method blank is analyzed at a minimum of 1 per preparation batch. In those instances for which no separate preparation method is used (example: volatiles in water) the batch is defined as environmental samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

c) Composition: The method blank is a quality system matrix that is similar to the associated samples and is known to be free of the analytes of interest.

d) Evaluation Criteria and Corrective Action: While the goal is to have no detectable contaminants, each method blank must be critically evaluated as to the nature of the interference and the effect on the analysis of each sample within the batch. The concentration of a targeted analyte in the blank is at or above the reporting limit as established by the test method or by regulation, AND is greater than 1/10 of the amount measured in any sample.

For DoD sponsored projects, if the method blank contamination exceeds **one-half** the reporting limit, evaluate whether reprocessing of the samples is necessary based on the above criteria.

The concentrations of common laboratory contaminants shall not exceed the reporting limit.

Any sample associated with a blank that fail these criteria checks shall be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. The source of contamination shall be investigated and measures are taken to minimize or eliminate the problem and affected samples reprocessed or data shall be appropriately qualified if:

1) If no sample volume remains for reprocessing, the results shall be reported with appropriate data qualifying codes

2) The blank contamination otherwise affects the sample results as per the test method requirements or the individual project data quality objectives.

ESSENTIAL QUALITY CONTROL REQUIREMENTS

3) When quality control measures fail the acceptance criteria, corrective action shall be taken based on project-specific requirements or project sponsor requirements and the magnitude of the problem. Where applicable, corrective actions may include:

- Determining the source of the problem
- Notifying the client,
- Reprocessing samples,
- Using data qualifiers to "flag" data, and
- Adding commentary in the case narrative.

D.1.1.2 Positive Control - Method Performance

D.1.1.2.1 Laboratory Control Sample (LCS)

a) Purpose: The LCS is used to evaluate the performance of the total analytical system, including all preparation and analysis steps. Results of the LCS are compared to established criteria. LCS found outside of these criteria indicates that the analytical system is "out of control". Any affected samples associated with an out of control LCS are reprocessed for re-analysis or the results are reported with appropriate data qualifying codes.

b) Frequency: The LCS is analyzed at a minimum of 1 per preparation batch. Exceptions would be for those analytes for which no spiking solutions are available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. In those instances for which no separate preparation method is used (example: volatiles in water) the batch shall be defined as environmental samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

c) Composition: The LCS is a quality system matrix, known to be free of analytes of interest, spiked with known and verified concentrations of analytes. NOTE: the matrix spike may be used in place of this control as long as the acceptance criteria are as stringent as for the LCS. Alternatively the LCS may consist of a media containing known and verified concentrations of analytes or as Certified Reference Material (CRM). All analyte concentrations shall be within the calibration range of the methods. The following shall be used in choosing components for the spike mixtures:

The components to be spiked are as specified by the mandated test method or other regulatory requirement or as requested by the client. In the absence of specified spiking components the laboratory shall spike per the following:

For those components that interfere with an accurate assessment such as spiking simultaneously with technical chlordane, toxaphene and PCBs, the spike should be chosen that represents the chemistries and elution patterns of the components to be reported.

For those test methods that have extremely long lists of analytes, a representative number may be chosen unless otherwise specified by the project. The analytes selected are representative of all analytes reported. The following criteria are used for determining the minimum number of analytes to be spiked.

1) For methods that include 1-10 targets, spike all components;

2) For methods that include 11-20 targets, spike at least 10 or 80%, whichever is greater;

3) For methods with more than 20 targets, spike at least 16 components.

To ensure that all targeted components are included in the spike mixture over a 2- year period, include all target analytes when performing PT samples.

Spiking Compounds for DoD sponsored projects:

ESSENTIAL QUALITY CONTROL REQUIREMENTS

- All target analytes must be spiked in the LCS. Target analytes are defined by the project or in Appendix DoD-C. For evaluation and acceptance criteria see Appendices DoD-B and DoD-D.
- For multi-component analytes (e.g. PCBs), the LCS should be spiked with the same constituents as the calibration standard. Multiple samples may be necessary to avoid interference.
- The concentration of the spiked compounds shall be at or below the midpoint of the calibration range or at the appropriate level of concern.

d) Evaluation Criteria and Corrective Action: The results of the individual batch LCS are calculated in percent recovery unless otherwise specified by the project or the method. Calculations are documented and reported as specified by the project.

The individual LCS is compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory shall determine internal criteria and document the method used to establish the limits or utilize client specified assessment criteria.

DoD Laboratory Control Sample (LCS): The acceptability of LCS results within a preparatory batch shall be determined using project-specified limits or the DoD limits (refer to Appendix DoD-D) If DoD limits are not available for certain analytes, LCS acceptability shall be based on its in-house limits.

Control limits are evaluated at mean ± 3 times the standard deviation of LCS percent recovery. In addition, control charts are maintained and used to detect trends and prevent out of control conditions. Control limits are continually monitored for shifts in mean recovery, changes in standard deviation, and development of trends. Refer to EMAX-QA06 for generation and updating procedures of control limits and control chart evaluation.

A LCS that is determined to be within the criteria effectively establishes that the analytical system is in control and validates system performance for the samples in the associated batch. Samples analyzed along with a LCS determined to be “out of control” is considered questionable requiring the samples reprocessed and re-analyzed or the data reported with appropriate data qualifying codes.

e) Application of Marginal Exceedance Limits (ME): If a large number of analytes are in the LCS, it becomes statistically likely that a few will be outside control limits. This may not indicate that the system is out of control; therefore corrective action may not be necessary. Upper and lower marginal exceedance (ME) limits can be established to determine when corrective action is necessary. A ME is defined as being beyond the LCS control limit (3 standard deviations), but within the ME limits. ME limits is 4 standard deviations around the mean.

The number of allowable marginal exceedances is based on the number of analytes in the LCS.

If more analytes exceed the LCS control limits than is allowed, or if any one analyte exceeds the ME limits, the LCS fails and corrective action is necessary. This marginal exceedance approach is relevant for methods with long lists of analytes. It will not apply to target analyte lists with fewer than 11 analytes.

The number of allowable marginal exceedances is as follows:

1) >90 analytes in LCS, 5 analytes allowed in ME of the LCS control limit;
2) 71-90 analytes in LCS, 4 analytes allowed in ME of the LCS control limit;
3) 51-70 analytes in LCS, 3 analytes allowed in ME of the LCS control limit;
4) 31-50 analytes in LCS, 2 analytes allowed in ME of the LCS control limit;
5) 11-30 analytes in LCS, 1 analytes allowed in ME of the LCS control limit;
6) <11 analytes in LCS, no analytes allowed in ME of the LCS control limit;

For DoD sponsored projects, application of ME does not allow any project-specific analytes of concern to exceed its LCS control limits, even marginally. In addition, DoD does not feel it is appropriate to control batch acceptance on poor performing analytes.

ESSENTIAL QUALITY CONTROL REQUIREMENTS

Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systemic problem. The source of the error must be located and corrective action taken. All LCS results are collected and monitored including those that fall within marginal exceedance allowance to ensure random behavior. However, the same analyte exceeding the LCS control limit 2 out of 3 consecutive LCS is considered indicative of non-random behavior.

D.1.1.3 Sample Specific Controls

Where applicable, the effect of the sample matrix on method performance is determined with the analytical batch. These procedures relate to the analyses of matrix specific Quality Control (QC) samples and are designed as data quality indicators for a specific sample using the designated test method.

Matrix specific QC include: Matrix Spike (MS); Matrix Spike Duplicate (MSD); sample duplicates; and surrogate spikes. Evaluation of matrix managing, and handling matrix specific QC criteria including spiking appropriate components at appropriate concentrations, calculating recoveries and relative percent difference, evaluating and reporting results based on performance of the QC samples.

D.1.1.3.1 Matrix Spike : Matrix Spike Duplicates

a) Purpose: Matrix specific QC samples indicate the effect of the sample matrix on the precision and accuracy of the results generated using the selected method. The information from these controls is sample/matrix specific and would not normally be used to determine the validity of the entire batch.

b) Frequency: The frequency of the analysis of matrix specific samples is dependent on the Data Quality Objectives of the project unless otherwise mandated by the test method. When sample amount is not adequate it shall be noted on the case narrative.

c) Composition: The components of the spike are specified in the analytical SOPs unless otherwise specified by the project. Any permit specified analytes, as specified by regulation or client requested analytes shall also be included.

For DoD projects all target analytes must be spiked in the project-specific MS and MSD.

For multi-component analytes (e.g., PCBs), the project-specific MS and MSD should be spiked with the same constituents as the calibration standard. Multiple samples may be necessary to avoid interference.

The concentration of the spiked compounds shall be at or below the midpoint of the calibration range or at the appropriate level of concern.

d) Evaluation Criteria and Corrective Action: The results from matrix spike/matrix spike duplicate are primarily designed to assess the precision and accuracy of analytical results in a given matrix and are expressed as percent recovery (%R), relative percent difference (RPD), or as specified by the project. Calculations for %R and RPD are detailed in the analytical SOPs.

Results are compared to project acceptance criteria. Where there are no established acceptance criteria, the in-house statistically generated MS/MSD control limits are applied.

Results and calculations are reviewed and data are archived with the data package. MS/MSD recoveries outside the project limits are discussed in the case narrative unless otherwise other corrective action is mandated by the project.

D.1.1.3.2 Matrix Duplicates

a) Purpose: Matrix duplicates are defined as replicate aliquots of the same sample taken through the entire analytical procedure. The results from this analysis indicate the precision of the results for the specific sample using the selected method. The matrix duplicate provides a usable measure of precision only when target analytes are found in the sample chosen for duplication.

ESSENTIAL QUALITY CONTROL REQUIREMENTS

b) Frequency: The frequency of the analysis of matrix duplicates is also dependent on the Data Quality Objectives of the project unless otherwise mandated by the test method. Methods that do not require MS duplicate analysis should be performed at a minimum frequency of once per preparatory batch per matrix type. When sample amount is not adequate it shall be noted on the case narrative

c) Composition: Matrix duplicates are performed on replicate aliquots of actual samples. The composition is usually not known.

d) Evaluation Criteria and Corrective Action: The results from matrix duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD) or another statistical treatment (e.g., absolute differences). Calculations for RPD are detailed in the analytical SOPs.

Results are compared to the acceptance criteria specified in the analytical SOPs unless specified by the project.

Matrix duplicates results outside established criteria are discussed in the case narrative or as specified by the project.

D.1.1.3.3 Surrogate Spikes

a) Purpose: Surrogates are used most often in organic chromatography test methods and are chosen to reflect the chemistries of the targeted components of the method. Added prior to sample preparation/extraction, they provide a measure of recovery for every sample matrix.

b) Frequency: Except where the matrix precludes its use or when not commercially available, surrogate compounds must be added to all samples, standards, and blanks for all appropriate test methods.

c) Composition: Surrogate compounds chosen to represent the various chemistries of the target are specified in the analytical SOPs.

d) Evaluation Criteria and Corrective Action: The results are compared to project-specific acceptance criteria. Where there are no established criteria, the in-house statistically generated surrogate control limits are applied.

Surrogates outside the acceptance criteria are evaluated for the effect indicated for the individual sample results. The appropriate corrective action applied is guided by the data quality objectives or other site specific requirements. Results reported from analyses with surrogate recoveries outside the acceptance criteria are qualified per project requirement.

D.1.2 Limit of Detection and Limit of Quantitation

All documentation for generating and verifying LOD and LOQ are retained and reviewed by the Operations Manager. Documents shall include all supporting data, sample preparation information, raw data, calculations and reviews. These documents are also reviewed during internal assessment and shall be available for external assessment.

D.1.2.1 Limit of Detection (LOD)

LOD is established as described in C.3.1. For projects requiring Method Detection Limit Study, refer to EMAX-QA04. Where applicable, results are reported at LOD with appropriate data flagging.

Where analytes are identified by a recognizable pattern (for example, PCBs, toxaphene, technical-chlordane), the limit of detection is based on the concentration of the mixture at which the pattern becomes qualitatively identified.

D.1.2.2 Limit of Quantitation (LOQ)

a) Any established LOQ must be above the LOD.

ESSENTIAL QUALITY CONTROL REQUIREMENTS

b) The LOQ is verified annually for each quality system matrix, method and analyte according to the procedure specified in C.3 or according to the frequency specified by the project.

D.1.3 Data Reduction

The procedures for data reduction, such as use of linear regression, are detailed in the analytical SOPs. In-house developed software for automated data processing are tested and validated. Refer to Software Testing and Quality Assurance SOP (EMAX-IS03) for details. This process involves a sample data test set test and verify the correct operation of these data reduction software that include data capture, manipulation, transfer, and reporting. This process is done every time the programming code is modified or otherwise manipulated.

D.1.4 Quality of Standards and Reagents

a) The source of standards shall comply with 5.6.2.2. Where available, standards are purchased as certified standard solutions traceable to NIST.

b) Analytical SOPs specifies the quality of reagents required for the analysis. In addition, reagent and water quality are checked prior to use.

1) Reagents – Reagents are purchased as reagent grade or better. Reagents undergo quality control testing prior to use. EMAX-QC01 details the process of quality control for chemicals. Chemicals/reagents that have passed the QC acceptance criteria shall bear a “QC PASSED” sticker, indicating the QC reference number traceable to the QC documentation. Reagents that do not pass the QC acceptance criteria shall be returned to the vendor.

2) Water - Reagent Water produced in-house is monitored daily as described in EMAX-QC01. A logbook is used to record the daily monitoring. Commercially purchased reagent water undergoes the same test as any chemical/reagent and shall conform to the method specified requirements.

3) Concentration of titrants is verified in accordance with specific analytical procedures.

D.1.5 Selectivity

a) Selectivity of qualitative determination for each target analytes is based on the requirement of the analytical method and instrument detector. Analyte identification is detailed in every analytical SOP.

Gas and liquid chromatography shall use peak absolute retention time as qualitative identification requiring tentatively identified analyte confirmation by another column or another detector. Both tentative and confirmation results shall be maintained and properly documented.

Retention time window study is based on three non-consecutive measurements of retention time for each analyte within a 72-hour period. The standard deviation (SD) and the mean retention time are calculated. The magnitude of retention time window is established by + 3 x SD.

New retention time study is established when new column is installed or when there is a major change in the instrument parameter setup.

b) Where test methods require confirmation, compound identification is confirmed through a second column or detector when positive results are detected on a sample. Such confirmations shall be performed on organic tests such as pesticides, herbicides, or acid extractable or when recommended by the analytical test method except when the analysis involves the use of a mass spectrometer.

Confirmation may be waived by the client in cases of periodic monitoring of well-characterized media. For data that are required to be confirmed, all results reported are confirmed or unconfirmed. If unconfirmed data are reported, they shall be identified separately in the report, with a narrative explaining why the data were not

ESSENTIAL QUALITY CONTROL REQUIREMENTS

confirmed. Evaluation criteria for the confirmation of results shall be specified by the method, unless otherwise specified by the client. If method-specific requirements do not exist, EMAX shall develop and document acceptance criteria for the confirmation of results. Confirmation is required unless stipulated in writing by the client. All confirmation shall be documented.

c) When analyzing an analytes using chromatography equipped with mass spectrometry, confirmation shall be evaluated by comparing the sample mass spectrum with characteristic ions in the reference mass spectrum. Mass spectral tuning shall be performed prior to daily calibration. Acceptance criteria are specified in the related test method SOPs.

D.1.6 Constant and Consistent Test Conditions

a) To maintain constant and consistent test conditions, EMAX performs assessment and evaluation of all quality control measures on an on-going basis. Quality control acceptance criteria determine the usability of the data. Refer to Appendix 1 of analytical procedures list the Summary of Quality Control Procedures for the essential testing measures. These Quality Control Procedures are also detailed in each of the analytical SOP.

The quality control protocols are attached to every work order distributed in the laboratory in the absence of project specific requirement.

Analytical instruments undergo routine daily maintenance and calibration check prior to sample analysis. Instrument blanks are analyzed to rule-out and document probable environment and instrument contamination.

D.1.6.1.1 GC/MS Performance Check

Mass spectrometer performance is monitored every 12 hours of operation period by measuring the mass/ion distribution of BFB (volatiles) or DFTPP (semi-volatiles). The mass/ion distribution of these compounds has to fulfill the method project's specific requirements before analysis can start. Furthermore, mass assignments are checked periodically by using perfluorobutylamine to ensure that mass number is properly assigned.

D.1.6.1.2 Pesticide Performance Evaluation

Pesticide analysis is subjected to the following additional QC to ensure the quality of data. A mixture of DDT and Endrin is analyzed at the beginning of analysis and at a 12-hour interval. Individual breakdown and the combined breakdown of Endrin and DDT should be less than predetermined criteria for the system to be acceptable.

D.1.6.1.3 Temperature Controlled Analyses

Analyses dependent on temperature controlled environment (e.g., leaching procedures, GPC, etc.) are performed in work cells where temperature are controlled by a thermostat and temperature is recorded in the analytical log.

b) Glassware Cleaning. All reusable labwares are decontaminated prior to reuse. A copy of the SOP for glassware cleaning is posted in the glassware cleaning area.

APPENDIX

E-2

EMAX FACILITIES

E-2.0 PHYSICAL FACILITIES - ACCOMMODATION & ENVIRONMENT

E-2.1 ENVIRONMENT

EMAX physical facilities were designed in consideration of following parameters:

- Laboratory accommodation, test areas, energy sources, lighting, heating and ventilation shall have adequate mechanical controls to facilitate proper performance of tests.
- The environment where testing and other related functions are undertaken shall not invalidate the results or adversely affect the required accuracy of measurement.
- The facility shall be as safe and free from any form of health hazard as possible.

The laboratory shall effectively monitor, control and record environmental conditions, as appropriate. Monitoring shall be conducted within the respective work areas *e.g. air flowrate of fume hoods, room temperature of temperature controlled tests, etc.) and recorded promptly.

E-2.2 WORK AREAS

E-2.2.1 LABORATORIES

E-2.2.1.1 Volatiles Lab

The Volatiles Lab is in an area of about 3,200 square feet. This laboratory consists of the main Volatiles Lab, DOE Volatiles Lab, the Supervisor's room, and the volatiles sample storage room. This laboratory is isolated from the rest of EMAX's operations and has its own mechanical controls. One Supervisor, three Analysts and one Technician operate this area.





The main Volatiles Lab has a total of 104 Lft. of workbench with two sinks, both equipped with a reagent water filtration system. It has five (5) GC/MS instruments, two with 32-Port Purge and Trap autosamplers and three GC/MS instruments with closed-system autosamplers.

The sample control room is furnished with four sample storage refrigerators, one analytical standard freezer, a total of 18 Lft of workbench, a fume hood and one analytical balance.

The DOE Volatiles lab has its own mechanical controls independent from the main Volatiles Lab. This lab has a total of 18 Lft. of workbench with one sink equipped with reagent water filtration system. This lab houses its own sample storage refrigerator.

E-2.2.1.2 Main Lab

The Main Lab is a separate area of about 6,000 square feet and includes three Supervisors's offices, the Project Managers' offices and a Standards Preparation room. This Lab has a total of 240 Lft. of workbench with a possibility for an 80 LFt expansion. This laboratory consists of the Semivolatile Lab, Fuels & HPLC Lab, and General Chemistry Lab.





The Semivolatiles GC/MS Lab has three (3) GC/MS instruments, three (3) GC instruments with dual ECD detector, and one (1) GC with NPD detector. One Supervisor and three analysts operate this work area.

The Fuels and HPLC Lab has two (2) GC instruments with FID detectors, one (1) GC instrument with 32-Port Purge and trap, one (1) closed-system auto sampler, and two (2) HPLC instruments equipped with a Fluorescence detector and an UV detector. One Supervisor and three analysts operate this work area.







The General Chemistry Lab has two (2) IC instruments, two (2) TOC instruments, one (1) Spectrometer, one (1) pH meter, one (1) turbidimeter, one (1) BOD meter, one (1) conductivity meter, one (1) Flash Point Tester and other supporting instruments for general chemistry testing. One Supervisor and three Analysts operate this work area.

The Standards Preparation room has three (3) fume hoods and three (3) standards storage refrigerators.



E-2.2.1.3 Metals Lab



The Metals Laboratory is a separate area about 1,100 square feet. This Lab is consists of a Digestion Lab, the Metals Analysis Lab and the Supervisor's Office.

The Digestion Lab has two acid resistant fume hoods with four hot plates and one fume hood for Standards preparation. The Metals Analysis Lab has two ICPs, one Mercury Analyzer and two GFAA instruments. One supervisor, three Analysts and two Technicians operate this work area.

E-2.2.1.4 Extraction Lab

The Extraction Lab is ocupies an area of about 2,500 square feet. This Lab is consists of the main Extraction Lab, the TCLP Lab and the Supervisor's office.





The main Extraction Lab has twelve (12) fume hoods, four (4) sonicators, six (6) concentrators, fifty (50) units of continuous liquid-liquid extractors, fifty (50) units of soxhlet extractors, and one reagent water system. The TCLP Lab has two (2) twelve-position TCLP extractors, three (3) GPC instruments, and one explosive extractor. One Supervisor and six Technicians operate this work area.

E-2.2.1.5 DOE Lab

The DOE Lab is a separate area about 1,200 square feet. This lab has its own mechanical controls independent from the rest of the laboratories. This room is designed to have negative pressure so that no air coming from this room migrates to the other labs. This lab has its own extraction lab, semivolatile lab and metals lab. It has a total of 42 Lft of workbench, three acid resistant hoods, one ASE extractor, eighteen (18) continuous liquid-liquid extractors, one concentrator, one sonicator, one GC/MS, one GC with dual ECD detectors, one GC with FID detector, one ICP and one Mercury Analyzer.







E-2.2.2 SUPPORT FACILITIES

E-2.2.2.1 Data Processing Lab

The Data Processing Lab occupies a space about 850 square feetand includes two Supervisors' Offices. This lab has seven computers dedicated to data processing, one printer and two copiers.





Two Supervisors and seven data processors operate this work area.

E-2.2.2.2 Sample Receipt, Sample Storage and Waste Storage Area

The Sample Receipt Area is about 500 square feet. It has a fume hood and cooler storage shelves.





The Sample Storage Area is about 1,000 square feet with one bottle preparation room and one office. It has eight sample storage refrigerators and 12Lft. of workbench.



The Waste Storage Area is an enclosed 200 square feet shed constructed outside the building.

One Supervisor, one Sample Custodian and two technicians operate the Sample Management Department.

E-2.2.2.3 Data Storage Room



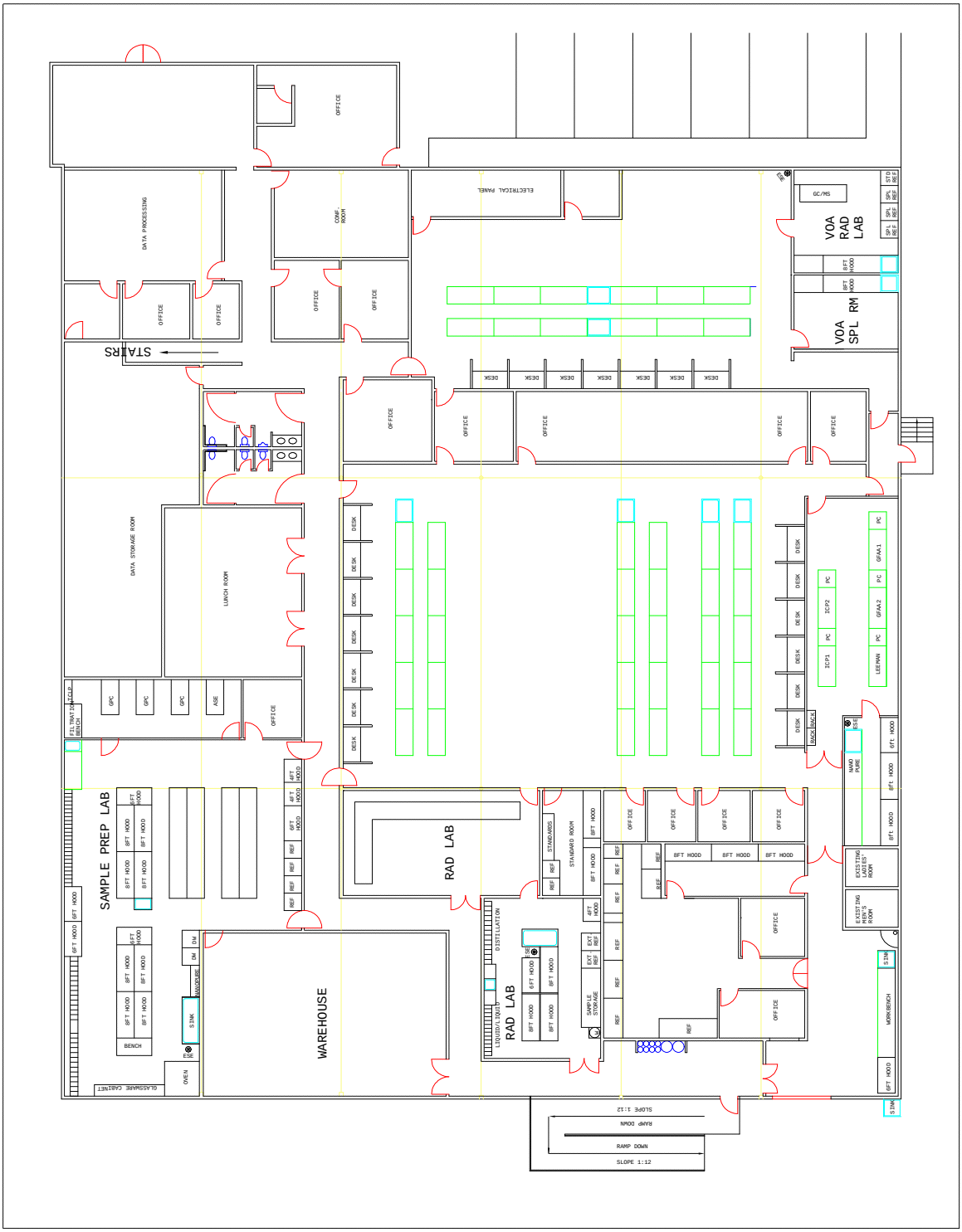
The data storage room is about 1,200 square feet. This room houses archived data packages, laboratory logbooks, and other documents related to the activities of EMAX.

E-2.2.2.4 Warehouse

The warehouse is about 1,200 square feet. The warehouse stores the laboratory supplies, solvents and reagents in appropriate cabinets.



E-2.2.2.5 EMAX Floor Plan



STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

NELAP - RECOGNIZED

ACCREDITATION

Is hereby granted to

EMAX LABORATORIES, INC.

1835 WEST 205th STREET

TORRANCE, CA 90501

Scope of accreditation is limited to the
"NELAP Fields of Accreditation"
which accompanies this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **02116CA**

Expiration Date: **08/31/2007**

Effective Date: **08/31/2006**

Richmond, California
subject to forfeiture or revocation

George C. Kulasingam, Ph.D.
Program Chief
Environmental Laboratory Accreditation Program

CALIFORNIA DEPARTMENT OF HEALTH SERVICES

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM - NELAP RECOGNIZED

Fields of Accreditation

EMAX LABORATORIES, INC.

Lab Phone (310) 618-8889

1835 WEST 205th STREET
TORRANCE, CA 90501

Certificate No: 02116CA Renew Date: 08/31/2007

102 - Inorganic Chemistry of Drinking Water			
102.030	001	EPA 300.0	Bromide
102.030	002	EPA 300.0	Chlorate
102.030	003	EPA 300.0	Chloride
102.030	005	EPA 300.0	Fluoride
102.030	006	EPA 300.0	Nitrate
102.030	007	EPA 300.0	Nitrite
102.030	008	EPA 300.0	Phosphate, Ortho
102.030	010	EPA 300.0	Sulfate
102.040	004	EPA 300.1	Bromate
102.045	001	EPA 314.0	Perchlorate
102.100	001	SM2320B	Alkalinity
102.120	001	SM2340B	Hardness
102.121	001	SM2340C	Hardness
102.130	001	SM2510B	Conductivity
102.140	001	SM2540C	Total Dissolved Solids
102.145	001	EPA 160.1	Total Dissolved Solids
102.150	001	SM4110B	Chloride
102.150	002	SM4110B	Fluoride
102.150	003	SM4110B	Nitrate
102.150	004	SM4110B	Nitrite
102.150	005	SM4110B	Phosphate, Ortho
102.150	006	SM4110B	Sulfate
102.200	001	SM4500-F C	Fluoride
102.260	001	SM5310B	Total Organic Carbon
102.261	001	SM5310B	DOC
102.270	001	SM5540C	Surfactants
102.520	001	EPA 200.7	Calcium
102.520	002	EPA 200.7	Magnesium
102.520	003	EPA 200.7	Potassium
102.520	004	EPA 200.7	Silica
102.520	005	EPA 200.7	Sodium
103 - Toxic Chemical Elements of Drinking Water			
103.130	001	EPA 200.7	Aluminum

As of 09/20/2006, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

103.130	003	EPA 200.7	Barium
103.130	004	EPA 200.7	Beryllium
103.130	005	EPA 200.7	Cadmium
103.130	007	EPA 200.7	Chromium
103.130	008	EPA 200.7	Copper
103.130	009	EPA 200.7	Iron
103.130	011	EPA 200.7	Manganese
103.130	012	EPA 200.7	Nickel
103.130	015	EPA 200.7	Silver
103.130	017	EPA 200.7	Zinc
103.140	001	EPA 200.8	Aluminum
103.140	002	EPA 200.8	Antimony
103.140	003	EPA 200.8	Arsenic
103.140	004	EPA 200.8	Barium
103.140	005	EPA 200.8	Beryllium
103.140	006	EPA 200.8	Cadmium
103.140	007	EPA 200.8	Chromium
103.140	008	EPA 200.8	Copper
103.140	009	EPA 200.8	Lead
103.140	010	EPA 200.8	Manganese
103.140	011	EPA 200.8	Mercury
103.140	012	EPA 200.8	Nickel
103.140	013	EPA 200.8	Selenium
103.140	014	EPA 200.8	Silver
103.140	015	EPA 200.8	Thallium
103.140	016	EPA 200.8	Zinc
103.161	001	EPA 245.2	Mercury

104 - Volatile Organic Chemistry of Drinking Water

104.030	001	EPA 504.1	1,2-Dibromoethane
104.030	002	EPA 504.1	1,2-Dibromo-3-chloropropane
104.040	000	EPA 524.2	Volatile Organic Compounds
104.040	001	EPA 524.2	Benzene
104.040	002	EPA 524.2	Bromobenzene
104.040	003	EPA 524.2	Bromochloromethane
104.040	006	EPA 524.2	Bromomethane
104.040	007	EPA 524.2	n-Butylbenzene
104.040	008	EPA 524.2	sec-Butylbenzene
104.040	009	EPA 524.2	tert-Butylbenzene
104.040	010	EPA 524.2	Carbon Tetrachloride
104.040	011	EPA 524.2	Chlorobenzene
104.040	012	EPA 524.2	Chloroethane

104.040	014	EPA 524.2	Chloromethane
104.040	015	EPA 524.2	2-Chlorotoluene
104.040	016	EPA 524.2	4-Chlorotoluene
104.040	018	EPA 524.2	Dibromomethane
104.040	019	EPA 524.2	1,3-Dichlorobenzene
104.040	020	EPA 524.2	1,2-Dichlorobenzene
104.040	021	EPA 524.2	1,4-Dichlorobenzene
104.040	022	EPA 524.2	Dichlorodifluoromethane
104.040	023	EPA 524.2	1,1-Dichloroethane
104.040	024	EPA 524.2	1,2-Dichloroethane
104.040	025	EPA 524.2	1,1-Dichloroethene
104.040	026	EPA 524.2	cis-1,2-Dichloroethene
104.040	027	EPA 524.2	trans-1,2-Dichloroethene
104.040	028	EPA 524.2	Dichloromethane
104.040	029	EPA 524.2	1,2-Dichloropropane
104.040	030	EPA 524.2	1,3-Dichloropropane
104.040	031	EPA 524.2	2,2-Dichloropropane
104.040	032	EPA 524.2	1,1-Dichloropropene
104.040	033	EPA 524.2	cis-1,3-Dichloropropene
104.040	034	EPA 524.2	trans-1,3-Dichloropropene
104.040	035	EPA 524.2	Ethylbenzene
104.040	036	EPA 524.2	Hexachlorobutadiene
104.040	037	EPA 524.2	Isopropylbenzene
104.040	038	EPA 524.2	4-Isopropyltoluene
104.040	039	EPA 524.2	Naphthalene
104.040	040	EPA 524.2	Nitrobenzene
104.040	041	EPA 524.2	N-propylbenzene
104.040	042	EPA 524.2	Styrene
104.040	043	EPA 524.2	1,1,1,2-Tetrachloroethane
104.040	044	EPA 524.2	1,1,2,2-Tetrachloroethane
104.040	045	EPA 524.2	Tetrachloroethene
104.040	046	EPA 524.2	Toluene
104.040	047	EPA 524.2	1,2,3-Trichlorobenzene
104.040	048	EPA 524.2	1,2,4-Trichlorobenzene
104.040	049	EPA 524.2	1,1,1-Trichloroethane
104.040	050	EPA 524.2	1,1,2-Trichloroethane
104.040	051	EPA 524.2	Trichloroethene
104.040	052	EPA 524.2	Trichlorofluoromethane
104.040	053	EPA 524.2	1,2,3-Trichloropropane
104.040	054	EPA 524.2	1,2,4-Trimethylbenzene
104.040	055	EPA 524.2	1,3,5-Trimethylbenzene

104.040	056	EPA 524.2	Vinyl Chloride
104.040	057	EPA 524.2	Xylenes, Total
104.045	001	EPA 524.2	Bromodichloromethane
104.045	002	EPA 524.2	Bromoform
104.045	003	EPA 524.2	Chloroform
104.045	004	EPA 524.2	Dibromochloromethane
104.045	005	EPA 524.2	Trihalomethanes
104.050	002	EPA 524.2	Methyl tert-butyl Ether (MTBE)
104.050	004	EPA 524.2	tert-Amyl Methyl Ether (TAME)
104.050	005	EPA 524.2	Ethyl tert-butyl Ether (ETBE)
104.050	006	EPA 524.2	Trichlorotrifluoroethane

108 - Inorganic Chemistry of Wastewater

108.016	001	EPA 110.2	Color
108.020	001	EPA 120.1	Conductivity
108.030	001	EPA 130.1	Hardness
108.040	001	EPA 130.2	Hardness
108.050	001	EPA 150.1	pH
108.060	001	EPA 160.1	Residue, Filterable
108.070	001	EPA 160.2	Residue, Non-filterable
108.080	001	EPA 160.3	Residue, Total
108.090	001	EPA 160.4	Residue, Volatile
108.100	001	EPA 160.5	Residue, Settleable
108.110	001	EPA 180.1	Turbidity
108.112	001	EPA 200.7	Boron
108.112	002	EPA 200.7	Calcium
108.112	004	EPA 200.7	Magnesium
108.112	005	EPA 200.7	Potassium
108.112	006	EPA 200.7	Silica
108.112	007	EPA 200.7	Sodium
108.120	001	EPA 300.0	Bromide
108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite, Total
108.120	007	EPA 300.0	Phosphate, Ortho
108.120	008	EPA 300.0	Sulfate
108.130	001	EPA 305.1	Acidity
108.140	001	EPA 310.1	Alkalinity
108.172	001	EPA 330.3	Chlorine Residual, Total
108.181	001	EPA 335.2	Cyanide, Total

108.191	001	EPA 340.2	Fluoride
108.201	001	EPA 350.2	Ammonia
108.212	001	EPA 351.3	Kjeldahl Nitrogen
108.234	001	EPA 353.3	Nitrate-nitrite, Total
108.235	001	EPA 353.3	Nitrate calc.
108.262	001	EPA 365.2	Phosphate, Ortho
108.263	001	EPA 365.2	Phosphorus, Total
108.270	001	EPA 370.1	Dissolved Silica
108.290	001	EPA 376.1	Sulfide
108.291	001	EPA 376.2	Sulfide
108.300	001	EPA 377.1	Sulfite
108.310	001	EPA 405.1	Biochemical Oxygen Demand
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.330	001	EPA 413.1	Oil and Grease
108.340	001	EPA 415.1	Total Organic Carbon
108.350	001	EPA 418.1	Total Recoverable Petroleum Hydrocarbons
108.360	001	EPA 420.1	Phenols, Total
108.370	001	EPA 425.1	Surfactants
108.380	001	EPA 1664	Oil and Grease
108.390	001	SM2130B	Turbidity
108.400	001	SM2310B	Acidity
108.410	001	SM2320B	Alkalinity
108.420	001	SM2340B	Hardness (calc.)
108.421	001	SM2340C	Hardness
108.430	001	SM2510B	Conductivity
108.440	001	SM2540B	Residue, Total
108.441	001	SM2540C	Residue, Filterable
108.442	001	SM2540D	Residue, Non-filterable
108.443	001	SM2540F	Residue, Settleable
108.480	001	SM4500-F C	Fluoride
108.490	001	SM4500-H+ B	pH
108.590	001	SM5210B	Biochemical Oxygen Demand
108.602	001	SM5220D	Chemical Oxygen Demand
108.610	001	SM5310B	Total Organic Carbon
108.630	001	SM5520B	Oil and Grease

109 - Toxic Chemical Elements of Wastewater

109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	003	EPA 200.7	Arsenic
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium

109.010	007	EPA 200.7	Cadmium
109.010	009	EPA 200.7	Chromium
109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	019	EPA 200.7	Selenium
109.010	021	EPA 200.7	Silver
109.010	023	EPA 200.7	Thallium
109.010	024	EPA 200.7	Tin
109.010	025	EPA 200.7	Titanium
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium
109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc
109.104	001	EPA 218.6	Chromium (VI)

110 - Volatile Organic Chemistry of Wastewater

110.040	001	EPA 624	Benzene
110.040	002	EPA 624	Bromodichloromethane
110.040	003	EPA 624	Bromoform
110.040	004	EPA 624	Bromomethane
110.040	005	EPA 624	Carbon Tetrachloride

110.040	006	EPA 624	Chlorobenzene
110.040	007	EPA 624	Chloroethane
110.040	008	EPA 624	2-Chloroethyl Vinyl Ether
110.040	009	EPA 624	Chloroform
110.040	010	EPA 624	Chloromethane
110.040	011	EPA 624	Dibromochloromethane
110.040	012	EPA 624	1,2-Dichlorobenzene
110.040	013	EPA 624	1,3-Dichlorobenzene
110.040	014	EPA 624	1,4-Dichlorobenzene
110.040	015	EPA 624	1,1-Dichloroethane
110.040	016	EPA 624	1,2-Dichloroethane
110.040	017	EPA 624	1,1-Dichloroethene
110.040	018	EPA 624	trans-1,2-Dichloroethene
110.040	019	EPA 624	1,2-Dichloropropane
110.040	020	EPA 624	cis-1,3-Dichloropropene
110.040	021	EPA 624	trans-1,3-Dichloropropene
110.040	022	EPA 624	Ethylbenzene
110.040	023	EPA 624	Methylene Chloride
110.040	024	EPA 624	1,1,2,2-Tetrachloroethane
110.040	025	EPA 624	Tetrachloroethene
110.040	026	EPA 624	Toluene
110.040	027	EPA 624	1,1,1-Trichloroethane
110.040	028	EPA 624	1,1,2-Trichloroethane
110.040	029	EPA 624	Trichloroethene
110.040	030	EPA 624	Trichlorofluoromethane
110.040	031	EPA 624	Vinyl Chloride
110.040	042	EPA 624	Oxygenates

111 - Semi-volatile Organic Chemistry of Wastewater

111.100	001	EPA 625	Acenaphthene
111.100	002	EPA 625	Acenaphthylene
111.100	003	EPA 625	Anthracene
111.100	004	EPA 625	Benzidine
111.100	005	EPA 625	Benz(a)anthracene
111.100	006	EPA 625	Benzo(b)fluoranthene
111.100	007	EPA 625	Benzo(k)fluoranthene
111.100	008	EPA 625	Benzo(g,h,i)perylene
111.100	009	EPA 625	Benzo(a)pyrene
111.100	010	EPA 625	Benzyl Butyl Phthalate
111.100	011	EPA 625	Bis(2-chloroethoxy)methane
111.100	012	EPA 625	Bis(2-chloroethyl) Ether
111.100	013	EPA 625	Bis(2-chloroisopropyl) Ether

111.100	014	EPA 625	Di(2-ethylhexyl) Phthalate
111.100	015	EPA 625	4-Bromophenyl Phenyl Ether
111.100	016	EPA 625	4-Chloro-3-methylphenol
111.100	017	EPA 625	2-Chloronaphthalene
111.100	018	EPA 625	2-Chlorophenol
111.100	019	EPA 625	4-Chlorophenyl Phenyl Ether
111.100	020	EPA 625	Chrysene
111.100	021	EPA 625	Dibenz(a,h)anthracene
111.100	022	EPA 625	1,2-Dichlorobenzene
111.100	023	EPA 625	1,3-Dichlorobenzene
111.100	024	EPA 625	1,4-Dichlorobenzene
111.100	025	EPA 625	3,3'-Dichlorobenzidine
111.100	026	EPA 625	2,4-Dichlorophenol
111.100	027	EPA 625	Diethyl Phthalate
111.100	028	EPA 625	2,4-Dimethylphenol
111.100	029	EPA 625	Dimethyl Phthalate
111.100	030	EPA 625	Di-n-butyl phthalate
111.100	031	EPA 625	Di-n-octyl phthalate
111.100	032	EPA 625	2,4-Dinitrophenol
111.100	033	EPA 625	2,4-Dinitrotoluene
111.100	034	EPA 625	2,6-Dinitrotoluene
111.100	035	EPA 625	Fluoranthene
111.100	036	EPA 625	Fluorene
111.100	037	EPA 625	Hexachlorobenzene
111.100	038	EPA 625	Hexachlorobutadiene
111.100	039	EPA 625	Hexachlorocyclopentadiene
111.100	040	EPA 625	Hexachloroethane
111.100	041	EPA 625	Indeno(1,2,3-c,d)pyrene
111.100	042	EPA 625	Isophorone
111.100	043	EPA 625	2-Methyl-4,6-dinitrophenol
111.100	044	EPA 625	Naphthalene
111.100	045	EPA 625	Nitrobenzene
111.100	046	EPA 625	2-Nitrophenol
111.100	047	EPA 625	4-Nitrophenol
111.100	048	EPA 625	N-nitrosodimethylamine
111.100	049	EPA 625	N-nitrosodi-n-propylamine
111.100	050	EPA 625	N-nitrosodiphenylamine
111.100	051	EPA 625	Pentachlorophenol
111.100	052	EPA 625	Phenanthrene
111.100	053	EPA 625	Phenol
111.100	054	EPA 625	Pyrene

111.100	055	EPA 625	1,2,4-Trichlorobenzene
111.100	056	EPA 625	2,4,6-Trichlorophenol
111.170	001	EPA 608	Aldrin
111.170	002	EPA 608	a-BHC
111.170	003	EPA 608	b-BHC
111.170	004	EPA 608	d-BHC
111.170	005	EPA 608	g-BHC (Lindane)
111.170	006	EPA 608	Chlordane
111.170	007	EPA 608	4,4'-DDD
111.170	008	EPA 608	4,4'-DDE
111.170	009	EPA 608	4,4'-DDT
111.170	010	EPA 608	Dieldrin
111.170	011	EPA 608	Endosulfan I
111.170	012	EPA 608	Endosulfan II
111.170	013	EPA 608	Endosulfan Sulfate
111.170	014	EPA 608	Endrin
111.170	015	EPA 608	Endrin Aldehyde
111.170	016	EPA 608	Heptachlor
111.170	017	EPA 608	Heptachlor Epoxide
111.170	018	EPA 608	Toxaphene
111.170	019	EPA 608	PCB-1016
111.170	020	EPA 608	PCB-1221
111.170	021	EPA 608	PCB-1232
111.170	022	EPA 608	PCB-1242
111.170	023	EPA 608	PCB-1248
111.170	024	EPA 608	PCB-1254
111.170	025	EPA 608	PCB-1260
111.170	031	EPA 608	PCBs

114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium

114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.103	001	EPA 7196A	Chromium (VI)
114.106	001	EPA 7199	Chromium (VI)
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury
114.222	001	EPA 9014	Cyanide
114.230	001	EPA 9034	Sulfides, Total
114.240	001	EPA 9040B	Corrosivity - pH Determination
114.241	001	EPA 9045C	Corrosivity - pH Determination
114.250	001	EPA 9056	Fluoride
115 - Extraction Test of Hazardous Waste			
115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
115.030	001	CCR Chapter11, Article 5, Appendix II	Waste Extraction Test (WET)
115.040	001	EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)
116 - Volatile Organic Chemistry of Hazardous Waste			
116.010	001	EPA 8011	1,2-Dibromoethane
116.010	002	EPA 8011	Dibromochloropropane
116.020	011	EPA 8015B	Ethylene Glycol
116.030	001	EPA 8015B	Gasoline-range Organics
116.040	002	EPA 8021B	Benzene
116.040	039	EPA 8021B	Ethylbenzene
116.040	041	EPA 8021B	Methyl tert-butyl Ether (MTBE)

116.040	047	EPA 8021B	Toluene
116.040	056	EPA 8021B	Xylenes, Total
116.080	001	EPA 8260B	Acetone
116.080	002	EPA 8260B	Acetonitrile
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	005	EPA 8260B	Allyl Alcohol
116.080	006	EPA 8260B	Allyl Chloride
116.080	007	EPA 8260B	Benzene
116.080	009	EPA 8260B	Bromoacetone
116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform
116.080	013	EPA 8260B	Bromomethane
116.080	014	EPA 8260B	n-Butyl Alcohol
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform
116.080	022	EPA 8260B	Chloromethane
116.080	023	EPA 8260B	Chloroprene
116.080	024	EPA 8260B	3-Chloropropionitrile
116.080	025	EPA 8260B	Crotonaldehyde
116.080	026	EPA 8260B	Dibromochloromethane
116.080	027	EPA 8260B	Dibromochloropropane
116.080	028	EPA 8260B	1,2-Dibromoethane
116.080	030	EPA 8260B	Dibromomethane
116.080	031	EPA 8260B	1,2-Dichlorobenzene
116.080	032	EPA 8260B	1,3-Dichlorobenzene
116.080	033	EPA 8260B	1,4-Dichlorobenzene
116.080	034	EPA 8260B	cis-1,4-Dichloro-2-butene
116.080	035	EPA 8260B	trans-1,4-Dichloro-2-butene
116.080	036	EPA 8260B	Dichlorodifluoromethane
116.080	037	EPA 8260B	1,1-Dichloroethane
116.080	038	EPA 8260B	1,2-Dichloroethane
116.080	039	EPA 8260B	1,1-Dichloroethene
116.080	040	EPA 8260B	trans-1,2-Dichloroethene
116.080	041	EPA 8260B	cis-1,2-Dichloroethene
116.080	042	EPA 8260B	1,2-Dichloropropane

116.080	043	EPA 8260B	1,3-Dichloropropane
116.080	044	EPA 8260B	2,2-Dichloropropane
116.080	045	EPA 8260B	1,1-Dichloropropene
116.080	046	EPA 8260B	cis-1,3-Dichloropropene
116.080	047	EPA 8260B	trans-1,3-Dichloropropene
116.080	048	EPA 8260B	1,3-Dichloro-2-propanol
116.080	049	EPA 8260B	1,2,3,4-Diepoxybutane
116.080	050	EPA 8260B	1,4-Dioxane
116.080	053	EPA 8260B	Ethylbenzene
116.080	055	EPA 8260B	Ethyl Methacrylate
116.080	056	EPA 8260B	Hexachlorobutadiene
116.080	058	EPA 8260B	2-Hexanone (MBK)
116.080	059	EPA 8260B	Iodomethane
116.080	060	EPA 8260B	Isobutyl Alcohol
116.080	061	EPA 8260B	Malononitrile
116.080	062	EPA 8260B	Methacrylonitrile
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)
116.080	065	EPA 8260B	Methylene Chloride
116.080	066	EPA 8260B	Methyl Ethyl Ketone
116.080	067	EPA 8260B	Methyl Methacrylate
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)
116.080	069	EPA 8260B	Naphthalene
116.080	070	EPA 8260B	Nitrobenzene
116.080	072	EPA 8260B	N-nitrosodi-n-butylamine
116.080	074	EPA 8260B	Pentachloroethane
116.080	075	EPA 8260B	Pentafluorobenzene
116.080	076	EPA 8260B	2-Picoline
116.080	078	EPA 8260B	Propionitrile
116.080	079	EPA 8260B	N-propylamine
116.080	080	EPA 8260B	Pyridine
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene
116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane

116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total
116.080	096	EPA 8260B	tert-Amyl Methyl Ether (TAME)
116.080	097	EPA 8260B	tert-Butyl Alcohol (TBA)
116.080	098	EPA 8260B	Ethyl tert-butyl Ether (ETBE)
116.080	099	EPA 8260B	Bromobenzene
116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2-Chlorotoluene
116.080	104	EPA 8260B	4-Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene

117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.015	001	LUFT GC/MS	Diesel-range Total Petroleum Hydrocarbons
117.016	001	LUFT	Diesel-range Total Petroleum Hydrocarbons
117.017	001	EPA 418.1	TRPH Screening
117.110	001	EPA 8270C	Acenaphthene
117.110	002	EPA 8270C	Acenaphthylene
117.110	003	EPA 8270C	Acetophenone
117.110	004	EPA 8270C	2-Acetylaminofluorene
117.110	005	EPA 8270C	1-Acetyl-2-thiourea
117.110	006	EPA 8270C	4-Aminobiphenyl
117.110	007	EPA 8270C	Aniline
117.110	008	EPA 8270C	Anthracene
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	017	EPA 8270C	p-Benzoquinone
117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate
117.110	020	EPA 8270C	Bis(2-chloroethoxy)methane

117.110	021	EPA 8270C	Bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Di(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	025	EPA 8270C	Carbazole
117.110	026	EPA 8270C	4-Chloroaniline
117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether
117.110	032	EPA 8270C	Chrysene
117.110	033	EPA 8270C	2-Cyclohexyl-4,6-dinitrophenol
117.110	034	EPA 8270C	2,4-Diaminotoluene
117.110	036	EPA 8270C	Dibenz(a,h)anthracene
117.110	037	EPA 8270C	Dibenzofuran
117.110	038	EPA 8270C	Dibenzo(a,e)pyrene
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	044	EPA 8270C	2,6-Dichlorophenol
117.110	045	EPA 8270C	Diethyl Phthalate
117.110	050	EPA 8270C	p-Dimethylaminoazobenzene
117.110	051	EPA 8270C	7,12-Dimethylbenz(a)anthracene
117.110	052	EPA 8270C	a,a-Dimethylphenethylamine
117.110	053	EPA 8270C	2,4-Dimethylphenol
117.110	054	EPA 8270C	Dimethyl Phthalate
117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	056	EPA 8270C	Di-n-octyl phthalate
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	063	EPA 8270C	Diphenylamine
117.110	064	EPA 8270C	1,2-Diphenylhydrazine
117.110	066	EPA 8270C	Ethyl Methanesulfonate
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene

117.110	072	EPA 8270C	Hexachloroethane
117.110	073	EPA 8270C	Hexachlorophene
117.110	074	EPA 8270C	Hexachloropropene
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	077	EPA 8270C	Isosafrole
117.110	078	EPA 8270C	Maleic Anhydride
117.110	079	EPA 8270C	3-Methylcholanthrene
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	082	EPA 8270C	Methyl Methanesulfonate
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	085	EPA 8270C	3-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	087	EPA 8270C	Naphthalene
117.110	088	EPA 8270C	1,4-Naphthoquinone
117.110	089	EPA 8270C	1-Naphthylamine
117.110	090	EPA 8270C	2-Naphthylamine
117.110	091	EPA 8270C	Nicotine
117.110	092	EPA 8270C	2-Nitroaniline
117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol
117.110	098	EPA 8270C	N-nitrosodi-n-butylamine
117.110	099	EPA 8270C	N-nitrosodiethylamine
117.110	100	EPA 8270C	N-nitrosodimethylamine
117.110	101	EPA 8270C	N-nitrosodi-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine
117.110	103	EPA 8270C	N-nitrosomethylethylamine
117.110	104	EPA 8270C	N-nitrosomorpholine
117.110	105	EPA 8270C	N-nitrosopiperidine
117.110	106	EPA 8270C	N-nitrosopyrrolidine
117.110	107	EPA 8270C	5-Nitro-o-toluidine
117.110	108	EPA 8270C	Pentachlorobenzene
117.110	109	EPA 8270C	Pentachloronitrobenzene
117.110	110	EPA 8270C	Pentachlorophenol
117.110	111	EPA 8270C	Phenacetin
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol

117.110	116	EPA 8270C	2-Picoline
117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	122	EPA 8270C	Safrole
117.110	124	EPA 8270C	1,2,4,5-Tetrachlorobenzene
117.110	125	EPA 8270C	2,3,4,6-Tetrachlorophenol
117.110	128	EPA 8270C	o-Toluidine
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.110	132	EPA 8270C	1,3,5-Trinitrobenzene
117.111	025	EPA 8270C	Dimethoate
117.111	026	EPA 8270C	Dinoseb
117.111	036	EPA 8270C	Famphur
117.111	039	EPA 8270C	Isodrin
117.111	040	EPA 8270C	Kepone
117.111	054	EPA 8270C	Parathion Ethyl
117.111	055	EPA 8270C	Parathion Methyl
117.111	056	EPA 8270C	Phorate
117.111	058	EPA 8270C	Sulfotepp
117.111	061	EPA 8270C	O,O,O-triethyl Phosphorothioate
117.140	001	EPA 8310	Acenaphthene
117.140	002	EPA 8310	Acenaphthylene
117.140	003	EPA 8310	Anthracene
117.140	004	EPA 8310	Benz(a)anthracene
117.140	005	EPA 8310	Benzo(a)pyrene
117.140	006	EPA 8310	Benzo(b)fluoranthene
117.140	007	EPA 8310	Benzo(k)fluoranthene
117.140	008	EPA 8310	Benzo(g,h,i)perylene
117.140	009	EPA 8310	Chrysene
117.140	010	EPA 8310	Dibenz(a,h)anthracene
117.140	011	EPA 8310	Fluoranthene
117.140	012	EPA 8310	Fluorene
117.140	013	EPA 8310	Indeno(1,2,3-c,d)pyrene
117.140	014	EPA 8310	Naphthalene
117.140	015	EPA 8310	Phenanthrene
117.140	016	EPA 8310	Pyrene
117.170	001	EPA 8330	4-Amino-2,6-dinitrotoluene
117.170	002	EPA 8330	2-Amino-4,6-dinitrotoluene
117.170	003	EPA 8330	1,3-Dinitrobenzene
117.170	004	EPA 8330	2,4-Dinitrotoluene

117.170	005	EPA 8330	2,6-Dinitrotoluene
117.170	006	EPA 8330	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
117.170	007	EPA 8330	Methyl-2,4,6-trinitrophenylnitramine
117.170	008	EPA 8330	Nitrobenzene
117.170	009	EPA 8330	2-Nitrotoluene
117.170	010	EPA 8330	3-Nitrotoluene
117.170	011	EPA 8330	4-Nitrotoluene
117.170	012	EPA 8330	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
117.170	013	EPA 8330	1,3,5-Trinitrobenzene
117.170	014	EPA 8330	2,4,6-Trinitrotoluene
117.190	001	EPA 8332	Nitroglycerine
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC
117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)
117.210	010	EPA 8081A	Chlorobenzilate
117.210	011	EPA 8081A	Chloroneb
117.210	012	EPA 8081A	Chlorothalonil
117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT
117.210	016	EPA 8081A	Diallate
117.210	020	EPA 8081A	Dieldrin
117.210	021	EPA 8081A	Endosulfan I
117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate
117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	029	EPA 8081A	Hexachlorobenzene
117.210	033	EPA 8081A	Methoxychlor
117.210	039	EPA 8081A	Toxaphene
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232

117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260
117.220	008	EPA 8082	2-Chlorobiphenyl
117.220	009	EPA 8082	2,3-Dichlorobiphenyl
117.220	010	EPA 8082	2,2',5-Trichlorobiphenyl
117.220	011	EPA 8082	2,4',5-Trichlorobiphenyl
117.220	012	EPA 8082	2,2',3,5'-Tetrachlorobiphenyl
117.220	013	EPA 8082	2,2',5,5'-Tetrachlorobiphenyl
117.220	014	EPA 8082	2,3',4,4'-Tetrachlorobiphenyl
117.220	015	EPA 8082	2,2',3,4,5'-Pentachlorobiphenyl
117.220	016	EPA 8082	2,2',4,5,5'-Pentachlorobiphenyl
117.220	017	EPA 8082	2,3,3',4',6-Pentachlorobiphenyl
117.220	018	EPA 8082	2,2',3,4,4',5'-Hexachlorobiphenyl
117.220	019	EPA 8082	2,2',3,4,5,5'-Hexachlorobiphenyl
117.220	020	EPA 8082	2,2',3,5,5',6-Hexachlorobiphenyl
117.220	021	EPA 8082	2,2',4,4',5,5'-Hexachlorobiphenyl
117.220	022	EPA 8082	2,2',3,3',4,4',5-Heptachlorobiphenyl
117.220	023	EPA 8082	2,2',3,4,4',5,5'-Heptachlorobiphenyl
117.220	024	EPA 8082	2,2',3,4,4',5',6-Heptachlorobiphenyl
117.220	025	EPA 8082	2,2',3,4',5,5',6-Heptachlorobiphenyl
117.220	026	EPA 8082	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl
117.240	001	EPA 8141A	Atrazine
117.240	002	EPA 8141A	Azinphos Methyl
117.240	004	EPA 8141A	Chlorfenvinphos
117.240	005	EPA 8141A	Chlorpyrifos
117.240	006	EPA 8141A	Chlorpyrifos Methyl
117.240	007	EPA 8141A	Demeton-O
117.240	008	EPA 8141A	Demeton-S
117.240	009	EPA 8141A	Diazinon
117.240	010	EPA 8141A	Dimethoate
117.240	012	EPA 8141A	EPN
117.240	013	EPA 8141A	Ethion
117.240	014	EPA 8141A	Famphur
117.240	015	EPA 8141A	Malathion
117.240	016	EPA 8141A	Mevinphos
117.240	017	EPA 8141A	Naled
117.240	018	EPA 8141A	Parathion Ethyl
117.240	019	EPA 8141A	Parathion Methyl
117.240	020	EPA 8141A	Phorate

117.240	022	EPA 8141A	Ronnel
117.240	024	EPA 8141A	Sulfotepp
117.240	026	EPA 8141A	Thionazin
117.250	001	EPA 8151A	2,4-D
117.250	002	EPA 8151A	2,4-DB
117.250	003	EPA 8151A	2,4,5-T
117.250	004	EPA 8151A	2,4,5-TP
117.250	006	EPA 8151A	Dalapon
117.250	007	EPA 8151A	Dichlorprop
117.250	008	EPA 8151A	Dinoseb
117.250	009	EPA 8151A	MCPA
117.250	010	EPA 8151A	MCPP
117.250	011	EPA 8151A	4-Nitrophenol
117.250	012	EPA 8151A	Pentachlorophenol
117.250	013	EPA 8151A	Picloram
117.250	014	EPA 8151A	Dicamba
117.250	015	EPA 8151A	3,5-Dichlorobenzoic Acid
117.250	016	EPA 8151A	Acifluorfen
117.250	017	EPA 8151A	Bentazon
117.250	018	EPA 8151A	Chloramben
117.250	019	EPA 8151A	DCPA

120 - Physical Properties of Hazardous Waste

120.010	001	EPA 1010	Ignitability
120.040	001	Section 7.3 SW-846	Reactive Cyanide
120.050	001	Section 7.3 SW-846	Reactive Sulfide
120.070	001	EPA 9040B	Corrosivity - pH Determination
120.080	001	EPA 9045C	Corrosivity - pH Determination

USACE Candidate Environmental Laboratory
Self-Declaration Form

The following self declaration form is provided to the candidate environmental laboratory by the COR, completed by the laboratory and returned to the COR. The self-declaration form should also be provided to the laboratory evaluator (if different from COR) with requested documentation that demonstrates compliance with the QSM prior to the provision of environmental analytical support for USACE contracts. Before testing services can be performed by the laboratory, the COR will notify the candidate laboratory of the acceptability of the declaration and supporting documentation. The form is to be updated on an annual basis.

Legal name of laboratory:	**EMAX Laboratories, Inc.**
Street address:	**1835 W. 205th Street** **Torrance, CA 90501**
Name of Owner:	**Kam Y. Pang, Ph.D.**
Owner address (if different):	
Phone number:	**310.618.8889**
E-Mail address:	**Info@emaxlabs.com**
Web site:	**www.emaxlabs.com**
Laboratory director:	**Tu Nisamaneepong, Ph.D.**
Phone number:	**310.618.8889**
E-Mail address:	**tunisa@emaxlabs.com**
Quality Assurance Officer:	**Kenette Pimentel**
Phone number:	**310.618.8889**
E-Mail address:	**KPimentel@emaxlabs.com**

USACE Candidate Environmental Laboratory
Self-Declaration Form

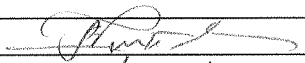
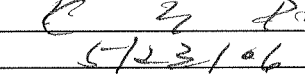
The undersigned persons understand and acknowledge that:

a. Laboratory operations, which will be utilized for testing in support of environmental analytical testing for USACE, are in full compliance with the most recent version of the DOD Quality Systems Manual (including NELAC Standard Chapter 5 and Appendix requirements). All written documentation provided to USACE, accompanying this declaration, accurately reflect policy and practices implemented by laboratory staff.

b. The Laboratory will notify USACE immediately of change in status of laboratory operations that may affect on-going compliance as declared per item a.

c. The Laboratory acknowledges that USACE may audit the laboratory, relative to policy compliance at any time deemed appropriate; and will allow a designated COR fill access to information and facilities to conduct such audit operations.

d. Signatories are authorized to sign this form on behalf of the owner and that there are no misrepresentations in the information provided in the initial laboratory assessment package.

Signature of Quality Assurance Officer:	
Date:	5/23/06
Signature of Laboratory Director:	
Date:	5/23/06

Note: *Minimally, the laboratory evaluator should receive the completed declaration form with the following material (to verify compliance with the QSM):*

- *A copy of the laboratory's most current Quality Assurance Manual (e.g., the laboratory's ethics program policies and quality system procedures), and select QA SOPs (minimally, the laboratory's SOPs for MDL studies and LCS control chart limits).*
- *The determinative and preparatory method SOP for the parameters for which testing will be performed.*
- *Method performance demonstration for the parameters of interest—minimally, MDL studies and LCS control ranges for the preparatory-determinative method combinations and PT sample results (from a NELAP accredited PT provider) for the parameters of interest (e.g., or NELAP accreditation for these parameters, when NELAP accreditation is offered for the parameter of interest).*

TOC ADD

STANDARD OPERATING PROCEDURE

SAMPLE RECEIVING

SOP No.:	EMAX-SM02 Revision No. 4	Effective Date:	15-Jan-04
Prepared By:	Cecilia Chavez	Date:	1-9-04
Approved By:	Kenette Pimentel, QA Manager	Date:	01.09.04
Approved By:	Kam Pang, Laboratory Director	Date:	1/9/04

Control Number: SM02-04-

1.0 PURPOSE

1.1. To describe sample acceptance policy, sample receiving and sample storage procedures.

2.0 POLICIES

2.1. Any sample received by EMAX Laboratories Inc. must be processed as described in this procedure to ensure that inspection is thorough, the documentation is complete and the chain of custody is maintained.

2.2. The Sample Custodian shall be responsible for implementing the procedures set forth in this SOP and shall adhere to the QC procedures as described in Appendix 1.

2.3. The Department Supervisor shall be responsible for checking and overseeing that the process is properly enforced and are effectively applicable for the functions it is designed for.

2.4. The Project Manager shall be responsible to make sure that the activities performed in this Section are in compliance to project specific requirements. The PM shall also obtain and relay resolution(s) of discrepancies on a timely manner.

2.5. All samples under the custody of EMAX Laboratories shall be stored in a properly maintained and secured Sample Control Room.

2.6. All refrigerators used for sample storage shall be maintained as described in EMAX-QC03.

3.0 ASSOCIATED SOP

3.1.	EMAX-SM01	-	Sample Management
3.2.	EMAX-QC03	-	Refrigerator Control
3.3.	EMAX-RS02	-	Receiving Radioactive Material
3.4.	EMAX-RS03	-	Control of Radioactive Samples

4.0 SAFETY

4.1. Read all MSDS of preservatives listed in this SOP.

4.2. Post the list of projects from superfund sites and projects requiring leaching procedures in the sample control room. All sample coolers from these projects must be opened under a fume hood.

4.3. Sample Chain of Custody comment section shall be reviewed prior to starting sample inspection. Any information related to proper sample handling should be disseminated in advanced by the Sample Custodian.

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4.4. All samples shall be treated as potential hazards. Observe the standard laboratory safety procedures. Protective gear, i.e., lab coat, safety glasses, gloves shall be worn at all times when performing this procedure.

5.0 PROCEDURES

5.1. Accepting Sample Custody

5.1.1. Samples Delivered by a Third Party (FedEx, UPS, etc.)

5.1.1.1. Check for the following:

- ✓ Presence of airbill/delivery receipt.
- ✓ Check if the delivery is for EMAX

5.1.1.2. Sign the third party delivery form and accept the cooler(s).

5.1.1.3. If samples were received from DOE site, refer to EMAX-RS02 and EMAX-RS03.

5.1.1.4. If more than one cooler is received, place a numeric mark on the coolers starting from #1. If coolers are numbered as received, use the existing number. Proceed to 5.2

5.1.2. Samples Delivered by the Client

5.1.2.1. Check the COC for the presence of the following:

- ✓ Client Name
- ✓ Client Address, Telephone #, and Fax #
- ✓ Project Name and Contact Person
- ✓ Turn Around Time
- ✓ Sampler Name and Signature
- ✓ Sample ID Number for Each Sample
- ✓ Sampling Time and Date
- ✓ Sample Container Type/Size
- ✓ Sample Matrix
- ✓ Analysis Required/Requested
- ✓ Signature of the courier with date and time

5.1.2.2. If discrepancies are found, notify the PM to resolve the issue with the client representative. If it can not be resolved, note it in the SRF.

5.1.2.3. Sign the COC, and write the date and time of receipt.

5.1.2.4. If more than one cooler is received, place a numeric mark on the coolers. Proceed to 5.2.

5.1.3. Samples Picked-up by EMAX Courier

5.1.3.1. Check that the coolers are intact.

5.1.3.2. If coolers are not sealed, check that samples are packed properly to prevent any breakage during transport

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5.1.3.3. If coolers are sealed prior to accepting the COC, note on COC comments section that coolers are sealed.

5.1.3.4. Follow steps 5.1.2

5.1.3.5. Sign the COC with date and time upon arrival at the laboratory

5.1.3.6. Endorse the coolers and the COC to the Laboratory Sample Custodian. If more than one cooler is received, place a numeric mark on the coolers.

5.1.3.7. Sample Custodian shall inspect/accept the custody of the COC and the coolers as described by 5.1.2. Proceed to 5.2

5.2. Sample Inspection

5.2.1. Bring the cooler(s) to the fume hood. Turn on the fume hood.

5.2.2. Check the COC for any warning regarding safety issues.

5.2.3. Open the coolers and check presence of cooler thermometer or temperature blank. If both are not present proceed to 5.2.4

5.2.3.1. If cooler thermometer is present, proceed to 5.2.5.

5.2.3.2. If a temperature blank is present, open the container and submerge the thermometer into the liquid. Proceed to 5.2.5.

5.2.4. Place the thermometer in between or near the sample(s).

5.2.5. Close the cooler and let it stand by for at least 5 minutes.

5.2.6. Read the thermometer and record the temperature for each cooler, in the COC(s) and SRF.

5.2.6.1. If all coolers are received with designated COC, record the temperature of each cooler in the associated COC.

5.2.6.2. If COC is not specific to each cooler, identify which samples are contained in each cooler in the comment section of the COC and correspondingly record the temperatures of each cooler.

Example: Three coolers were received accompanied by one COC. Cooler number one temperature reading is 3 ^{o}C, and contains samples, 1,3, 7 and 12. Cooler number two temperature reading is 4 ^{o}C and contains 2,4,5 and 6. Cooler number three-temperature reading is 4 ^{o}C and contains 8, 9, 10 and 11. The comment section of the COC should read:

1 - 3 ^{o}C – samples 1, 3, 7, 12

2 - 4 ^{o}C – samples 2, 4, 5, 6

3 - 4 ^{o}C –samples 8 to 11

5.2.7. Line-up the samples according to the COC sequence and check for agreement with the sample tag. At a minimum check for the following information:

- ✓ Client Sample ID
- ✓ Sampling Date/Time
- ✓ Analysis Requested
- ✓ Preservative

- ✓ Sample Container
- ✓ Matrix

5.2.8. Check for the sample integrity.

- ✓ Custody seal and sample container is intact
- ✓ Initial of sampler is present
- ✓ Check for sample holding time/preservation. Refer to Table 1.
- ✓ Check for pH if required
  - Ensure that the sample cap is sealed properly.
  - Shake the sample, open the cap and pour a small amount of sample into the cap. Trickle the transferred sample into an appropriate pH strip indicator.
  - Compare the pH strip with the pH indicator table.
  - Record the pH and any discrepancy on the SRF.
- ✓ Check for Sample Adequacy

5.2.9. Check for sample sufficiency (refer to Table 1)

- ✓ Sample(s) received is enough for all the analyses requested.
- ✓ Sample(s) for MS/MSD is enough for all analyses requested and if more than one container is sent, check visually the consistency of samples and label of containers; e.g. do all container labels agree, do the samples contained look the same.

5.3. **Assigning EMAX Control Number (ECN)**

5.3.1. Write the next available ECN[1] into the COC. Record the date, the project and sample location into the ECN log corresponding to the ECN taken.

5.3.2. Assign a unique Lab Sample ID (LSID) and Lab Sample Container ID (LSCID) to each sample received as described in EMAX-SM01.

5.4. **Labeling the Samples**

5.4.1. Line-up the samples according to the COC sequence.

5.4.2. Using the labeling gun, position the characters of the first line to agree with the LSID and the second line to agree with the LSCID.

5.4.3. Counter-check the COC sample label and ensure agreement with the sample tag.

5.4.4. Press the labeler trigger and attach the printed label on a free space of the sample label. Press the trigger again and attach on the sample cover.

5.4.5. Repeat steps 5.4.2 to 5.4.4 until all samples are labeled.

5.4.6. Have the sample labeling reviewed by the Supervisor or his/her designee and document review in the SRF.

5.4.7. Store samples as described in EMAX-SM01- Sample Management.

5.5. **Sample Receipt Form (SRF)**

[1] Refer to EMAX-SM01 for generating ECN.

5.5.1. Complete the SRF1 and SRF2 to have all the information pertinent to the sample(s) received (see Appendix 2).

5.5.2. For conformance to requirement of sample condition, refer to Table 1.

5.5.3. Write all discrepancies found in the SRF1.

5.5.4. Have the SRFs reviewed by the supervisor or his/her designee.

5.5.5. Make three copies of the SRFs and the COC(s) and distribute one set of copies to the PM, the Sample Preparation Dept. and the Operations Manager. The PM shall provide one set of copies of the SRF and COCs to the log-in after checking.

5.5.6. The PM resolves discrepancies with the Client.

6.0 QUALITY CONTROL

6.1. All samples shall be counter checked by a second person after labeling prior to sample storage.

6.2. All SRFs shall be reviewed by the Sample Management Supervisor or his/her designee.

6.3. All anomalies reported shall require closures before work orders commence.

6.4. All reviews shall be initialed and dated.

7.0 CORRECTIVE ACTION

7.1. The requirements for sample containers, preservations, holding time and minimum amount of sample is listed in Table 1. Acceptance criteria and corrective actions for samples are listed in Appendix 1.

7.2. The PM shall follow-up all resolutions to issues and discrepancies in a timely manner and shall document all correspondence.

7.3. The PM shall then relay the resolutions in writing [resolution on SRF1 and/or email/fax attached to the SRF1], to the Sample Management Dept. and all other affected departments for appropriate action.

8.0 SUPPLEMENTARY NOTES

8.1. Definition Of Terms

8.1.1. Chain-of-Custody (COC) – is a record where sample custody transfer is documented. At a minimum the COC shall contain the project ID, sample ID, sampling location, date/time of collection, chemical preservatives (if any) dated signatures of individuals involved in the sample transfer.

8.1.2. Composite Sample – is an equal amount of sample aliquot combined together from specified sample containers.

8.1.3. Corrective Action - Action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

8.1.4. EMAX Control Number (ECN) – is an identification given to a group of samples received from a project that arrived on the same day accompanied by a chain-of-custody (COC). Grouping of samples is determined by either the project or the Project Manager's discretion.

8.1.5. Internal COC (ICOC) – is a record used by the laboratory to document when samples are withdrawn from the sample control room. This record shall contain the Lab Sample IDs of

samples withdrawn, the intended analysis, the initials of the custodian and recipients, and the date and time of sample turn over.

8.1.6. Lab Sample ID – is EMAX sample identification to uniquely identify each sample.

8.1.7. Lab Sample Container ID (LSCID) – is EMAX sample container identification to uniquely identify each sample container.

8.1.8. Sample Receipt Form 1 (SRF1)- is a record where to logged-in the type of delivery, who delivered the samples, the packaging condition, temperature upon receipt and the conditions or any discrepancies of samples during receiving.

8.1.9. Sample Receipt Form 2 (SRF2)- is a record where to logged-in the container type, any chemical preservative and conditions per container of samples upon receipt.

8.1.10. Nonconformance - An indication or judgment that a product or service has not met the requirements of the relevant specifications, contract or regulation; also the state of failing to meet the requirements.

8.1.11. Preservative – is a chemical added to a sample to maintain its integrity prior to analysis.

8.1.12. Project Specific Requirement (PSR) – is a document containing the summary of project requirements, the QC references and other information needed to complete the work order.

8.1.13. Sample – is a specimen received in the laboratory bearing a unique client sample ID traceable to the accompanying COC. Each unique client sample ID shall have a corresponding unique Lab Sample ID, unless otherwise specified by the project. Hence, samples collected in different containers having the same client sample ID are labeled with the same corresponding Lab Sample ID.

8.1.14. Sample Delivery Group (SDG) – is a group of samples received over a period of 14 days or less, not exceeding 20 samples per analysis per matrix.

8.1.15. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

8.1.16. Trip Blank – is a target-analyte-free sample, which travels with the sample to monitor possible contamination during sample transport. This sample is analyzed for volatiles.

9.0 APPENDICES & TABLES

9.1. Table 1 - Required Sample Condition

9.2. Appendix 1 - Summary of Quality Control Procedures

9.3. Appendix 2 - Sample Receipt Forms (SRF1 & SRF2)

REQUIRED SAMPLE CONDITION-WATER SAMPLES

Parameters	Method		Sample Container	Preservative	Holding Time	Minimum Sample Amount, (ml)
Acidity	305.1	2310B	125-ml HDPE	4°C	14 days	100
Alkalinity	310.1	2320B	125-ml HDPE	4°C	14 days	100
Ammonia	350.2		500-ml HDPE	4°C,pH<2 H_2SO_4	28 days	100
Biochemical O_2 Demand	405.1	5210B	1000-ml HDPE	4°C,pH<2 H_2SO_4	48 hours	1000
BOD (Carbonaceous)	405.1	5210B	1000-ml HDPE	4°C,pH<2 H_2SO_4	48 hours	1000
Bromide	300.0		125-ml HDPE	4°C	28 days	25
Chloride	300.0		125-ml HDPE	4°C	28 days	100
Chromium VI	218.6	7196A	250-ml HDPE	4°C	24 hours	200
COD	410.1	5310B	125-ml HDPE	4°C,pH<2 H_2SO_4	28 days	50
Cyanide (Total and Amenable)	335.1 335.2	9010B 9014	1000-ml HDPE	4°C,Ph>12 NaOH	14 days	500
Fluoride	300.5	340.2	125-ml HDPE	None	28 days	25
Gross Alpha/Beta	900.0	9310	2000-ml HDPE	4°C,pH<2 $HN0_3$	180 days	2000
Hardness	130.1	2340B 2340C	125-ml HDPE	pH<2 $HN0_3$	180 days	100
Ignitability	1010		500-ml HDPE	4°C	ASAP (24-hrs from receipt)	500
Mercury	245.1	7470A	125-ml HDPE	HNO_3, pH<2; 4°C	28 days	100
Metals (Except Hg and Cr VI)	6010B	200.7	250-ml HDPE	HNO_3, pH<2; 4°C	180 days	100
Nitrate/Nitrite-N	300.0	353.3	125-ml HDPE	4°C,pH<2 H_2SO_4	28 days	25
Nitrate-N	300.0	354.1	125-ml HDPE	4°C	48 hours	25
Orthophosphate	300.0	365.2	125-ml HDPE	Filter Immediately 4°C	48 hours	100
Oil & Grease	413.1 413.2	1664	1000-ml Amber Glass	4°C,pH<2 HCl	28 days	1000
Perchlorate	314.0		125-ml HDPE	4°C	48 hours	25
PH (Hydrogen Ion)	150.1	9040A	125-ml HDPE	None	ASAP (24 hours from receipt)	50
Phenols	420.1		500-ml HDPE	4°C,pH<2 H_2SO_4	28 days	500
Phosphorus	365.2		250-ml HDPE	4°C,pH<2 H_2SO_4	28 days	50
Silica	370.1		125-ml HDPE	4°C	28 days	50

REQUIRED SAMPLE CONDITION-WATER SAMPLES

Parameters	Method		Sample Container	Preservative	Holding Time	Minimum Sample Amount, (ml)
Solids (TDS, TSS, TS)	160.1 160.2 160.3	2540C 2540D	125-ml HDPE	4°C	7 days	100
Solids, Settleable	160.5		1000--ml HDPE	4°C	24 hours	1000
Specific Conductance	120.1		125-ml HDPE	4°C	28 days	100
Sulfate	300.0	375.3	125-ml HDPE	4°C	28 days	25
Sulfide	376.1 376.2	9030	125-ml HDPE	4°C, NaOH to pH>9, Zinc Acetate	7days	100
Surfactants	425.1		250-ml HDPE	4°C	48 hours	250
TKN	351.3		125-ml HDPE	4°C,pH<2 H_2SO_4	28 days	50
TOC	415.1		125-ml HDPE	4°C,pH<2 H_2SO_4	28 days	25
TRPH	418.1		1000-ml Amber Glass	4°C,pH<2 H_2SO_4	14days	1000
Turbidity	180.1		125-ml HDPE	4°C	48 hours	40
Volatile Organics	624 8021B	8260B 8015B	40 ml Vial with Teflon-faced septa	4°C, HCl to pH <2	14 days	40
Extractable Organics	8015B 8081A 8082 8141A	8280 8151A 8270C 8310	1000-ml Amber Glass	4°C	7 days (40 days extracts)	1000
Explosives	8330		250-ml Amber Glass	4°C	7 days (40 days extracts)	200

REQUIRED SAMPLE CONDITION

Parameters	Method	Sample Container	Preservative	Holding Time	Minimum Sample Amount, (g)
Volatile Organics	8021B 8260B	Encore Tube (or equivalent)	4°C	48 hours	5
Volatile Organics	8021B 8260B	Encore Tube (or equivalent)	4°C, $Na_2S_2O_3$ solution or Methanol	14 days	5
Purgeable TPH	8015B	2-4 oz Jar/Shelby Tube	4°C	14 days	5
Extractable Organics	8015B 8081A 8082 8141A 8151A 8270C 8280 8310 8330	4-8 oz Jar/Shelby Tube	4°C	14 days (40 days extracts)	30
Ignitability	1020A	4-8 oz Jar/Shelby Tube	4°C	ASAP (24 hours from receipt)	100
Perchlorate	314.0	4-8 oz Jar/Shelby Tube	4°C	28 days	10
Metals	6010B	4-8 oz Jar/Shelby Tube	4°C	180 days	5
Chromium VI	7196A 7199	4-8 oz Jar/Shelby Tube	4°C	24 Hours	10
Mercury	7471A	4-8 oz Jar/Shelby Tube	4°C	28 days	5
Cyanide	9010B 9014	4-8 oz Jar/Shelby Tube	4°C	14 days	10
Sulfide	9030	4-8 oz Jar/Shelby Tube	4°C	7 days	10
PH (Hydrogen Ion)	9040 9045	4-8 oz Jar/Shelby Tube	None	ASAP (24 hours from receipt)	10
Specific Conductance	9050	4-8 oz Jar/Shelby Tube	None	ASAP (24 hours from receipt)	10
Anions (Br, Cl, F, NO_3/NO_2, SO_4)	9056	4-8 oz Jar/Shelby Tube	None	28 days	10
Nitrate-N	9056	4-8 oz Jar/Shelby Tube	None	48 Hours	10
TOC	9060 Walkley Black	4-8 oz Jar/Shelby Tube	None	28 days	10
Phenols	9066	4-8 oz Jar/Shelby Tube	None	24 Hours	10

SUMMARY OF QUALITY CONTROL PROCEDURES FOR SAMPLE RECEIVING

Parameter	Acceptance Criteria	Corrective Action
Cooler/Sample Custody Seal	To maintain sample integrity at all time, custody seal must be intact when samples are received.	• Take cooler temperature reading • Inform the client immediately. • Wait for the client response before proceeding.
Integrity Of Sample Container	All samples shall be protected from any form of contamination. Samples received must be intact.	• Place sample(s) in a double zipped locked bag. • Inform the client immediately • Wait for Client response before proceeding
Cooler Temperature	Samples must be received at 4°C (± 2°C).	• Take the cooler temperature reading. • Inform the client immediately • Wait for Client response before proceeding
Sample Holding Time	Samples must be analyzed within holding time. Refer to Table 1	• Check COC if special instruction is present. • Inform the client immediately. • Wait for Client response before proceeding.
Preservation	Samples must be received with proper and adequate preservative (refer to Table 1)	• Inform the client immediately • Wait for Client response before proceeding
Volatile Samples	Water samples for volatile analyses requires zero headspace Presence of air bubble must not to exceed 6mm. Samples must be accompanied with Trip Blank in the same cooler.	• Check the number of sample containers. If more than one is submitted, and the other sample is okay, note the discrepancy on the SRF and proceed with sample receiving. • Corresponding to the sample container ID, write “Bubble >6mm” as discrepancy in the SRF. If all vials for a sample have bubble >6mm, inform the PM immediately so that client can be notified promptly. • If there is only one sample container received, inform the client immediately. • If Trip Blank is misplaced or lacking, inform the client immediately.
Sample Amount	Refer to Table 1 for appropriate sample container for specific analysis.	• Inform the Client immediately • Wait for the response before proceeding.
Sample Label	COC and sample tag must agree.	• Document the discrepancy following the convention below: Sample Control #XXXXXX-XX Client sample ID XXXXXXXXX COC reads …… Field sample tag reads …….. • Submit copy to SRFs and COCs to PM for proper action.
Others (any other parameters observed that is not listed above.)	Must be verified.	• Report to the Supervisor

SAMPLE RECEIPT FORM 1

Type of Delivery	Delivered By/Airbill	ECN	
☐ EMAX Courier		Recepient	
☐ Client Delivery		Date	
☐ Third Party		Time	

COC Inspection

☐ Client Name	☐ Sampler Name	☐ Sampling Date/Time/Location
☐ Address	☐ Courier Signature/Dat	☐ Analysis Required
☐ Client PM/FC	☐ TAT	☐ Matrix
☐ Tel #/Fax #	☐ Sample ID	☐ Preservative (if any)
Safety Issues ☐ None	☐ High Concentrations expected	☐ Superfund Site Samples
Comments: ☐ Rad Screening Required		

Packaging Inspection

Container	☐ Cooler	☐ Box	☐	☐
Condition	☐ Custody Seal	☐ Intact	☐ Damaged	☐
Packaging	☐ Bubble Pack	☐ Styrofoam	☐ Sufficient	☐
Temperatures	☐ Cooler 1 _____	☑ Cooler 2 _____	☐ Cooler 3 _____	☐ Cooler 4 _____
	☐ Cooler 5 _____	☐ Cooler 6 _____	☐ Cooler 7 _____	☐ Cooler 8 _____
	☐ Cooler 9 _____	☐ Cooler 10 _____	☐ Cooler 11 _____	☐ Cooler 12 _____

Comments:

LSCID	Client ID	Discrepancy	Corrective Action

LSCID : Lab Sample Container ID

REVIEWS

Sample Labeling _____ SRF _____ PM _____

Date _____ Date _____ Date _____

SAMPLE RECEIPT FORM 2

SAMPLES RECEIVED FOR ECN:

LSID (*)	LSCID	CONTAINER TYPE								CHEMICAL PRESERVATIVE									Filtered	
		Jar	Amber	HDPE	Encore	Vial	Tube	Bag	Other	NONE	HCl	HNO3	H2SO4	ZnAc + NaOH	Picric Acid	Na2SO4	NaOH	Other	Yes	No
	* 1																			
	* 2																			
	* 3																			
	* 4																			
	* 5																			
	* 6																			
	* 7																			
	* 8																			
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	* 8																			
	* 9																			
	* 0																			

LSID Lab Sample ID
LSCID Lab Smple Container ID

PRINT DRF

TOC

STANDARD OPERATING PROCEDURE

SAMPLE MANAGEMENT

SOP No.:	EMAX-SM01 Revision No. 3	Effective Date:	15-Jan-04
Prepared By:	Cecilia Chavez	Date:	1-9-04
Approved By:	Kenette J. Pimentel, QA Manager	Date:	01.09.04
Approved By:	Kam Pang, Laboratory Director	Date:	1/9/04

Control Number: SM01-03-

1.0 PURPOSE

1.1. To describe EMAX's sample management, its internal control and work order distribution.

1.2. To ensure that samples and extracts under EMAX's custody shall be traceable at all times.

1.3. To maintain the internal sample custody to stand legally defensible by documenting the history of a sample, assuring that it has always been under the custody of an authorized individual, and that no sample is accidentally or purposely tampered.

2.0 POLICIES

2.1. Any sample processed for analysis must be handled under the chain-of-custody protocol. A sample is under custody when one of the following conditions is met:

- It is in your possession.
- It is in your view after being in your possession.
- It was in your possession and you locked or sealed it up to prevent tampering.
- It is in a designated secure area. The secured area is one, which is accessible only to authorized personnel.

2.2. All EMAX personnel associated with the analytical process should understand the requirements for the chain-of-custody protocol and shall comply with the provisions of this procedure.

2.3. The Sample Custodian shall be responsible for relinquishing the samples from the sample control room and receiving the samples back when returned. The Sample Custodian is also responsible to make sure that the ICOC is properly filled-out.

2.4. Any analyst having a sample in his/her possession is responsible for its custody and integrity. He/she shall be responsible in returning the samples to their designated storage area, under the supervision of the Sample Custodian.

2.5. The Department Supervisor shall be responsible for enforcing the policies set forth in this SOP.

2.6. Change orders shall be initiated by the Project Manager (PM). In the absence of the PM, the Laboratory director or the Operations Manager may act on behalf of the PM and will leave a copy of the change order on the PM's mailbox.

2.7. All discrepancies/anomalies related to sample management shall be forwarded to the PM to obtain proper resolution.

2.8. The QA Manager shall be responsible to ensure that the activities performed in this Section is in compliance to all requirements of the different programs EMAX is currently in participation.

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3.0 ASSOCIATED SOP

3.1.	EMAX-SM02	-	Sample Receiving
3.2.	EMAX-QC03	-	Refrigerator Control
3.3.	EMAX-QC04	-	Balance Calibration
3.4.	EMAX-RS02	-	Receiving Radioactive Material
3.5.	EMAX-RS03	-	Control of Radioactive Samples

4.0 SAFETY

4.1. All sample compositing and sub-sampling must be done under a fume hood.

4.2. Sample Chain-of-Custody (COC) comment section shall be read prior to starting sample inspection. Any information that may cause hazard to those that will handle, process and/or analyze the sample(s) shall be disseminated in advanced by the Sample Custodian.

4.3. All samples shall be treated as potential hazards. Observe the standard laboratory safety procedures. Protective gear, i.e., lab coat, safety glasses, gloves, shall be worn at all times when performing this procedure.

5.0 PROCEDURES

5.1. **EMAX Control Number (ECN)**

5.1.1. Generate an ECN to uniquely identify every group of samples received from one project on the same day (refer to Section 6.1 for definition) using the convention below.

YYMNNN

Where:

YY -Last two digits of the calendar year. (i.e., 00, 01, 03, etc)

M -The month in which the sample is brought in (A-Jan., B-Feb. … L-Dec.)

NNN -The sequential number that resets to 001for the first group of samples received every month

Example: The ECN for the first group of samples received from project XYZ on January of 2002 shall be ***02A001.***

5.2. **Lab Sample ID (LSID) and Lab Sample Container ID (LSCID)**

5.2.1. Assign a LSID to uniquely identify each sample received using the ECN followed by a two digit sequential number that resets to “01” in every ECN. This number corresponds with each client sample ID.

5.2.2. Assign a LSCID to uniquely identify each sample container received using the LSID followed by a three digit sequential number that resets to “001” in every ECN.

Example: The first group of sample received for the month of January 2002 were two vials for volatile bearing the same ID and two other samples bearing different IDs for metals analysis. The control numbers and sample labels shall read as follows:

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ECN	*LSID*	*LSCID*	*Sample Containers*
02A001	*A001-01*	*A001-01-001* *A001-01-002*	*2*
02A001	*A001-02*	*A001-02-003*	*1*
02A001	*A001-03*	*A001-03-004*	*1*

5.3. **Sample Delivery Group1 (SDG)**

5.3.1. Group samples received within 14 days or less not to exceed 20 per analysis, per matrix.

5.3.2. If an SDG is composed of more than one delivery, assign the first ECN as the SDG number. The ECN number is the SDG number if SDG is completed in one delivery.

5.4. **Sample Receiving**

5.4.1. Check that samples received have Project Specific Requirement (PSR) ready. If not, check with the Operations Manager for further advice. For samples from DOE refer to EMAX-RS01 and EMAX-RS03.

5.4.2. Login every group of samples received in the ECN Log (see Appendix 1).

5.4.3. Follow the procedures detailed in SOP EMAX-SM02 – Sample Receiving.

5.4.4. Make three copies of the COC, SRF and the PSR. Distribute to the following:

- Sample Preparation Supervisor
- Operations Manager
- Project Manager (PM)

5.4.5. If discrepancies are found at this stage, clarify with the Project Manager.

5.5. **Processing Work Orders**

5.5.1. Prepare Master Folder to contain the following:

- Original COC
- Airbill (if any)
- Original Sample Receipt Forms (SRF1 & SRF2)
- Copy of the Project Specific Requirement (PSR)

5.5.2. Prepare Analytical Folders for each analysis requested in the COC.

5.5.2.1. Choose the type of folder to be used.

- Use Manila folders for samples with regular turn around time (more than five working days).
- Use green folders for all samples with RUSH (seven working days or less) turn around time.

[1] This system of sample grouping shall only be applicable when it is specified by the project. Refer to 6.1 for definition.

- Use specified folder color for projects with designated color code.

5.5.2.2. The folder tab shall contain the following information:

- Analysis
- Client/Project
- EMAX Control Number (ECN)

5.5.2.3. The analytical folders shall contain the following:

- Copy of the COC
- Copy of the PSR
- Summary of QC Procedures (PSR)
- RL & QC Limits
- Other pertinent instructions/information for the analytical and/or reporting process, e.g. SRFs with discrepancies/corrective actions, change orders, etc.

5.5.3. Routing the Work Order

5.5.3.1. Endorse the Master Folder and the analytical folders to the Project Manager (PM) for review.

5.5.3.2. The PM reviews the Master Folder

5.5.3.3. After which the PM drops the analytical folders to the supervisor's work order boxes and the master folder to Data Processing.

5.5.3.4. Department Supervisors distributes the workload to analysts.

5.6. **Project Management**

5.6.1. Review of SRF

5.6.1.1. Sample Management reviews the SRFs to make sure that the form is properly filled and discrepancies (if any) are described properly and accurately.

5.6.1.2. The Project Manager reviews the SRF and resolves discrepancies (if any) contained in the SRF. Resolutions shall be documented/attached in the SRF and the PM shall inform all parties affected.

5.6.2. Electronic Sample Login

5.6.2.1. Using LabWorks LIMS, login the following:

- Client Information [name, project, address, recipient of report]
- Sample Information [client sample ID, collection date / time, receiving / due dates, EMAX control number]

5.6.2.2. Refer to LabWorks User's Manual for software operation procedures.

5.6.2.3. Generate review sheet and submit the review sheet to the PM.

5.6.2.4. The PM reviews the login and initials and dates the review sheet. If corrections are necessary, the review sheet with corrections is returned to the LIMS login for correction. Repeat the process until all information is correctly logged-in.

5.6.2.5. The PM attaches the review sheet(s) in the Master Folder and all pertinent records to the Master Folder and forwards the Master Folder to the LIMS login.

5.6.2.6. LIMS login generates the Analytical Record, attach it to the Master Folder and drops it to the Data Processing Master Folder box.

5.7. **Sample Storage**

5.7.1. Place the water samples for volatile analysis in refrigerators designated for volatile water sample storage only.

5.7.2. Place the soil samples for volatile analysis in refrigerators designated for volatile samples only, if the samples are received with separate container for volatiles.

5.7.3. Whenever possible, place the samples from the same project in one refrigerator.

5.7.4. Samples known to have high concentrations, pure products, and samples for leaching (TCLP, WET, etc.) shall be placed in double zipped locked bags before placing them inside the refrigerator.

5.7.5. Store samples for metal analysis in the same condition as they are received. Samples for Mercury must be stored at 4 oC (+ 2oC).

5.7.6. Place samples from overseas in refrigerator designated for overseas samples only.

5.7.7. Record the sample location on the ECN log, COC and Internal COC (ICOC).

5.8. **Internal Chain-of-Custody (ICOC)**

5.8.1. Fill-out the ICOC (see Appendix 2) and request for the sample release from the Sample Custodian.

5.8.2. When returning samples in the Sample Control Room, fill-out the return portion of the ICOC and endorse the samples to the Sample Custodian.

5.8.3. After the Sample Custodian has verified the returned samples, place the samples to its original location.

5.9. **Processing Change Orders**

5.9.1. Fill-out change order form (see Appendix 3)

5.9.2. Attach the information re-change order (i.e. written correspondence from the client, telephone log, etc.)

5.9.3. Endorse to Sample Custodian.

- If change order happens prior to release of Master Folder and analytical folders, incorporate the change order into the routing of work order.
- If change order involves additional analysis request after the original report has been generated, add a suffix letter to the ECN, sequential to the change orders (i.e. 00A001A, 00A001B...), then process the change order as a regular work order.
- If the change order involves cancellation of work order, make copies of the cancellation order and distribute to the Sections listed in COC Receipt form. Obtain the recipients' initials on the original change order form. File the original form with the Master Folder.

5.9.4. Recipients of change orders direct the implementation change order.

5.10. **Extract Storage and Custody**

5.10.1. Store the extracts in the designated extract refrigerator sequentially, in the order of the preparation batch, separating each batch by an empty slot.

5.10.2. Custody of extracts shall remain on the recipient until endorse for disposal.

5.11. **Sample Shipping**

5.11.1. Fill out a COC.

5.11.2. Withdraw the samples from the storage and line them up according to the COC order.

5.11.3. Have the Sample Custodian or the alternate Sample Custodian to countercheck for completeness of the samples requested for shipping.

5.11.4. Wrap each sample with bubble pack and place it in a zip-locked bag. Make sure that it is properly sealed.

5.11.5. Pack the samples in a cooler and place adequate ice to maintain 4 oC (+ 2oC) for at least 48 hours.

5.11.6. Label the cooler(s) and if it shall be shipped through a third party courier (FEDEX, UPS, etc.) weigh the cooler(s). Labels shall, at a minimum contain:

- Name of Company/Project
- Attention Line
- Street Address
- City, State, Zip Code
- Telephone Number of Contact Person/Recipient

5.11.7. Inform the Supervisor or a designee that the sample shipment is ready for checking. The Supervisor or a designee shall check for the following:

- Verify that all samples were checked for completeness.
- Check that each sample was properly packed.
- Check that it is going to where it is intended.

5.11.8. File the pink copy of the COC with the Master Folder.

5.11.9. Maintain a copy of COC and the shipping airway bill in the sample receiving..

5.12. **Composite Samples**

5.12.1. For soil samples, discard the top half-inch and any artifacts (e.g., vegetation, rocks, wood, etc) of each sample to be composited.

5.12.2. Place a clean 32-oz jar in a balance and tare-off.

5.12.3. Transfer 30-g to the jar from the first sample, then tare-off. Repeat this process until all samples to be composited is aliquoted.

Note: Sample amount may be adjusted to conform to the required analyses, as long as equal amounts shall be taken from each sample.

5.12.4. Using a clean stainless steel spatula, thoroughly mix the sample contained in the composite jar.

5.12.5. Label the jar using EMAX labeling convention corresponding to client composite sample ID.

5.12.6. Document the activity done on the COC comment section, sign and date it.

5.13. **Sub-Sampling**

5.13.1. For soil samples, discard the top half-inch of the sample and any artifacts (e.g., vegetations, rocks, wood, etc.).

5.13.2. Homogenize the sample and bring to room temperature.

5.13.3. Take sub-sample using a calibrated balance and uniquely identify the sub-sample with the sample preparation ID. Refer to EMAX-QC04 for details.

5.14. **Sample Disposal**

5.14.1. Endorse all unused samples that are stored in the sample control room to Waste Management Unit upon getting an approval from the PM.

5.14.2. Samples from overseas have to be identified properly when endorsing to ensure proper treatment prior to disposal.

5.14.3. Endorse all unused extracts/digestates to Waste Management Unit after 60 days from date of extraction/digestion unless otherwise specified by the project.

6.0 QUALITY CONTROL

6.1. Storage refrigerators for volatile samples shall be monitored to ensure that no cross contamination happens during the storage period.

6.2. Electronic login shall be reviewed by the PM or his/her designee, for correctness and completeness.

6.3. All samples withdrawn/returned shall be acknowledged with initials of both the receiver and the Sample Custodian or his/her designee.

6.4. All extracts received shall be acknowledged with the initial and date of receipt.

6.5. All samples/extracts, except leachates for metals analyses, shall be stored at 4 oC (+2oC), unless otherwise specified by the project.

6.6. All samples shall be traceable from the time it is received to the date it is disposed. Records shall be maintained at all stations.

6.7. Labels used for samples to extracts shall be durable.

6.8. All label markings shall be legible and only indelible ink shall be used.

6.9. Refrigerators used to store samples must be maintained and monitored as described in EMAX-QC03– Refrigerator Control.

6.10. In case of power failure, maintain all refrigerators closed for a maximum of two hours to maintain the temperature at 4oC (+2oC). If power does not come back within two hours, place ice bags in the refrigerators sufficient enough to maintain the required temperature. Monitor the refrigerators every two hours until the power is restored. Record the readings in the temperature/freezer log.

7.0 SUPPLEMENTARY NOTES

7.1. **Definition of Terms**

7.1.1. Chain-of-Custody (COC) – is a record where sample custody transfer is documented. At a minimum the COC shall contain the project ID, sample ID, sampling location, date/time of collection, chemical preservatives (if any) dated signatures of individuals involved in the sample transfer.

7.1.2. Composite Sample – is an equal amount of sample aliquot combined together from specified sample containers.

7.1.3. Corrective Action - Action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

7.1.4. EMAX Control Number (ECN) – is an identification given to a group of samples received from a project that arrived on the same day accompanied by a chain-of-custody (COC). Grouping of samples is determined by either the project or the Project Manager's discretion.

7.1.5. Internal COC (ICOC) – is a record used by the laboratory to document when samples are withdrawn from the sample control room. This record shall contain the Lab Sample IDs and Lab Sample Container IDs of samples withdrawn, the intended analysis, the initials of the custodian and recipients, and the date and time of sample turn over.

7.1.6. Lab Sample ID (LSID) – is EMAX sample identification to uniquely identify each sample.

7.1.7. Lab Sample Container ID (LSCID) – is EMAX sample container identification to uniquely identify each sample container.

7.1.8. Sample Receipt Form 1 (SRF1)- is a record where to logged-in the type of delivery, who delivered the samples, the packaging condition, temperature upon receipt and the conditions or any discrepancies of samples during receiving.

7.1.9. Sample Receipt Form 2 (SRF2)- is a record where to logged-in the container type, any chemical preservative and conditions per container of samples upon receipt.

7.1.10. Nonconformance - An indication or judgment that a product or service has not met the requirements of the relevant specifications, contract or regulation; also the state of failing to meet the requirements.

7.1.11. Preservative – is a chemical added to a sample to maintain its integrity prior to analysis.

7.1.12. Project Specific Requirement (PSR) – is a document containing the summary of project requirements, the QC references and other information needed to complete the work order.

7.1.13. Sample – is a specimen received in the laboratory bearing a unique client sample ID traceable to the accompanying COC. Each unique client sample ID shall have a corresponding unique Lab Sample ID, unless otherwise specified by the project. Hence, samples collected in different containers having the same client sample ID are labeled with the same corresponding Lab Sample ID.

7.1.14. Sample Delivery Group (SDG) – is a group of samples received over a period of 14 days or less, not exceeding 20 samples per analysis per matrix.

7.1.15. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

7.1.16. Trip Blank – is a target-analyte-free sample, which travels with the sample to monitor possible contamination during sample transport. This sample is analyzed for volatiles.

7.2. Sample management described in this SOP shall be applicable to all projects. In instances where there is project or program specific requirement, the project specification shall take precedence over this SOP.

8.0 APPENDICES

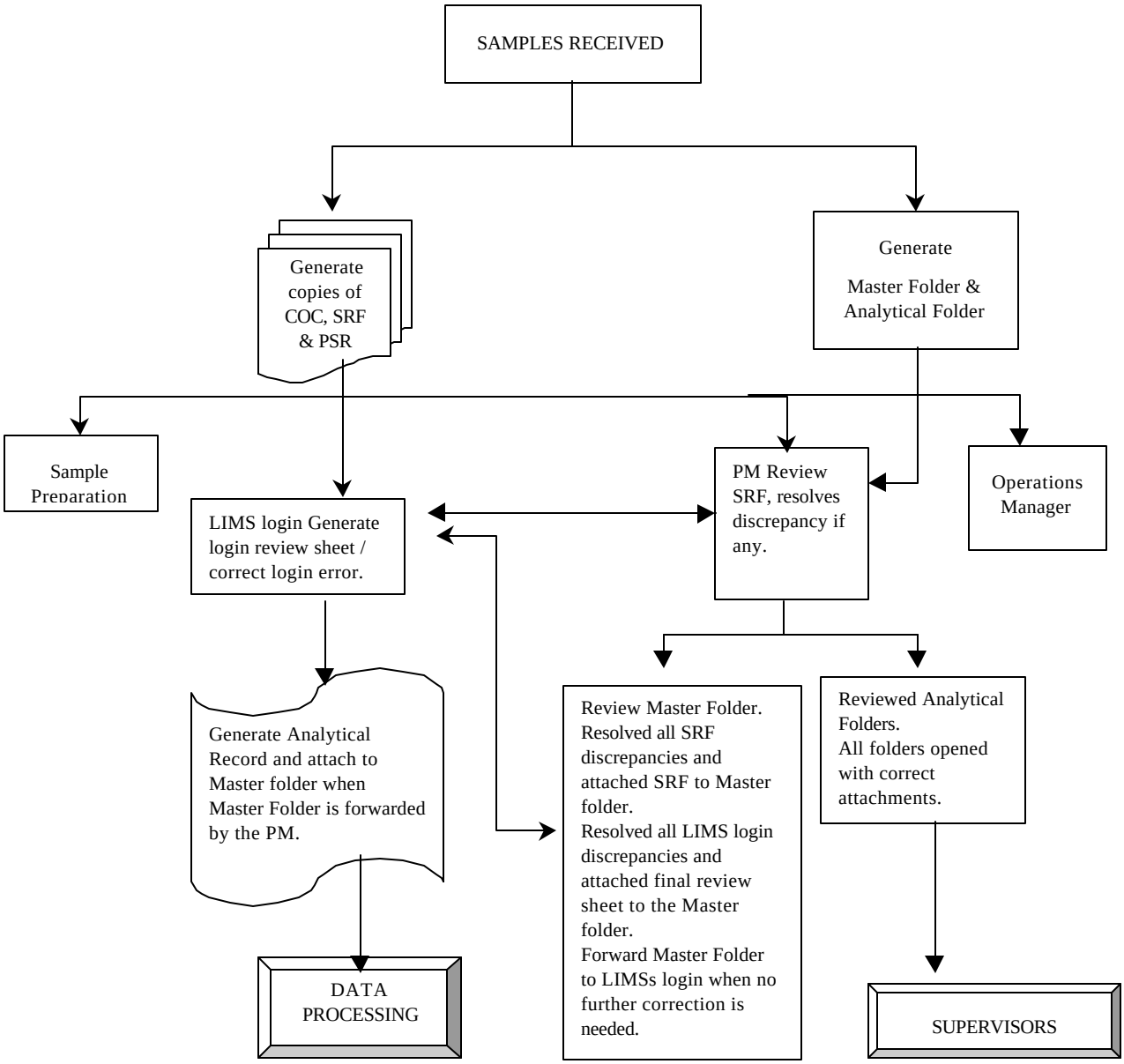
8.1. Figure 1 - Work Order System Flow

8.2. Appendix 1 - EMAX Control Number Log

8.3. Appendix 2 - Internal Chain-of-Custody

8.4. Appendix 3 - Change Order Form

FIGURE I WORK ORDER SYSTEM FLOW



EMAX CONTROL NUMBER LOG

YEAR 20 03 **MONTH JANUARY** **CODE A**

Date				Delivery /	Location			Recipient	SAMPLE DISPOSAL			
MM DD	ECN NUMBER	CLIENT	PROJECT	Pick-up	S	W	O	Initials	Information	Date	Initials	COMMENTS
01	03 A 0 0 1											
01	03 A 0 0 2											
01	03 A 0 0 3											
01	03 A 0 0 4											
01	03 A 0 0 5											
01	03 A 0 0 6											
01	03 A 0 0 7											
01	03 A 0 0 8											
01	03 A 0 0 9											
01	03 A 0 1 0											
01	03 A 0 1 1											
01	03 A 0 1 2											
01	03 A 0 1 3											
01	03 A 0 1 4											
01	03 A 0 1 5											
01	03 A 0 1 6											
01	03 A 0 1 7											
01	03 A 0 1 8											
01	03 A 0 1 9											
01	03 A 0 2 0											
01	03 A 0 2 1											
01	03 A 0 2 2											
01	03 A 0 2 3											
01	03 A 0 2 4											
01	03 A 0 2 5											
01	03 A 0 2 6											
01	03 A 0 2 7											
01	03 A 0 2 8											
01	03 A 0 2 9											
01	03 A 0 3 0											

INTERNAL CHAIN OF CUSTODY

ECN Page # 1

LOCATION (S) (W) (V) (A) BOOK # ICOC-03-12

RELINQUISHED				LSID	LSCID	ANALYSIS	MATRIX			RETURNED				REMARKS
BY	TO	DATE	TIME	(*)			S	W	OTHER	BY	TO	DATE	TIME	
					*									
					*									
					*									
					*									
					*									
					*									
					*									
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					*									
					*									
					*									
					*									

**LSID - Lab Sample ID*
LSCID - Lab Sample Container ID

CHANGE ORDER FORM

ECN	Analysis Request			
	☐ Change		☐ Additional	☐ Cancellation
Lab Sample ID	Previous Request	To	Analysis	Previous Request

Requested By (Client)		Logged By (EMAX)	
Project		Date/Time	
Ref. Log		Endorsed To	

PRINT DRF

STANDARD OPERATING PROCEDURE

INDUCTIVE COUPLED PLASMA EMISSION SPECTROMETRIC METHOD FOR TRACE METAL ANALYSES

SOP No.:	EMAX-6010	Revision No.	5	Effective Date:	15--Jun-06
Prepared By:	Gwen Ramos			Date:	6/15/06
Approved By:	Kenette Pimentel QA Manager			Date:	06-19-06
Approved By:	Kam Pang Laboratory Director			Date:	6/15/06
				Control Number:	**6010-05-**

1.0 SCOPE AND APPLICATION

1.1. This procedure is applicable for trace metal quantitative analyses of drinking water, wastewater, groundwater, aqueous, extract, soil, sludge, and sediment samples using the Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) method. All matrices require proper sample preparation prior to analysis. Two different ICPs are employed in this procedure. Two are Thermo-Jarrell Ash (TJA) TRACE-ICP-61E and the other is the regular TJA ICP-61E instrument.

1.2. The elements and their corresponding wavelengths are listed in Table 1 and Table 1A.

1.3. This SOP is an adaptation of the SW846 Method 6010B.

2.0 SUMMARY OF METHOD

2.1. Inductively coupled plasma atomic emission spectroscopy (ICP-AES) is employed to determine individual elements through their respective atomic or energy emission at different wavelengths. Samples are nebulized and the generated aerosol is carried through the center of the plasma torch, where the metals atoms are excited into high electronic states. Atomic and ionic line emission spectra characteristics of the particular metals are produced when the electron decays back to the lower energy levels. The emission is dispersed by a grating spectrometer and the intensities of the specific lines are monitored simultaneously by photomultiplier tubes. The photocurrent produced by the photomultiplier tube will increase in direct proportion to the concentration of the element in the sample within the linear range of a specific emission line. The photocurrent is processed by a computer system and related to concentration through a calibration procedure. The calibration procedure is made on the assumption that the instrumental response is linear with concentration within the dynamic range.

2.2. Calibration is performed by standardizing the instrument with a blank that is matrix matched to the digestate and one standard. The calibration curve is verified by another standard from a different source before any sample is analyzed. The intensity of emission of each element is measured and compared to a calibration curve for each element concentration versus intensity.

2.3. **Interference**

2.3.1. **Physical Interference.** Contamination might be introduced by the memory effect of metals during previous analysis (carry over) adhering to the walls of the pumping system and the nebulization chamber. Adequate rinsing of at least 90 seconds using matrix acid blank (refer to Section 9.2) shall be performed between sample analyses to minimize system contamination.

2.3.2. **Chemical Interference.** Matrix matching between digestates and all standard and samples dilution is used in sample analysis to eliminate/minimize chemical interference.

2.3.3. **Spectral Interference.** Both off-peak (background) and on-peak (inter-element correction coefficients) interference corrections are applied for all affected elements to take care of spectral interference. Refer to Section 10.3.4.

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3.0 QUANTITATION LIMITS

3.1. **Method Detection Limit**

3.1.1. Prepare and analyze a minimum of seven MDL samples with method blank (MB) and lab control sample (LCS) as described in Section 10. Refer to Table 2A of EMAX QA04 for suggested concentrations.

3.1.2. Refer to EMAX QA04 for acceptance criteria.

3.2. **Reporting Limits (RLs)**

3.2.1. Target analytes with respective reporting limits are listed in Table 4, Table 5 and Table 6.

3.3. **Instrument Detection Limit (IDL)**

3.3.1. Establish IDL as described in Section 10.3.5.

3.3.2. Determine IDL every three months.

4.0 LINEAR DYNAMIC RANGE (LDR)

4.1. Establish LDR for each element as described in Section 10.3.6.

4.2. Verify LDR every six months or when there is a significant change in the instrument signal.

5.0 SAMPLE HOLDING TIME AND PRESERVATION

5.1. **Water Samples**

5.1.1. Water samples are collected in polyethylene or glass bottles.

5.1.2. For total recoverable metal analysis, the sample is preserved at the time of collection to pH < 2 with nitric acid.

5.1.3. For dissolved metal analysis, the sample is filtered through a 0.45 µm filter at the time of collection and preserved to pH < 2. Samples requested to be properly preserved in the lab shall observe at least 24 hours from the time preservative is added before sample digestion.

5.1.4. Samples shall be stored in the same condition as received unless specified in the project requirement.

5.2. **Soil Samples**

5.2.1. Soil samples are collected in glass jars or brass tubes.

5.2.2. Soil samples are stored at 4 ^{o}C ($\pm$2^{o}C) until analysis.

5.3. **Holding Time**

5.3.1. All samples must be analyzed within 180 days from the collection date.

6.0 ASSOCIATED SOPs

6.1. EMAX-QC01 - Quality Control for Chemicals

6.2. EMAX-QC02 - Analytical Standard Preparation

6.3. EMAX-QA04 - IDL/MDL/RL

6.4. EMAX-QC07 - Glassware Cleaning

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6.5. EMAX-QA08 - Corrective Action

6.6. EMAX-SM04 - Analytical and QC Sample Labeling

6.7. EMAX-3005 - Acid Digestion, Total Recoverable or Dissolved Metals

6.8. EMAX-3010 - Acid Digestion, Total Metals (Aqueous)

6.9. EMAX-3050 - Acid Digestion, Total Metals (Solids)

7.0 SAFETY

7.1. Read all MSDS of chemicals listed in this SOP.

7.2. Treat all reagents, standards, and samples as potential hazards. Observe the standard laboratory safety procedures. Wear protective gear, i.e., lab coat, safety glasses, gloves at all times when performing this procedure. Observe all chemical hygiene procedures as mentioned in the Chemical Hygiene Plan .

7.3. Place all wastes generated during analytical process in the waste containers. Endorse these wastes to waste disposal section for proper disposal.

7.4. If for any reason, solvent and/or other reagents get in contact with the skin or any other part of the body, rinse the affected body part thoroughly with tap water. If irritations persist, inform your supervisor immediately so that proper action can be taken.

8.0 INSTRUMENTS, CHEMICALS, AND SUPPLIES

8.1. **Instruments and Supplies**

8.1.1. ICPs: Thermo-Jarrell Ash ICAP-61E; Thermo-Jarrell Ash Trace ICAP61E

8.1.2. Autosampler: Thermo-Jarrell Ash 300

8.1.3. Computer: IBM Compatible

8.1.4. RF Generator: TJA RF Generators

8.1.5. Data Acquisition: Thermospec Software Rev. 6.2

8.1.6. Autosampler rack(s): 13 mm, 75 positions

8.1.7. Culture tubes: 13 mm, polystyrene

8.1.8. Volumetric Flask: 100, 250, 500, 1000 ml

8.1.9. Micropipets: 100, 1000, 5000, 10000 µl

8.1.10. Pipet Tips: 200, 1000, 5000, 10000 µl

8.1.11. Polyethylene bottles: 125, 250, 500, 1000 ml

8.1.12. Liquid argon

8.1.13. Liquid nitrogen

8.2. **Chemicals and Reagents**

8.2.1. DI water, ASTM Type II or equivalent

8.2.2. Nitric Acid, Trace high purity grade, concentrated

8.2.3. Hydrochloric acid, Trace high purity grade, concentrated

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9.0 STANDARDS

9.1. Stock Standard

9.1.1. The stock standards are purchased as certified single element solutions in 1000 mg/L and 10,000 mg/L or as custom-made certified mixed stock solutions in various concentrations.

9.1.2. The following table is the list of the custom-made certified mixed stock standard solutions:

SOURCE	STANDARD	ELEMENTS	CONC. (mg/L)	MATRIX
AccuStandard	X-EMAX-4	Ca, Mg, Na, K	10000	5% HNO_3
AccuStandard	X-EMAX-6A	Sb, As, B, Mo, Sr, Tl, Ti, V, Zn, Se	500	5% HNO_3 and Trace HF/Tartaric Acid
	X-EMAX-6B	Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, Ag	500	10% HNO_3
CPI	MIX3	Ca, Mg, K, Na	10000	5% HNO_3
CPI	MIX2	Sb, Mo	500	5% HNO_3 and Trace HF
CPI	MIX1	As, Ba, Be, Bi, B, Cd, Cr, Co, Cu, Pb, ZN Mn, Ni, Se, Sr, Tl, V, Ti Ag	500	5% HNO_3 and Trace HF
AccuStandard	CRDL-1	Sb Ni Cu Zn Mn Pb Co, V As, Cr, Ag, Tl Be, Cd, Se	120 80 50 40 30 6 100 20 10	5% HNO_3
AccuStandard	INT-B1	Ag, Cd, Ni, Pb, Zn Ba, Be, Co, Cr, Cu, Mn, V	100 50	5% HNO_3
AccuStandard	INT-A1	Al, Ca, Mg Fe	5000 2000	5% HNO_3

9.1.3. Detailed procedure of standard preparation and labeling is described in EMAX-QC02 and EMAX-SM04, respectively.

9.2. Matrix Acid Blank (S0)

9.2.1. The matrix acid blank is used for dilutions of the standards and, digestates, if necessary.

9.2.2. Prepare this solution by mixing 6% by volume nitric acid and 5% by volume hydrochloric acid in reagent water. Transfer into a clean HDPE bottle and identify the solution as S_0.

9.3. Initial Calibration Standard

9.3.1. The initial calibration consists of a blank (S0) and one standard.

9.3.2. Prepare Reg-S_6 by diluting 4 ml each of X-EMAX-6A and EMAX-6B and 1-ml of 10,000 mg/L Sn to a final volume of 1-liter using S_0 (blank). Transfer the standard on a clean HDPE bottle and identify the solution as ICP-S_6.

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9.3.3. Prepare Reg-S_3 by diluting 10 ml of X-EMAX-4, 1-ml each of 10,000 mg/L of Al and Fe to a final volume of 1-liter using S_0. Transfer the standard on a clean HDPE and identify the solution as ICP-S_3.

9.3.4. Prepare Trace-S_2 by diluting 2-ml of each of EMAX-6A and EMAX-6B to a final volume of 1-liter with S_0. Transfer the standard on a clean HDPE and identify the solution as Trace-S_2.

9.3.5. Prepare Trace-S_5 by diluting 10-ml of each of EMAX-4 and 1-ml each of 10,000 mg/L of Al and Fe to a final volume of 1-liter with S_0. Transfer the standard on a clean HDPE and identify the solution as Trace-S_5.

9.3.6. Prepare ICP-Low – S_2 by diluting 2-ml of X-EMAX-6A to a final volume of 1000-ml with S_o (blank). Transfer the standard on a clean HDPE and identify as ICP-Low S_2.

9.3.7. Prepare ICP-Low – S_5 by diluting 2-ml of X-EMAX-6B to a final volume of 1000-ml with S_o (blank). Transfer the standard on a clean HDPE and identify as ICP-Low S_5.

9.3.8. Prepare ICP-Low – S_9 by diluting 10-ml of X-EMAX-4, 1-ml each of 10,000 mg/L of Aluminum (Al) and Iron (Fe), 1-ml of 1000 mg/L of Lithium (Li) and 10-ml of 1000 mg/L of Uranium (U) to a final volume of 1000-ml with S_o (blank). Transfer the standard on a clean HDPE and identify as ICP-Low S_9.

9.3.9. Refer to Tables 2, 3 and 6 for final concentrations.

9.4. **Initial Calibration Verification (ICV)**

9.4.1. Purchase ICV mixed stock standards solution from a different source other than the initial calibration standard. The concentrations of the analytes are approximately one-half of the concentration that is found in the initial calibration. Refer to Section 9.1 for the ICV analyte list.

9.4.2. Prepare ICV for ICP-61E by diluting 2-ml of CPI-MIX-1, 2mL CPI-MIX-2 and 5mL of CPI-MIX3 and 0.5 mL each of 10,000mg/L Al, Fe and Sn to 1-L with S_0. Transfer the solution into a clean HDPE bottle and identify the solution as ICP-ICV.

9.4.3. Prepare ICV for Trace by diluting 0.5-ml each of 1000-µg/ml As, Pb, Se, Tl, Cd, Mn, V, Zn, Cr, 10,000-µg/ml Al, Fe, and 5 ml each of 10,000-µg/ml Ca and Mg to a final volume of 1-liter with S_0. Transfer the solution into a clean HDPE bottle and identify the solution as ICV-Trace.

9.4.4. Prepare ICV for ICP-Low by diluting 1-ml of CPI Mix1 and Mix 2, 5-ml of CPI Mix3, 0.5-ml each 10,000 mg/L of Al and Fe, 0.5-ml of 1000 mg/L of Li and 5-ml of 1000 mg/L of Uranium to a final volume of 1000-ml of S_0.

9.4.5. Refer to Table 2, 3 and 6 for final concentrations.

9.5. **Continuing Calibration Verification (CCV) Standard**

9.5.1. Prepare ICP-CCV by diluting 7.5-ml of X-EMAX-4, 0.75-ml each of 10,000 µg/ml Al and Fe and Sn and 3-ml each of X-EMAX-6A and EMAX-6B to a final volume of 1-liter with S_0. Transfer the standard on a clean HDPE bottle and identify the solution as ICP-CCV.

9.5.2. Prepare CCV- Trace by diluting 0.4-ml each of 1000-µg/ml As, Pb, Se, Tl, Cd, Mn, V, Zn, Cr, 0.4-ml each of 10,000 µg/ml Al and Fe and 4-ml each of 10,000-µg/ml Ca and Mg to a final volume of 1-L with S_0. Transfer the standard on a clean HDPE and identify the solution as CCV- Trace.

9.5.3. Prepare CCV- ICP-Low by diluting 1.5-ml each of 1000-µg/ml X-EMAX-6A and 6B, 0.75-ml each of 10,000 µg/ml Al, Sn and Fe, 0.75-ml of 1000 µg/ml of Lithium, 7.5-ml each of X-EMAX-4 and 1000-µg/ml Uranium, to a final volume of 1-L with S_0. Transfer the standard on a clean HDPE and identify the solution as CCV- ICP-Low.

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9.5.4. Refer to Tables 2, 3 and 6 for final concentrations.

9.6. **Interference Check Standard, Primary Interferents A and Analytes B (ICSAB)**

9.6.1. Prepare ICSA by diluting 100-ml of INT-A1 to 1,000 ml with S_O. Transfer the solution into a HPDE bottle and identify the solution as ICSA. This solution can be use for both ICP-61E and Trace.

9.6.2. Prepare the ICSAB by diluting the following standards to 1,000 ml with S_O.

- 100-ml of INT-A1,
- 10-ml of INT-B1,
- 5-ml of K (10,000 mg/L), 1-ml Na (10,000 mg/L), 1-ml from each of As, Mo, Ti, (1000 mg/L individual standards), 3.6 ml Se, Tl (1,000 mg/L individual standards)
- 0.5 ml of B & Sr (1000 mg/L individual standards)
- 0.1-ml of Sb and Sn (10,000 mg/L individual standard).
- 1-ml of Li & U (1000 mg/L individual standards)

9.6.3. Transfer the solution into a HPDE bottle and identify the solution as ICP-ICSAB.

9.6.4. Dilute 100-ml of INT-A1 and 10-ml of INT-B1and 1-ml each of As, Se, Tl to 1-L with S0. Transfer the solution into a HDPE bottle and identify as Trace-ICSAB.

9.6.5. Refer to Table 4 and 5 for final concentrations.

9.7. **Application of Analytical Standards**

9.7.1. All standard concentrations described in Section 9 are typical concentrations. They may vary at any time to meet project requirement or any related requirement. Where changes are made, Method QC requirements and/or project requirement must be met.

10.0 PROCEDURES

10.1. **Sample Preparation**

10.1.1. For aqueous samples to be analyzed for total recoverable metals and/or dissolved metals – refer to EMAX-3005.

10.1.2. For aqueous samples to be analyzed for total metals – refer to EMAX-3010.

10.1.3. For solid samples to be analyzed for total metals – refer to EMAX-3050.

10.2. **Instrument Parameters**

10.2.1. **Regular ICP**

- RF Power: 1350 W
- Nebulizer Pressure: 15-45 psi
- Analysis Pump Rate: 100-200 RPM
- Flush Pump Rate: 100-200 RPM
- No. Lines: 31
- Analysis Time: 5 minutes
- No. of Replicates: 2

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10.2.2. **ICP-Low**

- RF Power: 950 W
- Nebulizer Pressure: 15-45 psi
- Analysis Pump Rate: 100-200 RPM
- Flush Pump Rate: 100-200 RPM
- No. Lines: 33
- Analysis Time: 6 minutes
- No. of Replicates: 2
- Internal Standard: Yttrium, 5 MG/L

10.2.3. **Trace ICP**

- RF Power: 950 W
- Nebulizer Pressure: 15-45 psi
- Analysis Pump Rate: 100-200 RPM
- Flush Pump Rate: 100-200 RPM
- No. Lines: 15 (2 Lines each of Lead and Selenium)
- Analysis Time: 5 minutes
- No. of Replicates: 2

10.3. **Calibration**

10.3.1. **Instrument Set-Up**

10.3.1.1. Set up the ICP-61E or TRACE-ICP with proper operating parameters. Refer to Section 10.2.1 and 10.2.2 respectively.

10.3.1.2. Ignite the plasma and allow the instrument to become thermally stable at least 1 hour.

10.3.1.3. Check the peristaltic pump to deliver a steady flow.

10.3.2. **Profile the Instrument**

Instrument	Profile Solution	Vernier Position
ICP-61E	10.0 µg/ml copper solution	± 0.05 or better
TRACE-ICP	1.0 µg/ml arsenic solution	± 0.05 or better
ICP-Low	1.0 µg/ml arsenic solution	± 0.05 or better

10.3.3. **Initial Calibration**

10.3.3.1. Set the system to flush with the matrix acid blank between each analysis run for a minimum of 90 seconds.

10.3.3.2. Run the calibration standards as described in Section 10.4. Refer to Appendix 1 for acceptance criteria.

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10.3.4. **Determination of Inter-Element Correction Factor(IEC)**

10.3.4.1. Analyze a 100-mg/L single element. For elements such as Fe, Mg, Ca and Al, use a 500-mg/L concentration. The analytical results of these target analyte shall fall below ½ of the reporting limit.

10.3.4.2. Calculate the IEC factor by dividing the apparent target analyte concentration to the actual concentration of the interference check solution found in the analysis.

10.3.4.3. Follow the same procedure for uncommon elements that may contribute spectral interference.

10.3.4.4. Verify and update all IEC factors or multivariate correction matrices every six months or when major instrumentation maintenance is performed (e.g., cleanup/changes of torch, nebulizer, injector, or plasma conditions)

10.3.5. **Establishing Instrument Detection Limit (IDL)**

10.3.5.1. Analzye a minimum of seven consecutive method blanks.

10.3.5.2. Repeat the process within three non-consecutive days.

10.3.5.3. Calculate the standard deviation of each run.

10.3.5.4. The average of the standard deviation of the three runs determines the IDL for each analyte.

10.3.6. **Establishing Linear Dynamic Range (LDR)**

10.3.6.1. Analyze a minimum of three standards at different concentrations, one of which is close to the upper limit of the linear range. Refer to Table 5 for suggested LDR concentration levels.

10.3.6.2. The upper limit of the linear range is an observed signal no more than 10% below the level extrapolated from lower standards.

10.3.6.3. Prepare a standard at the determined LDR, analyze and quantitate against the normal calibration curve to verify the LDR. Percent recovery must be within ± 10% of the expected value. If non-compliant, re-establish the LDR.

10.4. **Analysis**

10.4.1. **Analytical Sequence.**

10.4.1.1. Input the analytical sequence into the instrument using data acquisition software. Refer to Table 7.

10.4.1.2. Set QC limits on QC samples for easy verification while analytical samples are on the run.

10.4.1.3. Using the analytical sequence, shake the sample container then aliquot about 7 ml of standards/samples into the sample tubes placing them on the same order as the analytical sequence.

10.4.1.4. Dilution Test sample is prepared at 5 times dilution. Pipette 1.4- ml of sample , add 5.6-ml of S_0 into a sample tube. Seal the tube with parafilm and invert the tube several times to ensure adequate mixing.

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10.4.1.5. Prepare a Post Digestion Spike test sample. Using the un-spiked sample digestate (preferably the QC sample), add MS standard to maintain the same spike level as the MS sample digestate.

10.4.1.6. Set the prepared analytical samples into the auto-sampler and start the analytical run.

10.4.1.7. Check the initial calibration verification for compliance (see Appendix 1 for QC criteria). If non-compliant, stop the run, correct the problem and recalibrate.

10.4.1.8. Check the sample rack to ensure that the Autosampler did not skip any sample.

10.5. **Data Reduction**

10.5.1. Dilute and reanalyzed all samples that exceeded the DLR.

10.5.2. Check the MS/MSD, serial dilution and the post digestion spike results. If matrix interference is indicated, check the PSR if MSA is waived, otherwise refer to 10.5.3.

10.5.3. **Method of Standard Addition (MSA)**[1]

10.5.3.1. Perform MSA for all EP extracts, samples for delisting petition and whenever a new matrix is encountered.

10.5.3.2. Prepare two sample solutions (Ms1 and Ms2) with identical sample aliquot (V_x). Add reagent water to Ms1 and spike standard to Ms2. Choose a concentration and volume of spike standard so that the response of Ms1 is twice of Ms2 avoiding excessive dilution of the sample.

- $Ms1 = V_x + V_w$
- $Ms2 = V_x + V_s$

where:

V_x - volume of sample

V_s - volume of spike

V_w - volume of reagent water

Example: Sample concentration is tentatively determined at 5 mg/L.

Ms1 – take 5-ml of sample then add 5-ml of reagent water. This solution will have an approximate concentration of 2.5 mg/L.

Ms2 – take 5-ml of sample then add 5-ml of 5-mg/L spike standard. This solution will have an approximate concentration of 5 mg/L.

10.5.3.3. Analyze Ms1 and Ms2 and calculate the results using Eq-10.6.6.

10.5.3.4. For TCLP extracts, perform MSA* if;

- ✓ The recovery of the matrix spike is $\leq$ 50% and the concentration of the contaminant does not exceed the regulatory level.
- ✓ When the measured concentration of the analyte in the extract is within 20% of the appropriate regulatory level.

Note: *Matrix spike standards must be added after filtration (pre-digestion) of the TCLP extract and prior to preservation.

[1] Adopted from Section 8.7.1 USEPA SW846 Method 7000

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10.6. **Calculations**

10.6.1. The computer software is designed to calculate the concentrations in the digestates, based on the assumption that the initial calibration is linear through the origin. Thus, for aqueous samples, the computer-produced results represent the concentration of the sample.

10.6.2. For water samples, if the initial sample taken was V_s, different from 100 mI, then calculate the concentration using the following equation:

$$C_s = C_i\left(\frac{V_e}{V_s}\right)DF \qquad \text{Eq-10.6.2}$$

where:
C_s - concentration in the sample, mg/L
C_i - concentration in the digestate, mg/L
V_s - volume of sample taken, ml
V_e - volume of digestate, ml
DF - dilution factor

10.6.3. For solids, use the following equation to calculate the concentration.

$$C_s = C_i\left(\frac{V_e}{W_s}\right)\left(\frac{100}{100 - \%H_2O}\right)DF \qquad \text{Eq-10.6.3}$$

Where:
C_s – concentration in the sample, mg/Kg
C_i – concentration in the digestate (computer generated), mg/Kg
W_s – sample amount taken, g
V_e – volume of digestate, ml
$\%H_2O$ – percent moisture of the sample
DF – dilution factor

10.6.4. Calculate the percent recovery (%R)

$$\%\ Recovery = \frac{Cf - C}{Cs} * 100 \qquad \text{Eq-10.6.4}$$

where:

C_f – concentration found

C – concentration of sample

C_s – concentration of spike

10.6.5. Relative Percent Difference (%RPD)

$$RPD = \frac{|C_1 - C_2|}{\left(\frac{C_1 + C_2}{2}\right)} \times 100 \qquad \text{Eq-10.6.5}$$

Where:

RPD = Relative Percent Difference

C_1 = Measured concentration of the first sample aliquot

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C_2 = Measured concentration of the second sample aliquot

10.6.6. Calculate for sample result from determined from MSA

$$C_x = \frac{(S_2)(V_s)(C_s)}{(S_2 - S_1)V_x} \qquad \text{Eq-10.6.6}$$

Where:

C_x – concentration of the sample

C_s – concentration of the spike

S_1- analytical signal of Ms1

S_2- analytical signal of Ms2

V_x – volume of sample aliquot

V_s – volume of spike/reagent water

10.7. **Report Generation**

10.7.1. Print the summary of the analytical run, perform a data transfer into a disk, and convert the instrument electronic output file into an ASCII file format.

10.7.2. Run the ICPCHK.exe program for calibration check.

10.7.3. Identify samples that need to be re-analyzed, if any, and report all samples that met the analytical requirements.

10.7.4. Generate the report using the following in-house reporting program:

Executable Files	Required Support Files	Output
WDBX[2].exe	Login File (requires network) Seq_name.sq; Gcints.txt	Method.txt [this file integrates the login sample information and the analytical sample information]
IF1VX.exe	Method.txt; Method.met; Method.crf; Project.pln; Qcell.txt	Sample Results (Form1)
IQCVX.exe	Method.txt; Method.crf; Method.qc; Project.pln;Qcell.txt	QC Summary for LCS and MS
QCX	Method.txt; Method.crf; Method.qc; Project.pln;Qcell.txt	Summary for Dilution Test

10.7.5. **Data Review**

10.7.5.1. Arrange the analysis package in sequence as detailed below using section separators. Attach all raw data to every form generated and re-analyses.

- Sample Results
- LCS Summary
- MS/MSD Summary

[2] X – latest program version

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- CCV Summary
- ICV Summary
- ICAL Summary

10.7.6. Perform a 100% data review in accordance to EMAX-DM01and the PSR.

- ✓ Review the ICPCHK.exe output file to ensure that it agrees with the instrument output. Check Project Specific Requirement (PSR) or Appendix 1 for acceptance criteria.
- ✓ Check frequency of calibration verification. Verify results to be within acceptance limits.
- ✓ Check of target analytes concentration to be within linear range.
- ✓ Verify interference check results to be within acceptance limits.

10.7.6.1. If any of the above checkpoints is non-compliant, re-analysis is required.

10.7.7. Generate the case narrative to include discussion of the following as found in the review process:

- ➢ Number of samples analyzed
- ➢ Analytical method(s) applied
- ➢ Holding Time – That samples were analyzed within holding time. For non-compliance, state the number of days/hours that the sample(s) were off from holding time.
- ➢ Initial Calibration – That all target analytes met calibration requirements. For non-compliance, state the analyte(s) that is (are) non-compliant and the data qualified.
- ➢ Initial Calibration Verification (ICV) – That all target analytes met calibration requirements For non-compliance, state the analyte(s) that is (are) non-compliant and the data qualified.
- ➢ Method Blank – That MB was analyzed at a frequency specified by the project and that results are compliant to project requirement. For non-compliance, state the analyte affected and the associated sample results were flagged with “B”.
- ➢ Lab Control Sample – That LCS was analyzed at a frequency specified by the project and that recoveries met the project QC limits. For non-compliance, reference the associated forms, e.g. QC Summary form, and state that non-compliant results were indicated by an asterisk “*”. Furthermore, if corrective action is not possible (e.g., no more samples to re-analyze) state that results were qualified.
- ➢ Matrix Spike/Matrix Spike Duplicate – That MS/MSD is extracted with the samples and analyzed at a frequency specified by the project and that recoveries met the project QC limits. For non-compliance, reference the MS Summary form, and that non-compliant results were indicated by an asterisk “*”.
- ➢ Dilution Test and Post Digestion Spike – That dilution test and post digestion spike are analyzed for every preparation batch. That positive results of dilution test are evaluated to meet the method requirement and that Post Digestion Spike is evaluated for analytes that are not detected. For non-compliant analytes, reference the associated form, (Serial Dilution Test or Analytical Spike) and that non-compliant results were indicated by “*” or refer to MSA result.

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- Sample Analysis – That samples were analyzed in conformance to the method and project requirements. That positive results were qualitatively identified in accordance to the method and applied quantitation is based on the initial calibration.
- Other Anomalies (if any) – Shall be discussed on a case to case basis concurred by the Supervisor or the Lab Director. Include the NCR in the data package if required by the project, otherwise archive the NCR with the analytical folder.

10.7.8. Submit the analysis package for secondary review.

10.8. **Preventive Maintenance**

10.8.1. Perform daily instrument check prior to sample analysis. Refer to 6010-F3 – Instrument Maintenance Log.

10.8.2. Maintain an inventory of instrument parts and supplies for routinely maintenance.

11.0 QUALITY CONTROL ANALYSES

11.1. **Sample Preparation QC**

11.1.1. A preparative batch consists of 20 or fewer samples of the same matrix, that are prepared for analysis simultaneously or sequentially, using the same lots of all reagents.

11.1.2. Every preparative batch shall have at least one method blank, one LCS and a set of MS/MSD unless otherwise specified by the project. These QC samples shall be digested together with the field samples.

11.1.3. All reagents shall be subjected to QC check prior to its use. Refer to EMAX-QC01 for details.

11.2. **Sample Analysis QC**

11.2.1. Every analytical run shall be preceded with an initial calibration and initial calibration verification (ICV). Obtain he ICV standard from a different source from that of the initial calibration. Analyze an instrument calibration blank (ICB) after the ICV. No further analysis shall be valid unless acceptance criteria are met.

11.2.2. Verify inter-element and background correction factors with ICSA and ICSAB standards after ICB.

11.2.3. Verify calibration with continuing calibration verification (CCV) standard and continuing calibration blank (CCB) after every ten samples and at the end of the analytical run.

11.2.3.1. Dilution Test shall be performed whenever a new or unusual sample matrix is encountered.

11.2.3.2. Evaluate Post Digestion Spike result if the dilution test failed to meet the acceptance criteria.

11.2.4. Refer to Appendix 1 for acceptance criteria.

11.3. **Method QC**

11.3.1. Method Detection Limit Study must be established before the analytical procedure can be used.

11.3.2. Method proficiency must be established before the analytical procedure can be used.

11.3.3. All analysts conducting this analysis must have established demonstration of proficiency.

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11.3.4. Perform dynamic range study at least every six months or whenever there is a significant change in instrument response. The analytically determined concentration of this standard must be within 10% of the expected value.

12.0 CORRECTIVE ACTION

12.1. Quality control procedures and corresponding corrective actions are summarized in Appendix 1.

12.2. When ICV is non-compliant consider the following options to correct the problem prior to recalibration:

- Check the gas flow if it is conforming to the instrument parameter setting and correct if necessary.
- Check the pump tubings and replace if necessary.
- Check the nebulizer for clogs and clean if necessary.
- Prepare new standards and re-calibrate

12.3. When ICB/CCB is non-compliant, consider the following suggestions to correct the problem:

- Replace the instrument blank (S0) with a fresh reagent water and re-analyze the blank.
- If problem persist, check the pump tubings and the nebulizer for clogs and perform maintenance as necessary.

12.4. When Method Blank (MB) is non-compliant, consider the following suggestions to correct the problem:

- Check if associated samples detected the same analytes detected in the MB.
- If analytes detected on the MB is not detected in the associated samples, report the results and flag the analytes detected on the MB as required by the project.
- If similar analytes are detected at concentration levels greater than 10X the detection limits, refer the issue to the PM if the result is reportable, otherwise check the source of contamination, correct the problem and re-digest all associated samples.
- Prepare and analyze a reagent blank to contain the same acid strength as the digested method blank. If contamination exists, check reagent to identify where the contamination is coming from. Use new reagents as necessary and re-digest/re-analyze all associated samples.

12.5. A Non-Conformance Report (NCR) is required when the following circumstances occur:

12.5.1. Corrective action needs the function of other department, e.g. the sample needs to be re-digested. Refer to EMAX-QA08 for details of completing an NCR.

12.5.2. Corrective action needs the assistance of the Project Manager, e.g. sample passed the holding time, insufficient amount of sample, etc.

12.5.3. Corrective action prescribed in the IQC Summary does not correct the problem.

12.6. For other problems encountered, inform the supervisor immediately for further instruction.

13.0 POLLUTION PREVENTION

13.1. Unused samples, digestates and instrument wastes are very acidic and are very corrosive. Endorse the wastes to the Waste Management Unit for proper treatment or disposal.

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14.0 WASTE MANAGEMENT

14.1. All unused samples expired analytical standards and other waste generated during the analytical process, endorse to WDU shall be disposed in accordance to EMAX-SM03.

15.0 SUPPLEMENTARY NOTES

15.1. **Definition of Terms**

15.1.1. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagents.

15.1.1.1. **Preparation batch** is composed of one to 20 samples of the same matrix, a method blank, a lab control sample and matrix spike/matrix spike duplicate.

15.1.1.2. **Analytical batch** is compose of prepared samples (extracts, digestates, or concentrates), which are analyzed together as a group using an instrument in conformance to the analytical requirement. An analytical batch can include samples originating from various matrices, preparation batches, and can exceed 20 samples.

15.1.2. Calibration – is defined as an instrument response per unit measure. It is an experimental value by measuring the response of an instrument per unit target analyte under the method specific condition. A determinant measured from a standard to obtain the correct value of an instrument output.

15.1.3. Instrument Method – is a file generated to contain the instrument calibration and instrument parameter settings for a particular analysis.

15.1.4. Instrument Blank – is a target-analyte-free solvent subjected to the entire analytical process to establish zero baseline or background value.

15.1.5. Lab Control Sample (LCS) – is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LCS is analyze to monitor the accuracy of the analytical system.

15.1.6. Matrix – is a physical state of a sample. Most of environmental samples are classified as water, soil or air.

15.1.7. Matrix Spike (MS) – is a sample spiked with a verified known amount of target analyte(s) subjected to the entire sample preparation and/or analytical process. MS is analyze to monitor matrix effect on a method's recovery efficiency.

15.1.8. Matrix Spike Duplicate (MSD) – is a replicate of MS analyzed to monitor precision or recovery.

15.1.9. Method Blank – is a target-analyte-free sample subjected to the entire sample preparation and/or analytical procedure to monitor contamination.

15.1.10. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise specified by the project.

15.1.11. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

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15.1.12. Sample Duplicate – is a replicate of a sub-sample taken from one sample, prepared and analyzed within the same preparation batch.

15.2. **Application of EMAX QC Procedures**

15.2.1. The procedures and QC criteria summarized in this SOP shall be applied to all projects when performing metals analysis by ICP. In instances where there is a project or program QAPP, the requirements given in the project shall take precedence over this SOP.

15.3. **Air Force Center for Environmental Excellence (AFCEE) Projects**

15.3.1. When samples from AFCEE sponsored projects are analyzed for metals by ICP, the calibration, QC, corrective action, and data flagging requirements shall follow the specifics outlined in the Quality Assurance Project Plan, the latest version.

15.4. **U.S. Army Corps of Engineers (USACE) Projects**

15.4.1. When samples from USACE sponsored projects are analyzed for metals by ICP, the calibration, QC, corrective action, and data flagging requirements shall follow the specifics outlined in the project QAPP. In the absence of a project QAPP or directive from the client project manager, Shell Document latest version shall be applied.

15.5. **Naval Facilities Engineering Service Center (NFESC) Projects**

15.5.1. When samples from NFESC sponsored projects are analyzed for metals by ICP, the calibration, QC, corrective action, and data flagging requirements shall follow the specifics outlined in the project QAPP. In the absence of a project QAPP or directive from the client project manager, NFESC Laboratory Quality Assurance Guide latest version shall be applied

15.6. **Department of Energy Basic Ordering Agreement (DOE-BOA) Projects**

15.6.1. For samples from DOE-BOA sponsored projects follow BOA Guidance Document, latest version in the absence of project QAPP.

16.0 REFERENCES

16.1. Test Methods for Evaluating Solid Waste, Method 6010B, Physical and Chemical Methods, US EPA SE-846, 3rd edition, 1992.

16.2. Quality Assurance Manual, EMAX Laboratories, as updated.

17.0 TABLES AND APPENDICES

17.1. **Tables**

Table 1	ICP Elements & Wavelengths
Table 1A	ICP-Low Elements & Wavelengths
Table 2	Initial Calibration Standard Preparation Method for ICP-61E
Table 3	Initial Calibration Standard Preparation Method for Trace-ICP
Table 4	Calibration Standards Concentration and Reporting Limit for ICP-61E
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Table 7	ICP Analytical Sequence
Table 8	MDL Concentration Levels

17.2. **Figures**

Figure 1	Typical Sample Report
Figure 2	Typical LCS/LCSD Summary
Figure 3	Typical MS/MSD Summary
Figure 4	Typical Serial Dilution Test Report
Figure 5	Typical Analytical Spike Report
Figure 6	Typical Case Narrative

17.3. **Appendices**

Appendix 1	Summary of Internal Quality Control and Procedures - Metals by ICP Method 6010B
Appendix 2	Demonstration of Capability for Metals

17.4. **Forms**

6010F1	Analytical Run Log For ICP Metals
6010F2	Sample Preparation Log
6010F3	ICP Instrument Maintenance Log
6010F4	Trace-ICP Instrument Maintenance Log

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TABLE 1
ICP ELEMENTS & WAVELENGTHS

ELEMENT	SYMBOL	WAVELENGTHS		
		ICP-61E	TRACE-ICP	
			Wavelength	Channel
Aluminum	Al	308.215	308.215	
Antimony	Sb	206.838		
Arsenic	As	193.696	189.042	
Barium	Ba	493.409		
Beryllium	Be	313.042		
Boron	B	249.678		
Cadmium	Cd	228.802	228.800	
Calcium	Ca	317.933	317.933	
Chromium	Cr	267.716		
Cobalt	Co	228.616		
Copper	Cu	324.754	324.754	
Iron	Fe	259.940	271.441	
Lead	Pb	220.353	220.351 (1) 220.352 (1)	Channel 2203/1 Channel 2203/2
Magnesium	Mg	279.078	279.078	
Manganese	Mn	257.610	257.610	
Molybdenum	Mo	202.030		
Nickel	Ni	231.604		
Potassium	K	766.491		
Selenium	Se	196.026	196.021 (2) 196.022 (2)	Channel1960/1 Channel 1960/2
Silver	Ag	328.068		
Sodium	Na	588.995		
Strontium	Sr	421.552		
Thallium	Tl	190.864	190.862	
Tin	Sn	189.989		
Titanium	Ti	334.941		
Vanadium	V	292.402	292.402	
Zinc	Zn	213.856	213.856	

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TABLE 1-A
ICP-Low ELEMENTS & WAVELENGTHS

ELEMENT	SYMBOL	WAVELENGTH	HIGH STANDARD	LOW STANDARD
1960_1	--	196.090	S_2	S_O
1960_2	--	196.091	S_2	S_O
2203_1	--	220.353	S_5	S_O
2203_2	--	220.354	S_5	S_O
Aluminum	Al	308.215	S_9	S_O
Antimony	Sb	206.833	S_2	S_O
Arsenic	As	189.042	S_2	S_O
Barium	Ba	493.409	S_5	S_O
Beryllium	Be	313.042	S_5	S_O
Boron	B	249.678	S_2	S_O
Cadmium	Cd	226.502	S_5	S_O
Calcium	Ca	317.933	S_9	S_O
Chromium	Cr	267.716	S_5	S_O
Cobalt	Co	228.616	S_5	S_O
Copper	Cu	324.754	S_5	S_O
Iron	Fe	271.441	S_9	S_O
Lead	Pb	220.355	None	None
Lithium	Li	670.784	S_9	S_O
Magnesium	Mg	279.079	S_9	S_O
Manganese	Mn	257.610	S_5	S_O
Molybdenum	Mo	202.030	S_2	S_O
Nickel	Ni	231.604	S_5	S_O
Potassium	K	766.490	S_9	S_O
Selenium	Se	196.092	None	None
Silver	Ag	328.068	S_5	S_O
Sodium	Na	588.995	S_9	S_O
Strontium	Sr	421.552	S_2	S_O
Thallium	Tl	190.864	S_2	S_O
Tin	Sn	189.989	S_5	S_O
Titanium	Ti	334.941	S_2	S_O
Uranium	U	409.014	S_9	S_O
Vanadium	V	292.402	S_2	S_O
Zinc	Zn	213.856	S_2	S_O

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Table 2
CALIBRATION STANDARD PREPARATION
METHOD 6010B (ICAP-61E)

Standard #	Mixed Standard Name	Conc. (mg/L)	Source	Preparation		
				Aliquot (mL)	Final Vol. (ml)	Final Conc. (mg/L)
S3	EMAX-4	10000	Accu std	10.0	1000	100
	Fe	10000	Accu std	1.0		10
	Al	10000	Accu std	1.0		10
S6	EMAX-6A	500	Accu std	4.0	1000	2
	EMAX-6B	500	Accu std	4.0		2
	Sn	10000	Accu std	1.0		10
ICV	EMAX-MIX-3	10000	CPI	5.0	1000	50.0
	EMAX-MIX-2	500	CPI	2.0		1.0
	EMAX-MIX-1	500	CPI	2.0		1.0
	Al	10000	CPI	0.5		5.0
	Fe	10000	CPI	0.5		5.0
	Sn	1000	CPI	5.0		5.0
CCV	EMAX-4	10000	Accu std	7.5	1000	75
	Al	10000	Accu std	.75		7.5
	Fe	10000	Accu std	.75		7.5
	Sn	10000	Accu std	.75		7.5
	EMAX-6A & 6B	500	Accu std	3		1.5

Table 3
CALIBRATION STANDARD PREPARATION
METHOD 6010B (TRACE-ICP)

Standard #	Mixed Standard Name	Conc. (mg/L)	Source	Preparation		
				Aliquot (mL)	Final Vol. (ml)	Final Conc.
S2	EMAX-6A	500	AccuStd	2	1000	1.0
	EMAX-6B	500	AccuStd	2	1000	1.0
S5	EMAX-4 Al Fe	10000 10000 10000	AccuStd AccuStd AccuStd	10.0 1.0 1.0	1000	100 10.0 10.0
ICV	(As, Pb, Se, Tl, Cd, Cr, Mn, V, Zn) Al, Fe	1000 10000 10000	CP1 CP1 CP1	0.5 0.5 5.0	1000	0.5 5.0 50
CCV	(As, Pb, Se, Tl, Cd, Cr, Mn, V, Zn) Al, Fe Ca, Mg	1000 10000 10000	AccuStd AccuStd AccuStd	0.4 0.4 4.0	1000	0.4 4.0 40

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TABLE 4

CALIBRATION STANDARDS CONCENTRATION AND REPORTING LIMIT FOR ICP-61E

ELEMENT	S3 (mg/L)	S6 (mg/L)	ICV /CCV (mg/L)	CCV (mg/L)	ICSA (mg/L)	ICSAB (mg/L)	RL (Water) (mg/L)	RL (Soil) (mg/Kg)
Aluminum	10		5	7.5	500	500	0.20	20
Antimony		2	1	1.5	0	1	0.10	10
Arsenic		2	1	1.5	0	1	0.10	10
Barium		2	1	1.5	0	0.5	0.01	1
Beryllium		2	1	1.5	0	0.5	0.01	1
Boron		2	1	1.5	0	0.5	0.10	10
Cadmium		2	1	1.5	0	1	0.01	1
Calcium	100		50	75	500	500	1.00	100
Chromium		2	1	1.5	0	0.5	0.02	2
Cobalt		2	1	1.5	0	0.5	0.02	2
Copper		2	1	1.5	0	0.5	0.01	2
Iron	10		5	7.5	200	200	1.00	20
Lead		2	1	1.5	0	1	0.10	10
Magnesium	100		50	75	500	500	1.00	100
Manganese		2	1	1.5	0	0.5	0.1	1
Molybdenum		2	1	1.5	0	1	0.1	5
Nickel		2	1	1.5	0	1	0.02	2
Potassium	100		50	75	0	50	5.00	500
Selenium		2	1	1.5	0	3.6	1.0	10
Silver		2	1	1.5	0	1.0	0.02	2
Sodium	100		50	75	0	10	1.00	100
Strontium		2	1	1.5	0	0.5	0.02	1
Thallium		2	1	1.5	0	3.6	0.10	5
Tin		10	5	7.5	0	1	0.10	5
Vanadium		2	1	1.5	0	0.5	0.01	2
Zinc		2	1	1.5	0	1	0.02	1

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TABLE 5
CALIBRATION STANDARDS CONCENTRATION AND REPORTING LIMIT FOR TRACE-ICP

ELEMENT	S2 (µg/L)	S5 (µg/L)	ICV (µg/L)	CCV (µg/L)	ICSA (µg/L)	ICSAB (µg/L)	RL (Water) (µg/L)	RL (Soil) (mg/Kg)
Aluminum	0	10000	5000	4000	500000	500000	200.00	20.00
Arsenic	1000	0	500	400	0	1000	10.00	1.00
Cadmium	1000	0	500	400	0	1000	5.00	0.50
Calcium	0	100000	50000	40000	500000	500000	1000.00	100.00
Copper	1000	0	500	400	0	1000	5.00	0.50
Iron	0	10000	5000	4000	200000	200000	200.00	20
Lead	1000	0	500	400	0	1000	10.00	1.00
Magnesium	0	100000	50000	40000	500000	500000	1000.00	100.00
Manganese	1000	0	500	400	0	500	5.00	1.00
Selenium	1000	0	500	400	0	1000	10.00	1.00
Thallium	1000	0	500	400	0	1000	10.00	1.00
Vanadium	1000	0	500	400	0	500	10.00	1.00
Zinc	1000	0	500	400	0	1000	20.00	1.00

TABLE 6
CALIBRATION STANDARDS CONCENTRATION AND REPORTING LIMIT FOR ICP-Low

ELEMENT	S2 (µg/L)	S5 (µg/L)	S9 (µg/L)	ICV /CCV (µg/L)	CCV (µg/L)	ICSA (µg/L)	ICSAB (µg/L)	RL (Water) (µg/L)	RL (Soil) (µg/Kg)
Aluminum			10000	5000	7500	500000	500000	200	20000
Antimony	1000			500	750	0	1000	100	10000
Arsenic	1000			500	750	0	1000	10	1
Barium		1000		500	750	0	500	10	1000
Beryllium		1000		500	750	0	500	10	1000
Boron	1000			500	750	0	500	100	10000
Cadmium		1000		500	750	0	1000	5	0.5
Calcium			100000	50000	75000	500000	500000	1000	100000
Chromium		1000		500	750	0	500	20	2000
Cobalt		1000		500	750	0	500	20	2000
Copper		1000		500	750	0	500	10	2000
Iron			10000	5000	7500	200000	200000	1000	20000
Lead		1000		500	750	0	1000	10	1
Lithium			1000	500	750	0	500	100	10000
Magnesium			100000	50000	75000	500000	500000	1000	100000
Manganese		1000		500	750	0	500	5	0.5
Molybdenum	1000			500	750	0	1000	100	5000
Nickel		1000		500	750	0	1000	20	2000
Potassium			100000	50000	75000	0	75000	5000	500000
Selenium	1000			500	750	0	1000	10	1
Silver		1000		500	750	0	1000	10	1
Sodium			100000	50000	75000	0	75000	1000	10000

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ELEMENT	S2 (µg/L)	S5 (µg/L)	S9 (µg/L)	ICV /CCV (µg/L)	CCV (µg/L)	ICSA (µg/L)	ICSAB (µg/L)	RL (Water) (µg/L)	RL (Soil) (µg/Kg)
Strontium	1000			500	750	0	500	20	1000
Thallium	1000			500	750	0	1000	10	1
Tin	1000			500	750	0	1000	100	5000
Uranium			10000	5000	7500	0	1000	1000	50000
Vanadium	1000			500	750	0	500	10	2000
Zinc	1000			500	750	0	1000	20	1000

TABLE 7
ICP ANALYTICAL SEQUENCE FOR 6010B METHOD

RUN ID LABEL		SAMPLE DESCRIPTION	SOLUTION ID LABEL
ICP	TRACE		
S0	S0	Calibration Standard 1 (blank)	S0
S3, S6	S2;S5 or S2, S5, S9	ICP-61E Calibration Standard 3/ TRACE-61E Calibration Standard 2,5	S3, S2, S5,S6, S9
ICV	ICV	Initial Calibration Verification	ICV
ICB	ICB	Initial Calibration Blank	ICB
ICSA	ICSA	Initial Interference Solution A	ICSA
ICSAB	ICSAB	Initial Interference Solution A and B	ICSAB
CCV1	CCV1	Continuing Calibration Verification #1	CCV
CCB1	CCB1	Continuing Calibration Blank #1	S0
ICMSSSXB	ICMSSSXB	Preparation Blank	
ICMSSSXL/C	ICMSSSXL/C	Lab Control Sample	
Sample 1	Sample 1	Sample 1	
Sample 1M	Sample 1M	Sample 1 MS Duplicate	
Sample 1S	Sample 1S	Sample 1 Matrix Spike	
Sample 1T	Sample 1T	Sample 1 Serial Dilution(5 x dilution sample 1) only if sample is unusual	
Sample 1A	Sample 1A	Sample 1 Post Digestion spike only if sample is unusual	
Sample 2 to 4	Sample 2 to 4	Sample 2 to Sample 5	
CCV2	CCV2	Continuing Calibration Verification #2	CCV
CCB2	CCB2	Continuing Calibration Blank #2	S0
Sample 5 to 14	Sample 5 to 14	Maximum of 10 Samples	
CCV3	CCV3	Continuing Calibration Verification #3	CCV
CCB3	CCB3	Continuing Calibration Blank #3	S0
Sample 15 to 20	Sample 15 to 20	Sample 15 to 20 or a maximum of 10 samples (sample 15 to 24)	
CCV4	CCV4	Continuing Calibration Verification #4	CCV
CCB4	CCB4	Continuing Calibration Blank #4	S0

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TABLE 8
MDL CONCENTRATION LEVELS

ELEMENT	WATER (µg/L)	SOIL (µg/kg)
Aluminum	100	10
Antimony	150	15
Arsenic	150	15
Barium	5	0.5
Beryllium	5	0.5
Boron	20	2.0
Cadmium	20	2.0
Calcium	500	50
Chromium	20	20
Cobalt	50	5.0
Copper	10	1.0
Iron	50	5.0
Lead	100	10
Lithium	20	2.0
Magnesium	500	5.0
Manganese	50	5.0
Molybdenum	50	5.0
Nickel	50	5.0
Potassium	2000	200
Selenium	300	30
Silver	40	4.0
Sodium	500	50
Strontium	5	0.5
Thallium	300	30
Tin	300	30
Titanium	10	1.0
Uranium	500	50
Vanadium	20	2.0
Zinc	20	2.0

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TYPICAL SAMPLE REPORT

METHOD 3010A/6010B
METALS BY ICP

Client : XYZ, INC.	Date Collected: 03/08/06
Project : CLEAN LAND PROJECT	Date Received: 03/09/06
SDG NO. : 06C091	Date Extracted: 03/20/06 11:30
Sample ID: V8JSW1AS	Date Analyzed: 03/23/06 16:42
Lab Samp ID: C091-01A	Dilution Factor: 1
Lab File ID: I07C054017	Matrix : WATER
Ext Btch ID: IPC040W	% Moisture : NA
Calib. Ref.: I07C054010	Instrument ID : EMAXTI07

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
Aluminum	10400	200	60
Antimony	4590	100	40
Barium	1020	5	2
Beryllium	1030	5	1.0
Cadmium	991	5	2
Calcium	68100	500	100
Chromium	997	10	5
Cobalt	981	15	5
Copper	984	10	5
Iron	11300	100	40
Magnesium	79500	200	100
Manganese	1200	5	3
Molybdenum	978	15	10
Nickel	966	20	10
Potassium	53800	1000	830
Silver	962	10	5
Sodium	276000	500	250
Vanadium	998	10	5
Zinc	1050	20	5

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TYPICAL LCS/LCSD SUMMARY

EMAX QUALITY CONTROL DATA
LCS/LCD ANALYSIS

CLIENT: XYZ, INC.
PROJECT: CLEAN LAND PROJECT
SDG NO.: 06C091
METHOD: METHOD 3010A/6010B

MATRIX:	WATER			% MOISTURE:	NA
DILTN FACTR:	1	1	1		
SAMPLE ID:	MBLK1W				
CONTROL NO.:	IPC040WB	IPC040WL	IPC040WC		
LAB FILE ID:	I07C054012	I07C054013	I07C054014		
DATIME EXTRCTD:	03/20/0611:30	03/20/0611:30	03/20/0611:30	DATE COLLECTED:	NA
DATIME ANALYZD:	03/23/0616:21	03/23/0616:25	03/23/0616:30	DATE RECEIVED:	03/20/06
PREP. BATCH:	IPC040W	IPC040W	IPC040W		
CALIB. REF:	I07C054010	I07C054010	I07C054010		

ACCESSION:

PARAMETER	BLNK RSLT ug/L	SPIKE AMT ug/L	BS RSLT ug/L	BS % REC	SPIKE AMT ug/L	BSD RSLT ug/L	BSD % REC	RPD %	QC LIMIT %	MAX RPD %
Aluminum	ND	10000	10700	107	10000	10600	106	2	80-120	20
Antimony	ND	5000	4950	99	5000	4900	98	1	80-120	20
Barium	ND	1000	1000	100	1000	977	98	2	80-120	20
Beryllium	ND	1000	1050	105	1000	1030	103	2	80-120	20
Cadmium	ND	1000	1030	103	1000	1020	102	1	80-120	20
Calcium	ND	50000	54600	109	50000	54000	108	1	80-120	20
Chromium	ND	1000	1040	104	1000	1020	102	1	80-120	20
Cobalt	ND	1000	1020	102	1000	1000	100	1	80-120	20
Copper	ND	1000	1020	102	1000	998	100	2	80-120	20
Iron	ND	10000	10900	109	10000	10700	107	1	80-120	20
Magnesium	ND	50000	54700	109	50000	53200	106	3	80-120	20
Manganese	ND	1000	1030	103	1000	1020	102	2	80-120	20
Molybdenum	ND	1000	1050	105	1000	1020	102	2	80-120	20
Nickel	ND	1000	1010	101	1000	1010	101	1	80-120	20
Potassium	ND	50000	52500	105	50000	53000	106	1	80-120	20
Silver	ND	1000	993	99	1000	637	64*	44*	80-120	20
Sodium	ND	50000	53200	106	50000	52100	104	2	80-120	20
Vanadium	ND	1000	1030	103	1000	1010	101	2	80-120	20
Zinc	ND	1000	1070	107	1000	1050	105	2	80-120	20

TYPICAL MS/MSD SUMMARY

EMAX QUALITY CONTROL DATA
MS/MSD ANALYSIS

CLIENT: XYZ, INC.
PROJECT: CLEAN LAND PROJECT
SDG NO.: 06C091
METHOD: METHOD 3010A/6010B

MATRIX:	WATER			% MOISTURE:	NA
DILTN FACTR:	1	1	1		
SAMPLE ID:	V8JSW1				
CONTROL NO.:	C091-01	C091-01M	C091-01S		
LAB FILE ID:	I07C054018	I07C054015	I07C054016		
DATIME EXTRCTD:	03/20/0611:30	03/20/0611:30	03/20/0611:30	DATE COLLECTED:	03/08/06
DATIME ANALYZD:	03/23/0616:47	03/23/0616:34	03/23/0616:38	DATE RECEIVED:	03/09/06
PREP. BATCH:	IPC040W	IPC040W	IPC040W		
CALIB. REF:	I07C054010	I07C054010	I07C054010		

ACCESSION:

PARAMETER	SMPL RSLT ug/L	SPIKE AMT ug/L	MS RSLT ug/L	MS % REC	SPIKE AMT ug/L	MSD RSLT ug/L	MSD % REC	RPD %	QC LIMIT %	MAX RPD %
Aluminum	ND	10000	10500	105	10000	10500	104	0	80-120	20
Antimony	ND	5000	4890	98	5000	4920	98	0	80-120	20
Barium	60.2	1000	1020	96	1000	1020	96	1	80-120	20
Beryllium	ND	1000	1030	103	1000	1030	103	0	80-120	20
Cadmium	ND	1000	1010	101	1000	1010	101	0	80-120	20
Calcium	18100	50000	70200	104	50000	70800	105	1	80-120	20
Chromium	ND	1000	1010	101	1000	1010	101	0	80-120	20
Cobalt	ND	1000	995	99	1000	1000	100	1	80-120	20
Copper	ND	1000	994	99	1000	989	99	0	80-120	20
Iron	866	10000	11400	106	10000	11500	106	1	80-120	20
Magnesium	30600	50000	81300	101	50000	82100	103	1	80-120	20
Manganese	211	1000	1210	99	1000	1210	100	0	80-120	20
Molybdenum	ND	1000	1010	101	1000	1000	100	1	80-120	20
Nickel	ND	1000	991	99	1000	984	98	1	80-120	20
Potassium	3900	50000	57300	107	50000	57200	107	0	80-120	20
Silver	ND	1000	965	97	1000	953	95	1	80-120	20
Sodium	234000	50000	275000	81	50000	274000	78*	1	80-120	20
Vanadium	ND	1000	1010	101	1000	1010	101	0	80-120	20
Zinc	29.4	1000	1070	104	1000	1060	104	0	80-120	20

EMAX QUALITY CONTROL DATA

SERIAL DILUTION ANALYSIS

CLIENT: XYZ, INC.
PROJECT: CLEAN LAND PROJECT
BATCH NO.: 06C091
METHOD: METHOD 3010A/6010B

MATRIX:	WATER		% MOISTURE:	NA
DILUTION FACTOR:	1	5		
SAMPLE ID:	V8JSW1	V8JSW1DL		
EMAX SAMP ID:	C091-01	C091-01J		
LAB FILE ID:	I07C054018	I07C054019		
DATE EXTRACTED:	03/20/0611:30	03/20/0611:30	DATE COLLECTED:	03/08/06
DATE ANALYZED:	03/23/0616:47	03/23/0616:51	DATE RECEIVED:	03/09/06
PREP. BATCH:	IPC040W	IPC040W		
CALIB. REF:	I07C054010	I07C054010		

ACCESSION:

PARAMETER	SMPL RSLT (ug/L)	SERIAL DIL RSLT (ug/L)	DIF RSLT %	QC LIMIT (%)
Aluminum	ND	ND	NA	10
Antimony	ND	ND	0	10
Barium	60.2	58.4	3	10
Beryllium	ND	ND	0	10
Cadmium	ND	ND	0	10
Calcium	18100	17900	1	10
Chromium	ND	ND	0	10
Cobalt	ND	ND	0	10
Copper	ND	ND	0	10
Iron	866	857	1	10
Magnesium	30600	30100	2	10
Manganese	211	210	0	10
Molybdenum	ND	ND	0	10
Nickel	ND	ND	0	10
Potassium	3900	ND	NA	10
Silver	ND	ND	0	10
Sodium	234000	224000	4	10
Vanadium	ND	ND	0	10
Zinc	29.4	.041J	NA	10

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TYPICAL ANALYTICAL SPIKE REPORT

EMAX QUALITY CONTROL DATA
ANALYTICAL SPIKE ANALYSIS

CLIENT: XYZ,INC.
PROJECT: CLEAN LAND PROJECT
SDG NO.: 06C091
METHOD: METHOD 3010A/6010B

MATRIX:	WATER		% MOISTURE:	NA
DILTN FACTR:	1	1		
SAMPLE ID:	V8JSW1			
CONTROL NO.:	C091-01	C091-01A		
LAB FILE ID:	I07C054018	I07C054017		
DATIME EXTRCTD:	03/20/0611:30	03/20/0611:30	DATE COLLECTED:	03/08/06
DATIME ANALYZD:	03/23/0616:47	03/23/0616:42	DATE RECEIVED:	03/09/06
PREP. BATCH:	IPC040W	IPC040W		
CALIB. REF:	I07C054010	I07C054010		

ACCESSION:

PARAMETER	SMPL RSLT (ug/L)	SPIKE AMT (ug/L)	AS RSLT (ug/L)	AS % REC	QC LIMIT (%)
Aluminum	ND	10000	10400	103	75-125
Antimony	ND	5000	4590	92	75-125
Barium	60.2	1000	1020	96	75-125
Beryllium	ND	1000	1030	103	75-125
Cadmium	ND	1000	991	99	75-125
Calcium	18100	50000	68100	100	75-125
Chromium	ND	1000	997	100	75-125
Cobalt	ND	1000	981	98	75-125
Copper	ND	1000	984	98	75-125
Iron	866	10000	11300	104	75-125
Magnesium	30600	50000	79500	98	75-125
Manganese	211	1000	1200	99	75-125
Molybdenum	ND	1000	978	98	75-125
Nickel	ND	1000	966	97	75-125
Potassium	3900	50000	53800	100	75-125
Silver	ND	1000	962	96	75-125
Sodium	234000	50000	276000	82	75-125
Vanadium	ND	1000	998	100	75-125
Zinc	29.4	1000	1050	102	75-125

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TYPICAL CASE NARRATIVE

CLIENT: **XYZ, INC.**

PROJECT: **CLEAN LAND PROJECT**

SDG: **06C091**

METHOD 3010A/6010B
METALS BY ICP

Seven (7) water samples were received on 03/09/06 for Metals analysis by Method 3010A/6010B in accordance with "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW846, 3rd edition and DOD QSM (2002).

1. Holding Time
All samples were analyzed within holding time.

2. Calibration
Initial calibration was analyzed at a frequency specified by the project and verified by initial and continuing calibration verifications (ICV/ICB and CCV/CCB). All target analytes met calibration requirements.

3. Method Blank
Method blank was digested and analyzed with the samples at a frequency specified by the project and that results are compliant to project requirement.

4. Lab Control Sample/Lab Control Sample Duplicate
Lab control samples were analyzed at a frequency specified by the project and recoveries met the project QC limits.

5. Matrix Spike/Matrix Spike Duplicate
MS/MSD are digested with the samples and analyzed at a frequency specified by the project. All analytes were within the project QC limits except Sodium which was spiked at a concentration level much lower than the sodium concentration found in the sample. Non-compliant result was indicated by an asterisk "*" (refer to MS/MSD Report Summary).

6. Dilution Test and Post Digestion Spike
Dilution test and post digestion spike were analyzed for every preparation batch. Positive results of dilution test met method requirements.
Post Digestion Spike Summary reported Sodium below QC limits confirming the result of MS/MSD. No action is further taken because Dilution Test for Sodium met the required limit.

7. Sample Analysis
Samples were analyzed in conformance to the method and project requirements. Positive results were qualitatively identified in accordance to the method and applied quantitation is based on the initial calibration.

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SUMMARY OF IN-HOUSE QUALITY CONTROL PROCEDURES

QC PROCEDURES	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	FLAGGING CRITERIA	1st Rvw	2nd Rvw
Initial Calibration (min. 1 standard and a blank)	Daily initial calibration prior to sample analysis	Acceptable ICV	Correct the problem and repeat initial calibration.			
Initial Calibration Verifications (ICV) Second Source	Daily after initial calibration.	All analytes within ± 10% of expected value RSD of Replicate integrations: < 5%	Correct the problem and repeat initial calibration.			
Calibration Verifications (CCV)	Daily before sample analysis, every 10 samples and at the end of the analysis sequence	All analytes within ± 10% of expected value RSD of replicate integrations < 5%	Repeat calibration and reanalyze all samples since last successful calibration.			
Calibration Blanks (ICB/CCB)	After every calibration verification	No analytes detected ≥ 3X IDL	Correct problem then reanalyze calibration blank and previous samples.			
Interference Check Sample (ICSA/ICSAB)	Analyzed at the beginning of each analytical run	Within ± 20% of expected value	Terminate analysis, correct the problem, reanalyze ICS, and reanalyze all affected samples			
Method Blank	One per preparation batch	No analytes detected ≥ RL	Reprep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B to specific analyte(s) on all associated samples		
Laboratory Control Sample (LCS)	One per preparation batch	% Recovery : 80 - 120%	Reprep and reanalyze LCS and all associated samples			
Matrix Spikes (MS/MSD)	One MS/MSD every 20 project samples per matrix	% Recovery: 75 – 125% RPD ± 20%	Discuss in case narrative			
Dilution Test (5X)	Each new sample matrix	1:5 dilution must agree within ± 10% of the original determination	Perform post digestion spike addition			
Post Digestion Spike Addition	When dilution test fails	Recovery within 75-125% of expected value	Refer to project requirement.			
Results reported between MDL and RL	N/A	N/A	N/A	Refer to PSR		
Comments:				Reviewed By: Date:		

DEMONSTRATION OF CAPABILITY_
METHOD 3010-6010B

Conc. Unit: mg/L
Date Digested: 01/05/06

Sample Amount(ml): 50
Data Analyzed: 01/05/06

Extract Volume(ml): 50
Analyzed by: Karen Hirakawa

PARAMETER	Found Concentration (mg/L)				True Value (mg/L)	Ave. Conc. (mg/L)	Ave. Rec. (%)	SD	RSD (%)	QC Criteria %Rec.	Comments
	IPA007WC I73A004_12	IPA007WC1 I73A004_13	IPA007WL I73A004_14	IPA007WL1 I73A004_15							
Aluminum	10.3	9.96	10.3	9.98	10.0	10.1	101	0.19	1.9	80 - 120	PASSED
Antimony	5.23	5.24	5.17	5.13	5.0	5.19	104	0.05	1.0	80 - 120	PASSED
Arsenic	1.03	1	1.03	1	1.0	1.02	102	0.02	1.7	80 - 120	PASSED
Barium	0.97	0.94	0.97	0.94	1.0	0.96	96	0.02	1.8	80 - 120	PASSED
Beryllium	1.02	1	1.02	1	1.0	1.01	101	0.01	1.1	80 - 120	PASSED
Boron	1.09	1.09	1.08	1.07	1.0	1.08	108	0.01	0.9	80 - 120	PASSED
Cadmium	0.98	0.95	0.97	0.95	1.0	0.96	96	0.02	1.6	80 - 120	PASSED
Calcium	49.4	48	50.7	47.7	50.0	49	98	1.38	2.8	80 - 120	PASSED
Chromium	1	0.97	1	0.97	1.0	0.99	99	0.02	1.7	80 - 120	PASSED
Cobalt	0.97	0.94	0.97	0.95	1.0	0.96	96	0.01	1.6	80 - 120	PASSED
Copper	1.02	1	1.03	0.99	1.0	1.01	101	0.02	1.8	80 - 120	PASSED
Iron	10.9	10.6	10.9	10.6	10.0	10.8	108	0.17	1.6	80 - 120	PASSED
Lead	0.99	0.96	0.99	0.97	1.0	0.98	98	0.01	1.5	80 - 120	PASSED
Magnesium	49.6	48.1	50.8	48	50.0	49.1	98	1.34	2.7	80 - 120	PASSED
Manganese	0.99	0.96	0.99	0.96	1.0	0.98	98	0.02	1.8	80 - 120	PASSED
Molybdenum	1	1	0.99	0.98	1.0	0.99	99	0.01	1.0	80 - 120	PASSED
Nickel	0.98	0.95	0.97	0.95	1.0	0.96	96	0.02	1.6	80 - 120	PASSED
Potassium	50.5	46.4	53.3	48	50.0	49.6	99	3.02	6.1	80 - 120	PASSED
Selenium	1.01	0.96	1	0.97	1.0	0.99	99	0.02	2.4	80 - 120	PASSED
Silver	1.01	0.98	1.01	0.98	1.0	1	100	0.02	1.7	80 - 120	PASSED
Sodium	49.2	47.7	50.7	47.3	50.0	48.7	97	1.55	3.2	80 - 120	PASSED
Strontium	1.04	1.04	1.04	1.02	1.0	1.04	104	0.01	1.0	80 - 120	PASSED
Thallium	1.03	0.98	1.02	0.98	1.0	1	100	0.03	2.6	80 - 120	PASSED
Tin	1.01	1.01	1.01	1	1.0	1.01	101	0.00	0.5	80 - 120	PASSED
Titanium	1.04	1.05	1.04	1.02	1.0	1.04	104	0.01	1.2	80 - 120	PASSED
Vanadium	1.01	0.98	1.01	0.98	1.0	1	100	0.02	1.7	80 - 120	PASSED
Zinc	1.01	0.98	1.01	0.98	1.0	1	100	0.02	1.7	80 - 120	PASSED

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DEMONSTRATION OF CAPABILITY
METHOD 3050B-6010B

Conc. Unit: mg/L
Sample Amt(ml): 50
Extract Vol.(ml): 50

Date Digested: 01/05/06
Data Analyzed: 01/06/06
Analyzed by: Karen Hirakawa

PARAMETER	Found Concentration (mg/kg) IPA008 SC I07A008_ 11	IPA008 SC1 I07A008_ 12	IPA008 SL I07A008_ 13	IPA008 SL1 I07A008_ 14	True Value (mg/kg)	Ave. Conc. (mg/L)	Ave. Rec. (%)	SD	RSD (%)	QC Criteria % Rec.	Comments
Aluminum	990	951	965	952	1000	965	96	18.16	1.9	80 - 120	PASSED
Antimony	454	436	445	443	500	445	89	7.42	1.7	80 - 120	PASSED
Arsenic	98.4	93.8	95	94	100	95.3	95	2.13	2.2	80 - 120	PASSED
Barium	94.4	93.4	92.9	106	100	96.7	97	6.25	6.5	80 - 120	PASSED
Beryllium	101	96.4	98.2	96.7	100	98.1	98	2.10	2.1	80 - 120	PASSED
Boron	98.9	94.6	96.1	94.8	100	96.1	96	1.98	2.1	80 - 120	PASSED
Cadmium	95.3	91.8	92.8	92.3	100	93.1	93	1.55	1.7	80 - 120	PASSED
Calcium	4810	4580	4760	4630	5000	4700	94	107.86	2.3	80 - 120	PASSED
Chromium	96.7	92.3	94.3	92.9	100	94.1	94	1.96	2.1	80 - 120	PASSED
Cobalt	95	90.6	92.4	91	100	92.3	92	1.99	2.2	80 - 120	PASSED
Copper	95.9	92.3	93.7	92.5	100	93.6	94	1.65	1.8	80 - 120	PASSED
Iron	998	960	974	964	1000	974	97	17.05	1.8	80 - 120	PASSED
Lead	95	91.6	92.9	91.6	100	92.8	93	1.60	1.7	80 - 120	PASSED
Magnesium	4730	4540	4680	4560	5000	4630	93	92.15	2.0	80 - 120	PASSED
Manganese	95.9	91.8	93.6	92.2	100	93.4	93	1.85	2.0	80 - 120	PASSED
Molybdenum	94.4	91.2	93.4	91.1	100	92.5	93	1.64	1.8	80 - 120	PASSED
Nickel	94.4	92	92.7	91.9	100	92.8	93	1.16	1.2	80 - 120	PASSED
Potassium	4760	4510	4640	4580	5000	4620	92	105.95	2.3	80 - 120	PASSED
Selenium	93.1	93.6	88.4	88.2	100	90.8	91	2.92	3.2	80 - 120	PASSED
Silver	96	89.4	93.7	92.9	100	93	93	2.74	2.9	80 - 120	PASSED
Sodium	4830	4620	4760	4630	5000	4710	94	102.31	2.2	80 - 120	PASSED
Strontium	99	95.4	96.8	95.5	100	96.7	97	1.68	1.7	80 - 120	PASSED
Thallium	96	90.7	96.5	96.8	100	95	95	2.89	3.0	80 - 120	PASSED
Tin	96.5	94.6	95.4	93.5	100	95	95	1.27	1.3	80 - 120	PASSED
Titanium	98.9	95.1	96.9	95.3	100	96.6	97	1.76	1.8	80 - 120	PASSED
Vanadium	96.3	92.4	94.3	92.6	100	93.9	94	1.81	1.9	80 - 120	PASSED
Zinc	96.8	93	94.9	94	100	94.7	95	1.62	1.7	80 - 120	PASSED

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ANALYSIS RUN LOG

ANALYSIS RUN LOG FOR ICP

SOP ➔➔**EMAX-6010-Rev. 3** ➔➔**EMAX-CLP-TAL** ➔ **Method File:** **Autosampler Table:**

Matrix: **Start Date:** **Time:** **End Date:** **Time:** **Book# A31 -034**

	Data File Name	Prep. Batch	Lab Sample ID	DF	Matrix	Notes
ANALYTICAL BATCH ____*	01					
	02					
	03					
	04					
	05					
	06					
	07					
	08					
	09					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					

	Data File Name	Prep. Batch	Lab Sample ID	DF	Matrix	Notes
ANALYTICAL BATCH ____*	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					
	41					
	42					
	43					
	44					
	45					
	46					
	47					
	48					
	49					
	50					

Instrument No.	**31**
Std.	ID
S_0	
S_1	
S_2	
S_3	
S_4	
S_5	
S_6	
ICV	
ICVH1	
ICVH2	
CCV	
ICSA	
ICSAB	
MRL	

Comments:

Analyzed By: _____

Date Disposed: _____

This page is checked during data review.

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

SAMPLE PREPARATION LOG

DIGESTION LOG FOR ICP METALS

SOP o **EMAX-3005 Rev. No.3** o **EMAX-3010 Rev. No. 2** o **EMAX-3050 Rev. No. 2** o **EMAX-CLP-TAL** o **Book # EIP-046**

Matrix: **Start Date:** **Time:** **Temp:** °C **Ending Date:** **Time:** **Temp.:** °C

*BATCH:*_____

Sample Prep ID	Lab Sample ID	Matrix Description			Turbidity	Sample Amount	pH	Extract Volume	Digestate Description	
		Color	Texture / Clarity	Artifacts	<1 NTU	(g | ml)		(ml)	Color	Clarity
01										
02										
03										
04										
05										
06										
07										
08										
09										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										

Standards	ID	Amount Added (ml)
LCS -1		
LCS -2		
LCS -3		
MS		
Reagent	Lot# / ID	Amount Added (ml)
HNO_3		
HCl		
H_2O_2		
HNO3 (1:1)		

Digestate Location	
Extract Location	

Legend:

Texture	Cs = Coarse	Md = Medium	Fn = Fine
Clarity	Cr = Clear	Cy = Cloudy	Td = Turbid
Artifacts	Rk = rocks	Sl = Shale	Vg=Vegetation
Color	Bu = blue	Bk = Black	Bn = Brown
	Gn = Green	Og = Orange	Rd = Red
	Yw = Yellow	Cl = Colorless	

Comments: Samples for Methods 200.7 or 200.8 Analyses

If turbidity ≤ 1 NTU no digestion is required unless otherwise required by th

Prepared By: Standard Added By:

Witnessed By: Extracts Rcvd. By:

Checked By:

Date Disposed: Disposed by:

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

INSTRUMENT MAINTENANCE LOG

ICP MAINTENANCE LOG

Instrument No: 24 **Month:** **Year: 200_** **Book # M24-002**

Date							
Argon							
Nitrogen							
Instrument Discharge							
Nebulizer							
SB/FAT							
Pump Tubings							
Rinse Bottle							
Printer Paper							
Autosampler							
Cooling Water							
Fume Hood							
Power Supply							
Analysis Pump Rate -100-200 RPM							
Flush Pump Rate - 100-200 RPM							
Nebulizer Pressure - 15-45 psi							
ICP Profile							
Room Temperature							
Vernier Setting							
Peak Position							
Peak Intensity							
Peak Width							
Analyst Initials							

Trouble Shooting							
Problem(s) Encountered							
Corrective Action							
Return To Specs (Analyst Initials)							

Code	Problems Encountered	Code	Corrective Action

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INSTRUMENT MAINTENANCE LOG

TRACE ICP MAINTENANCE LOG

Instrument No: 31 **Month:** **Year: 200_** **Book # M31-002**

Date							
Argon							
Nitrogen							
Instrument Discharge							
Nebulizer							
SB/FAT							
Pump Tubings							
Rinse Bottle							
Printer Paper							
Autosampler							
Cooling Water							
Fume Hood							
Power Supply							
Analysis Pump Rate -100-200 RPM							
Flush Pump Rate - 100-200 RPM							
Nebulizer Pressure - 15-45 psi							
ICP Profile							
Room Temperature							
Vernier Setting							
Peak Position							
Peak Intensity							
Vacuum Reading							
Analyst Initials							

Trouble Shooting							
Problem(s) Encountered							
Corrective Action							
Return To Specs (Analyst Initials)							

Code	Problems Encountered	Code	Corrective Action

STANDARD OPERATING PROCEDURE

ACID DIGESTION, TOTAL METALS FOR SOLIDS

SOP No.:	EMAX-3050	Revision No. 3	Effective Date: 7-Sep-04
Prepared By:	Gwen Ramos		Date: 08-30-04
Approved By:	Kenette Pimentel QA Manager		Date: 08.30.04
Approved By:	Kam Pang Laboratory Director		Date: 08-30-04

Control Number: 3050-03-

1.0 SCOPE AND APPLICATION

1.1. This method describes the acid digestion for soils, sludge, sediments and other related substances that are solid in nature, in preparation for metals analysis by either GFAA or ICP analytical technique. This is an adaptation of SW846 Method 3050B.

2.0 SUMMARY OF METHOD

2.1. Metal analytes are acid digested from a pre-measured sample. Nitric acid is added to the sample and heated to initialize digestion. It is further oxidized with 30% hydrogen peroxide and the acid used for final reflux is dictated by the analytical technique.

2.2. Digestates to be analyzed by GFAA shall use nitric acid for the final reflux.

2.3. Digestates to be analyzed by ICP shall use HCl as the final reflux. If antimony needs to be analyzed by GFAA, the ICP extract shall be used.

2.4. **Interferences**

2.4.1. Sludge samples can contain diverse matrix types, which may present analytical challenge.

2.4.2. Samples having high concentrations may cause memory effect on the digestion vessels. Treating the vessels with 1:1 v/v of HCL and HNO3 will decontaminate the digestion vessels..

3.0 METHOD DETECTION AND REPORTING LIMITS

3.1. **Method Detection Limit**

3.1.1. Prepare a minimum of eight digestion vessels. Add 1 ml of MDL spike standard to each of the 7 vessels and treat the other one as method blank sample. Digest them as described in Sec. 10. MDL validation shall be performed quarterly.

3.1.2. Follow the sample preparation steps, analysis and calculations as described in Section 10.0.

3.1.3. Refer to EMAX-QA04 for MDL evaluation and verification.

3.2. **Reporting Limit**

3.2.1. Refer to applicable analytical procedure.

4.0 DYNAMIC RANGE

4.1. Refer to applicable analytical procedure.

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5.0 SAMPLE HOLDING TIME AND PRESERVATION

5.1. **Holding Time**

5.1.1. All samples shall be digested within 180 days from sampling date.

5.2. **Preservation**

5.2.1. All samples shall be stored at the condition specified by the project.

6.0 ASSOCIATED SOP

6.1.	EMAX-QC04	Balance Calibration
6.2.	EMAX-QC06	Calibration of Micropipettes
6.3.	EMAX-QC07	Glassware Cleaning
6.4.	EMAX-SM04	Analytical and QC Labeling
6.5.	EMAX-7000	Trace Element Analyses of Water, Soil, Aqueous, Sludge, Sediment and Waste Samples By GFAA
6.6.	EMAX-6010	ICP Emission Spectrometric Method for Trace Metal Analyses

7.0 SAFETY

7.1. Read the MSDS of all chemicals listed in this SOP.

7.2. All reagents, standards and samples shall be treated as potential hazard. Observe the standard laboratory safety procedures. Protective gear, i.e., lab coat, safety glasses, gloves, shall be worn at all times when performing this procedure.

7.3. All wastes generated during digestion, i.e., filter papers, paper towels, etc., and/or any solid material contaminated with acid, shall be placed in the wastes containers under the fume hoods. These wastes shall be labeled acidic wastes and shall be given to the waste management unit for proper disposal. NO ACIDIC WASTE SHALL BE DISPOSED IN THE TRASH CAN.

7.4. All acidic rinsate ($pH \leq 2$) shall be labeled acidic water and shall be given to the waste management unit for proper disposal. NO ACID WASTE SHALL BE DISPOSED IN THE SINK.

7.5. If for any reason, acid and/or other reagents get in contact with your skin or any other part of your body, rinse the affected body part thoroughly with copious amount of tap water. If irritations or any other discomfort related to the incident persist, inform your supervisor immediately, so that proper action can be taken.

8.0 INSTRUMENTS, CHEMICALS & REAGENTS

8.1. **Instruments & Supplies**

8.1.1.	Balance	Sartorius LC 620 S or equivalent
8.1.2.	Spatula	Stainless steel or equivalent
8.1.3.	Digestion vessel	50 ml, 100 ml Killdee Digestion tubes
8.1.4.	Pipet	1ml, 0.100 ml

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8.1.5.	Hot Plate	Thermolyne 2200 or equivalent
8.1.6.	Digestion block	Aluminum blocks or equivalent
8.1.7.	Thermometer	Range 0 - 110°C
8.1.8.	Watch Glass	Killdee Conical Watch glass or equivalent
8.1.9.	Filter	Whatman #41 or equivalent
8.1.10.	Digestate Container	125 ml Polyethylene bottle, Graduated

8.2. **Chemicals & Reagents**

Reagent water	De-ionized water
Nitric Acid	NX0407-2 EM Science or equivalent
Hydrochloric Acid	HX0607-2 EM Science or equivalent
Hydrogen Peroxide	VW3690-5 VWR or equivalent

9.0 STANDARD

9.1. ICP Matrix Spike and Laboratory Control Solution

ICP MATRIX SPIKE AND LCS STANDARD 1					
PARAMETER					CONCENTRATION (mg/L)
Arsenic	Barium	Beryllium	Cadmium	Chromium	100
Cobalt	Copper	Lead	Manganese	Nickel	
Selenium	Silver	Thallium	Vanadium	Zinc	
Aluminum	Iron				1000

ICP MATRIX SPIKE AND LCS STANDARD 2					
PARAMETER					CONCENTRATION (mg/L)
Antimony					500
Bismuth	Boron	Molybdenum	Strontium	Tin	100
Titanium					

ICP MATRIX SPIKE AND LCS STANDARD 3				
PARAMETER				CONCENTRATION (mg/L)
Calcium	Magnesium	Potassium	Sodium	5000

9.2. GFAA Matrix Spike and Laboratory Control Solution

PARAMETER	CONCENTRATION (mg/L)
Lithium	1.0
Copper	1.0
Cadmium	0.2
Selenium	2.0

Chromium	2.0
Arsenic	2.0
Thallium	2.0
Lead	1.0
Silver	0.4
Nickel	1.0
Antimony	2.0

10.0 PROCEDURES

10.1. Sample Preparation

10.1.1. Sample Handling

10.1.1.1. Based from the work order, determine the samples to form a preparative batch (not to exceed 20 field samples). Withdraw the sample(s) from the sample control room and bring them to the weighing area. Allow the samples to equilibrate at room temperature.

10.1.1.2. Take digestion vessels and label each one corresponding to the samples withdrawn. Take four more vessels and label them as preparation blank, LCS, matrix spike and matrix spike duplicate. If samples are to be analyzed for both ICP and GFAA analyses, double the number of digestion vessels determined above.

10.1.1.3. Mix the sample thoroughly to achieve homogeneity.

10.1.1.4. Tare the digestion vessel to the nearest 0.001g. Using a stainless spatula, scoop 1-2g of the homogenized sample into the digestion vessel. Record the weight to the nearest 0.001-g. Cover the vessel with conical watch glass and place it in a digestion block.

10.1.2. Pre-heating the Hot Plate

10.1.2.1. Put a thermometer inside a digestion vessel, fill it with tap water halfway, and insert it in a digestion block. Place the digestion block in the hot plate and turn the thermostat to a pre-determined mark to deliver heat at approximately 95^{o}C ($\pm$5 ^{o}C).

10.1.3. Standard Addition.

10.1.3.1. Call for a witness for standard addition. Have the witness verify the setting of the micropippet and the expiration dates of the spike standards.

10.1.3.2. Add matrix spike solution to matrix spike samples.

- For ICP, add 1 ml of each from ICP Spike 1, 2 and 3 (Sec. 9.1)
- For GFAA, add 1 ml of GFAA Spike Solution (Sec. 9.2)

10.1.4. Acid Digestion

10.1.4.1. Add 10 ml of 1:1 (v/v) nitric acid (HNO_3) into the vessels, swirl the vessel to mix the acid and the sample. Add same amount of acid into a clean and empty vessel and designate it as blank. Insert the vessels in the digestion block(s). Cap the vessels with conical watch glass.

10.1.4.2. Check the temperature of the hot plate (95^{o}C $\pm$ 5^{o}C), adjust if necessary. If temperature happens to be $\geq$100 ^{o}C, adjust the thermostat and wait until temperature falls within 95^{o}C $\pm$ 5 ^{o}C. Record the temperature reading in the digestion log.

10.1.4.3. Place the digestion blocks on the hot plate and reflux for 10 to 15 minutes without boiling.

10.1.4.4. Transfer the vessels into unheated digestion blocks and allow the vessels to cool down for at least 5 minutes. Lift the watch glass and add 5 ml of concentrated HNO_3. Place the watch glass back before working on the next vessel.

10.1.4.5. Return the vessels to the digestion blocks on the hot plate and reflux for another 30 minutes.

10.1.4.6. Repeat steps 10.4.4 and 10.4.5 until no brown fumes are visible in the digestion vessels, indicating complete reaction with HNO_3. Then continue to reflux at 95°C ± 5°C without boiling for two (2) hours or until the volume is reduced to approximately 5-ml.

10.1.4.7. Transfer the vessels into unheated digestion blocks and allow the vessels to cool down for at least 5 minutes.

10.1.4.8. Add 2 ml of reagent water. Then add 3 ml of 30% hydrogen peroxide (H_2O_2) to each vessel, swirling each one of them after every addition to initiate peroxide reaction.

10.1.4.9. Return the vessels to the heated digestion blocks. Care must be taken to ensure that losses do not occur due to excessive effervescence.

10.1.4.10. Continue to add 30 % H_2O_2 in 1 ml aliquot at a time (not to exceed 10 ml) with warming, until effervescence is minimal or until the general appearance of the digestate is unchanged.

10.1.4.11. Continue to reflux the mixture at 95°C ± 5°C for 2 hours or until volume is reduced to approximately 5 ml, whichever comes first. Remove the digestion vessels from the hot plate.

10.1.4.12. If digestates shall be analyzed by GFAA, proceed to step 10.1.5. If digestate shall be analyzed by ICP proceed to 10.1.4.13.

10.1.4.13. Lift the watch glass, add 10 ml of concentrated HCl. Swirl the vessel until added reagents are properly mixed with the solution. Place the watch glass back before working on the next vessel. Return the vessels into the heated digestion block. Reflux for additional 15 minutes. Subsequently, remove the digestion vessels from the hot plate, allow the vessels to cool down and proceed to 10.1.5.

10.1.5. Digestate Filtration

10.1.5.1. Place Whatman #41 filter paper into each funnel resting on holders. Rinse the filter papers with reagent water.

10.1.5.2. Place a pre-labeled digestate container under each funnel making sure that the labels are visible.

10.1.5.3. Check the labels to make sure that they agree. Pour the digestate into the filter.

10.1.5.4. Filter and collect the digestates in the labeled container. Dilute the digestate with reagent water to the 100-ml mark of the digestion vessel. Cover the vessel and invert it several times.

10.1.5.5. The digestates are now ready for analysis. If antimony is required by GFAA analyzed the ICP digestate.

10.2. **Instrument Parameters**

10.2.1. The hot plate shall be monitored by putting a thermometer inside a digestion vessel, filled with tap water halfway, inserted it in a digestion block. The digestion block is place on the hot plate together with the samples being digested and is to be check from time to time to ensure that it delivers heat at about 95°C(±5°C).

10.3. **Calibration**

10.3.1. Calibration of pipet shall be carried out as described by EMAX-QC06.

10.3.2. Calibration of balance shall be carried out as described by EMAX-QC04.

10.3.3. Check acid dispenser monthly using a class A graduated cylinder for accuracy prior to acid digestion. Adjust the dispenser stopper if necessary. Document the dispenser calibration on the digestion log.

10.3.4 **Digestate Vessel QC Check**

10.3.4.1 Randomly select 3 vessels from the lot.

10.3.4.2 Using a calibrated balance, tare off digestion vessel.

10.3.4.3 Fill the vessel to the 50-ml mark with reagent water and record the weight.

10.3.4.4 Fill the vessel to the 100-ml mark with reagent water and record the weight.

10.3.4.5 Repeat steps 10.3.3.2 to 10.3.3.4 on the other two vessels.

10.3.4.6 Take the temperature reading of the reagent water used. Read the density of reagent water from the Density/Temperature Table attached to the Digestion Vessel QC Log.

10.3.4.7 Calculate for actual volume measured indicated by the graduation on each of the digestion vessel using Eq.-10.6.1.

10.3.4.8 Calculate the average volume measured for each vessel using Eq-10.6.2.

10.3.4.9 Calculate the standard deviation using Eq-10.6.3.

10.3.4.10 Acceptance criteria shall be ± 2% of the expected value. All measurements must fall into the acceptance criteria, otherwise reject the lot.

10.4. **Analysis**

10.4.1. For ICP Analytical Technique - refer to EMAX-6010
For GFAA Analytical Technique - refer to EMAX-7000

10.5. **Data Reduction**

10.5.1. Refer to analytical procedures.

10.6. **Calculations**

10.6.1. Calculate for actual volume measured as indicated by the graduation of the vessel.

$$V = \frac{W}{D} \qquad \text{Eq-10.6.1}$$

where:

V = Actual volume measure

W = Weight of reagent water

D = Density of reagent water at the measured temperature

10.5.1. Calculate for average volume measured for each vessel.

$$V_{ave} = \frac{\sum V}{n}$$ Eq-10.6.. 2

where:

$\sum V$ = Summation of volume calculated from each trial

n = Number of measurements

V_{ave} = = Average volume measured

10.5.2. Calculate the Standard Deviation.

$$SD = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$ Eq-10.6.3

where:

SD = Standard Deviation

$\bar{x}$ = Mean

x_i = Result at i^{th} measurement

n = Number of measurements

10.7. **Report Generation**

10.7.1. Refer to analytical method

10.8. **Data Review**

10.8.1. Refer to analytical method

10.9. **Preventive Maintenance**

10.9.1. The digestion area in general shall be maintained clean at all times to prevent contamination

11.0 QUALITY CONTROL

11.1. The maximum number of original field samples in an analytical batch shall be 20 unless otherwise specified by the project.

11.2. Matrix spike samples shall be taken from a specified matrix spike field sample. In the absence of a specified matrix spike field sample, the analyst performing the extraction shall choose from any of the samples within the analytical batch.

11.3. A method blank, LCS, MS and MSD shall be prepared in every analytical batch, unless otherwise specified by the project. They shall be subjected to the same process that the field samples undergo as described in section 10.

11.4. In the event that there is insufficiency of sample to be used for MS/MSD, LCS duplicate shall be prepared to demonstrate precision.

11.5. All labwares to be used in the sample preparation shall be properly treated as specified in EMAX-QC07.

11.6. All reagents shall undergo quality control acceptance prior to its use.

11.7. Every lot of digestion vessels shall be checked for accuracy prior to its use. Record the verification in the Digestion Vessel QC Log (see Appendix 3).

11.8. MDL shall be established prior to the use of this SOP. Perform MDL verification quarterly.

11.9. Demonstration of proficiency is required prior to performing this procedure.

12.0 CORRECTIVE ACTION

12.1. Corrective action for each Quality Control procedure is summarized in Appendix 1 of the analytical method.

12.2. A non-conformance report (NCR) shall be filled out and attached to the analysis folder whenever the following circumstances occur. Corrective action shall be undertaken as advised below:

12.2.1. For insufficiency of sample(s), inform the Supervisor immediately for further advice.

12.2.2. Insufficient preservation of sample. If sample pH is ≥2, and no special instruction is provided by the analysis folder, inform your supervisor immediately for further action.

12.2.3. Breakage of sample container. Identify the sample and check for sample spare. If a spare is found replace the broken sample, if not inform your supervisor immediately for further action.

12.2.4. Sample overflow due to excessive effervescence. Identify the sample and check for sample spare. If a spare is found redigest the sample, if none inform your supervisor immediately for further action.

12.2.5. Breakage of digestate container or sample was spilled prior to dilution to final volume. Identify the digestate. If it is a method blank or LCS, re-digest the whole analytical batch. If it is a sample, re-digest the sample with a method blank and LCS. If re-extraction is not possible, inform your supervisor for further action.

13.0 POLLUTION PREVENTION

13.1. All unused samples shall be endorsed to the Waste Disposal Unit (WDU) for proper disposal. No samples shall be dumped in the laboratory sink.

13.2. All unused expired analytical standards shall be separated and properly identified prior to endorsing them to the WDU for proper disposal.

14.0 WASTE MANAGEMENT

14.1. Collect all waste generated, i.e. acidic rinsates, filter papers, etc. , into properly labeled waste containers and properly turn them over to the waste disposal unit.

15.0 SUPPLEMENTARY NOTES

15.1. Method performance was performed utilizing this procedure. See Appendix 1.

15.2. The procedures and QC criteria specified in this SOP shall be applied to all projects that do not have a specific project requirement for this method. In the instance where there is a project or program specific requirement, the requirements given in the project shall take precedence over this SOP.

15.3. **Definition of Terms**

15.3.1. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagents.

15.3.1.1. **Preparation batch** is composed of one to 20 samples of the same matrix, a method blank, a lab control sample and matrix spike/matrix spike duplicate.

15.3.1.2. **Analytical batch** is composed of prepared samples (extracts, digestates, or concentrates), which are analyzed together as a group using an instrument in conformance to the analytical requirement. An analytical batch can include samples originating from various matrices, preparation batches, and can exceed 20 samples.

15.3.2. Calibration – is a determinant measured from a standard to obtain the correct value of an instrument output.

15.3.3. Lab Control Sample (LCS) – is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LCS is analyzed to monitor the accuracy of the analytical system.

15.3.4. Matrix – is a component or form of a sample.

15.3.5. Matrix Spike (MS) – is a sample spiked with a verified known amount of target analyte(s) subjected to the entire sample preparation and/or analytical process. MS is analyzed to monitor matrix effect on a method's recovery efficiency.

15.3.6. Matrix Spike Duplicate (MSD) – is a replicate of MS analyzed to monitor precision or recovery.

15.3.7. Method Blank – is a target-analyte-free sample subjected to the entire sample preparation and/or analytical to monitor contamination.

15.3.8. Reagent Water – is purified water free from any target analyte or any other substance that may interfere with the analytical process.

15.3.9. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise specified by the project.

15.3.10. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

15.3.11. Sample Duplicate – is a second sample aliquot of any sample (preferably the MS sample) to check matrix homogeneity and precision of method in a given matrix.

15.4. **Application of EMAX QC Procedures**

15.4.1. The procedures and QC criteria specified in this SOP shall be applied to all projects when performing acid digestion of soil, sludge, and sediment samples for metals analysis. In the instance where there is a project or program specific requirement, the requirements given in the project shall take precedence over this SOP.

15.5. **Air Force Center for Environmental Excellence (AFCEE) Projects**

15.5.1. For samples from AFCEE sponsored projects follow the AFCEE Quality Assurance Project Plan, latest version in the absence of project QAPP.

15.6. **U.S Army Corps of Engineers (USACE) Projects**

15.6.1. For samples from USACE sponsored projects follow In the Shell Document, latest version in the absence of project QAPP.

15.7. **Naval Facilities Engineering Center (NFESC) Projects**

15.7.1. For samples from NFESC sponsored projects follow NFESC Interim Guidance Document, latest version in the absence of project QAPP.

16.0 REFERENCES

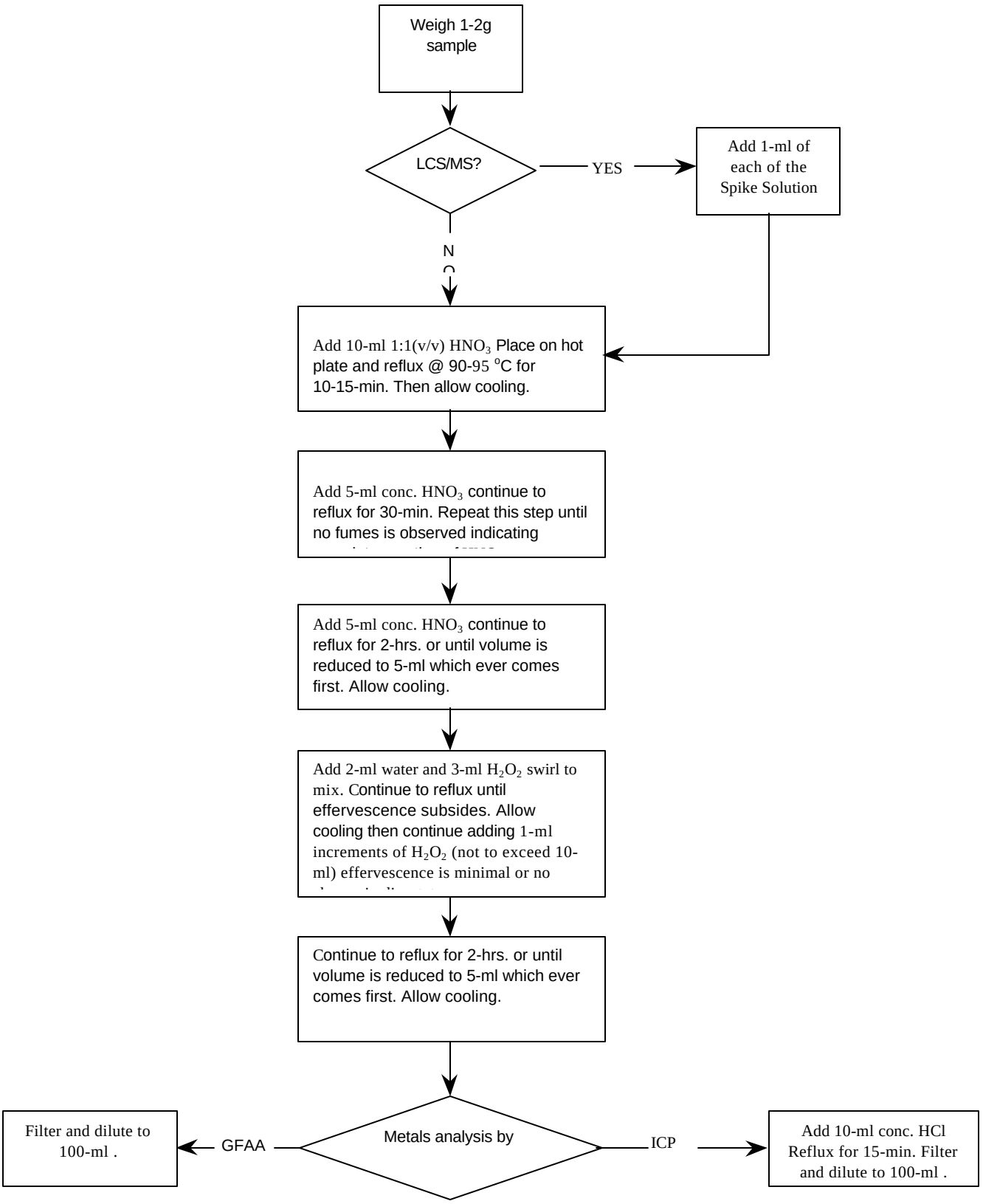
16.1. USEPA SW846, Method 3050B

16.2. EMAX Quality Systems Manual, as updated

17.0 APPENDICES

17.1.	Figure 1	Acid Digestion Flow Diagram
17.2.	Appendix 1	Demonstration of Capability
17.3.	Appendix 2	Digestion Log
17.4.	Appendix 3	Digestion Vessel QC Log

ACID DIGESTION FLOW DIAGRAM



DEMONSTRATION OF CAPABILITY
Method 3050B-6010B

Conc. Unit: mg/Kg
Sample Amount(g): 1
Extract Volume(ml): 100

Date Analyzed: 07/07/01
Digested By: MC
Analyzed By: FF
Batch: IPF032S

PARAMETER	I07G016S_11	I07G016S_12	I07G016S_13	I07G016S_14	True Value (mg/Kg)	Ave. Conc.	Ave. % Rec.	SD	RPD	QC Criteria	Comments
Aluminum	908.98	927.15	922.21	930.48	1000	922.2	92	9.45	1	80 - 120	Passed
Antimony	401.73	410.00	409.66	412.28	500	408.4	82	4.61	1	80 - 120	Passed
Arsenic	91.43	93.76	94.67	93.99	100	93.5	93	1.41	2	80 - 120	Passed
Barium	94.24	96.15	95.10	96.89	100	95.6	96	1.16	1	80 - 120	Passed
Beryllium	92.32	94.25	93.30	94.74	100	93.7	94	1.07	1	80 - 120	Passed
Boron	102.90	105.04	104.22	105.56	100	104.4	104	1.16	1	80 - 120	Passed
Cadmium	91.67	93.70	92.81	93.94	100	93.0	93	1.03	1	80 - 120	Passed
Calcium	4502.12	4611.79	4576.32	4614.77	5000	4576.3	92	52.42	1	80 - 120	Passed
Chromium	92.91	94.95	94.59	95.00	100	94.4	94	0.99	1	80 - 120	Passed
Cobalt	92.95	94.88	94.37	95.17	100	94.3	94	0.99	1	80 - 120	Passed
Copper	93.21	95.10	94.58	95.57	100	94.6	95	1.02	1	80 - 120	Passed
Iron	921.55	937.51	934.29	942.80	1000	934.0	93	9.03	1	80 - 120	Passed
Lead	90.09	93.52	93.41	91.69	100	92.2	92	1.63	2	80 - 120	Passed
Magnessium	4752.31	4805.53	4784.95	4903.30	5000	4811.5	96	64.99	1	80 - 120	Passed
Manganese	93.99	95.81	95.10	96.27	100	95.3	95	0.99	1	80 - 120	Passed
Molybdenum	86.71	88.33	87.96	88.52	100	87.9	88	0.81	1	80 - 120	Passed
Nickel	92.15	93.96	93.74	94.01	100	93.5	93	0.89	1	80 - 120	Passed
Potassium	4699.72	4769.61	4817.28	4827.04	5000	4778.4	96	58.15	1	80 - 120	Passed
Selenium	85.52	91.44	91.49	89.22	100	89.4	89	2.81	3	80 - 120	Passed
Silver	90.44	92.62	91.58	92.95	100	91.9	92	1.14	1	80 - 120	Passed
Sodium	4767.17	4851.83	4801.27	4882.41	5000	4825.7	97	51.39	1	80 - 120	Passed
Strontium	92.46	94.38	93.39	95.08	100	93.8	94	1.15	1	80 - 120	Passed
Thallium	90.37	93.07	93.52	94.12	100	92.8	93	1.66	2	80 - 120	Passed
Tin	91.98	93.99	96.09	95.43	100	94.4	94	1.82	2	80 - 120	Passed
Titanium	93.53	95.45	94.48	96.03	100	94.9	95	1.10	1	80 - 120	Passed
Vanadium	92.15	94.36	93.53	94.65	100	93.7	94	1.12	1	80 - 120	Passed
Zinc	91.16	93.63	92.63	93.60	100	92.8	93	1.16	1	80 - 120	Passed

DIGESTION LOG

DIGESTION LOG FOR ICP METALS

SOP ☐ **EMAX-3005 Rev. No.3** ☐ **EMAX-3010 Rev. No. 2** ☐ **EMAX-3050 Rev. No. 2** ☐ **EMAX-CLP-TAL** ☐ **Book # EIP-034**

Matrix: **Start Date:** **Time:** **Temp:** °C **Ending Date:** **Time:** **Temp.:** °C

BATCH:_____

Sample Prep ID	Lab Sample ID	Matrix Description			Sample Amount (g | ml)	pH	Extract Volume (ml)	Digestate Description	
		Color	Texture / Clarity	Artifacts				Color	Clarity
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Standards	ID	Amount Added (ml)
LCS -1		
LCS -2		
LCS -3		
MS		
Reagent	Lot# / ID	Amount Added (ml)
HNO_3		
HCl		
H_2O_2		
HNO3 (1:1)		

Digestate Location	
Extract Location	

Legend:

Texture	Cs = Coarse	Md = Medium	Fn = Fine
Clarity	Cr = Clear	Cy = Cloudy	Td = Turbid
Artifacts	Rk = rocks	Sl = Shale	Vg=Vegetation
Color	Bu = blue	Bk = Black	Bn = Brown
	Gn = Green	Og = Orange	Rd = Red
	Yw = Yellow	Cl = Colorless	

Comments: _____

Prepared By: _____ Standard Added By: _____

Witnessed By: _____ Extracts Received By: _____

Checked By: _____

Date Disposed: _____ Disposed by: _____

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DIGESTION LOG

DIGESTION LOG FOR GFAA METALS

SOP ☐ EMAX-3020 Rev. No.: 2 ☐ EMAX-3050 Rev. No. 2 ☐ EMAX-CLP-TAL ☐ EMAX-3005 Rev. No.3 ☐ EMAX-3010 Rev. No. 2 ☐ Book # EGF-007

Matrix: Start Date: Time: Temp: °C Ending Date: Time: Temp.: °C

PREPARATION BATCH * _____

Sample Prep ID	Lab Sample ID	Matrix Description			Sample Amount (g | ml)	pH	Extract Volume (ml)	Matrix Description		Notes
		Color	Texture / Clarity	Artifacts				Color	Clarity	
*01										
*02										
*03										
*04										
*05										
*06										
*07										
*08										
*09										
*10										
*11										
*12										
*13										
*14										
*15										
*16										
*17										
*18										
*19										
*20										
*21										
*22										
*23										
*24										
*25										
*26										

Standards	ID	Amount Added (ml)
LCS		
MS		

Reagent	Lot# / ID	Amount Added (ml)
HNO_3		
H_2O_2		

Digestate Location	
Extract Location	

Legend:

Texture	Cs = Coarse	Md = Medium	Fn = Fine
Clarity	Cr = Clear	Cy = Cloudy	Td = Turbid
Artifacts	Rk = rocks	Sl = Shale	Vg=Vegetation
Color	Bu = blue	Bk = black	Bn = Brown
	Gn = Green	Og = Orange	Rd = Red
	Yw = Yellow		

Comments: _____

Prepared By: _____

Standard Added By: _____

Witnessed By: _____

Checked By: _____

Extracts Received By: _____

DIGESTATE VESSEL QC LOG

DIGESTATE VESSEL QC LOG

Lot # _____ Book # QC-DV-01

Date _____ Ref. No. _____

DIGESTATE VESSEL SAMPLE 1

Calibration Points	Balance Readings (g) 50 ml	100 ml
1		
2		
3		
Calibration Solution		DI WATER
Temperature(°C)		20
Density		0
Result	50 ml	100 ml

Calibration Points	Calculated Results (ml) 50	100
1		
2		
3		
Average		
SD		
True Value	50	100
Criteria (±)	1.000	2.000
Upper Limit	51.000	102.000
Lower Limit	49.000	98.000

DIGESTATE VESSEL SAMPLE 2

Calibration Points	Balance Readings (g) 50 ml	100 ml
1		
2		
3		
Calibration Solution		DI WATER
Temperature(°C)		
Density		
Result	50 ml	100 ml

Calibration Points	Calculated Results (ml) 50	100
1		
2		
3		
Average		
SD		
True Value	50	100
Criteria (±)	1.000	2.000
Upper Limit	51.000	102.000
Lower Limit	49.000	98.000

DIGESTATE VESSEL SAMPLE 3

Calibration Points	Balance Readings (g) 50 ml	100 ml
1		
2		
3		
Calibration Solution		DI WATER
Temperature(°C)		
Density		
Result	50 ml	100 ml

Calibration Points	Calculated Results (ml) 50	100
1		
2		
3		
Average		
SD		
True Value	50	100
Criteria (±)	1.000	2.000
Upper Limit	51.000	102.000
Lower Limit	49.000	98.000

Calibrated by _____ Checked by: _____

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STANDARD OPERATING PROCEDURE

SAMPLE CONTAINERS HANDLING & SHIPPING

SOP No.:	EMAX-SM05	Revision No. 0	Date: 12-Jan-00
Prepared By:	W. Tu Nisamaneepong		Date: 01/04/00
Approved By:	Kenette Pimentel QA Manager		Date: 01-12-00
Approved By:	Kam Pang Laboratory Director		Date: 1/13/2000

Control Number: SM05-00

1.0 PURPOSE

1.1. This procedure describes the process of how sample containers are purchased, prepared and shipped to clients. It also details the Quality Control involved to assure contamination prevention, traceability, and proper handling.

2.0 POLICIES

2.1. All containers shipped to clients and/or for samples/sub-samples shall undergo the process set forth by this SOP.

2.2. The Sample Management shall be responsible for:

- Placing orders of sample containers to properly meet the required specification
- Sample container preparation
- Packaging sample containers for shipping

2.3. The Client Relations Officer (CRO) shall be responsible for:

- Providing requisitions for sample containers and other related supplies
- Shipping the requested sample containers and other related supplies to the client.
- Contacting the client re-status of requisition, verification/tracking of shipped materials.
- Maintaining the records of bottle orders and shipping.

2.4. The QA Manager shall, at a minimum, include in the system audits:

- Verification of proper implementation of this SOP
- Make recommendation to improve the process

3.0 ASSOCIATED SOP

3.1. EMAX-SM01 - Sample Management

3.2. EMAX-SM02 - Sample Receiving

4.0 SAFETY

4.1. Read all MSDS of chemicals listed in this SOP.

4.2. Goggles, lab coat, and polyethylene gloves are mandatory during the execution of the entire procedure. Caution is highly emphasized because preservatives are extremely corrosive.

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4.3. All wastes generated during the preservation process of shall be placed in the appropriate wastes containers. These wastes shall be turned over to the waste management unit for proper disposal.

4.4. If for any reason, solvent and/or other chemicals get in contact with the skin or any part of the body, rinse the affected body part thoroughly with tap water. If irritations persist, inform your supervisor immediately so that proper action can be taken.

5.0 INSTRUMENTS, CHEMICAL AND REAGENTS

5.1. Chemicals. All chemicals shall be reagent grade.

5.1.1. Nitric Acid - Concentrated

5.1.2. Hydrochloric Acid - Concentrated

5.1.3. Sulfuric Acid - Concentrated

5.1.4. Sodium Hydroxide - 10 N

5.1.5. Zinc Acetate - 2 N

5.1.6. Sodium Thiosulfate - 10% (dissolve 10 g of sodium thiosulfate into 90-g reagent water)

5.2. Others

5.2.1. Balance

5.2.2. Reagent Bottles

5.2.3. Pipette

5.2.4. Sample Containers

6.0 PROCEDURES

6.1. Procurement of Sample Container

6.1.1. Maintain a minimum inventory of sample containers and other related supplies in a clean storage area at all times (see Appendix 4).

6.1.2. Un-preserved containers may be drop-shipped or shipped from the EMAX warehouse. For drop-shipping follow the steps below:

6.1.2.1. Complete a Purchase Order Form (see Appendix 2)

6.1.2.2. Have it approved by the immediate supervisor

6.1.2.3. Write special instruction (if any) on the comment's section

6.1.2.4. Endorse the approved from to the Purchasing Officer.

6.2. Preservation of Sample Containers

6.2.1. Take the sample containers from the warehouse.

6.2.2. Check required preservatives and label the containers. The container label shall, at a minimum, include the name and the ID of the pre-preserved bottle.

6.2.3. Record lot number of the bottle and the reagent ID of the preservative in the requisition form (see Appendix 3)

6.2.4. Add preservative as described in the QC Schedule for Pre-Preserved Sample Containers (see

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Appendix 1) under a clean fume hood.

6.2.5. Seal each container immediately after adding the preservative.

6.2.6. Endorse the prepared bottles to the CRO.

6.3. Shipping Sample Containers

6.3.1. Check the sample containers prepared by the Sample Management Department against the requisition.

6.3.2. Pack the containers with proper packing materials to maintain its integrity during transport.

6.3.3. Make a copy of the bottle requisition. Fold the requisition form in such a way that the address and the recipient's name shall be visible on the packing slip jacket (see Figure-1).

- The address shall include:
- The name of the company receiving the package
- Project Name
- Attention Line
- Street Address and Suite Number if any
- The City, State and Zip Code

Example:

Better Environmental Engineering

Clean City Project

Atten.: Mr. John Doe

241 EPA Lane, Suite C

Noland City, CA 98764

6.3.4. Ship the containers as specified in the sample container requisition form.

6.3.5. Write airbill number on the original requisition form.

6.3.6. File and maintain the requisition form in a 3-ring binder.

7.0 QUALITY CONTROL

7.1. All samples containers shall be purchased pre-cleaned. They shall be traceable by their lot numbers and certificate of analysis can be requested from the manufacturer if required.

7.2. All reagents used in this procedure shall conform to the QC schedule described in Appendix 3.

7.3. All sample containers shipped shall be appropriately packed to preserve its integrity during transport.

7.4. All sample containers requiring preservatives shall be freshly prepared upon receipt of requisition.

8.0 REFERENCES

8.1. USEPA SW846

8.2. EMAX QA Manual

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9.0 SUPPLEMENTARY NOTES

9.1. The amount of the preservatives described in Appendix 3 is based on regular sample amount as described by the specific methods. Preservatives shall be proportioned accordingly as stated by the deviation and/or depending on the condition of sample matrix.

10.0 APPENDICES

10.1. Appendix 1 - QC Schedule for Pre-Preserved Sample Containers

10.2. Appendix 2 - Purchase Order Form for Drop-Shipping

10.3. Appendix 3 - Requisition Form for Sampling supplies

10.4. Appendix 4 - Minimum Inventory of Sample Containers

10.5. Figure 1 - Illustration of Packing Slip

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QC SCHEDULE FOR PRE-PRESERVED SAMPLE CONTAINERS

APPLICATION	PRESERVATIVE	AMOUNT ADDED	QC PROCESS	FREQUENCY OF CHECKING	QC CRITERIA	CORRECTIVE ACTION
Metals Analysis	Nitric Acid	1 ml / Liter	Dilute 5 ml of nitric acid to 100 ml of reagent water and have it analyze for metals.	Per lot	1 ml shall be sufficient to preserve 1 liter of reagent water (pH≤2). No target analytes detected. Shall not cause interference with any target analyte.	Confirm that reagent water is free from any contaminant, then re-analyze. If results are unsatisfactory, condemn the lot and use another lot.
Volatiles Purgeables	Hydrochloric Acid	5 drops / 40 ml vial	Place 5 drops of hydrochloric acid into 40 ml vial. Slowly add reagent water until water forms a dome on the rim, of the vial. Seal the vial properly and analyze for volatiles.	Per lot	5 drops shall be sufficient to preserve 40 ml vial of water (pH≤2). No target analytes detected. No peaks interfering with the target analytes.	Confirm that reagent water is free from any contaminant, then re-analyze. If results are unsatisfactory, condemn the lot and use another lot.
Volatiles	Sodium Thiosulfate 10%	5 drops / 40 ml vial	Place 5 drops of 10% sodium thiosulfate into 40 ml vial. Slowly add reagent water until water forms a dome on the rim of the vial. Seal the vial properly and analyze for volatiles.	Per lot	5 drops shall be sufficient to preserve 40 ml vial of water (pH≤2). No target analytes detected. No peaks interfering with the target analytes.	Confirm that reagent water is free from any contaminant, then re-analyze. If results are unsatisfactory, condemn the lot and use another lot.
Cyanide Reactivity Sulfides *	Sodium Hydroxide 10N	1 ml / Liter	Purchase 1 case of 10N Sodium Hydroxide and request for certificate of analysis. Maintain a file for the certificate of analysis for traceability purposes.	Per lot	1 ml shall be sufficient to preserve 1 liter of reagent water (pH≥11). No target analytes detected. Shall not cause interference with any target analyte.	If certificate of analysis does not satisfy the QC criteria, inform the purchasing officer so he can return the lot.
Sulfides	Zinc Acetate 2N	1 ml / Liter	Purchase 1 case of 2N Zinc Acetate and request for certificate of analysis. Maintain a file for the certificate of analysis for traceability purposes.	Per lot	1 ml shall be sufficient to preserve 1 liter of reagent water (pH≥11). No target analytes detected. Shall not cause interference with any target analyte.	If certificate of analysis does not satisfy the QC criteria, inform the purchasing officer so he can return the lot.
Oil & Grease, TRPH Ammonia, COD, TKN, TOC, TOX, Total Phenols, Total Phosphorus	Sulfuric Acid	1 ml /Liter	Purchase 1 case of Sulfuric Acid and request for certificate of analysis. Maintain a file for the certificate of analysis for traceability purposes.	Per Lot	1 ml shall be sufficient to preserve 1 liter of reagent water (pH≤2). No target analytes detected. Shall not cause interference with target analytes.	If certificate of analysis does not satisfy the QC criteria, inform the purchasing officer so he can return the lot.

PURCHASE ORDER FORM FOR DROP-SHIPPING

SHIP/BILL TO:	PURCHASE ORDER	
Better Environmental Engineering Clean City Project **Atten.: Mr. John Doe** **241 EPA Lane, Suite C** **Noland City, CA 98764** Tel. # 800-123-4567	VENDOR	VWR Scientific Products
	TEL. #	800-932-5000
	FAX #	415-330-4074
	Date	12-Jan-00
Page _1_ of _1_	P.O. NUMBER	VWR-248

Instructions:	Regular	Fedex Overnight	Fedex 2nd Day	

Requested by: _____ Date: 12-Jan-00

Name Phil Toy

Department Project Management

Approved by: _____ Date: 12-Jan-00

Name Kam Pang

Title Laboratory Director

CATALOG NO.	DESCRIPTION	QTY	UNIT PRICE	EXTENDED PRICE	NOTES
	4 oz Jars	10 cs	$XX.xx	$XXX.xx	
	1Liter Amber Bottles	12 cs	$XX.xx	$XXX.xx	
~~nothing followsnothing follows nothing follows nothing follows nothing follows nothing follows nothing follows~~					

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REQUISITION FORM FOR SAMPLING SUPPLIES

Client		Ship On:	
Project		Requested By:	
Attention		Date Requested:	
Address		Needed On:	
City/State/Zip		Airbill No.	
Phone:			

Analysis		Containers			Preservative	
Analysis	Qty	Type	Qty	Lot #	Type	ID/Lot #

Other Sampling Supplies					
Labels		Coolers		Custody Seals	
COC's		Packing Materials		Blue Ice	

Shipped Via:						
UPS	Next Day		2nd Day		3rd Day	
FEDEX	Sat. Del.		Ground Track		Regular Ground	
California Overnight	Next Day		Regular Next Day		Sat. Del.	

Special Instructions: Please FAX upon receipt to (310) 618-0818, Attention CRO.

Prepared By: _____ Delivered By: _____ Received By: _____

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MINIMUM INVENTORY OF SAMPLE CONTAINERS & SAMPLING SUPPLIES

DESCRIPTION	Minimum Inventory
40 mL Vial	5 cases
250 mL Glass Amber	5 cases
500 mL Glass Amber	5 cases
250 mL Glass Amber	5 cases
500 mL HDPE	10 cases
250 mL HDPE	5 cases
1 L HDPE	10 cases
1 L Glass Amber	10 cases
250 mL Glass Amber	5 cases
500 mL Glass Amber	5 cases
2 oz Glass Jar	5 cases
4 oz Glass Jar	5 cases
8 oz Glass Jar	10 cases
16 oz Glass Jar	5 cases
32 oz Glass Jar	5 cases
Custody Seal	100 pcs
Bubble Packs	1 box
Blue Ice Small Large	 50 pcs 50 pcs
Coolers Small Medium Large	 10 pcs 10 pcs 20 pcs

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ILLUSTRATION OF PACKING SLIP

PACKING LIST

Client	BETTER ENVIRONMENT ENGINEERING
Project	Clean City Project
Attention MR. JOHN DOE	
Address	241 EPA Lane, Suite C
City/State/Zip	Noland City , CA 98765
Phone	800-123-4567

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Appendix E

ERIS Database Format

ERIS BATCH UPLOAD SPECIFICATION - Version 6.1 - February 7, 2008

Record / Field	Format	Maximum Length	Description	Required for Insert	Required for Update	See Sheet
HEADER						
EDD_ID	Char	20		**Y**	**Y**	
EDD_VERSION	Char	20		**Y**	**Y**	
EDD_IMPLEMENTATION_ID	Char	30		**Y**	**Y**	
EDD_IMPLEMENTATION_VERSION	Char	20		**Y**	**Y**	
GENERATING_SYSTEM_ID	Char	20		**Y**	**Y**	
GENERATING_SYSTEM_VERSION	Char	20		**Y**	**Y**	
CREATED_BY	Char	50		**Y**	**Y**	
DATE_FORMAT	Char	80		N	N	General - Date Format
SUBSYSTEM	Char	2	*** This field is depreciated in ERIS 3.0 ***	N	N	*** This field is depreciated in ERIS 3.0 ***
HEADER_COMMENT	Char	240		N	N	
INSTALLATION						
NOTES:						
Administrative privileges are required for Installation record uploads.						
See "Spatial Rules" section at the end of this page.						
INSTALLATION_NAME *or* NAME	Char	See Sheet		**Y**	**Y**	Installations
FFID *or* FEDERAL_FACILITY_IDENTIFICATION	Char	11		**Y**	N	
ORGANIZATION *or* ORGANIZATION_NAME	Char	50		**Y**	N	
COORDINATE_TYPE	Char	See Sheet		**Y**	N	Coordinate_Type
POINT	Number	Float	* A minimum of three points are required for an Installation. This tag must precede the X_COORDINATE and Y_COORDINATE tags. An example is provided at the bottom of this page.	**Y***	N*	

X_COORDINATE	Number	Float	* A minimum of three X_COORDINATE values are required for an Installation. This tag must be preceded by a POINT tag and accompany a Y_COORDINATE tag. An example is provided at the bottom of this page.	**Y***	N*	General - X and Y Coordinate
Y_COORDINATE	Number	Float	* A minimum of three Y_COORDINATE values are required for an Installation. This tag must be preceded by a POINT tag and accompany a X_COORDINATE tag. An example is provided at the bottom of this page.	**Y***	N*	General - X and Y Coordinate
COMMENT *or* DESCRIPTION	Char	2000		N	N	
RANGE						
NOTES:						
Administrative privileges are required for Range record uploads.						
See the "Spatial Rules" section at the end of this page.						
RANGE_NAME *or* NAME	Char	See Sheet		**Y**	**Y**	Installations
INSTALLATION_NAME *or* NAME	Char	See Sheet		**Y**	**Y**	Installations
COORDINATE_TYPE	Char	See Sheet		**Y**	N	Coordinate_Type
POINT	Number	Float	* A minimum of three points are required for an Range. This tag must precede the X_COORDINATE and Y_COORDINATE tags. An example is provided at the bottom of this page.	**Y***	N*	
X_COORDINATE	Number	Float	* A minimum of three X_COORDINATE values are required for an Range. This tag must be preceded by a POINT tag and accompany a Y_COORDINATE tag. An example is provided at the bottom of this page.	**Y***	N*	General - X and Y Coordinate

Y_COORDINATE	Number	Float	* A minimum of three Y_COORDINATE values are required for an Range. This tag must be preceded by a POINT tag and accompany a X_COORDINATE tag. An example is provided at the bottom of this page.	**Y***	N*	General - X and Y Coordinate
COMMENT *or* DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
AQUIFER *or* AQUIFER_DEFINITION						
INSTALLATION_NAME	Char	See Sheet		**Y**	**Y**	Installations
AQUIFER_NAME	Char	50		**Y**	**Y**	
CLASSIFICATION_CODE	Char	See Sheet		**Y**	N	Aquifer_Classification
COMMENT *or* DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
AQUIFER_LOCATION *or* AQUIFER_MATRIX						
~ The Aquifer name is not required if preceded by a valid Aquifer record.						
NOTES:						
The Begin_Depth cannot exceed the End_Depth.						
AQUIFER_NAME	Char	50		**Y~**	**Y~**	
INSTALLATION_NAME	Char	See Sheet		**Y**	**Y**	Installations
LOCATION_NAME *or* LOC_NAME	Char	50	A defined Sample, Soil, Surface Water,	**Y**	**Y**	
LOCATION_CATEGORY *or* LOC_CATEGORY	Char	See Sheet		**Y**	**Y**	Loc_Category
BEGIN_DEPTH *or* START_DEPTH *or* TOP_DEPTH	Number	See	Valid Range: 0 to 9999.99	**Y**	N	

END_DEPTH *or* BOTTOM_DEPTH	Number	See	Valid Range: 0.1 to 9999.99	**Y**	N	
DEPTH_UNITS *or* DEPTH_NOTATION	Char	See Sheet		**Y**	N	Dimension_Units
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
ENV_SITE *or* **ENVIRONMENTAL_SITE**						
NOTES:						
See the "Spatial Rules" section at the end of this page.						
NAME	Char	50		**Y**	**Y**	
INSTALLATION_NAME	Char	See Sheet		**Y**	**Y**	Installations
LOCATION_NAME *or* LOC_NAME	Char	50	* Required for SHAPE=CIRCLE. A defined location in the specified	N*	N*	
LOCATION_CATEGORY *or* LOC_CATEGORY	Char	See Sheet	* Required for SHAPE=CIRCLE	N*	N*	Loc_Category
AEDBR_FLAG *or* DSERTS_FLAG	Char	3	YES or NO --> Flag delineates whether			
COORDINATE_TYPE	Char	See Sheet	* Required for SHAPE=POLYGON	N*	N*	Coordinate_Type
SHAPE	Char	20	Valid entries are CIRCLE and POLYGON	**Y**	N	
RADIUS	Number	See Description	* Required for SHAPE=CIRCLE. Valid Range: 0.01 to 99999.99	N*	N	

RADIUS_NOTATION	Char	See Sheet	* Required for SHAPE=CIRCLE	N*	N	Dimension_Units
COMMENT *or* DESCRIPTION	Char	2000		N	N	
POINT	Number	Float	* Required for SHAPE=POLYGON. A minimum of three points are required for	N*	N*	
X_COORDINATE	Number	Float	* Required for SHAPE=POLYGON. A	N*	N*	General - X and Y
Y_COORDINATE	Number	Float	* Required for SHAPE=POLYGON. A minimum of three Y_COORDINATE	N*	N*	General - X and Y Coordinate
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
ENV_SURVEY or **ENVIRONMENTAL_SURVEY**						
NOTES:						
The End_Date cannot be earlier than the Begin_Date.						
See the "Spatial Rules" section at the end of this page.						
NAME	Char	50		**Y**	**Y**	
LOCATION_NAME *or* LOC_NAME	Char	50	* Required for SHAPE=CIRCLE. A defined location in the specified installation.	N*	N*	
LOCATION_CATEGORY *or* LOC_CATEGORY	Char	See Sheet	* Required for SHAPE=CIRCLE	N*	N*	Loc_Category
INSTALLATION_NAME	Char	See Sheet		**Y**	**Y**	Installations
COORDINATE_TYPE	Char	See Sheet	* Required for SHAPE=POLYGON	N*	N*	Coordinate_Type
TYPE	Char	See Sheet		**Y**	**Y**	Survey_Type
AREA_CODE	Char	See Description	Must be either: 1) *Whole* - the whole installation, 2) *User_Defined* or *New* - Environmental shape definition via	**Y**	N	

SHAPE	Char	See	* Required for AREA_CODE = New or	N*	N*	
BEGIN_DATE	Date	See Sheet		N	N	General - Date Format
END_DATE	Date	See Sheet		N	N	General - Date Format
COMMENT *or* DESCRIPTION	Char	2000		N	N	
RADIUS	Number	See Description	* Required for SHAPE=CIRCLE. Valid Range: 0.01 to 99999.99	N*	N	
RADIUS_NOTATION	Char	See Sheet	* Required for SHAPE=CIRCLE	N*	N	Dimension_Units
ENV_SITE	Char	50	* Req. for AREA_CODE=EXISTING. A	N*	N	
POINT	Number	Float	* Required for SHAPE = POLYGON. A	N*	N*	
X_COORDINATE	Number	Float	* Required for SHAPE = POLYGON. A minimum of three X_COORDINATE	N*	N*	General - X and Y Coordinate
Y_COORDINATE	Number	Float	* Required for SHAPE = POLYGON. A	N*	N*	General - X and Y
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
BOREHOLE *or* **BOREHOLE_LOCATION**						

NOTES:

The End_Drill_Date cannot be earlier than the Start_Drill_Date.

See the "Spatial Rules" section at the end of this page.

NAME	Char	50		**Y**	**Y**	
INSTALLATION_NAME	Char	50		**Y**	**Y**	
COORDINATE_TYPE	Char	See Sheet		**Y**	N	Coordinate_Type
X_COORDINATE	Number	Float		**Y**	N	General - X and Y
Y_COORDINATE	Number	Float		**Y**	N	General - X and Y
XY_ACCURACY	Char	See Sheet		**Y**	N	Accuracy
ELEVATION_TYPE *or* ELEV_TYPE *or*	Char	See Sheet		**Y**	N	Measurement_Point
ELEVATION_QUANTITY	Number	See	Valid Range: -1,000 to 400,000	**Y**	N	
ELEVATION_UNITS *or* ELEVATION_NOTATION	Char	See Sheet		**Y**	N	Dimension_Units
ELEVATION_ACCURACY	Char	See Sheet		**Y**	N	Accuracy
DRILLED_DATE *or* START_DRILL_DATE	Date	See Sheet		N	N	General - Date Format
END_DRILL_DATE *or* FINISH_DRILL_DATE	Date	See Sheet		N	N	General - Date Format
COMMENT *or* DESCRIPTION	Char	2000		N	N	
DRILL_ANGLE	Number	See	Valid Range: 0 to 90	N	N	
TOTAL_DEPTH *or* DEPTH	Number	See	Valid Range: 0.1 to 9999.99	N	N	
DEPTH_UNITS *or* DEPTH_NOTATION	Char	See Sheet	* Required if a total depth value is	N*	N*	Dimension_Units
FLUID_TYPE	Char	See Sheet		N	N	BH_Fluid_Type
FLUID_LEVEL	Number	See Description	Valid Range: -10 to 9999.99	N	N	
FLUID_LEVEL_UNITS *or*	Char	See Sheet	* Required if a fluid level value is	N*	N	Dimension_Units
DISPOSITION_CODE	Char	See Sheet		N	N	Borehole_Disposition
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	

BOREHOLE_LITHOLOGY *or* **LITHOLOGY**

~ The installation and borehole names are not required if preceded by a valid Borehole record.

NOTES:

The Begin_Depth cannot exceed the End_Depth.

Lithology records for the same borehole cannot have overlapping depth ranges.

INSTALLATION_NAME	Char	See Sheet		**Y~**	**Y~**	Installations
BOREHOLE_NAME	Char	50	A defined borehole for the specified installation.	**Y~**	**Y~**	
BEGIN_DEPTH *or* START_DEPTH *or*	Number	See	Valid Range: 0 to 9999.99	**Y**	N	
END_DEPTH *or* BOTTOM_DEPTH	Number	See	Valid Range: 0.1 to 9999.99.	**Y**	N	
DEPTH_UNITS *or* DEPTH_NOTATION	Char	See Sheet		**Y**	N	Dimension_Units
LITHOLOGY_CODE	Char	See Sheet		**Y**	N	Lithology_Code
LOG_DATE *or* LITHOLOGY_LOG_DATE	Date	See Sheet		N	N	General - Date Format
COMMENT *or* DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	

SAMPLE *or* **SAMPLE_LOCATION** *or* **SOIL**

NOTES:

See the "Spatial Rules" section at the end of this page.

NAME	Char	50		**Y**	**Y**	
INSTALLATION_NAME	Char	See Sheet		**Y**	**Y**	Installations
COORDINATE_TYPE	Char	See Sheet		**Y**	N	Coordinate_Type
X_COORDINATE	Number	Float		**Y**	N	General - X and Y
Y_COORDINATE	Number	Float		**Y**	N	General - X and Y
XY_ACCURACY	Char	See Sheet		**Y**	N	Accuracy
ELEVATION_TYPE *or* ELEV_TYPE *or*	Char	See Sheet		**Y**	N	Measurement_Point

ELEVATION_QUANTITY	Number	See Description	Valid Range: -1,000 to 400,000	**Y**	N	
ELEVATION_NOTATION	Char	See Sheet		**Y**	N	Dimension_Units
ELEVATION_ACCURACY	Char	See Sheet		**Y**	N	Accuracy
COMMENT *or* DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
WELL *or* **WELL_LOCATION**						

NOTES:

If a valid ASSOCIATED_BOREHOLE is provided, the borehole's X_COORDINATE, Y_COORDINATE, COORDINATE_TYPE, XY_ACCURACY, ELEVATION_TYPE, ELEVATION, ELEVATION_UNITS, and ELEVATION_ACCURACY values are extracted from the database for the WELL record. However, these extracted values

The Water_Depth cannot exceed the total Depth.

See the "Spatial Rules" section at the end of this page.

NAME	Char	50		**Y**	**Y**	
INSTALLATION_NAME	Char	See Sheet		**Y**	**Y**	Installations
CONSTRUCTION_DATE *or* INSTALL_DATE	Date	See Sheet	Not required when	**Y**	N	General - Date Format
INSTALL_DATE_UNKNOWN	Char	1	Y or N	N	N	
ASSOCIATED_BOREHOLE *or* BOREHOLE *or*	Char	50	See Notes.	N	N	
WELL_STATUS	Char	See Sheet		N	N	Well_Status
OWNERSHIP_CODE	Char	See Sheet		N	N	Ownership_Code
COORDINATE_TYPE	Char	See Sheet		**Y**	N	Coordinate_Type
X_COORDINATE	Number	Float		**Y**	N	General - X and Y Coordinate
Y_COORDINATE	Number	Float		**Y**	N	General - X and Y Coordinate
XY_ACCURACY	Char	See Sheet		**Y**	N	Accuracy

ELEVATION_TYPE *or* ELEV_TYPE *or*	Char	See Sheet		**Y**	N	Measurement_Point
ELEVATION *or* ELEVATION_QUANTITY	Number	See	Valid Range: -1,000 to 400,000	**Y**	N	
ELEVATION_NOTATION	Char	See Sheet		**Y**	N	Dimension_Units
ELEVATION_ACCURACY	Char	See Sheet		**Y**	N	Accuracy
COMMENT *or* DESCRIPTION	Char	2000		N	N	
WELL_TYPE *or* TYPE	Char	See Sheet		N	N	Well_Type
DEPTH	Number	See	Valid Range: 0.1 to 9999.99	N	N	
DEPTH_UNITS *or* DEPTH_NOTATION	Char	See Sheet	* Required if a depth value is entered.	N*	N*	Dimension_Units
WATER_DEPTH	Number	See	Valid Range: 0.1 to 9999.99	N	N	
WATER_DEPTH_UNITS *or*	Char	See Sheet	* Required if a depth value is entered.	N*	N*	Dimension_Units
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
WELL_CONSTRUCTION *or*						
~ The Installation and Well names are not required if preceded by a valid Well record.						
NOTES:						
The Begin_Depth cannot exceed the End_Depth.						
WELL_NAME	Char	50	A defined well for the specified	**Y~**	**Y~**	
INSTALLATION_NAME	Char	See Sheet		**Y~**	**Y~**	Installations
OBJECT_TYPE	Char	See Sheet		**Y**	**Y**	Well_Object_Type
COMMENT *or* DESCRIPTION	Char	2000		N	N	
DIAMETER	Number	See Description	Valid Range: 0.001 to 91.000	**Y**	**Y**	
DIAMETER_NOTATION	Char	See Sheet		**Y**	**Y**	Dimension_Units
BEGIN_DEPTH *or* START_DEPTH *or* TOP_DEPTH	Number	See	Valid Range: -99999.99 to 999999.99	**Y**	**Y**	

END_DEPTH *or* BOTTOM_DEPTH	Number	See Description	Valid Range:0.1 to 999999.99	**Y**	**Y**	
DEPTH_UNITS *or* DEPTH_NOTATION	Char	See Sheet		**Y**	**Y**	Dimension_Units
RELATIVE_POSITION	Number	See	Position values: 1 - 99	**Y**	**Y**	
MATERIAL_TYPE	Char	See Sheet		**Y**	**Y**	Well_Material_Type
PERCENT_OPEN_AREA	Number	See Description	* Required. for Object_Type=Well_Screen. Valid Range: 0 to 99.99	N*	N*	
SCREEN_SIZE	Number	See	* Required. for	N*	N*	
SCREEN_SIZE_NOTATION	Char	See Sheet	* Required. for	N*	N*	Screen_Size_Units
SCREEN_OPEN_TYPE	Char	See Sheet	* Required. for	N*	N*	Screen_Type
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
WELL_MAINTENANCE *or*						

~ The Installation and Well names are not required if preceded by a valid Well or Well Construction record.

NOTES:

A Well Maintenance record can be associated with either a Well or Well Construction record. If it is associated with a Well, the Well Maintenance record must either contain the Well and Installation names or be preceded by a valid Well record (i.e., the Well and Installation names are omitted from the Well

WELL_NAME	Char	50	A defined well for the specified	**Y~**	**Y~**	
INSTALLATION_NAME	Char	See Sheet		**Y~**	**Y~**	Installations
MAINT_DATE	Date	See Sheet		**Y**	N	General - Date Format
MAINT_TYPE	Char	See Sheet		**Y**	N	Well_Maintenance_Type
COMMENT *or* DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
STATIC_LIQUID_LEVEL *or* **LIQUID_LEVEL**						

LOC_NAME	Char	50	A defined location for the specified installation.	**Y**	**Y**	
LOC_CATEGORY	Char	See Sheet		**Y**	**Y**	Loc_Category
INSTALLATION_NAME	Char	See Sheet		**Y**	**Y**	Installations
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
LIQUID_LEVEL_MEASURE *or*						
NOTES:						
The Static Liquid Level Measure record must be preceded by a valid Static Liquid Level or Location (Well, Borehole, Sediment, Soil, etc.) record.						
The Begin_Depth cannot exceed the End_Depth.						
MEASURE_DATE	Date	See Sheet	Should include time.	**Y**	**Y**	General - Date Format
FLUID_PRESENT	Char	3	Yes or No	N	N	
BEGIN_INTERVAL_DEPTH *or* BEGIN_DEPTH *or*	Number	See	* Required if Fluid_Present=Yes. Valid	N*	N	
END_INTERVAL_DEPTH *or* END_DEPTH *or*	Number	See	* Required if Fluid_Present=Yes. Valid	N*	N	
DEPTH_UNITS *or* DEPTH_NOTATION *or*	Char	See Sheet	* Required if Fluid_Present=Yes.	N*	N	Dimension_Units
FLUID_TYPE	Char	See Sheet	* Required if Fluid_Present=Yes.	N*	N	SLL_Fluid_Type
COMMENT *or* DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	

SUBSURFACE_PROPERTY_TEST *or* **SUBSURFACE_PROP_TEST**						
~ The Installation and Well names are not required if preceded by a valid Well record.						
NOTES:						
The End_Date cannot be earlier than the Begin_Date.						
WELL_NAME	Char	50	A defined well for the specified	**Y~**	**Y~**	
INSTALLATION_NAME	Char	See Sheet		**Y~**	**Y~**	Installations
TYPE_CODE	Char	See Sheet		**Y**	**Y**	Property_Test_Type
BEGIN_DATE	Date	See Sheet		**Y**	**Y**	General - Date Format
END_DATE	Date	See Sheet		**Y**	**Y**	General - Date Format
ASSOCIATED_WELL *or* ASSOC_WELL	Char	50	A defined Well for the specified	N	N	
COMMENT *or* DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
SS_WELL_ASSOCIATION *or*						
NOTES:						
The Subsurface Property Test Well Association record must be preceded by a valid Subsurface Property Test record.						
WELL_NAME	Char	50	A defined well for the specified	**Y**	**Y**	
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	

SUBSURFACE_PROPERTY *or* **SS_PROPERTY** *or* **SPT_PROPERTY**						
NOTES:						
A Subsurface Well Association record must be preceded by a valid Subsurface Property Test record.						
PHYSICAL_PARAMETER	Char	See Sheet		**Y**	**Y**	SS_Phys_Parm
METHOD_CODE	Char	See Sheet		**Y**	**Y**	SS_Test_Method
VALUE	Number	Float		N	N	
VALUE_NOTATION or VALUE_NOT	Char	See Sheet	* Required if value is entered.	N*	N	SS_Parm_Units
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
ENVIRONMENTAL_FIELD_SAMPLE *or*						
~ The Installation name, Location name, and Location Category fields are not required if preceded by a valid Location (Well, Borehole, Sediment, Soil, etc.)						
NOTE:						
The Collected_End date cannot be earlier than Collected date.						
The Collected and Collected_End dates must be the same for Composite=NO.						
The Begin_Depth cannot exceed the End_Depth.						
FIELD_SAMPLE_ID	Char	20		**Y**	**Y**	
LOCATION_NAME	Char	20	A defined location for the specified	**Y~**	**Y~**	
LOCATION_CATEGORY_CODE or	Char	See Sheet		**Y~**	**Y~**	Loc_Category
INSTALLATION_NAME	Char	See Sheet		**Y~**	**Y~**	Installations
COLLECTED	Date	See Sheet		**Y**	**Y**	General - Date Format

COLLECTED_END	Date	See Sheet		**Y**	**Y**	General - Date Format
FIELD_SAMPLE_BEG_DEPTH or BEGIN_DEPTH or	Number	See	Valid Range: 0 to 9999.99	N	N	
FIELD_SAMPLE_END_DEPTH or END_DEPTH or	Number	See	Valid Range: 0.1 to 9999.99	N	N	
DEPTH_UNITS or DEPTH_NOTATION	Char	See Sheet	* Required if Begin or End Depth	N*	N	Dimension_Units
COMPOSITE	Char	See Sheet		**Y**	**Y**	Composite
MATRIX_NAME/MATRIX_ID	Char	See Sheet		**Y**	**Y**	Matrix
RANGE_FLAG	Char	3	Specifies whether the field sample is	N	N	
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
LABORATORY_METHOD *or* **METHOD**						
NOTES:						
A Laboratory Method record must be preceded by a valid Environmental Field Sample record.						
The Percent_Moisture value plus the Percent_Solids value must equal 100 exactly.						
The valid range lower limit is 0 for temperatures in Kelvin units.						
LAB_ID	Char	See Sheet		**Y**	**Y**	Labs
LAB_SAMPLE_ID	Char	20		**Y**	**Y**	
CLIENT_METHOD_ID	Char	See Sheet		**Y**	**Y**	Client_Method
CUSTODY_ID	Char	20		N	N	
LAB_RECEIPT	Date	See Sheet		**Y**	N	General - Date Format
LAB_REPORTING_BATCH	Char	30		**Y**	N	
METHOD_BATCH	Char	30		N	N	
ORIGINAL_CLIENT_SAMPLE_ID	Char	20		N	N	
ORIGINAL_LAB_SAMPLE_ID	Char	20		N	N	
PERCENT_MOISTURE	Number	See	Valid Range: 0 to 100	**Y**	N	
PERCENT_SOLIDS	Number	See Description	Valid Range: 0 to 100	**Y**	N	

PH	Number	See Description	Valid Range: 0 to 14	N	N	
PRESERVATIVE	Char	50		N	N	
QC_LINKAGE	Char	30		N	N	
QC_TYPE	Char	See Sheet		N	N	QC_Type
TEMPERATURE	Number	See	Valid Range: -999.999 to 999.999	N	N	
TEMPERATURE_UNITS	Char	See Sheet	* Required if temperature entered.	N*	N	Temp_Units
PHASE_ANALYZED	Char	15		N	N	
COMMENT *or* DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
SAMPLE_AND_METHOD *or*						
~ The installation name, Location name, and Location Category fields are not required if preceded by a valid Location (Well, Borehole, Sediment, Soil, etc.) record. For this scenario, these fields must be omitted in the sample and method record definition. If any of these fields are present in the record definition						
NOTES:						
The Sample and Method record combines the Environmental Field Sample and Laboratory Method record fields.						
The Collected_End date cannot be earlier than Collected date.						
The Collected and Collected_End dates must be the same for Composite=NO.						
The Begin_Depth cannot exceed the End_Depth.						
The Percent_Moisture value plus the Percent_Solids value must equal 100 exactly.						
The valid range lower limit is 0 for temperatures in Kelvin units.						
INSTALLATION_NAME	Char	See Sheet		**Y~**	**Y~**	Installations
LOCATION_NAME	Char	20	A defined location for the specified	**Y~**	**Y~**	
LOCATION_CATEGORY_CODE *or*	Char	See Sheet		**Y~**	**Y~**	Loc_Category
FIELD_SAMPLE_ID	Char	20		**Y**	**Y**	
COLLECTED	Date	See Sheet		**Y**	N	General - Date Format
COLLECTED_END	Date	See Sheet		**Y**	N	General - Date Format
FIELD_SAMPLE_BEG_DEPTH *or* BEGIN_DEPTH *or*	Number	See	Valid Range: 0 to 9999.99	N	N	

FIELD_SAMPLE_END_DEPTH *or* END_DEPTH *or*	Number	See	Valid Range: 0.1 to 9999.99	N	N	
DEPTH_UNITS *or* DEPTH_NOTATION	Char	See Sheet	* Required if Begin or End Depth	N*	N	Dimension_Units
COMPOSITE	Char	See Sheet		**Y**	N	Composite
MATRIX_NAME/MATRIX_ID	Char	See Sheet		**Y**	N	Matrix
LAB_ID	Char	See Sheet		**Y**	N	Labs
LAB_SAMPLE_ID	Char	20		**Y**	N	
CLIENT_METHOD_ID	Char	See Sheet		**Y**	N	Client_Method
LAB_RECEIPT	Date	See Sheet		**Y**	N	General - Date Format
LAB_REPORTING_BATCH	Char	30		**Y**	N	
PERCENT_MOISTURE	Number	See	Valid Range: 0 to 100	**Y**	N	
PERCENT_SOLIDS	Number	See	Valid Range: 0 to 100	**Y**	N	
CUSTODY_ID	Char	20		N	N	
METHOD_BATCH	Char	30		N	N	
ORIGINAL_CLIENT_SAMPLE_ID	Char	20		N	N	
ORIGINAL_LAB_SAMPLE_ID	Char	20		N	N	
PH	Number	See	Valid Range: 0 to 14	N	N	
PRESERVATIVE	Char	50		N	N	
QC_LINKAGE	Char	30		N	N	
QC_TYPE	Char	See Sheet		N	N	QC_Type
TEMPERATURE	Number	See	Valid Range: -999.999 to 999.999	N	N	
TEMPERATURE_UNITS	Char	See Sheet	* Required if temperature entered.	N*	N	Temp_Units
PHASE_ANALYZED	Char	15		N	N	
RANGE_FLAG	Char	3	Specifies whether the field sample is	N	N	
COMMENT *or* DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT *or* CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
SAMPLE_HANDLING *or* **HANDLING**						
NOTES:						
A Sample Handling record must be preceded by a valid Laboratory Method or Sample and Method record.						
CLIENT_METHOD_ID	Char	See Sheet		**Y**	**Y**	Client_Method
HANDLING_DATE or HANDLED	Date	See Sheet		**Y**	**Y**	General - Date Format

HANDLING_BATCH	Char	30		**Y**	**Y**	
HANDLING_TYPE	Char	See Sheet		**Y**	**Y**	Handling_Type
PROCEDURE_ID	Char	20		N	N	
PROCEDURE_NAME	Char	50		N	N	
PERCENT_SOLIDS	Number	See	Valid Range: 0 to 100	N	N	
COMMENT or DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT or CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
SAMPLE_ANALYSIS_GROUP *or*						
NOTES:						
An Analysis Group record must be preceded by a valid Laboratory Method or Sample and Method record.						
ANALYSIS_GROUP	Char	30		**Y**	**Y**	
ANALYSIS_TYPE	Char	See Sheet		**Y**	N	Analysis_Type
COMMENT or DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT or CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
SAMPLE_ANALYSIS *or* **ANALYSIS**						
NOTES:						
An Analysis record must be preceded by a valid Laboratory Method or Sample and Method record.						
LAB_ANALYSIS_ID	Char	20		**Y**	**Y**	
ANALYSIS_BATCH	Char	30		**Y**	N	
ANALYZED	Date			**Y**	N	General - Date Format
RESULT_BASIS	Char	3	Dry or Wet	**Y**	N	
RUN_BATCH	Char	30		N	N	
CLIENT_METHOD_ID	Char	See Sheet		N	N	Client_Method
CONFIRMATION_ANALYSIS_ID or	Char	20		N	N	
DILUTION_FACTOR	Number	Float	Valid Range: >= 0.01	N	N	
INSTRUMENT_ID	Char	20		N	N	

PROCEDURE_ID	Char	20		N	N	
PROCEDURE_NAME	Char	50		N	N	
ANALYSIS_GROUP	Char	30	A defined group name	N	N	
ANALYSIS_TYPE	Char	See Sheet		N	N	Analysis_Type
COMMENT or DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT or CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
PREP_OR_CLEANUP *or*		*ION*				
NOTES:						
A Preparation and/or Cleanup record must be preceded by a valid Analysis record.						
CLIENT_METHOD_ID	Char	See Sheet		**Y**	**Y**	Client_Method
PREPARATION_DATE or PREPARED	Date	See Sheet		**Y**	**Y**	General - Date Format
PREPARATION_BATCH	Char	30		**Y**	**Y**	
PREPARATION_TYPE	Char	See Sheet		N	N	Prep_Type
PROCEDURE_ID	Char	20		N	N	
PROCEDURE_NAME	Char	50		N	N	
COMMENT or DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT or CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
PREP_OR_CLEANUP *or*		*VERSION)*				
NOTES:						
A Preparation and/or Cleanup record must be preceded by a valid Analysis record.						
CLIENT_METHOD_ID	Char	See Sheet		**Y**	**Y**	Client_Method
CLEANUP_DATE or CLEANED_UP	Date	See Sheet		**Y**	**Y**	General - Date Format
CLEANUP_BATCH	Char	30		**Y**	**Y**	
CLEANUP_TYPE	Char	See Sheet		N	N	Cleanup_Type
PROCEDURE_ID	Char	20		N	N	
PROCEDURE_NAME	Char	50		N	N	

COMMENT or DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT or CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
RESULT *or* **SAMPLE_RESULT**						
NOTES:						
A Sample Result record must be preceded by a valid Analysis or Analysis Group record.						
A least one of Detection, Quantitation, or Reporting Limit and Type must be entered.						
All four of the Percent_Recovery fields must be populated if any one of them is entered.						
All three of the Relative_Percent_Difference fields must be populated if any one of them is entered.						
ANALYTE_NAME	Char	See Sheet		**Y**	**Y**	Analyte
RESULT	Number	Float		**Y**	N	
RESULT_UNITS	Char	See Sheet		**Y**	N	Chem_Qty
ANALYTE_TYPE	Char	See Sheet		N	N	Analyte_Type
MEASUREMENT_BOOLEAN or RESULT_TYPE	Char	See Sheet		N	N	Result_Type
AMOUNT_ADDED	Number	Float		N	N	
AMOUNT_ADDED_UNITS	Char	See Sheet	* Required if Amount_Added value	N*	N	Chem_Qty
DETECTION_LIMIT	Number	Float	Valid Range: > 0	N	N	
DETECTION_LIMIT_TYPE	Char	See Sheet	* Required if Detection_Limit value	N*	N	Det_Limit_Type
PERCENT_RECOVERY	Number	See	Valid Range: 0.01 to 999.99	N	N	
PERCENT_RECOVERY_LIMIT_HIGH	Number	See	Valid Range: 0.01 to 999.99	N	N	
PERCENT_RECOVERY_LIMIT_LOW	Number	See	Valid Range: 0.01 to 999.99	N	N	
PERCENT_RECOVERY_LIMIT_TYPE	Char	See Sheet		N	N	Prcnt_Rec_Limit_Type
QUANTITATION_LIMIT	Number	Float	Valid Range: > 0	N	N	
QUANTITATION_LIMIT_TYPE	Char	See Sheet	* Required if Quantitation_Limit value	N*	N	Quant_Limit_Type
RELATIVE_PERCENT_DIFFERENCE or PERCENT_DIFFERENCE	Number	See Description	Valid Range: 0.01 to 99.99	N	N	
RELATIVE_PERCENT_DIFFERENCE_HIGH	Number	See	Valid Range: 0.01 to 99.99	N	N	
RELATIVE_PERCENT_DIFFERENCE_TYPE	Char	See Sheet		N	N	Rel_Prcnt_Diff_Type
REPORTING_LIMIT	Number	Float	Valid Range: > 0	N	N	

REPORTING_LIMIT_TYPE	Char	See Sheet	* Required if Reporting_Limit value	N*	N	Rpt_Limit_Type
RETENTION_TIME	Number	Float	Valid Range: >= 0	N	N	
RETENTION_TIME_UNITS	Char	See Sheet	* Required if Retention_Time value	N*	N	Ret_Time_Units
COMMENT or DESCRIPTION	Char	2000		N	N	
AUDIT_COMMENT or CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	
QUALIFIER *or* **RESULT_QUALIFIER** *or*						
NOTES:						
A Qualifier record must be preceded by a valid Sample Result record.						
~ One of the three sets of parameters must be provided: (1) VALIDATION_QUALIFIER; (2) LAB_QUALIFIER; (3) VALIDATION_QUALIFIER, LAB_QUALIFIER.						
VALIDATION_QUALIFIER	Char	See Sheet		**Y~**	**Y**	Val_Qual
LAB_QUALIFIER	Char	See Sheet		**Y~**	N	Lab_Qual
DATE_ENTERED	Date	15		N	N	Applies to validation
VALIDATOR	Char	50		N	N	Applies to validation
SOURCE	Char	20		N	N	Applies to validation qualifiers only.
VERSION	Char	2		N	N	Applies to validation qualifiers only.
AUDIT_COMMENT or CHANGE_REMARKS	Char	2000	Required for record updates.	N	**Y**	

SPATIAL RULES

1) Default for sampling locations (bores, wells, etc.) is a point.
2) Environmental sites must specify a shape. Environmental surveys must specify a shape for new area.
3) Points of a polygon must be proceeded by a line of "Point="

Example:

Point=1
X_Coordinate=-76
Y_Coordinate=35
Z_Coordinate=5
Point=2
X_Coordinate=-76
Y_Coordinate=37
Z_Coordinate=35

4) Polygons should end on the same point that they started.

5) The upload assumes that geometries are not compond (multiple shapes).

6) Spatial data for environmental sites and surveys are restructed to two dimensions.

A single blank line is required between the header, each record, and after the last record in the file.

Everything to the right of the colon ':' and equal sign '=' is considered valid and part of the string's value; therefore, there should be no leading spaces after the colon or equal sign in order for the data to be evaluated correctly.

Example:

RECORD:SAMPLE_AND_METHOD
INSTALLATION_NAME=ABERDEEN PROVING GROUND
LOCATION_CATEGORY=Borehole

The Audit_Comment field on each record is only required when the data being uploaded is changing data already in the database. It should be blank or left out completely for data that is being inserted for the first time.