UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

July 30, 2009

Commander,
Radford Army Ammunition Plant
Attn: SJMRF-OP-EQ (Jim McKenna)
P.O. Box 2
Radford, VA 24141-0099

P.W. Holt
Environmental Manager
Alliant Techsystems, Inc.
Radford Army Ammunition Plant
P.O. Box 1
Radford, VA 24141-0100

Re: Radford Army Ammunition Plant, Va.
Review of Army's Final Site Screening Process (SSP) Report for the
Military Munitions Response Program (MMRP) Small Arms Range

Dear Mr. McKenna and Ms. Holt:

The U.S. Environmental Protection Agency (EPA) and Virginia Department of Environmental Quality (VDEQ) have reviewed the U.S. Army's (Army's) May 2009 Final SSP Report for the MMRP Small Arms Range, located at the Radford Army Ammunition Plant (RFAAP) in Radford, Virginia. Based upon our review, the report is approved, and in accordance with Part II. (E) (5) of RFAAP's Corrective Action Permit, it can now be considered final.

If you have any questions, please call me at 215-814-3413. Thanks.

Sincerely,

William Geiger
RCRA Project Manager
Office of Remediation (3LC20)

cc: James Cutler, VDEQ

ATK Armament Systems
Energetic Systems
dford Army Ammunition Plant
ute 114, P.O. Box 1
Radford, VA 24143-0100

www.atk.com

May 29, 2009

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, Replacement Pages for Final Site Screening Process Report
Radford Army Ammunition Plant, Virginia, Military Munitions Response Program, May 2009
EPA ID# VA1 210020730

Dear Mr. Geiger and Mr. Cutler:

Enclosed is the certification for the subject document that was sent to you on May 21, 2009. Also enclosed is the 21 May 2009 transmittal email. Our understanding from the February 18, 2009 partnering meeting is that we anticipate approval of this document.

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

Sincerely,

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

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

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

09-815-85
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

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

Coordination: J McKenna
J. McKenna

MMMiano
M. A. Miano

09-815-85
JMcKenna

Concerning the following:

Radford Army Ammunition Plant
Replacement Pages for
Final Site Screening Process Radford Army Ammunition Plant
Military Munitions Response Program
May 2009

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: Colonel, US Army
Commanding

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

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

05/21/2009 01:32 PM

To <Sarah_Gettier@URSCorp.com>, <anne.greene@atk.com>, <ealohman@deq.virginia.gov>, "Druck, Dennis E Mr CIV USA MEDCOM CHPPM" <dennis.druck@us.army.mil>,

cc

bcc

Subject RE: Final Site Screening Process Report Replacement Pages for Radford (UNCLASSIFIED)

History: This message has been replied to.

Classification: UNCLASSIFIED
Caveats: FOUO

All:

Note the contractor will ship the subject document's replacement pages with a copy of this email to the POCs and tracking numbers below. The CD provided will include a PDF of the entire revised report.

For your reference, these final pages will replace pages in your current Stakeholder Draft hard copy of the SSP Report.

These pages include the following:

- Color Cover & Spine
- page iii
- ES-1
- ES-2
- 4-1
- 4-11
- 7-2

In addition, a new appendix will be added to the back of the report.
Appendix J MRSPP NOTIFICATION LETTER AND PUBLIC NOTICE

Certification letter will follow from Radford AAP under separate cover.

Immediately below are the POCs with tracking numbers:

Jim McKenna - 797614044129
Radford Army Ammunition Plant
1 hard copy, 2 CDs (one for Jerry Redder, ATK)

Rich Mendoza - 797614059419
Army Environmental Command-RIA
1 hard copy, 1 CD

Jim Cutler -796626606588
Virginia Dept of Environmental Quality
2 hard copies, 2 CDs (one for Durwood Willis)

Elizabeth A. Lohman - 797614084730
Virginia Dept of Environmental Quality
1 CD

Nancy Flaherty - 796626622275
USACE-Baltimore

DEPARTMENT OF THE ARMY
US ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MD 21010-5403

MCHB-TS-REH

19 FEB 2009

MEMORANDUM FOR Office of Environmental Quality, Radford Army Ammunition Plant (SJMRF-OP-EQ/Mr. Jim McKenna), P.O. Box 2, Radford, VA 24143-0002

SUBJECT: Stakeholder Draft Site Screening Process Report, Army Reserve Small Arms Range, Radford Army Ammunition Plant, Virginia, January 2009

1. The US Army Center for Health Promotion and Preventive Medicine reviewed the subject document on behalf of the Office of The Surgeon General pursuant to Army Regulation 200-1 (Environmental Protection and Enhancement). We appreciate the opportunity to review this report and a few comments and recommendations are enclosed.

2. The document was reviewed by Mr. Dennis Druck, Environmental Health Risk Assessment Program. He can be reached at DSN 584-2953, commercial (410) 436-2953 or electronic mail "dennis.druck@us.army.mil".

FOR THE COMMANDER:

Jeffrey S. Kirkpatrick

Encl

JEFFREY S. KIRKPATRICK
Director, Health Risk Management

CF:
HQDA (DASG-PPM-NC) (wo/encl)
IMCOM-NE (IMNE-PWD-E) (w/encl)
USACE (CEHNC-CX-ES) (w/encl)
USAEC (IMAE-CD/Mr. Rich Mendoza) (w/encl)

COMMENTS AND RECOMMENDATIONS

Stakeholder Draft Site Screening Process Report, Army Reserve Small Arms Range, Radford Army Ammunition Plant, Virginia, January 2009

1. Page ES-1, Executive Summary

Comment: The last sentence of the fourth paragraph on this page states that with the exception of lead, other potential MC are not likely to be of concern. However, the results and conclusions of this particular study have shown that other MC, like arsenic and antimony, can be of human health and/or ecological concern at small arms range sites.

Recommendation: Please consider rewriting the sentence to clarify that lead is not the only MC that may be a concern at such sites. The same statement is also found in the last sentence of the second paragraph on page 1-2.

2. Page 4-1, Section 4.2.1.1

Risk-based Screening (RSLs)

Comment: The statement is made that: "The industrial RSLs were treated as ARARs in the risk-based screening". It is not understood why such a statement is made when these Regional Screening Levels are merely guidance and have not been duly promulgated so as to be considered ARARs.

Recommendation: Suggest rewording this sentence to clarify that Army does not consider such screening levels to be ARARs.

3. Page 4-11, Section 4.3.2.1

Approach

Comment: The first sentence states that soil samples were collected from 0 to 1 ft bgs but in section 3.2 on page 3-2, it says that the soil samples were collected from a depth of 0 to 6 inches.

Recommendation: Please correct this discrepancy.

4. Page 7-2, Section 7.3

Recommendation for Action

Comment: The reason given in the second paragraph for recommending that an RFI be conducted at this site is limited to a discussion of lead concentrations exceeding human health screening levels. However, nothing is said about arsenic also exceeding its human health screening criteria as well as lead, antimony, and arsenic exceeding an ecological hazard quotient of one.

Recommendation: Please consider including the other MC exceedances that support conducting an RFI at this site.

Encl

ATK

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

www.atk.com

January 30, 2009

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, Site Screening Process Report, Military Munitions Response Program, January 2009
EPA ID# VA1 210020730

Dear Mr. Geiger and Mr. Cutler:

Enclosed is the certification for the subject document that was sent to you on January 14, 2009. Also enclosed is the 14 January 2009 transmittal email.

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

Sincerely,

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

c: Karen Sismour
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

09-815-9
JMcKenna

Rich Mendoza
U.S. Army Environmental Command
1 Rock Island Arsenal
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IMAE-CDN
Rock Island, Illinois 61299

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. A. Miano

09-815-9
JMcKenna

Concerning the following:

Radford Army Ammunition Plant
Stakeholder Draft
Site Screening Process Report
Military Munitions Response Program
January 2009

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: For Jon R. Drushal
TITLE: Lieutenant Colonel (P), US Army
Commanding

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

09-815-9
JMcKenna

Greene, Anne

[illegible]m: McKenna, Jim
[illegible]t: Wednesday, January 14, 2009 11:02 AM
To: Greene, Anne; ealohman@deq.virginia.gov; Druck, Dennis E Mr CIV USA MEDCOM CHPPM; diane.wisbeck@arcadis-us.com; durwood willis2; Geiger.William@epamail.epa.gov; Redder, Jerome; jim spencer; jlcutler@deq.virginia.gov; kjsismour@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
Subject: MMRP SSP Report draft January 2009 (UNCLASSIFIED)

Importance: High

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.

Please complete your review and provide your comments to me and Sarah Gettier with URS within 20 business days (February 17, 2009).

Immediately below are the POCs with tracking numbers:

Jim McKenna - 0201 7972 4922 5800
Radford Army Ammunition Plant
[illegible]rd copy, 2 CDs (one for Jerry Redder, ATK)

Rich Mendoza - 0201 7962 5283 2142
Army Environmental Command-RIA
1 hard copy, 1 CD

Jim Cutler - 0201 7972 4925 9392
Virginia Dept of Environmental Quality
2 hard copies, 2 CDs (one for Durwood Willis)

Elizabeth A. Lohman - 0201 7962 5284 3106 Virginia Dept of Environmental Quality
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Nancy Flaherty - 0201 7962 5285 4548
USACE-Baltimore
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Mary Ellen Maly - 0201 7962 5286 2101
U.S. Army Environmental Command
1 hard copy, 1 CD

William Geiger - 0201 7962 5301 1789
US EPA Region III
1 hard copy, 1 CD

James Spencer - 0201 7972 4942 9605
URS Corporation
1 CD

[illegible]k you for your support of the Radford AAP Installation Restoration Program.

[illegible] McKenna

FINAL

SITE SCREENING PROCESS REPORT 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

May 2009

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

ARMY RESERVE SMALL ARMS RANGE MRS
MILITARY MUNITIONS RESPONSE PROGRAM
SITE SCREENING PROCESS REPORT

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

Section ***Page***

FIGURES

TABLES

APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

%	Percent
AEDB-R	Army Environmental Database-Restoration
AES	Atomic Emission Spectroscopy
ANSAR	Army Reserve Small Arms Range
ARAR	Applicable or Relevant and Appropriate Requirements
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
EPC	Exposure Point Concentration
ERIS	Environmental Restoration Information System
ft	Feet
GPS	Global Positioning System
HAZCOM	Hazard Communication
HQ	Hazard Quotient
HRR	Historical Records Review
HSP	Health and Safety Plan
HSPA	Health and Safety Plan Addendum
HTRW	Hazardous, Toxic, and Radioactive Waste
MC	Munitions Constituents
MDC	Maximum Detected Concentration
MDL	Method Detection Limit
MEC	Munitions and Explosives of Concern
mL	Milliliter
mg/kg	milligram per kilogram
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

LIST OF ABBREVIATIONS AND ACRONYMS (cont'd)

PM	Project Manager
PPE	Personal Protective Equipment
QA	Quality Assurance
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
RSL	Risk-Based Screening Levels
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-Trinitrotoluene
TPP	Technical Project Planning
TRV	Toxicity Reference Values
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

GLOSSARY OF TERMS

Closed Range – A military range that has been taken out of service as a range and that either has been put to new uses that are incompatible with range activities or is not considered by the military to be a potential range area. A closed range is still under the control of a Department of Defense (DoD) component.

Defense Site – All locations that currently are or formerly were owned by, leased to, or otherwise possessed or used by the DoD. The term does not include any operational range, operating storage or manufacturing facility, or facility that is used or was permitted for the treatment or disposal of military munitions. (10 U.S.C. 2710(e)(1))

Discarded Military Munitions (DMM) – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded explosive ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations. (10 U.S.C. 2710(e)(2))

Explosive Ordnance Disposal (EOD) – The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded ordnance by a military response unit. It may also include explosive ordnance that has become hazardous by damage or deterioration.

Explosives Safety – A condition where operational capability and readiness, personnel, property, and the environment are protected from unacceptable effects of an ammunition or explosives mishap.

Formerly Used Defense Site (FUDS) – A DoD program that focuses on compliance and cleanup efforts at sites that were formerly used by the DoD. A FUDS property is eligible for the Military Munitions Response Program if the release occurred prior to October 17, 1986; the property was transferred from DoD control prior to October 17, 1986; and the property or project meets other FUDS eligibility criteria.

Military Munitions – All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DoD, the U.S. Coast Guard, the U.S. Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes and incendiaries, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components of the above. The term does not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, other than non-nuclear components of nuclear devices that are managed under the nuclear weapons program of the Department of Energy after all required sanitation operations under the Atomic Energy Act of 1954 (42 U.S.C. 2011 *et seq*.) have been completed. (10 U.S.C. 101(e)(4))

Munitions and Explosives of Concern (MEC) – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means unexploded ordnance, as defined in 10 U.S.C. 101(e)(5); DMM as defined in 10 U.S.C 2710(e)(2); or munitions constituents (e.g., Trinitrotoluene [TNT] or Cyclotrimethylenetrinitramine [RDX]) as defined in 10 U.S.C 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

Munitions Constituents (MC) – Any materials originating from unexploded ordnance, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 U.S.C. 2710(e)(3))

Munitions Response Site (MRS): A discrete location requiring a munitions response as recommended in military munitions response program (MMRP) policy guidance and protocols.

Operational Range – A range that is under jurisdiction, custody, or control of the Department of Defense and that is used for range activities or, although not currently being used for range activities, that is still considered by the Secretary to be a range and has not been put to new use incompatible with range activities. (10 U.S.C. 101(e)(3))

Other than Operational Range – Includes all property that is under jurisdiction, custody, or control of the Secretary of Defense that is not defined as an Operational Range.

Range – A designated land or water area set aside, managed, and used for range activities of the DoD. Ranges include firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access and exclusionary areas, and airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration. (10 U.S.C 101(e)(1)(A) and (B))

Transferred Range – A range that is no longer under military control and had been owned, leased or otherwise possessed and used by the DoD, transferred, or returned from the DoD to another entity, including federal entities. This includes a military range that was used under the terms of an executive order, special-use permit or authorization, right-of-way, public land order, or other instrument issued by the federal land manager. Additionally, property that was previously used by the military as a range, but did not have a formal use agreement, also qualifies as a transferred range.

Transferring Range – A range that is proposed to be leased, transferred, or returned from the DoD to another entity, including federal entities. This includes a military range that was used under the terms of a withdrawal, executive order, special-use permit or authorization, right-of-way, public land order, or other instrument issued by the federal land manager or property owner. An active range will not be considered a transferring range until the transfer is imminent (generally defined as the transfer date is within 12 months and a receiving entity has been notified).

Unexploded Ordnance (UXO) – Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and remain unexploded either by malfunction, design, or any other cause. (10 U.S.C. 101(e)(5))

EXECUTIVE SUMMARY

RFAAP investigates sites under the Resource Conservation and Recovery Act (RCRA) Corrective Action Permit issued by the Environmental Protection Agency, Region III (USEPA) in October 2000.

As part of the Military Munitions Response Program (MMRP), the 2002 Closed, Transferring, and Transferred (CTT) Range Inventory Report for RFAAP identified three CTT ranges: Army Reserve Small Arms Range, Northern Burning Grounds and Western Burning Grounds. The CTT found that the Northern and Western Burning Grounds are evaluated under RFAAP's Installation Restoration Program (IRP). Therefore, the Historical Records Review (HRR) Report addressed the Army Reserve Small Arms Range, which is the only site eligible for investigation under the MMRP (see Table ES-1).

Table ES-1: Summary of Radford Sites Evaluated for the SSP

Site Name	AEDB-R* Number	CTT vs. HRR Acreage	Comments
Army Reserve Small Arms Range	RFAAP-001-R-01	3/7.6	Active Army MMRP eligible. Historical research indicates that the past use of small arms firing at this site suggests a potential for MC to be present. There is no evidence of MEC at the site. Acreage was revised during the HRR based on site data and aerial photographs.
Northern Burning Grounds	N/A	2/0	Site managed through the IRP and therefore not MMRP-eligible.
Western Burning Grounds	N/A	2/0	Site managed through the IRP and therefore not MMRP-eligible.

*Army Environmental Database-Restoration (AEDB-R)
IRP – Installation Restoration Program

The Army Reserve Small Arms Range is a former small arms firing range used for training from approximately 1941 to 1968. Based on the *HRR Report* 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 Unit (MMA) of RFAAP. A berm is still present at the site and the direction of fire was southeast. The acreage of this site, as determined from geographic information system (GIS) analysis of historical maps and aerial photographs in the *HRR Report*, is 7.6 acres. The findings of this Site Screening Process (SSP) Report did not alter the size of this munitions response site (MRS) from the *HRR Report* (URS, 2008a).

Historical research concluded that munitions and explosives of concern (MEC) is not a concern at this site. Expended small arms, which are expected to be at the site, are not MEC, and unexpended small arms are not expected to be present. During the second Technical Project Planning (TPP) meeting it was agreed that the recommendation for MEC be no further action (NFA). Based on findings for similar small arms ranges operated by the U.S. Army, there was a potential for munitions constituents (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 in front of the target locations. Although there are other potential MC associated with small arms and blanks, 90-99% of small arms projectiles (the bullet that goes down range when a munitions is fired) is comprised of lead.

The following field work activities were performed at RFAAP in October 2008 to determine the potential effects on soil quality at the Army Reserve Small Arms Range:

- Visual inspection for MC on the surface of the berm and at sample locations below the vegetative mat using a shovel to examine for bullet fragments.
- Collection of surface soil samples for arsenic, antimony, and lead analysis at the berm and the hillside behind the berm.
- Collection of surface soil samples in the construction debris pile behind the berm for arsenic, chromium and lead analysis.

The field work activities indicated the presence of MC. Lead, arsenic and antimony concentrations at the site are above the USEPA residential and industrial criterion, consequently, a RCRA Facility Investigation (RFI) for MC is recommended. This site received an initial Munitions Response Site Prioritization Protocol (MRSPP) rating of 7.

The findings and recommendations of the SSP are summarized in Table ES-2.

Table ES-2: Summary of SSP Findings and Recommendations

MRS (AEDB-R No.)	Acreage CTT/HRR/SSP	MRSPP Priority	Recommendations		Basis for Recommendation	
			MEC	MC	MEC	MC
Army Reserve Small Arms Range (RFAAP-001-R-01)	3/7.6/7.6	7	NFA	RFI	MEC not likely to be present; site was used only for small arms training.	Detected lead concentrations in the former berm were above screening criterion. Detected arsenic concentrations in the hillside were above screening criterion and facility wide background.

This SSP Report blends the established report formats from both the MMRP Site Inspection (SI) and the SSP. The SSP includes additional evaluation (human health risk screen and ecological risk screen) as required by VDEQ in the established SSP Guidance (Appendix B).

1.0 INTRODUCTION

This Site Screening Process (SSP) report presents the results and findings of the Resource Conservation and Recovery Act (RCRA) investigation conducted at the Radford Army Ammunition Plant (RFAAP) for the Army Reserve Small Arms Range, a Military Munitions Response Program (MMRP) eligible site. The project site is located in Radford, Virginia (Figure 1-1). The SSP Report serves the same purpose as an MMRP Site Inspection (SI) Report.

The work was conducted by URS Group, Inc. (URS) to fulfill the requirements set forth in the 2000 RCRA Corrective Action permit as tasked by the United States Army Corps of Engineers (USACE), Baltimore District, in accordance with Contract Number W912DR-06-C-028.

URS performed the SSP in accordance with the specific SSP developed for RFAAP and Work Plan Addendum (WPA) 024 to the Master Work Plan (MWP) (URS 2008b), which was developed to address specific aspects of this project and to describe project-related activities not included in the MWP. These documents, approved by the United States Environmental Protection Agency (USEPA) Region III and the Virginia Department of Environmental Quality (VDEQ), contain the Master Quality Assurance Plan (MQAP), the Master Health and Safety Plan (MHSP), and associated project-specific addenda.

1.1 PROJECT TERMINOLOGY

The United States Congress established the MMRP under the Defense Environmental Restoration Program (DERP) to address Department of Defense (DoD) sites with unexploded ordnance (UXO), discarded military munitions (DMM), and munitions constituents (MC) located on current and former military installations. Sites that are not eligible for the MMRP include: sites that had releases after September 30, 2002, properties classified as operational military ranges, permitted disposal facilities, and operating munitions storage facilities. The U.S. Army's (Army) inventory of closed, transferring, and transferred (CTT) military ranges and defense sites where UXO, DMM, or MC is suspected or has been identified are sites that are eligible for action 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 the 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 USEPA Region III in October 2000. Therefore, the SSP follows 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. This report presents the results of the MMRP SSP.

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

1.2 SITE OVERVIEW

As part of the MMRP, the 2002 *Closed, Transferring, and Transferred (CTT) Range Inventory Report* for RFAAP identified three CTT ranges: Army Reserve Small Arms Range, Northern Burning Grounds and Western Burning Grounds. The CTT inventory identified that the Northern and Western Burning Grounds are evaluated under RFAAP's Installation Restoration Program (IRP). Therefore, the *Historical Records Review (HRR) Report* addressed the Army Reserve Small Arms Range, which is the only site eligible for investigation under the MMRP (see Table 1-1).

Table 1-1: Summary of RFAAP Sites Evaluated for the SSP

Site Name	AEDB-R* Number	CTT vs. HRR Acreage	Comments
Army Reserve Small Arms Range	RFAAP-001-R-01	3/7.6	Active Army MMRP eligible. Historical research indicates that the past use of small arms firing at this site suggests a potential for MC to be present. There is no evidence of MEC at the site. Acreage was revised during the HRR based on site data and aerial photographs.
Northern Burning Grounds	N/A	N/A	Site managed through the IRP and therefore not MMRP-eligible.
Western Burning Grounds	N/A	N/A	Site managed through the IRP and therefore not MMRP-eligible.

*Army Environmental Database-Restoration

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 the *HRR Report* 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 MMA of RFAAP. A berm is still present at the site and the direction of fire was southeast. The acreage of this site, as determined from geographic information system (GIS) analysis of historical maps and aerial photographs in the *HRR Report*, is 7.6 acres. The SSP findings did not alter the size of this munitions response site (MRS) from the *HRR Report* (URS, 2008a).

Historical research concluded that munitions and explosives of concern (MEC) is not a concern at this site. Expended small arms, which are expected to be at the site, are not MEC, and unexpended small arms are not expected to be present. Based on findings for similar small arms ranges operated by the U.S. Army, there was 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 in front of the target locations. Although there are other potential MC associated with small arms and blanks, 90-99% of small arms projectiles, (the bullet that goes down range when a munitions is fired) is comprised of lead.

1.3 MMRP SSP PROJECT OBJECTIVES

The purpose of this project is to assess the presence or absence of MEC and 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 goals of the SSP are to collect the necessary information to help the Army improve Cost to Complete (CTC) estimates for the remediation of the Army Reserve Small Arms Range and to prepare the Munitions Response Site Prioritization Protocol (MRSPP). In compliance with Title 32 of the Code of Federal Regulations (CFR) §179.5, the MRSPP score for the RFAAP Army Reserve Small Arms Range included in this SSP is considered interim pending stakeholder input.

200 Orchard Ridge Drive
Gaithersburg, MD 20878

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Senior: SG

Figure 1-1
Installation Location Map
RFAAP, VA

The rationale and methods for the SSP field investigation were developed and presented in the final MWP Addendum 024 SSP (URS, 2008b). The purpose of the SSP field work was to obtain the information needed to fill data gaps and provide sufficient data regarding the Army Reserve Small Arms Range to complete its evaluation in this MMRP SSP Report. The objectives and specific field investigation activities were developed in conjunction with regulatory stakeholders, including representatives from USACE, Baltimore District, the United States Army Environmental Command (USAEC), the VDEQ, the Environmental Protection Agency (USEPA), and RFAAP during Technical Project Planning (TPP) meetings. The second TPP meeting (TPP2) was held as a teleconference call on December 18, 2007, meeting minutes are presented as Appendix H.

1.4 ADDITIONAL SSP OBJECTIVES

The SSP is designed to assess whether releases of hazardous substances, pollutants, constituents, hazardous wastes, or hazardous constituents have occurred to the environment at the sites evaluated. The SSP process includes additional objectives that partially overlap the MMRP SSP objectives. The SSP consists of the following steps as identified in the SSP Guidance document (USEPA 2001, provided in Appendix B):

- Performance of a desktop audit and site visit to develop the scope of the SSP Work Plan (accomplished in the *HRR Report*);
- 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 or 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.

1.5 REPORT ORGANIZATION

Section 2.0 presents site background information. Section 3.0 outlines the field investigation program. SSP risk screening procedures, assumptions, and results are presented in Section 4.0. The MMRP conceptual site model is presented in Section 5.0. The MRSPP results are provided in Section 6.0. Conclusions and recommendations for the site are provided in Section 7.0.

2.0 SITE BACKGROUND

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

Table 2-1: Summary of the MRS at RFAAP

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

2.1 SITE DESCRIPTION

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 2-1, 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 adjacent inset figure). The berm is approximately 10 feet (ft) 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 site visit. 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.

2.2 ENVIRONMENTAL SETTING

2.2.1 Physiography

The site is located within a nearly level alluvial plain at an elevation of approximately 1,715 ft mean sea level (msl). Areas across Stroubles Creek to the south slope steeply upward from the creek to an elevation of more than 1,950 ft msl. Most of the site is an open grass field with wooded areas located along the banks of Stroubles Creek.

2.2.2 Tanks and Structures

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

2.2.3 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. No other surface water bodies, drainage ditches, manholes, or catch basins are 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. Runoff on the opposite side of the berm would flow away from Stroubles Creek toward the north for a short distance and then turn back toward Stroubles creek. 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.

2.2.4 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 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).

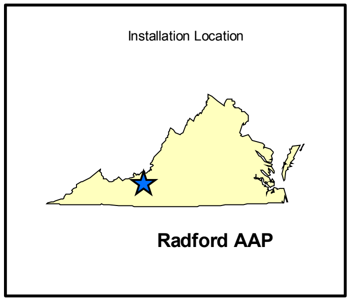
The lithology below the site is alluvium, which consists of unconsolidated alluvial deposits within the flood plain of Stroubles Creek. Carbonate bedrock of the Cambrian Elbrook Formation underlies these alluvial deposits. Mississippian rocks of the Price Formation crop out across Stroubles Creek from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

2.2.5 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.

Army Reserve Small Arms Range MRS

URS
200 Orchard Ridge Drive
Gaithersburg, MD 20878



Legend

- ▭ MRS Boundary
- Perimeter fence (approx. location)
- ▭ Historic Feature
- Streams

Source of Aerial:
USDA NAIP 2005 imagery

1:2,117

0 5 10 20 30 40 Meters

0 25 50 100 150 200 Feet

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Date: 1/08/2009
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Senior: SG

Figure 2-1
MRS Site Layout
Army Reserve Small Arms Range
RFAAP, VA

2.3 PREVIOUS INVESTIGATIONS

The *HRR Report* was completed to support the SSP (URS, 2008a). The HRR expanded on the information collected during the CTT Range/Site 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.

The Final *HRR Report* was submitted in January 2008 to USACE, Baltimore District, the USAEC, RFAAP, USEPA, and the VDEQ. The report is included on CD as Appendix I.

3.0 FIELD INVESTIGATION PROGRAM

The SSP field program was developed based on the *HRR Report* conclusions regarding the potential for MEC and MC at the Army Reserve Small Arms Range MRS. Field activities were conducted October 7 and 8, 2008. MEC not is expected at the Army Reserve Small Arms Range because of its use as only a small arms and pistol firing range. Sampling decisions were developed to investigate MC at the site. Tables 3-1 and 3-2 summarize the decisions made to address MEC and MC.

Table 3-1: Summary of MEC Decisions

MRS	MEC SSP Activities	
	Activity	Purpose
Army Reserve Small Arms Range	No MEC expected based on site history of small arms use only.	No additional data are needed, as indicated by site history.

Table 3-2: Summary of MC Decisions

MRS	SSP 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 six composite surface soil samples located in the berm. Collect seven composite surface soil samples located in the hillside behind the berm. In addition, collect two composite surface soil samples in the construction debris pile behind berm for arsenic, chromium, and lead. Environmental media sampled is surface soil (0-6 inches).	Compare site data to the following: - Lead comparison criteria associated with Commercial/ Industrial Use. - USEPA residential lead comparison criteria of 400 milligrams per kilogram (mg/kg), published in the Revised Interim Soil Lead Guidance for CERCLA Sites, OSWER Directive 9355.4-12 (USEPA, 1994). - USEPA Region III residential Risk Based Concentrations (RBCs) October 2007. - USEPA Region III Soil Screening Levels (soil-to-groundwater). - Background Facility-Wide Point Estimates for Soil. - Aid in completing MRSPP, Module 3.

Lead is the primary potential constituent of concern at small arms ranges because it constitutes the largest percentage of the bullet and, if present, constitutes the greatest potential risk due to its toxicity. Therefore, if lead is not identified as a constituent at a small arms range MRS, the same conclusion can be reached for other minor constituents.

3.1 MC INVESTIGATION ACTIVITIES

Before soil sampling, URS field personnel visually examined the berm (front and back) and the hillside for bullet fragments at the surface and conducted a sweep for potential bullet fragments using a Radio Shack Discovery Model 1100 metal detector. Locations where target responses occurred were limited to the berm. Target responses were marked with flag pins. A shovel was used to scrape the surface of the soil at the marked locations to a depth of several inches to investigate whether bullet fragments were present at these locations. Bullet fragments were identified at 10 of the marked locations at the front of the berm at depths of 3 to 4 inches (Figure 3-1). Composite soil samples were collected from 6 of the 10 locations where bullet fragments were found as discussed in Section 3.2. Ten additional random locations in other areas of the berm outside of the response areas were evaluated for bullet fragments by shoveling soil to a depth of 6 inches. Bullet fragments were not identified at these locations.

There were no recordable metal detector responses for the hillside area and visual evidence of bullet fragments at the surface was not apparent. A shovel was used at seven locations across the hillside area in between rock outcrop areas to evaluate whether bullet fragments were present at shallow depths. Soil was removed to a depth of 6 inches in each area. Bullet fragments were not observed at these locations. Composite soil samples were collected from each of the seven locations as discussed in Section 3.2.

3.2 SAMPLING AND ANALYSIS

The SSP sampling and analysis program for the Army Reserve Small Arms Range MRS is summarized in Table 3-3 including sample types, number of samples, and analytical parameters.

Table 3-3: 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 3.4.2.
(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

Soil samples were collected from a depth of 0 to 6 inches at the locations shown on Figure 3-1. Composite samples were collected using the “spoke and hub” technique, as described in Section 3.4.2 and consistent with the procedures outlined in SOP 30.1 (Appendix A). Two of the composite samples were collected from a construction debris area located behind the easternmost portion of the berm. Material that was observed in this debris included a tire, fence material, wood post, rock and concrete debris, and small pieces of conductive flooring material. Identified areas containing conductive flooring material were included in one of the composite samples.

Soil samples were analyzed for arsenic, antimony, and lead from the berm and hillside, and for arsenic, chromium, and lead from the construction debris area using USEPA SW-846 6010B Trace.

3.3 QUALITY ASSURANCE

URS has met the project-specific data quality objectives (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 in Section 2 of WPA 024. 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.

Army Reserve Small Arms Range MRS

URS
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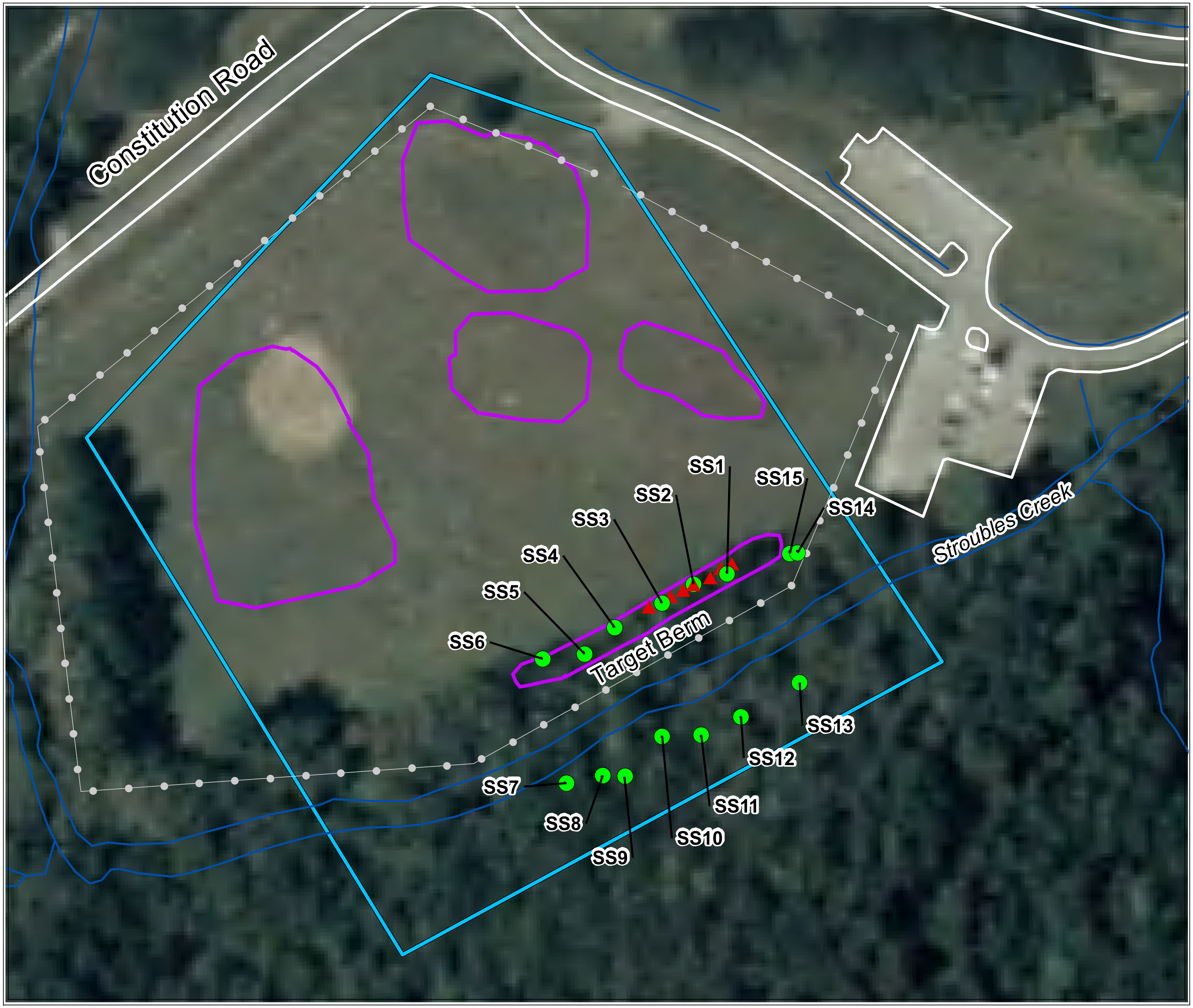
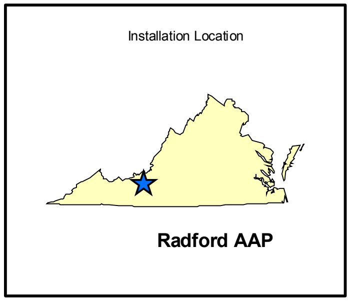
Gaithersburg, MD 20878





Legend

- 🟦 MRS Boundary
- 🟪 Historic Feature
- Perimeter fence (approx. location)
- ▲ Fragment Location
- ● Soil Sample
- Streams

Source of Aerial:
USDA NAIP 2005 imagery

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Figure 3-1
SSP Sample Locations
Army Reserve Small Arms Range
RFAAP, VA

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, USEPA and USACE regulations and guidelines, and the specific goals and requirements stated in WPA 024.

Oversight of sample collection, analysis, and assessment was performed by technical project personnel. Laboratory equipment has been maintained and calibrated, and records of these activities will be kept in accordance with established procedures. This has included laboratory oversight by URS project personnel, as well as laboratory data and document review.

Per the USEPA 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 has been 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 has determined that the data acquired are usable for the intended purpose of this project as outlined in Appendix G.

3.4 INVESTIGATION METHODOLOGY

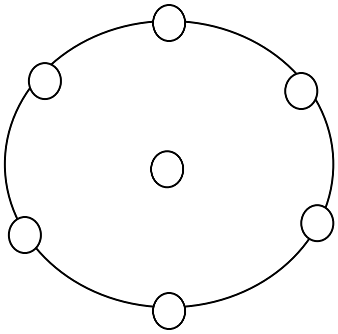
3.4.1 MC Investigation Activities

The presence of bullet fragments was evaluated by several methods. A visual examination of the study area was conducted along with a metal detector sweep to identify potential bullet fragments. A Radio Shack Discover Model 1100 metal detector was used in “all-metal mode” to allow for detection of bullet fragments. Target response areas were marked with flag pins for further evaluation. Target response areas were further investigated by using a shovel to scrape the surface of the soil to a depth of 6 inches to determine whether bullet fragments were present. Composite soil samples were collected from 6 of the 10 locations in the berm where bullet fragments were identified. Ten additional random locations in other areas of the berm outside of the response areas were evaluated for bullet fragments by shoveling soil to a depth of 6 inches. Bullet fragments were not identified at these locations.

3.4.2 Composite Soil Samples

Composite soil samples were collected using the “spoke and hub” method. Six grab soil samples were collected from a wheel-shaped layout and a seventh grab sample from the center of the wheel using a dedicated, pre-cleaned stainless steel spoon and combined in a dedicated plastic sampling bag consistent with SOP 30.1 (Appendix C). A sample layout is shown below. The radius of the wheel was 1.5 ft.

Sample Layout



The seven sub-samples per sampling grid were composited into one sample. The procedure used for sample collection and compositing was as follows:

- Sample locations were identified and recorded in the field logbook following SOP 10.1 (Appendix C). Clean nitrile gloves were donned prior to sample collection and measures were taken to prevent sampling equipment to contact potential sources of constituents.
- A pre-cleaned spoon/trowel was used to dig-down approximately 6 inches at each of the seven sub-sample locations. The radius from the center sub-sample was approximately 1.5 ft from the center sample. Vegetation was avoided when collecting the samples if possible.
- Soil from each sampling location was placed into a dedicated plastic bag. Samples were composited by thoroughly mixing and shaking the soil within the closed bag until the sample color was homogeneous.
- Once the sample was collected, a Global Positioning System (GPS) point was 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 was set aside and used to log a description of the soil characteristics (using the Unified Soil Classification System) on a soil sampling log form following SOP 10.2 (Appendix C). After the soil sample was put into the ice chest, the chain of custody (COC) was filled out consistent with SOP 10.4 (Appendix C). Only pre-cleaned sampling equipment was used to avoid the need for sampling equipment decontamination. Any excess soil was returned to the sample holes and used as backfill material. Soil sampling forms are presented in Appendix D.3.

3.4.3 GPS Surveying

Each sample location was 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 were established for each sample location to an accuracy of 1 meter. Bullet fragment locations were recorded with GPS, photographed, and recorded in the field notes.

3.5 WORK PLAN FIELD CHANGES

Some bedrock outcropping was observed on the hillside south of Stroubles Creek within the study area thereby reducing the amount of areas where soil sampling could be conducted. However, the outcropping did not limit the number of samples that could be collected and, therefore, significant change to the WPA was not required in this area. Field conditions did not require changes to the planned field investigation programs in the berm or construction debris areas as presented in WPA 024.

4.0 SSP DATA EVALUATION AND PRE-REMEDIAL RISK SCREENING

4.1 ANALYTICAL RESULTS

The SSP analytical results for detected chemicals in soil are presented in Table 4-1. A summary of the site screening process and the results of the screening for the site are presented below. The SSP guidance is provided in Appendix B.

4.2 HUMAN HEALTH RISK SCREENING

The purpose of the SSP human health risk screening is to evaluate site data using conservative criteria so a site can be eliminated from further consideration or identify if the site requires further evaluation. The human health risk screening for RFAAP is divided into two tiers. The first tier screening identifies the chemicals of potential concern (COPCs) using the following screening criteria:

- Comparison with USEPA residential and industrial risk-based screening levels (RSLs);
- Comparison to migration from soil-to-groundwater screening levels (SSLs);
- Chemical-specific screening for lead;
- Comparison to applicable or relevant and appropriate requirements (ARARs); and
- Comparison to background point estimates (available for select metals).

The second tier is a screening-level cumulative risk assessment which conservatively estimates cumulative cancer risk and non-cancer hazard from exposure to multiple COPCs. The two tiers and the results of the screening are described in greater detail below.

4.2.1 Identification of COPCs (Tier 1)

4.2.1.1 Risk-based Screening (RSLs)

COPCs were identified for the site by comparing the maximum detected concentration (MDC) for detected chemicals in soil to USEPA residential and industrial RSLs as presented in the USEPA regional screening level table (USEPA, 2008). In accordance with USEPA Region III guidance, RSLs for noncarcinogenic chemicals were adjusted downward to a Hazard Quotient (HQ) of 0.1 to ensure that chemicals with additive effects were not prematurely eliminated during screening. For the purpose of COPC identification and risk screening, data from duplicate sample pairs were averaged and treated as one result. If a chemical was detected in one of the sample pair, half the detection limit of the non-detect was averaged with the detected result, and the result was considered detected. Chemicals that had a MDC greater than the adjusted RSL or for which no screening value (NSV) existed were retained as COPCs for quantitative assessment.

Table 4-2 presents the results of the COPC screening for soil. RSL COPCs identified for soil include: antimony, arsenic, and lead.

The maximum concentrations of both antimony and lead were detected in sample SS3 located in the target berm at 24.4 and 1,630 mg/kg, respectively. The maximum concentration of arsenic was found on the hillside behind the berm at a concentration of 49.2 mg/kg.

Chromium was not retained as a COPC. Chromium was analyzed for as a potential indicator for the conductive flooring material found in the construction debris area behind the berm. The two samples in this area (SS14 and SS15) were analyzed for arsenic, chromium and lead. Analytical results are presented on Table 4-1. Lead and chromium were detected below the soil screening levels for both residential and industrial criteria in SS14 and SS15.

4.2.1.2 Migration from Soil-to-Groundwater Screening (SSLs)

An SSL screening was conducted for detected chemicals in soil to evaluate the potential for leaching of chemicals from soil to groundwater. As presented in Table 4-3, the MDC for each detected chemical in soil was compared to its USEPA SSL included in the USEPA Regional Screening Table (USEPA, 2008). The MDC comparisons of soil to risk-based and MCL-based SSLs for detected chemicals indicated that antimony, arsenic, and lead are above their SSLs (Table 4-3).

4.2.1.3 Chemical-specific Screening for Lead

The MDC for lead in soil at the site was above the residential lead screening level of 400 mg/kg, and therefore, the potential hazard associated with lead was evaluated using the Integrated Exposure Uptake Biokinetic (IEUBK) model for the child resident scenario.

Site-specific lead exposures were evaluated for residential exposures at the site using the IEUBK model (USEPA, 2005). This calculation was based on the site-specific mean concentration of lead detected in total soil (353 mg/kg). The results of the modeling presented in Appendix E.1 predict the probability of children expected to have blood levels of 10 microgram per deciliter (μg/dL) or greater. The lead risks are considered unacceptable if the child-blood lead level for more than 5% of children is estimated to equal or greater than the Center for Disease Control and Prevention (CDCP) concern threshold of 10 μg/dL. The results of the lead modeling predicted the probability of the child resident receptor for the site expected to have blood levels of 10 μg/dL or greater was 2.9%, which is below the established threshold of 5%.

The IEUBK model is used to predict the risk of elevated blood lead levels in children (under age seven) that are exposed to environmental lead from many sources (e.g., lead in air, diet, drinking water, soil, house dust, and lead-based paint). The model assumes that a child resident is living at the site which is an unlikely current or future scenario for the Army Reserve Small Arms Range.

4.2.1.4 Background Comparison - Soil

The final step in the risk screening process is the comparison of the MDCs of COPCs identified in soil to the established Facility-wide inorganic background point estimate concentrations for metals (IT, 2001). Arsenic and lead MDCs were greater than their background point estimates (Table 4-4). A background point estimate is not available for antimony.

Table 4-1
Summary of Results in Soil Analytical Samples
MMRP SSP Report
Radford Army Ammunition Plan, Radford, Virginia

Sample ID	ARSARSS1		Criteria Exceeded?	MDL	RL	DUP-1 (ARSARSS1)		Criteria Exceeded?	MDL	RL	ARSARSS2		Criteria Exceeded?	MDL	RL	ARSARSS3		Criteria Exceeded?	MDL	RL
Sample Date	10/7/2008					10/7/2008					10/7/2008					10/7/2008				
Sample Depth (ft bgs)	0-0.5					0-0.5					0-0.5					0-0.5				
Constituent	Result	LQ, VQ, r				Result	LQ, VQ, r				Result	LQ, VQ, r				Result	LQ, VQ, r			
Metals (mg/kg)																				
Antimony	**7**	J,L,m	B,D,E	1.11	11.1	**8.98**	J,L,m	B,D,E	1.1	11	**19.4**	L,m	B,D,E	1.18	11.8	**24.4**	L,m	B,D,E	1.15	11.5
Arsenic	**4.22**		B,C,D,E	0.443	1.11	**3.9**		B,C,D,E	0.442	1.1	**5.45**		B,C,D,E	0.471	1.18	**6.01**		B,C,D,E	0.462	1.15
Chromium[1]	NT					NT					NT					NT				
Lead	**319**		A,E	0.221	1.11	**407**		A,B,E	0.221	1.1	**1,600**		A,B,C,E	0.236	1.18	**1,630**		A,B,C,E	0.231	1.15

Sample ID	ARSARSS4		Criteria Exceeded?	MDL	RL	ARSARSS5		Criteria Exceeded?	MDL	RL	ARSARSS6		Criteria Exceeded?	MDL	RL	ARSARSS7		Criteria Exceeded?	MDL	RL
Sample Date	10/7/2008					10/7/2008					10/7/2008					10/8/2008				
Sample Depth (ft bgs)	0-0.5					0-0.5					0-0.5					0-0.5				
Constituent	Result	LQ, VQ, r				Result	LQ, VQ, r				Result	LQ, VQ, r				Result	LQ, VQ, r			
Metals (mg/kg)																				
Antimony	**4.47**	J,L,m	B,D,E	1.12	11.2	<11.3	U,UL,m		1.13	11.3	**3.1**	J,L,m	B,D,E	1.14	11.4	**1.32**	J,L,m	D,E	1.22	12.2
Arsenic	**4.56**		B,C,D,E	0.447	1.12	**4.56**		B,C,D,E	0.454	1.13	**4.03**		B,C,D,E	0.456	1.14	**9.59**		B,C,D,E	0.488	1.22
Chromium[1]	NT					NT					NT					NT				
Lead	**400**		A,B,E	0.223	1.12	**27.1**		A,E	0.227	1.13	**328**		A,E	0.228	1.14	**225**		A,E	0.244	1.22

Sample ID	ARSARSS8		Criteria Exceeded?	MDL	RL	ARSARSS9		Criteria Exceeded?	MDL	RL	ARSARSS10		Criteria Exceeded?	MDL	RL	ARSARSS11		Criteria Exceeded?	MDL	RL
Sample Date	10/8/2008					10/8/2008					10/8/2008					10/8/2008				
Sample Depth (ft bgs)	0-0.5					0-0.5					0-0.5					0-0.5				
Constituent	Result	LQ, VQ, r				Result	LQ, VQ, r				Result	LQ, VQ, r				Result	LQ, VQ, r			
Metals (mg/kg)																				
Antimony	<13.3	U,UL,m		1.33	13.3	<13.2	U,UL,m		1.32	13.2	<14.1	U,UL,m		1.41	14.1	<14.5	U,UL,m		1.45	14.5
Arsenic	**8.44**		B,C,D,E	0.533	1.33	**30.4**		A,B,C,D,E	0.53	1.32	**25.1**		A,B,C,D,E	0.564	1.41	**32.6**		A,B,C,D,E	0.58	1.45
Chromium[1]	NT					NT					NT					NT				
Lead	**88.6**		A,E	0.266	1.33	**96.1**		A,E	0.265	1.32	**174**		A,E	0.282	1.41	**104**		A,E	0.29	1.45

Sample ID	ARSARSS12		Criteria Exceeded?	MDL	RL	ARSARSS13		Criteria Exceeded?	MDL	RL	ARSARSS14		Criteria Exceeded?	MDL	RL	DUP-2 (ARSARSS14)		Criteria Exceeded?	MDL	RL
Sample Date	10/8/2008					10/8/2008					10/7/2008					10/7/2008				
Sample Depth (ft bgs)	0-0.5					0-0.5					0-0.5					0-0.5				
Constituent	Result	LQ, VQ, r				Result	LQ, VQ, r				Result	LQ, VQ, r				Result	LQ, VQ, r			
Metals (mg/kg)																				
Antimony	**1.32**	J,L,m	D,E	1.3	13	<13	U,UL,m		1.3	13	NT					NT				
Arsenic	**49.2**		A,B,C,D,E	0.519	1.3	**37**		A,B,C,D,E	0.521	1.3	**7.04**		B,C,D,E	0.504	1.26	**4.65**		B,C,D,E	0.504	1.26
Chromium[1]	NT					NT					**18**			0.252	1.26	**17.7**			0.252	1.26
Lead	**138**		A,E	0.26	1.3	**51.5**		A,E	0.26	1.3	**55.6**		A,E	0.252	1.26	**51.6**		A,E	0.252	1.26

Sample ID	ARSARSS15		Criteria Exceeded?	MDL	RL
Sample Date	10/7/2008				
Sample Depth (ft bgs)	0-0.5				
Constituent	Result	LQ, VQ, r			
Metals (mg/kg)					
Antimony	NT				
Arsenic	**5.95**		B,C,D,E	0.453	1.13
Chromium[1]	**13**			0.227	1.13
Lead	**16.6**		E	0.227	1.13

SCREENING CRITERIA:

			A	B	C	D	E
Constituent	CAS #	C/N	Facility-Wide Background Point Estimate(A)	Adjusted Soil Screening Levels (Residential)	Adjusted Soil Screening Levels (Industrial)	Protection of Groundwater Risk-based SSL	Protection of Groundwater MCL-based SSL
Metals (mg/kg)							
Antimony	7440-36-0	N	--	3.1	41	0.66	0.27
Arsenic	7440-38-2	C	15.8	0.39	1.6	0.0013	0.29
Chromium[1]	7440-47-3	C	65.3	280	1,400	9.90E+07	--
Lead	7439-92-1	N	26.8	400	800	--	14

Notes:

CAS = Chemical Abstracts Service
ft bgs = Feet Below Ground Surface
mg/kg = Milligram Per Kilogram
MDL = Method Detection Limit
RL = Reporting Limit
LQ = Laboratory Qualifier
VQ = Validation Qualifier
r = Reason Code

NT = Not Tested
-- = No Value Available
Screening Levels = USEPA Regional Screening Table (September 2008)
SSL = Site Screening Level, 12 September 2008
Adjusted RBCs = a Hazard Quotient (HQ) of 0.1 applied to non-carcinogens
C/N = Carcinogenic/Noncarcinogenic per EPA SSL Table (September 2008)
MCL = Maximum Contaminant Level
[1] = Chromium III Groundwater SSL used
(A) = Facility-Wide Background Point Estimate as Reported in the Facility-Wide Background Study Report (IT, 2001).

Note that all detections are **bolded**.

Laboratory Qualifiers

J	Estimated value.
U	The compound was analyzed for but not detected. The reporting limit will be adjusted to reflect any dilution, and for soil, the percent moisture.

Validation Qualifiers

L	Analyte present. Reported value may be biased low. Actual value is expected to be higher.
UL	Not detected, quantitation limit is probably higher.

Reason Codes MS/MSD recovery failure
m

Table 4-2
COPC/RSL Screening
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Exposure point	CAS #	Chemical	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	RSL Residential (N/C)		Potential ARAR/TBC Value*		Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
Surface Soil		**TAL Metals**														
	7440-36-0	Antimony	1.32	24.4	mg/kg	ARSARSS3	7/13	1.1 - 1.45	24	3.1	N	41	N	IND	Y	**ARES**
	7440-38-2	Arsenic	4.03	49.2	mg/kg	ARSARSS12	15/15	0.442 - 0.58	49.2	0.39	C	1.6	C	IND	Y	***ARES/IND***
	7440-47-3	Chromium	13	17.9	mg/kg	ARSARSS14 DUP AVG	2/2	0.227 - 0.252	17.85	280	C	1,400	C	IND	N	BSL
	7439-92-1	Lead [1]	16.6	1,630	mg/kg	ARSARSS3	15/15	0.221 - 0.29	1630	400	N	800	N	IND	Y	***ARES/IND***

Notes:
COPC = Chemical of Potential Concern
mg/kg = Milligram Per Kilogram
CAS = Chemical Abstracts Service
TAL = Target Analyte List
RSL = USEPA Risk-Based Screening Level from USEPA Regional Screening Table (September 2008)
Adjusted RSLs = a Hazard Quotient (HQ) of 0.1 applied to non-carcinogens
N = Noncarcinogenic per USEPA RSL Table (September 2008)
C = Carcinogenic per USEPA RSL Table (September 2008)
[1] = USEPA Lead Action Level used
-- = No Value Available
ARAR = Applicable or Relevant and Appropriate Requirement
TBC = To-Be-Considered
IND = Adjusted Industrial RSL
AL = USEPA Action Level

ARES = Above Residential RSL
ARES/IND = Above Residential RSL/Industrial RSL
BSL = Below Residential/Industrial RSL Screening Levels
NSV = No Screening Value Available
*These values are equivalent to the USEPA Adjusted Industrial RSLs (September 2008)

Table 4-3
COPC/SSL Screening
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Groundwater Risk-based SSL	Groundwater MCL-based SSL	COPC Flag (Y/N)	Rationale for Selection or Deletion
TAL Metals												
Antimony	7440-36-0	1.32	24.4	mg/kg	ARSARSS3	7/13	1.1 - 1.45	24	0.66	0.27	Y	**ASSL/AMCL-SSL**
Arsenic	7440-38-2	4.03	49.2	mg/kg	ARSARSS12	15/15	0.442 - 0.58	49.2	0.0013	0.29	Y	**ASSL/AMCL-SSL**
Chromium [1]	7440-47-3	13	17.85	mg/kg	ARSARSS14 DUP AVG	2/2	0.227 - 0.252	17.85	9.9E+07	--	N	BSL
Lead	7439-92-1	16.6	1,630	mg/kg	ARSARSS3	15/15	0.221 - 0.29	1630	--	14	Y	**AMCL-SSL**

Notes:
CAS = Chemical Abstracts Service
TAL = Target Analyte List
mg/kg = Milligram Per Kilogram
SSL = Soil Screening Level (soil to groundwater migration pathway)
from USEPA Regional Screening Table (September 2008)
[1] = Chromium III Risk-based SSL used
ASSL = Above Risk-based SSL
AMCL-SSL = Above MCL-based SSL
BSL = Below SSLs

Table 4-4
COPC/Background Screening
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

CAS #	Chemical	Minimum Concentration Surface Soil	Maximum Concentration Surface Soil	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Point Estimate[A]	Background Comparison
	TAL Metals									
7440-36-0	Antimony	1.32	24	mg/kg	ARSARSS3	7/13	1.1 - 1.45	24	--	NBE
7440-38-2	Arsenic	4.03	49.2	mg/kg	ARSARSS12	15/15	0.442 - 0.58	49.2	15.8	**Y**
7440-47-3	Chromium	13	17.85	mg/kg	RSARSS14 DUP AV	2/2	0.227 - 0.252	17.85	65.3	N
7439-92-1	Lead	16.6	1,630	mg/kg	ARSARSS3	15/15	0.221 - 0.29	1,630	26.8	**Y**

Notes:

CAS = Chemical Abstracts Service
TAL = Target Analyte List
mg/kg = Milligram Per Kilogram
(A) = Facility-Wide Background Point Estimate as Reported in the Facility-Wide Background Study Report (IT, 2001).
NBE = No Background Point Estimate Available

4.2.2 Cumulative Risk Screen (Tier 2)

The cumulative screening-level human health risk assessment consisted of calculating the ratios between the MDCs and exposure point concentrations (EPCs) of COPCs in soil and the corresponding RSL. Appendix E.2 provides the statistical calculations and selection of EPCs for the screening. Appendix E.3 presents the cumulative screening-level human health risk assessment results.

For purposes of this screening process, MDCs or a 95% UCL (if appropriate) were considered in the cumulative risk screening as representative EPCs. Both carcinogenic and noncarcinogenic effects were evaluated in accordance with Section 6.1.1.2 of the SSP Guidance (Appendix B). If the cumulative cancer risk is greater than or equal to 1E-05 then a quantitative risk assessment may be performed. If the cumulative cancer risk for a site is less than 1E-05 and constituent concentrations are below other screening criteria evaluated for the SSP, then NFA would be recommended for the site.

If the noncarcinogenic cumulative hazard index (HI) is greater than 1, there is a potential for adverse noncarcinogenic health effects. In such cases, COPCs are divided into categories based on the target organ affected (e.g., liver, kidney) and target organ-specific HIs are calculated. The results of the cumulative risk screens are interpreted as follows:

- If the cumulative HI for a site is greater than or equal to 0.5 for a target organ, then a quantitative risk assessment would be recommended for the site; or
- If the cumulative HI for a site is less than 0.5 for each target organ, and constituent concentrations are below other screening criteria evaluated for the SSP, then NFA would be recommended for the site.

4.2.2.1 Cumulative Risk Screen

The cumulative risk screening results for soil using the MDC as the concentration is presented in Table E.3-1 of Appendix E.3. A summary of the EPCs (95% UCLs) is provided in Table E.2-3 in Appendix E.2 and the EPC-based cumulative risk screening for soil is presented in Table E.3-2 of Appendix E.3. A summary of the screening results is presented in Table 4-5.

Table 4-5: Cumulative Human Health Risk Screening Results for Soil

	MDC-Based Results			EPC-Based Results		
Residential Risk	Above	1.E-04	Arsenic	Above	8.E-05	Arsenic
Industrial Risk	Above	3.E-05	Arsenic	Above	2.E-05	Arsenic
Residential Hazard	Above	3	Arsenic (2) Antimony (0.8)	Above	1	Arsenic (1.5)
Industrial Hazard	Below	0.2	--	Below	0.1	--

The cumulative human health screenings risks, using the both the MDCs and EPCs (95% UCLs) as the concentrations in soil, were above the established SSP risk of 1E-05 for both the residential and industrial scenarios. The total hazard (both MDC- and EPC-based results) was also above the established SSP threshold of 0.5 for the residential scenario, but below for the industrial scenario. Arsenic and antimony contributed to the residential scenario highest HI of 3 using MDCs; the target organ-specific HIs above the cumulative SSP HI threshold of 0.5 are as follows: blood (antimony) and skin and vascular system (arsenic). Arsenic's chemical-specific HI and target organ-specific HIs for skin and vascular system were above the

SSP HI threshold of 0.5 for the EPC-based residential screening. See Appendix E.3 for the cumulative screening results.

4.2.3 Human Health Risk Screening Summary

The risk-based and migration from soil-to-groundwater Tier 1 screening identified the following soil COPCs: antimony, arsenic, and lead. For the background comparison, arsenic and lead concentrations were above their background point estimates. However, a background point estimate was not available for antimony. The lead modeling result (2.9%) was below the established USEPA threshold of 5% for the hypothetical child resident.

The cancer results of the Tier 2 cumulative screening-level assessment indicate that the residential and industrial scenarios (MDC- and EPC-based results) are above the established SSP cancer threshold (1E-05) for soil due to arsenic.

The non-cancer results of the Tier 2 cumulative screening-level assessment indicate that the residential scenario hazard estimates are above the established SSP threshold (HI=0.5 for any target organ). The target organ-specific HIs above the threshold include the following:

- Residential MDC-based cumulative screening: blood (antimony) and skin and vascular system (arsenic); and
- Residential EPC-based cumulative screening: skin and vascular system (arsenic).

The Tier 2 industrial worker scenario non-cancer hazard estimates (both MDC- and EPC-based) were below the threshold of 0.5.

4.2.4 Uncertainties Analysis

Cumulative risk screening involves the use of assumptions, judgments, and incomplete data to varying degrees that contribute to the uncertainty of the final estimates of risk. Uncertainties result both from the use of assumptions or models in lieu of actual data and from the error inherent in the estimation of risk-related parameters and may cause risk to be overestimated or underestimated. Based on the uncertainties described below, this risk screening should not be construed as presenting an absolute estimate of risk to persons potentially exposed to COPCs.

Consideration of the uncertainty associated with various aspects of the cumulative risk screening allows better interpretation of the risk screening results and understanding of the potential adverse effects on human health. In general, the primary sources of uncertainty are associated with environmental sampling and analysis, selection of chemicals for evaluation, toxicological data, and exposure assessment. The effects of these uncertainties on the risk estimates are discussed below.

4.2.4.1 Environmental Sampling and Analysis

Uncertainty in environmental chemical analysis can stem from several sources including errors inherent in the sampling or analytical procedures. Analytical accuracy errors or sampling errors can result in rejection of data, which decreases the available data for use in the human health risk screening, or in the qualification of data, which increases the uncertainty in the detected chemical concentrations. There is uncertainty associated with chemicals reported in samples at concentrations below the reporting limit (RL) but still included in data analysis and with those chemicals qualified with the letter J, indicating that the concentrations are estimated. Another issue involves the amount of blank-related (i.e., B-qualified) data in the data set. The effects of using data with these uncertainties may overestimate or underestimate risks. Some data for RFAAP were J-flagged but none had blank contamination issues.

4.2.4.2 Selection of Chemicals for Evaluation

A comparison of EPCs to USEPA RSLs was conducted for surface soil. Only chromium whose EPC was below the R-RSL was not carried through the Tier 2 risk screening. R-RSL is based upon conservative exposure assumptions and conservatively derived toxicity criteria. Although following this methodology does not provide a quantitative risk estimate for every chemical, it focuses the assessment on the chemicals accounting for the greatest risks and/or hazards (i.e., chemicals whose EPCs are greater than their respective RSLs) and the cumulative risk screening estimates would not be expected to be significantly greater.

The background comparison was used for informational reasons only; no metal was removed from the Tier 1 and Tier 2 screening if the MDC was below background. It is unlikely that the risk-based screening (Tier 1 and Tier 2) excluded chemicals that should be included. Uncertainties associated with excluding the use of background data may lead to low-to-moderate overestimation of risks due to metals.

Uncertainty is introduced at the COPC selection step for chemicals that have adjusted RSLs or SSLs lower than the method detection limit (MDL). As shown in Table 4-1, arsenic's adjusted R-RSL is lower than the MDL. Arsenic and antimony's SSLs are also lower than the MDL.

4.2.4.3 Exposure Point Concentrations

In establishing EPCs, the concentrations of chemicals in the media evaluated are assumed to remain constant over time. Depending on the properties of the chemical and the media in which it was detected, this assumption could overestimate risks, depending on the degree of chemical transport to other media.

When calculating EPCs from sample data, one half of the MDL was used for non-detect samples in the calculation of the 95% UCL of the mean. The uncertainty of the EPC will increase as the number of non-detects in a data set increases and the uncertainty could result in either the overestimation or underestimation of EPCs. Sample results for antimony contained six non-detections which accounted for 46% of the data used for deriving the EPC. The other metals sampled at RFAAP reported no non-detect data.

The 95% UCL is used as the EPC for each medium if at least eight samples are available and the 95% UCL is lower than the MDC. The MDC is conservatively used as the default EPC when there are too few samples to derive a representative 95% UCL or when the 95% UCL is greater than the MDC. Using a value that is based on one sampling location (i.e., the maximum) has associated uncertainty and it adds a great deal of conservatism to the assessment. Enough sample data were available to derive a 95% UCL for arsenic and antimony therefore, the uncertainty associated with the Tier 2 screening results is lower.

4.2.4.4 Toxicological Data

Toxicological factors contributing to uncertainties associated with the human health risk screening process include the use of RSL age-adjusted ingestion and inhalation rates and the lack of toxicity criteria for some chemicals. A provisional inhalation toxicity value was used for arsenic in deriving the RSLs; provisional toxicity criteria present a source of uncertainty because USEPA has evaluated the compound, but consensus has not been established on the toxicity criteria.

4.3 ECOLOGICAL RISK SCREENING PROCESS

The purpose of the ecological risk screening is to provide conclusions and recommendations regarding potential ecological risk associated with the site. The screening level ecological risk assessment (SLERA) was performed in accordance with the Final Process for Ecological Risk Assessment – Radford AAP (URS, 2007a). The SLERA process is summarized below in Sections 4.3.1 through 4.3.7. Refer to Appendix F.1 for a detailed description of the SLERA process used for the site evaluations and an example calculation. A summary of the SLERA results are provided below and the complete SLERA tables are provided in Appendix F.2.

4.3.1 Scope of Work

The SLERA includes Steps 1, 2, and 3a of Ecological Risk Assessment Guidance for Superfund [ERAGS] (USEPA, 1997). Step 1 includes a screening-level problem formulation and ecological effects evaluation. Step 2 includes a preliminary exposure estimate and risk calculation. Step 3a reviews and refines the conservative assumptions used in the risk calculation (Step 2). The addition of Step 3a focuses the outcome of the SLERA, streamlines the review process, and functions as the initial basis for making ecological risk management decisions.

The objectives of the ecological risk screening are to:

- Identify potentially complete exposure pathways between chemicals of potential ecological concern (COPECs) and receptors;
- Assess whether the COPECs are greater than the toxicological screening values that are considered to be protective of ecological receptors;
- Identify uncertainty and/or data gaps in the ecological risk screening; and
- Identify an appropriate scientific management decision point (SMDP) for the site based on the ecological risk screening results.

4.3.1.1 Ecological Site Characterization

An overview of the site physiography, water resources, geology, and soil for the site is presented in Section 2.0. The site is a former small arms firing range used from approximately 1941 to 1968, by both the National Guard and the Army Reserve for .30 caliber firing. The closed range is located along the southeastern boundary of the MMA of RFAAP and occupies approximately 7.6 acres. As illustrated on Figure 2-2, 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 adjacent inset figure). The berm is approximately 10 ft 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. The study area for the SLERA included the berm area and the area located across from Stroubles Creek (Figure 3-1) occupies approximately 1 acre.

In addition to the information contained in Section 2.0, additional site characterization is required for the ecological risk screening, which includes local ecological receptors (threatened and endangered species) and ecological resources. A discussion of potential biota likely to use the site area is included in this section. During site visits, wildlife species were observed at the site such as squirrels, deer, and red foxes.

The Virginia Department of Game and Inland Fisheries Installation-Wide Biological Survey (1999) recorded various species associated with the grassland communities at RFAAP. Based on their survey of the grassland habitats, the invertebrates (approximately 250 species) and birds (83 species) accounted for the majority of species observations at RFAAP. Potential species using the grassland areas of the site include common passerine birds (e.g., American robin) and small mammals (e.g., short-tailed shrew). Larger mammals (e.g., white-tailed deer and red fox) and raptors (e.g., red-tailed hawk) may potentially use the grassland habitat for foraging. Animals such as the mallard duck, belted kingfisher, and raccoon could be expected to forage in the New River.

The Virginia Department of Game and Inland Fisheries survey identified three threatened wildlife species and two rare plant species associated with RFAAP grassland communities (currently not on the 2002 Plant Watch List; http://www.dcr.state.va.us/dnh/plantlist02.pdf). They include:

- Regal Fritillary Butterfly (*Speyeria idalia*);
- Henslow's Sparrow (*Ammodramus henslowii*);

- Loggerhead Shrike (*Lanius ludovicianus*);
- Midland Sedge (*Carex mescochorea*); and
- Shaggy False Gromwell (*Onosmodium hispidissimum*).

Threatened wildlife observations in 1999 at RFAAP included the Regal Fritillary Butterfly (VDGIF 1999). The Regal Fritillary Butterfly was documented in the east-central and eastern edges of the MMA.

4.3.2 Identification of Chemicals of Potential Ecological Concern

4.3.2.1 Approach

Soil samples were collected from 0 to 6 inches below organic layers at the surface. This layer contains the zone of highest biological activity of soil organisms and the soil that is most frequently contacted by terrestrial biota. Although fossorial wildlife may be in contact with soil below 6 inches, the preys of these animals are primarily associated with surficial soil. Furthermore, incidental exposure to the soil below 6 inches is likely to be insignificant relative to surface soil exposure.

Surficial soil (0 to 6 inches) represents the potential exposure media to ecological receptors. The following sections describe the process used to evaluate soil, the selection of COPECs evaluated in the SLERA, and the uncertainties associated with COPEC selection.

4.3.2.1 Terrestrial

Potential ecological receptors at the site may be exposed to COPECs in soil through the following exposure routes:

- Direct contact/absorption from soil;
- Direct ingestion of soil;
- Incidental ingestion of soil; and
- Direct ingestion of biota with accumulated COPECs.

Although receptors may be exposed to COPECs through inhalation or drinking surface water, sufficient literature regarding toxicity due to these pathways is lacking to quantitatively evaluate such exposure routes. Given the potential mobility of COPECs between food web trophic levels, a number of terrestrial categories were selected. Individual receptor species were selected to represent five wildlife receptor categories and these species possess the following characteristics that are essential for assessing COPEC mobility within the food web:

- Highly likely to occur at the site in relatively high abundance;
- Limited home range;
- Important role in the local food web; and
- Sufficient toxicological information is available in the literature.

Receptor categories and the species selected to represent the wildlife categories include:

- Plant communities;
- Soil invertebrate/microbial communities;
- Omnivorous birds: American Robin (*Turdus migratorius*);
- Carnivorous birds: Red-tailed Hawk (*Buteo jamaicensis*);

- Herbivorous animals: Meadow Vole (*Microtus pennsylvanicus*);
- Omnivorous mammals: Red Fox (*Vulpes vulpes*); and
- Carnivorous mammals: Short-tailed Shrew (*Blarina brevicauda*).

Potential wildlife using the site includes passerine bird and small mammalian species common to RFAAP grasslands (VDGIF, 1999).

4.3.3 Identification of Exposure Pathways and Potential Receptors Analysis

4.3.3.1 Data Organization

The following table identifies the soil samples used for the SLERA. These samples were analyzed for antimony (selected samples), arsenic, chromium (selected samples), and lead. Refer to Table 3-1 for a detailed list of samples and analytes.

Soil Samples Evaluated for SLERA

ARSARSS1	ARSARSS9
ARSARSS2	ARSARSS10
ARSARSS3	ARSARSS11
ARSARSS4	ARSARSS12
ARSARSS5	ARSARSS13
ARSARSS6	ARSARSS14
ARSARSS7	ARSARSS15
ARSARSS8	

Detected chemical occurrence and distribution tables for surface soil are presented in Table F.2-1. Refer to Table 4-1 for a complete list of results for detected analytes. Chemicals that were not detected in at least one sample were considered as uncertain analytes in the evaluation of risk. Other qualified analytical data were retained in the assessment.

4.3.3.2 Ecological Conceptual Site Model (ECSM)

The terrestrial ECSM is presented on Figure 4-1. Surface soil is a potential exposure medium of concern based on historical activities at the site. Based on the site characterization and data, the terrestrial receptor exposure to surface soil pathway exists.

4.3.4 Identification of Assessment and Measurement Endpoints

Assessment endpoints are explicit statements of ecological resources (entities) and attributes of those entities that are important to protect (USEPA, 1998). Measurement endpoints represent quantifiable ecological characteristics that can be measured, interpreted, and related to ecological resources chosen as assessment endpoints. Assessment and measurement endpoints for the resources in the terrestrial sites are outlined below.

4.3.4.1 Terrestrial

Assessment and measurement endpoints for terrestrial receptors are as follows:

Assessment Endpoints	Measurement Endpoints
• Survival, growth, and reproduction of terrestrial plants	• MDCs for chemicals detected in surface soil will be compared to concentrations representing no adverse effects thresholds to the survival of plants communities reported in the scientific literature
• Survival, growth, and reproduction of soil invertebrates and microbial communities	• MDCs for chemicals detected in surface soil will be compared to concentrations representing no adverse effects thresholds to the survival of soil invertebrates or microbial communities reported in the scientific literature
• Survival, growth, and reproduction of terrestrial wildlife (birds and mammals) populations and communities	• MDCs for detected bioaccumulative chemicals in soil will be compared to no observable adverse effects levels (NOAELs) and lowest observable adverse effects levels (LOAELs) associated with effects on growth, reproduction, or survival of terrestrial wildlife

4.3.5 Preliminary Exposure Estimate and Ecological Effects Evaluation

The preliminary exposure estimate and ecological effects evaluation considers the most conservative risk scenario. Highly conservative assumptions are used to estimate COPEC exposure to terrestrial receptors for pathways to be quantitatively evaluated. Conservative toxicity reference values (TRVs) are used to evaluate the ecological effects of exposure using the two approaches discussed below.

Risk is assessed by comparing the preliminary exposure estimate (MDC) of each detected chemical to the established TRV (detailed in Appendix F.1, Section 2.1). The preliminary risk is characterized in terms of a HQ, which is expressed as:

$$\mathbf{HQ = MDC/TRV}$$

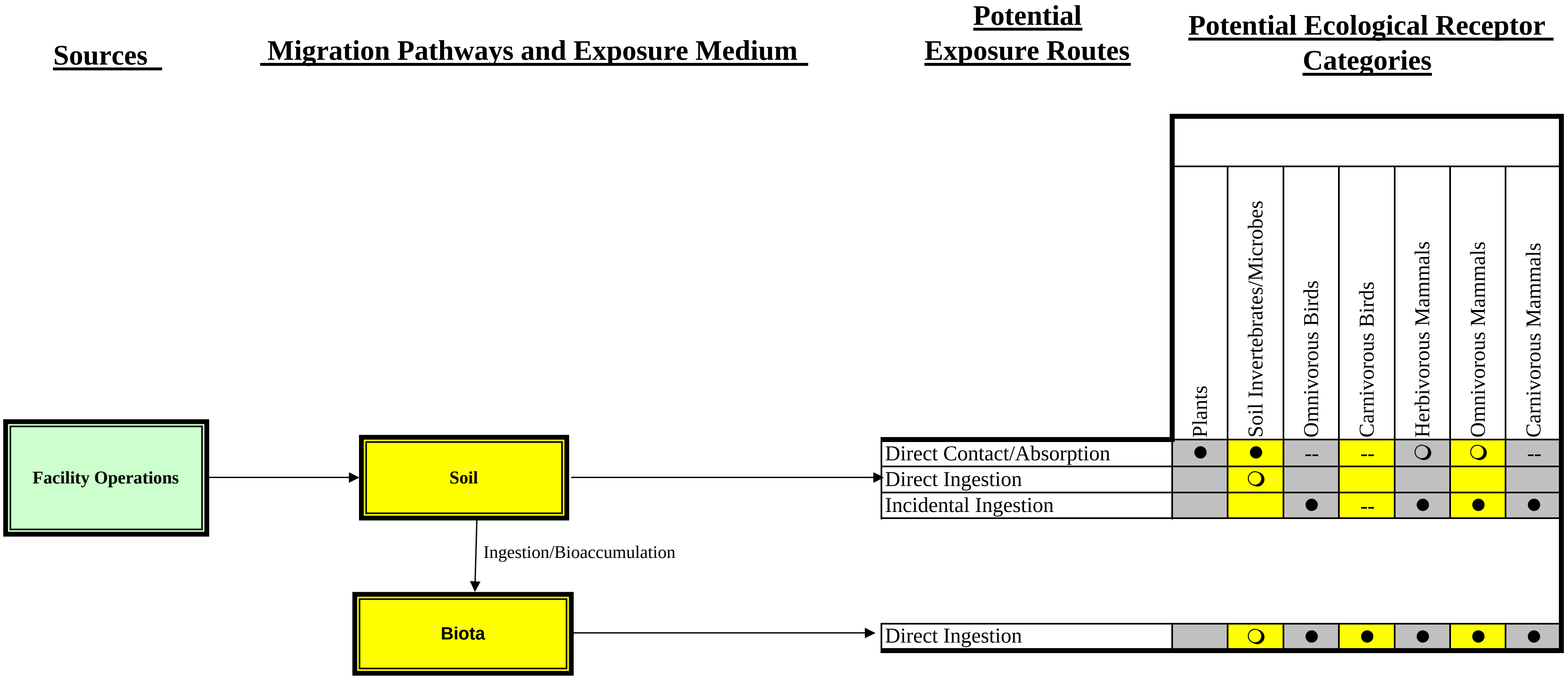
where:

HQ = Hazard Quotient for the constituent (unitless)

MDC = Maximum Detected Concentration for constituent (mg/kg)

TRV = Screening Level for constituent (mg/kg)

Figure 4-1
Terrestrial Ecological Conceptual Site Model
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia



	Plants	Soil Invertebrates/Microbes	Omnivorous Birds	Carnivorous Birds	Herbivorous Mammals	Omnivorous Mammals	Carnivorous Mammals
Direct Contact/Absorption	●	●	--	--	❍	❍	--
Direct Ingestion		❍					
Incidental Ingestion			●	--	●	●	●
Direct Ingestion		❍	●	●	●	●	●

Notes:
● = POTENTIALLY COMPLETE PATHWAY EVALUATED QUANTITATIVELY
❍ = COMPLETE PATHWAY EVALUATED QUALITATIVELY
-- = PATHWAY IS INSIGNIFICANT
BLANK = INCOMPLETE PATHWAY

An HQ of less than 1 indicates no or negligible risk. The potential for risk increases as the HQ increases above unity. However, this result should be considered in the context of other characteristics of the exposure area. A summary of the results of the preliminary exposure assessment are presented in Appendix F.2.

4.3.5.1 Direct Contact Approach

The maximum soil concentrations for detected chemicals are used as the preliminary exposure estimate concentrations to develop a conservative risk scenario for the direct contact pathway to soil invertebrates and terrestrial plants. The results of the preliminary exposure assessments for plants and invertebrates are provided below.

Terrestrial Plants

Preliminary direct contact HQs calculated for plants are presented in Table F.2-4 for detected chemicals. Of the detected chemicals for which screening values were available, the concentrations of antimony, aluminum, chromium, and lead resulted in HQ values that were greater than 1.

Soil Invertebrates and Microbial Communities

Preliminary direct contact HQs calculated for invertebrates are presented in Table F.2-6 for detected chemicals. Of the detected chemicals for which screening values were available, the concentrations of chromium resulted in an HQ value that was greater than 1.

4.3.5.2 Dose Rate Modeling Approach

Preliminary risk characterization for wildlife receptors uses the conservative preliminary exposure estimate and ecological effects evaluation to characterize risk to potential terrestrial receptors. Risk is assessed by comparing the preliminary exposure estimate of each detected bioaccumulative chemical, as defined in Table 4-2 in Bioaccumulative Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status, and Needs, EPA-823-R-00-001, to the TRV developed in the ecological effects evaluation. An example calculation for dose rate modeling is provided in Appendix F.1, Section 4.1, using the equation below.

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food} \; (BAF_{food} \cdot DF) + IR_{s} \;)AF}$$

where:

C_{TRV} = NOAEL or LOAEL-based screening level (mg chemical/kg soil)

ADD = NOAEL or LOAEL (mg COPC/kg body weight-day)

BW = Minimum Body Weight of the receptor (kg)

IR_{food} = Maximum Ingestion Rate of food (kg food ingested per day, dry weight)

BAF_{food} = Bioaccumulation Factor (BAF) of the dietary component with the highest concentration was used, specific to prey type and COPC (ratio of mg of COPC/kg fauna, wet weight to mg COPC/ kg substrate, dry weight)

DF = Dietary Fraction (dietary component with the highest concentration assumed to be 100% of diet)

IR_{s} = Maximum Incidental Ingestion Rate of soil (kg substrate ingested per day, dry weight)

AF = 100% Area Use Factor

In the preliminary dose rate modeling approach, the maximum COPEC concentrations for detected bioaccumulative chemicals, along with assumptions of maximum ingestion rate, minimum body weight, 100% area use, and 100% bioavailability are used in the conservative risk scenario as the preliminary exposure estimate for soil and compared to the calculated TRVs. Preliminary receptor-specific exposure parameters are presented on Table F.2-7. A summary of the results of the preliminary exposure assessment for terrestrial wildlife is provided below.

Terrestrial Wildlife

Quantitative risk characterization for terrestrial wildlife is limited to direct ingestion of biota and incidental ingestion of soil. The preliminary risks for detected bioaccumulative chemicals are summarized in Table F.2-22 for each terrestrial wildlife receptor and the chemicals with HQs greater than 1 are summarized below.

Receptor	NOAEL Only (HQ ≥ 1)	NOAEL and LOAEL (HQ ≥ 1)
Meadow Vole	None	arsenic, lead
Short-tailed Shrew	Chromium	arsenic, lead
Red Fox	Chromium	arsenic, lead
American Robin	arsenic, chromium, lead	arsenic, chromium, lead
Red-tailed Hawk	None	lead

4.3.6 Refined Exposure Estimate and Risk Characterization

Refined exposure estimates and ecological effects are developed for two major receptor categories having complete exposure pathways to be quantitatively evaluated: 1) direct contact to plants and invertebrates, and 2) wildlife ingestion (i.e., omnivorous birds and mammals, carnivorous birds and mammals, and herbivorous mammals). The refined exposure and risk characterization, Step 3a of ERAGS, reviews and refines the conservative assumptions used in the risk calculation (USEPA 1997). In Step 3a, conservative assumptions used in the preliminary exposure and risk characterization are replaced with more environmentally realistic assumptions to evaluate risk posed by constituents identified in the preliminary risk characterization. The addition of Step 3a focuses the outcome of the SLERA, streamlines the review process, and functions as the initial basis for ecological risk management decision-making.

As noted below for the refined exposure estimate and risk characterization, the 95% UCL is used as the exposure concentration rather than the MDC. Methods used to calculate 95% UCLs are based on guidance provided in the following documents *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (USEPA, 2002b) and *On the Computation of a 95% Upper Confidence Limit of the Unknown Population Mean Based Upon Data Sets with Below Detection Limit Observations* (USEPA, 2006).

In general, the method used to calculate a 95% UCL depends on: 1) the prevalence of non-detects, and 2) the data distribution (e.g., normal or lognormal). Non-detects introduce uncertainty in the data set because the true concentration may be between zero to just below the detection limit. Therefore, distributional assumptions are difficult to make for COPCs with a high rate of non-detects. ProUCL 4.0 is used to calculate EPCs for the sites. EPCs for soil COPECs are presented in Table F.2-2 for the site (Appendix F.2)

For the refined evaluation, risk is assessed by comparing the EPC (95% UCL) of each detected chemical to the TRV. The refined risk HQ is expressed as:

$$\mathbf{HQ = EPC/TRV}$$

where:

HQ = Hazard Quotient for the constituent (unitless)

EPC = Calculated Exposure Point Concentration for chemical (mg/kg)

TRV = Screening Level for chemical (mg/kg)

An HQ of less than 1 indicates no or negligible risk. The potential for risk increases as the HQ increases above unity. However, this result should be considered in the context of other characteristics of the exposure area. Results of the refined exposure assessment are presented in Appendix F.2.

4.3.6.1 Direct Contact Approach

The refined exposure estimate for the direct contact pathway to soil invertebrate and microbial communities incorporates the 95% UCL as the exposure concentration for evaluating the COPECs using a conservative yet more realistic exposure assumption than MDCs. A summary of the results of the refined exposure assessment for plants and invertebrates is provided below.

Terrestrial Plants

Refined direct contact HQs calculated for plants are presented in Table F.2-4 for detected chemicals. Of the detected chemicals for which screening values were available, the concentrations of antimony, arsenic, chromium, and lead resulted in refined HQ values that were greater than 1.

Soil Invertebrates and Microbial Communities

Refined direct contact HQs calculated for invertebrates are presented in Table F.2-6 for detected chemicals. Of the detected chemicals for which screening values were available, the concentration of chromium resulted in a refined HQ value greater than 1.

4.3.6.2 Dose Rate Modeling Approach

The conservative assumptions used in the preliminary exposure estimate and ecological effects evaluation were replaced with more environmentally realistic assumptions resulting in a more realistic estimate of potential risk. An example calculation for dose rate modeling is provided in Appendix F.1, Section 4.4, using the equation below.

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food} \sum (BAF_{food} \cdot DF) + IR_s)AF}$$

where:

C_{TRV} = NOAEL or LOAEL-based screening level (mg chemical/kg soil)

ADD = NOAEL or LOAEL (mg COPC/kg body weight-day)

BW = Average Body Weight of the receptor (kg)

IR_{food} = Average Ingestion Rate of food (kg food ingested per day, dry weight)

BAF_{food} = BAF of dietary component used, specific to prey type and COPC (ratio of mg of COPC/kg fauna, wet weight to mg COPC/ kg substrate, dry weight)

DF = Dietary Fraction

IR_s = Average Incidental Ingestion Rate of soil (kg substrate ingested per day, dry weight)

$AF_{refined}$ = Refined Area Use Factor (detailed below)

The refined exposure estimates and ecological effects are developed for wildlife receptors having complete exposure pathways to be quantitatively evaluated (i.e., omnivorous birds, and carnivorous and herbivorous mammals). In the refined model, an average body weight, average ingestion rate, and a 95% UCL as the EPC are used. Refined receptor-specific exposure parameters are presented on Table F.2-7 (Appendix F.2). In addition, a realistic area use factor ($AF_{refined}$) was calculated as the ratio of the site area to the average home range of the receptor which is also presented in Table F.2-7 (Appendix F.2). A summary of the results of the refined exposure assessment for terrestrial wildlife is provided below.

Terrestrial Wildlife

The refined risk characterization results are presented in Table F.2-22 and summarized below for each of the receptors with chemical HQs greater than 1:

Receptor	NOAEL Only (HQ ≥ 1)	NOAEL and LOAEL (HQ ≥ 1)
Meadow Vole	arsenic (3.6)	none
Short-tailed Shrew	arsenic (6.1), lead (1.7)	none
Red Fox	None	none
American Robin	None	lead (15/1.5)
Red-tailed Hawk	None	none

4.3.7 Risk Management – Scientific Management Decision Point

The findings of the ecological risk screen including site characterization and risk calculations are used as input to risk management decision-making for the site. The purpose of the SMDP based on the ecological risk screening is to determine which 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.

Terrestrial plant COPECs with refined HQs greater than 1 included: antimony (HQ=1.9), arsenic (HQ=1.8), chromium (HQ=18), and lead (HQ=5.5). Chromium concentrations are below background point estimates (see Section 4.2.5); therefore, this chemical is not considered site-related.

Soil invertebrates and microbial processes COPECs with a refined HQ greater than 1 included chromium (HQ=45). Chromium concentrations are below background point estimates (see Section 4.2.5); therefore, this chemical is not considered site-related.

The refined risk characterization for wildlife resulted in the identification of lead for the American Robin with a LOAEL-based HQ greater than 1.

After consideration of spatial distribution of data at site, the results of the SLERA, and background concentrations, the SMDP is the following:

> *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.*

4.4 EXPOSURE AND RISK UNCERTAINTY ANALYSIS

Based on this assessment, while factors such as lack of TRV and wildlife profile assumptions may create limited uncertainty, the overall result of the conservative nature of the process has produced a conservative assessment of potential ecological risks associated with the site.

Assumptions and other factors that tend to overestimate, underestimate, or have an unknown effect on the findings of the ecological risk screening are presented below with a discussion of their uncertainty.

4.4.1 Data Quality

Insufficient sampling density or the analyte list may not provide a representative estimate of exposure to COPECs. Misrepresentation of exposure results in uncertainty and may lead to an overestimation or underestimation of risk. Ten or more sampling locations at the site under consideration reduce this uncertainty. Moreover, the targeted list of constituents analyzed reduces the likelihood of failing to identify a COPEC. Therefore, the uncertainty in the ecological risk screening results associated with data quality is likely minimal.

4.4.2 COPEC Bioavailability

Chemical analyses of exposure media measured the total levels of the COPECs rather than the more bioavailable toxic forms. The availability of the total concentrations alone assumes that the entire fraction is bioavailable and toxic. This is likely to be a very conservative assumption that varies from constituent to constituent. It was also assumed that no geochemical factors limited receptor exposure to, or the potential for toxic expression of COPECs. It is likely that COPECs may, to some degree, adsorb to fine-grained particles and/or complex with chemical complexing agents and organic ligands in the exposure media. Such actions may change the chemical speciation of the COPECs to a less toxic form, or reduce the concentrations of bioavailable chemicals and subsequent uptake by receptors. Therefore, risk is likely to be overestimated.

4.4.3 Wildlife Profile Assumptions

Dose rate models require a number of assumptions, which could result in either an overestimation or underestimation of risk to receptors. For example, body weights and ingestion rates are estimated from limited information. In addition, receptors are assumed to feed on specified food sources, although some such as the Red Fox may feed opportunistically on a greater variety of food types.

Area use factors (AFs) were estimated based on the size of the site relative to the home ranges of the receptors. However, the foraging of birds and mammals is not assessed simply by size, but rather a function of habitat suitability, habitat productivity, and species-specific foraging behaviors. Therefore, because habitat quality is not accounted for in estimating AF, the risk to terrestrial receptors in this assessment is likely to be overestimated.

4.4.4 TRVs

NOAEL and LOAEL TRVs identified for wildlife receptors represent the most conservative application of toxicity test results identified from the literature. High uncertainty factors were used to provide TRVs representative of chronic exposure and sub-lethal effects. This approach is likely to overestimate the sensitivity of many ecological receptors and likely overestimates risk to potential receptors.

4.4.5 Hazard Quotients

Uncertainties in characterizing risks are primarily associated with the assumption that an HQ greater than 1 is an adequate indicator of the potential for ecological risks of individual chemicals. Given the use of conservative and realistic exposure and effects assumptions previously discussed, there is minimal uncertainty that the potential for ecological risks of individual chemicals are not identified in the ecological risk screening of the site. Conversely, there is a strong possibility for false positive identification of ecological risks for some individual chemicals.

4.4.6 Exposure and Risk Uncertainty Conclusions

While factors such as lack of TRV and wildlife profile assumptions may create limited uncertainty, the very small size and negligible habitat quality of the site in combination with these limited uncertainties has produced a conservative assessment of potential ecological risks associated with the site.

4.5 CONCLUSIONS AND RECOMMENDATION

Based on the results of the screening, a focused RFI is recommended for the site for metals.

5.0 MMRP CONCEPTUAL SITE MODEL

This section is separated into two parts. The first part provides a discussion of the physical characteristics (climate, geology, etc.) and land use components for RFAAP as a whole. The second part presents the site-specific CSM developed for the MRS, including MEC and MC occurrence and potential for exposure. The CSMs consider exposure and migration pathways via soil, surface water/sediment, and groundwater. Because MC associated with these sites (explosives and metals) are not volatile, the air migration pathway is not considered to be complete and is not included in either of the CSMs.

5.1 GENERAL RFAAP PROFILE

5.1.1 Geography

RFAAP is located in the mountains of southwest Virginia in Pulaski and Montgomery Counties. RFAAP lies in one of a series of narrow valleys typical of the Valley and Ridge Province of the Appalachian Mountains. Oriented in a northeast-southwest direction, the valley is approximately 25 miles long, with a width of 8 miles at the southwest end, narrowing to 2 miles at its northeast end. The plant lies along the New River in the relatively narrow northeast corner of the valley.

5.1.2 Land Use and Demographics

Because of the steep terrain, the area surrounding RFAAP has not been highly developed. Land use is mostly rural; the less rugged areas are primarily used for agriculture. The Jefferson National Forest is located approximately 2 miles north of the Installation. The majority of land in the New River Valley, which includes Montgomery, Pulaski, Giles, and Floyd Counties as well as the city of Radford, is forested. Thirty-eight % of the area of the New River Valley is classified as non-forest land, including agricultural land, developed land, and water acreage (Dames & Moore, 1992). The Blacksburg-Christiansburg-Virginia Polytechnic Institute Water Authority owns four parcels of land adjacent to RFAAP.

According to FedStats, the estimated population of Montgomery County in 2006 was 84,541 and the estimated population of Pulaski County was 35,055. These local populations have 47.4% and 50.3% females, respectively. The majority of the local population in both counties is white. The median age of the population in Montgomery County is 26 years and in Pulaski County is 40 years (Virginia Economic Development Partnership).

5.1.3 Physical Profile

The details in the physical profile data for RFAAP are primarily from the *RFAAP Master Work Plan* (URS, 2003). This report did not specifically address MMRP sites, but is a peer-reviewed source of physical data for the Installation.

5.1.3.1 Climate

The climate of the area encompassing RFAAP is classified as “moderate continental,” characterized by moderately mild winters and warm summers. The prevailing winds are from the southwest, with a northerly component during the cold season. The average yearly wind speed is 8 miles per hour (Dames & Moore, 1992).

Montgomery County, where the Army Reserve Small Arms Range is located, is characterized by a moderate climate with an average rainfall of 38 inches. Table 5-1 presents the average monthly temperatures and precipitation data for RFAAP. The average annual temperature in the nearby town of Pulaski, Virginia is 64.6 degrees F. July has the highest average total precipitation and November the lowest. July is the warmest month with an average maximum temperature of 83.3 degrees F and January the coldest month with an average minimum temperature of 22.9 degrees F (Southeast Regional Climate Center).

Table 5-1: Average Monthly Temperature and Precipitation Data for RFAAP

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max Temperature (F)	43.0	46.5	55.6	65.5	73.4	79.8	83.3	82.4	76.4	66.7	56.4	46.0	64.6
Average Min. Temperature (F)	22.9	24.8	31.5	39.3	47.8	55.9	60.2	59.0	52.1	40.6	32.9	25.6	41.1
Average Total Precipitation (inches)	2.70	2.72	3.33	2.93	3.66	3.68	4.01	3.33	2.85	2.70	2.51	2.75	37.16

http://radar.meas.ncsu.edu/cgi-bin/sercc/cliRECtM.pl?va6955
Period of Record: 8/1/1948 to 12/31/2005

Snowfall in the RFAAP area averages 17 inches annually. Montgomery and Pulaski Counties lie in one of the areas of highest occurrence of dense fog in the United States. Dense fog can be expected to occur between 20 and 45 days per year.

5.1.3.2 Geology

RFAAP is located in the New River Valley, which crosses the Valley and Ridge province approximately perpendicular to the regional strike of bedrock, and chiefly cuts Cambrian and Ordovician limestone or dolostone. Deep clay-rich residuum is prevalent in areas underlain by carbonate rocks. The valley is covered by river floodplain and terrace deposits; karst topography is dominant.

Karst features at RFAAP include sinkholes, bedrock voids, pinnacled bedrock, and springs formed by the dissolution of calcium carbonate by naturally occurring carbonic acid in rainwater. The greatest areas of karst features are controlled by bedrock stratigraphy and structure, and by the presence of major drainages.

RFAAP occupies the central portion of the Pulaski fault thrust sheet (Schultz, 1988). Four major rock units underlie RFAAP including the Elbrook Formation (Cambrian), the Rome Formation (Cambrian), the Conococheague Formation (Cambrian), and the McCrady/Price Formation (Mississippian). The Elbrook and McCrady/Price Formations outcrop at RFAAP. Unconsolidated sediments of Quaternary age overlie the rock units; this sediment includes alluvial, residual, and colluvial deposits.

5.1.3.3 Topography

RFAAP lies within the Valley and Ridge province of the Appalachian physiographic division. The Valley and Ridge province is characterized by a series of long, narrow, flat-topped mountain ridges separated by valleys of varying widths. RFAAP is located within a valley.

The topography within the Installation varies from a relatively flat floodplain to elevated uplands in the extreme southeast section. The New River forms the RFAAP boundary on the north, with the elevation approximately 1,675 ft msl. The eastern boundary represents a transition from floodplain elevation of 1,680 ft msl to an upland elevation of 1,900 ft msl. The southern boundary traverses terrain consisting of creek bottoms and sharply rising summits. The western boundary follows the bluff line overlooking the New River to a point where the Norfolk and Western Railroad crosses the lower arm of the horseshoe area. There is an overall relief of 342 ft at the Installation. In the horseshoe area to the north and east, the New River has a narrow floodplain. The horseshoe area exhibits rolling karst terrain, with three prominent terraces and escarpments, which are remnants of ancient New River floodplains.

RFAAP contains prominent karstic features including sinkholes, caves, and caverns. Karst landforms occur in carbonate rock formations as the result of the dissolution of rock by naturally occurring carbonic acid in rainwater migrating along bedding planes and fractures. As the rock is dissolved, solution features such as cavities and channels form beneath the surface. Occasionally, large cavities collapse producing a depression or sinkhole on the surface. Numerous sinkholes are apparent along the western and southern boundaries of the Installation.

5.1.3.4 Soil

As part of the Montgomery County and Pulaski County soil surveys, the SCS has prepared detailed maps and descriptions of the soil types underlying the MMA. There are 27 SCS soil types that underlie the MMA. The physical and chemical characteristics of the primary soil types (soil comprising 5 % of the soil at the MMA or greater) are summarized below (SCS, 1985a and 1985b).

Braddock Loam (2 to 30% slopes). Braddock soil comprises approximately 17% of the soils at the MMA and consists of soils situated on gentle to steep slopes on high terraces.

Reaction of Braddock soils ranges from very strongly to strongly acid. The organic matter content of this soil is moderately low and permeability is moderate. Available water capacity of the Braddock soil is moderate and surface runoff is medium. The Braddock soil does not have a seasonally high water table within 60 inches of the surface.

A typical profile of the Braddock soil consists of a 7-inch thick surface layer of dark yellowish brown loam underlain by a minimum 60-inch thick subsoil of yellowish-red clay and red clay. Depth to bedrock is greater than 60 inches.

Caneyville-Opequon-Rock Outcrop Complex (25 to 60% slopes). This complex comprises approximately 21% of the soils at the MMA in primarily undeveloped areas of the Installation. The Caneyville-Opequon-Rock Outcrop complex consists of approximately 30% Caneyville soils, 25% Opequon soils, 20% rock outcrop, and 25% other soils.

Reaction of the Caneyville soil ranges from strongly acid to neutral. Reaction of the Opequon soil ranges from medium acidic to mildly alkaline. The organic matter content is moderate for both soils with rapid surface runoff. Permeability is moderately slow in the Caneyville soil and moderately slow or moderate in the Opequon soil. Available water capacity is low in the Caneyville soil and very low in the Opequon soil.

A typical profile of the Caneyville soil consists of an 8-inch thick surface layer of brown silt loam underlain by a 24-inch thick subsoil of yellowish-red very plastic clay. Limestone bedrock is typically at a depth of 30 inches.

Generally, the typical Opequon soil profile consists of a 4-inch thick surface layer of brown silt, clay loam underlain by an 11-inch thick subsoil of yellowish-brown sticky and plastic clay. The substratum is olive brown, very shaly clay approximately 15 inches thick. This clay is sticky and plastic. Limestone bedrock is typically at a depth of 15 inches.

Unison-Urban Land Complex (2 to 25% slopes). This complex comprises approximately 32% of the soils at the MMA and occurs on side slopes and ridgetops. The unit consists of approximately 50% Unison soils, 25% Urban land, and 25% other soils.

Reaction of Unison soils ranges from strongly to medium acid. The organic matter content of this soil is low to moderate and permeability is moderate. Available water capacity of the Unison soil is moderate and surface runoff is medium. In disturbed areas, the above soil characteristics are extremely variable. A typical profile of the Unison soil in undisturbed areas consists of a 15-inch thick surface layer of dark brown and brown loam underlain by a 43-inch thick subsoil of yellowish-red sticky and plastic clay. The substratum is red sandy clay loam below a depth of approximately 58 inches. Depth to bedrock is greater than 60 inches. Urban land consists of soil covered by streets, parking lots, buildings, and other structures.

Wheeling Sandy Loam. This soil unit comprises approximately 9% of the soils of the MMA and consists of soils situated on nearly level terraces.

Reaction of the Wheeling soils ranges from strongly acid to medium acid. The organic matter content of this soil is moderately low and permeability is moderate. Available water capacity of the Wheeling soil is moderate and surface runoff is slow. The Wheeling soil does not have a seasonally high water table within 60 inches of the surface. A typical profile of the Wheeling soil consists of a 10-inch thick surface layer of dark brown sandy loam underlain by a 42-inch thick subsoil of dark brown sandy clay loam and sandy loam. The substratum is dark brown, gravelly sandy loam to minimum depth of 60 inches.

5.1.3.5 Hydrogeology

Hydrogeologic conditions at RFAAP are not well characterized. Groundwater is found in two types of aquifers: alluvium water table aquifer and bedrock aquifer. The alluvium aquifer occurs primarily within the flood plain areas adjacent to the New River. In these areas, groundwater flow may occur within alluvium present above bedrock at a depth of 15 to 25 ft below ground surface (bgs). A water table within thealluvium has been identified both in the MMA and horseshoe area.

Hydrogeological conditions of the bedrock aquifer at RFAAP are complex because of (1) the intense structural deformation of the bedrock units, and (2) the karst nature of the aquifer contained within limestone and dolostones underlying the Installation. Geologic mapping and photolineament studies at RFAAP have shown that there is a significant potential for movement of water through solution features such sinkholes and for preferential movement of water with karst conduits and along fractures or faults.

5.1.3.6 Hydrology

The New River is the most significant surface water feature within RFAAP. The Installation is built within and adjacent to a prominent meander loop of this river. Within RFAAP, the river width varies from 200 to 1,000 ft, but averages approximately 400 ft. The river flow varies due to water management at Claytor Dam, approximately 9 miles upgradient (south) from RFAAP. Downstream from the Claytor Dam, typical flows of the New River range between 3,200 and 8,000 million gallons per day. During typical flow conditions, the depth is approximately 4 to 6 ft; however, pools may be 10 ft deep. There are 13 miles of river shoreline within the RFAAP boundaries.

The headwaters of the New River are in northwestern North Carolina, near the Tennessee state border. In the RFAAP area, the New River flows northwesterly cutting cliffs through the bedrock. The path of the New River, which is generally perpendicular to the ridgelines of the Valley and Ridge province, indicates that the river existed prior to the Paleozoic folding of these rocks. In some areas, this river has eroded 4,000 ft of rock. During the Paleozoic, the erosion rate of the river was higher than the uplift rate of the rocks. This produced the entrenched river channel present today.

Stroubles Creek is the largest local tributary of the New River and flows through the southeast sector of RFAAP. Several branches that originate on and off the Installation feed this creek. Flow within Stroubles Creek and its tributaries consist primarily of storm water runoff. Groundwater discharging from the karst bedrock may also supply significant stream flow. Manmade, surface drainage ways at RFAAP also influence local surface water flow. The direction of surface drainage flow within RFAAP is ultimately toward the New River. Prior to entering the Installation, branches of Stroubles Creek flow through rural areas and the town of Blacksburg.

5.1.3.7 Vegetation

The Virginia Department of Game and Inland Fisheries (1999) conducted an Installation-wide biological survey at RFAAP. Eight community types were identified at RFAAP: bottomland forest, calcareous forest, cliffs, grasslands, oak forest, pine plantation, successional forest, and water. Tree species at RFAAP include the short leaf pine, loblolly pine, eastern white pine, yellow poplar, and black walnut. Grassland communities at RFAAP comprise 4,379 acres, or about 63 % of the 6,901-acre total. Plant species include but are not limited to fescues, sedges, flaxes, and milkweed.

The RFAAP MMA contains 13 acres of wetland habitat and 225 acres of deepwater habitat. The New River contains 3.5 acres of wetland habitat. This combined acreage amounts to 2 % of the total land area. A *Wetlands Inventory Report for Radford Army Ammunition Plant, Montgomery and Pulaski Counties, Virginia*, identifies dominant species in the wetland plant communities as Red Maple, Cattail, and Phragmites. Common Associates include Sycamore, Black Gum, Bluejoint, and Sedge. Other plants observed include Beak Rush, Bluegrass, Blue-joint, Canada Rush, Broom Sedge, Common Reed, Soft Rush, and Duckweed (U.S. Fish and Wildlife Service, 2002).

5.1.3.8 Beneficial Resources

RFAAP provides habitat for white-tailed deer, groundhogs, squirrels, raccoons, red fox, opossum, red-tailed hawk, opossum, shrew, voles, mice, and bats. A variety of reptiles and amphibians are common on the Installation.

The RFAAP property contains 2,240 buildings and structures, most of which are industrial structures built during the World War II era. In pursuance of the 1993 Programmatic Agreement (PA) arising from the Army's program to Cease Maintenance, Excess and Dispose (CEMED), a stipulated program of documentation of the RFAAP's World War II history and architectural-engineering complex was completed during 1995-1996. For the lifespan of the PA, 1993-1998, this documentation fulfilled the CEMED requirements with regard to the treatment of the RFAAP's World War II-period resources. The documentation also fulfilled the mitigation for ceasing maintenance of the structures identified for disposal at RFAAP (ICRMP, 2006).

A site-wide archeological survey has not been conducted at the Installation. Systematic archaeological surveys have been undertaken of a few selected tracts within RFAAP, and a number of known sites have been recorded. Based on available information and the large size of the RFAAP property, it is expected that many additional archaeological resources are present within the property, representing both the prehistoric and historic period (ICRMP, 2006).

5.1.3.9 Ecological Profile

Endangered plants and animals were not observed at RFAAP during the biological survey. Five state-listed rare plants were observed at RFAAP during the survey: *Clematis* coattails, *Cystoptris tennesseensis* (Tennessee bladder fern), *Hasteola suaveolens* (false Indian plaintain), *Sagittaria rigida (*sessile-fruited arrowhead), and *Eleocharis intermedia* (matted spikerush). State-threatened animals located at RFAAP include the invertebrate *Speyeria idalia (*regal fritillary butterfly) and the birds *Ammodramus henslowii* (Henslow's sparrow) and *Lanius ludovicianus (*loggerhead shrike).

Migratory waterfowl are found throughout the spring and winter near the New River because the Installation is on the Atlantic Flyway. Federally protected black vultures are present at RFAAP during certain times of the year. Public fishing occurs in the New River where it flows through RFAAP.

5.1.3.10 Security

Access to RFAAP is restricted through the use of manned checkpoints that limit access using gates and/or roadblocks on all roads leading into the Installation. The Installation is surrounded by a perimeter fence. Access to the Installation is restricted to Army personnel, authorized civilian personnel, contractors, and visitors. Security personnel routinely patrol the Installation by vehicle.

5.2 ARMY RESERVE SMALL ARMS RANGE

5.2.1 Area and Layout

The Army Reserve Small Arms Range is a 7.6-acre site located south of Constitution Road. The firing direction for this range was to the southeast. A firing berm is still present at the site.

5.2.2 Structures

A 1985 *Historic American Engineering Record* identified 1,230 buildings at RFAAP with 1,050 at the Radford site and 180 at the New River site (Mack and Hess, 1985). The structures present at this range include a berm that served as a backstop during firing and is located along the southeast side of the site. Two deteriorating baseball backstops are present.

5.2.3 Utilities

Telephone lines running parallel to Constitution Road are present at the site.

5.2.4 Boundaries

The land uses outside the boundaries of the Army Reserve Small Arms Range are described as follows:

• Western boundary:	RFAAP property
• Eastern boundary:	RFAAP property
• Northern boundary:	Constitution Road, RFAAP property
• Southern boundary:	Stroubles Creek, RFAAP installation boundary heavily forested

5.2.5 Security

The MRS is surrounded by an unlocked fenced, and is accessible to all authorized personnel and visitors that are allowed on the installation.

5.2.6 Physical Profile

The physical profile of the Army Reserve Small Arms Range is similar to that presented in Section 5.1.3 with the following site-specific details.

The topography of the site is relatively flat with Stroubles creek bordering the site on the west and south. The southern side of the MRS is a steep hillside directly south of Stroubles Creek. The crest of the hillside is estimated to be approximately 1,990 ft above msl. However, only a portion of the hillside is included in the MRS, as the estimated maximum height of impact to the hillside behind the stream is 20 ft based on the 10-foot high berm. Groundwater is present at depths of approximately 15 to 25 ft bgs.

5.3 LAND USE AND EXPOSURE PROFILE

5.3.1 Current Land Use/Activities

The Army Reserve Small Arms Range is a grassy field and is periodically used for helicopter landings.

5.3.2 Current Human Receptors

Current human receptors include RFAAP military personnel, civilian contractors, and trespassers at RFAAP.

5.3.3 Potential Future Land Use

Potential future land use is expected to be consistent with current land use as an active military Installation.

5.3.4 Potential Future Human Receptors

Potential future human receptors are the same as current human receptors.

5.3.5 Zoning/Land Use Restrictions

RFAAP and the Army Reserve Small Arms Range are reserved for military uses. A grassed baseball field now occupies the site of the former training range.

5.4 MUNITIONS/RELEASE PROFILE

5.4.1 Munitions Types and Release Mechanisms

Table 5-2 summarizes the types of munitions that may potentially exist at the site based on information obtained during the SSP and HRR. Munitions at Army Reserve Small Arms Range are limited to small arms ammunition associated with training on rifles or other small arms. The typical release mechanisms are intentional activities, such as firing into a target area, and unintentional activities, such as rounds fired falling outside the target area or rounds discarded for various reasons.

Table 5-2: Summary of Potential Munitions Types

MMRP Site	Potential Munitions	Primary Release Mechanism
Army Reserve Small Arms Range	Small arms, rifle firing	Firing range training

5.4.2 Maximum Probable Penetration Depth

According to the *Characterization and Remediation of Soils at Closed Small Arms Range, Technical/ Regulatory Guidelines* (ITRC, 2003b), the penetration depths of small arms projectiles into the impact berm can be over 1 foot, depending primarily on the soil composition of the berm. Penetration into the range floor tends to be much shallower, with projectiles typically found lying on the surface or within the top 6 inches of soil. MC components, such as spent shell casings and residual smokeless powder constituents, are expected to have been directly deposited on the soil surface.

5.4.3 MEC Density

MEC presence is not expected at the Army Reserve Small Arms Range due to its singular use as a small arms training site.

5.4.4 Munitions Debris/Fragments

No munitions debris or fragment-producing munitions were identified for the Army Reserve Small Arms Range.

5.4.5 Associated Munitions Constituents

Lead is the primary potential constituent of concern at small arms ranges. There are other potential MC associated with small arms and blanks which include copper (Cu), zinc (Zn), antimony (Sb), and constituents associated with smokeless powder [nitrocellulose, dinitrotoluene (DNT), phenylamines, tin (Sn), bismuth (Bi), lead (Pb), potassium nitrate, potassium sulfate] . However, 90-99% of small arms projectiles, (the bullet that goes down range when a munition is fired) are comprised of lead. Lead also constitutes the greatest potential risk due to its toxicity. Other potential constituents are not likely to be of concern since they are present in negligible quantities/concentrations in the ammunition and are typically consumed when the item is fired. In summary, if lead is not identified as a constituent at a small arms range MRS, the same conclusion can be reached for the other more minor constituents.

5.4.6 Transport Mechanisms/Migration Routes

The primary transport mechanisms identified for the Army Reserve Small Arms Range include the following:

> ***Erosion:*** *The Army Reserve Small Arms Range is vegetated and erosional forces (e.g., heavy rains) may transport soil to a small degree. Wind is considered an insignificant cause of soil erosion.*
>
> ***Soil Disturbance:*** *Surface and subsurface soil disturbance can cause the transport and migration of MC from one environmental medium to another (soil to surface or groundwater or both) through surface water runoff and erosion. Since there has been no development of the Army Reserve Small Arms Range, the potential for soil disturbance is very low.*
>
> ***Infiltration:*** *Based on the soil types present in the Army Reserve Small Arms Range, the potential for MC to migrate from surface soil to subsurface soil and to groundwater via infiltration exists.*

5.5 PATHWAY ANALYSIS

5.5.1 MEC

A MEC pathway analysis was not prepared for the Army Reserve Small Arms Range because MEC is not expected to be present.

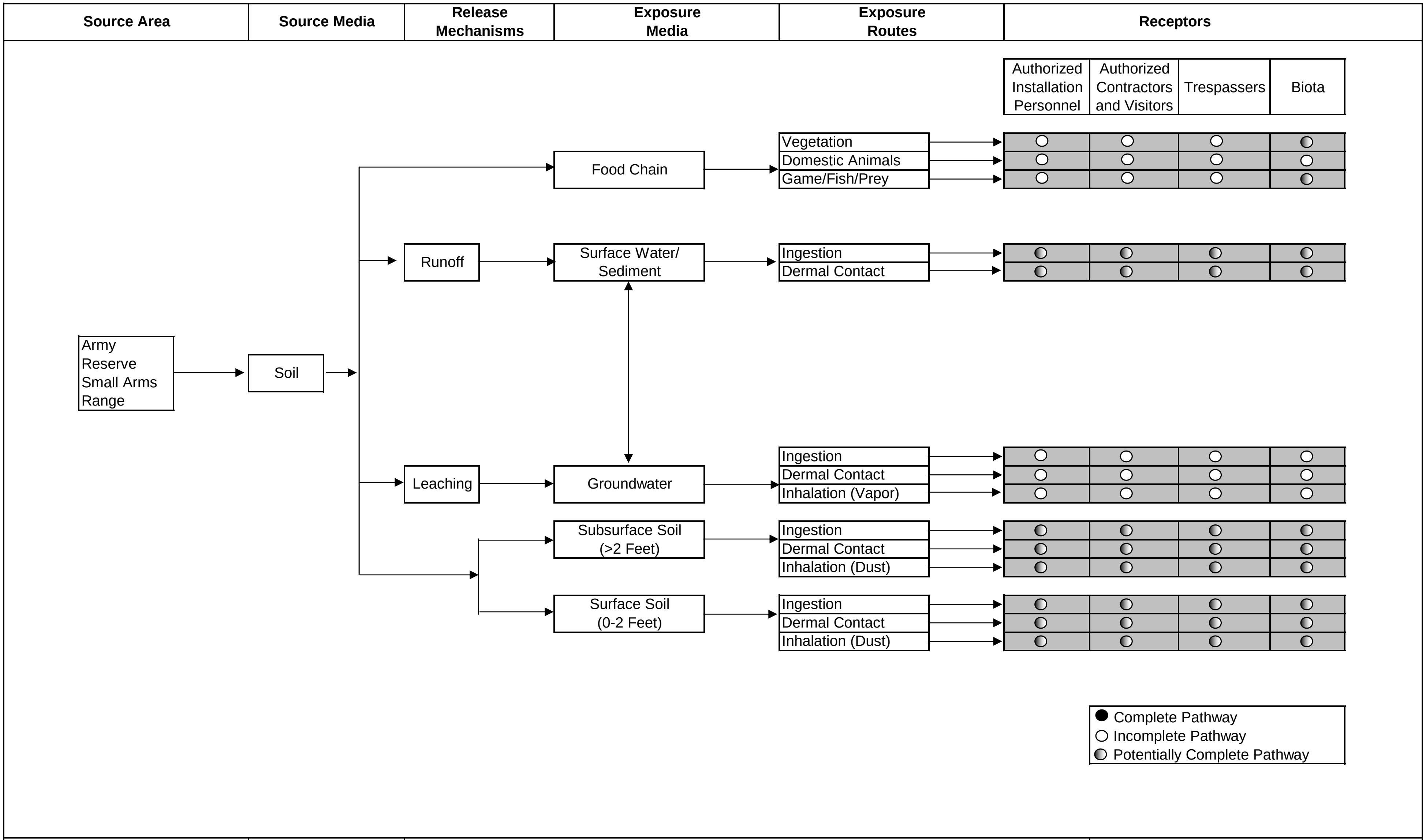
5.5.2 MC

An MC pathway analysis was prepared for the Army Reserve Small Arms Range (Figure 5–1). Biota is the only receptor expected to ingest vegetation at this site. Crops are not grown, and domestic animals are not raised at the site. Biota has potentially complete pathways for contact with vegetation affected with MC. All other pathways for vegetation in the food chain are expected to be incomplete.

The pathways between game/fish/prey and Installation personnel, contractors, and visitors are incomplete because hunting is not allowed in this area, and the only water body at the site does not support fishing. Biota has potentially complete pathways through the potential ingestion of prey that may have fed on site vegetation affected with MC.

Potentially complete pathways for ingestion and dermal contact exist between surface water/sediment and all receptors at this site because there is a potential for erosion to enable the migration of MC to Stroubles Creek located along the western and eastern boundary of the site.

The groundwater ingestion exposure route is incomplete because there are no groundwater supply wells at the site. Potentially complete pathways for all exposure routes for both surface and subsurface soil exist for all receptors. Given the current use of the site, the potential for soil disturbance to occur exists which may expose subsurface soils. Also, the subsurface pathway would be potentially complete for biota because they may nest or burrow at this site.



Exposure Media	Exposure Routes	Authorized Installation Personnel	Authorized Contractors and Visitors	Trespassers	Biota
Food Chain	Vegetation	○	○	○	◐
	Domestic Animals	○	○	○	○
	Game/Fish/Prey	○	○	○	◐
Surface Water/ Sediment	Ingestion	◐	◐	◐	◐
	Dermal Contact	◐	◐	◐	◐
Groundwater	Ingestion	○	○	○	○
	Dermal Contact	○	○	○	○
	Inhalation (Vapor)	○	○	○	○
Subsurface Soil (>2 Feet)	Ingestion	◐	◐	◐	◐
	Dermal Contact	◐	◐	◐	◐
	Inhalation (Dust)	◐	◐	◐	◐
Surface Soil (0-2 Feet)	Ingestion	◐	◐	◐	◐
	Dermal Contact	◐	◐	◐	◐
	Inhalation (Dust)	◐	◐	◐	◐

● Complete Pathway
○ Incomplete Pathway
◐ Potentially Complete Pathway

URS

Prepared for: USACE

Historical Records Review

MC Exposure Pathway Analysis
Army Reserve Small Arms Range

URS Corporation

Figure 5-1
9/10/2007

6.0 MUNITIONS RESPONSE SITE PRIORITIZATION PROTOCOL RESULTS

MRSPP ranking was completed for the Army Reserve Small Arms Range based on information obtained during the HRR, SSP field sampling, and previously completed investigations. MRSPP priority rankings are used by the DoD to prioritize sites for further action. In general, the lower the numerical ranking, the higher priority the site is given. In compliance with 32 CFR §179.5, the MRSPP score for the MRS is considered interim pending stakeholder input. MRSPP worksheets are included as Appendix A, and Table 6-1 summarizes the MRSPP priority ranking for Army Reserve Small Arms Range.

Table 6-1: Summary of MRSPP Priority Ranking

MRS Name	AEDB-R Number	Priority Ranking
Army Reserve Small Arms Range	RFAAP-001-R-01	7

7.0 CONCLUSIONS AND RECOMMENDATION FOR FUTURE ACTION

The *CTT Range Inventory Report* identified three potential MRSs at RFAAP: Army Reserve Small Arms Range, Northern Burning Grounds, and Western Burning Grounds. However, the CTT inventory found that the Northern and Western Burning Grounds are evaluated under RFAAP's IRP. Therefore, the *HRR Report* addressed the Army Reserve Small Arms Range, which is the only site eligible for investigation under the MMRP. Table 7-1 summarizes the RFAAP site that was evaluated in the SSP and Figure 7-1 shows the location of this site.

Table 7-1: Summary of RFAAP MRS Evaluated for the SSP

Site Name	AEDB-R* Number	CTT vs. HRR Acreage	Comments
Army Reserve Small Arms Range	RFAAP-001-R-01	3/7.6	Active Army MMRP eligible. Historical research indicates that the past use of small arms firing at this site suggests a potential for MC to be present. There is no evidence of MEC at the site. Acreage was revised during the HRR based on site data and aerial photographs.

An SSP has been completed for the Army Reserve Small Arms Range following the USEPA approved SSP process for RFAAP (USEPA, 2001a). The SSP included sampling of soil to evaluate releases to the environment and completion of pre-remedial human health and ecological risk screening elements outlined in the SSP guidance. The sections below summarize the human health risk screening, ecological risk screening, and the MMRP recommendation for action.

7.1 HUMAN HEALTH RISK SCREENING

The risk-based and migration from soil-to-groundwater Tier 1 screening identified the following soil COPCs: antimony, arsenic, and lead. For the background comparison, arsenic and lead concentrations were above their background point estimates. However, a background point estimate was not available for antimony. The lead modeling result (2.9%) was below the established USEPA threshold of 5% for the hypothetical child resident.

The cancer results of the Tier 2 cumulative screening-level assessment indicate that the residential and industrial scenarios (MDC- and EPC-based results) are above the established SSP cancer threshold (1E-05) for soil due to arsenic.

The non-cancer results of the Tier 2 cumulative screening-level assessment indicate that the residential scenario hazard estimates are above the established SSP threshold (HI=0.5 for any target organ). The target organ-specific HIs above the threshold include the following:

- Residential MDC-based cumulative screening: blood (antimony) and skin and vascular system (arsenic); and
- Residential EPC-based cumulative screening: skin and vascular system (arsenic).

The Tier 2 industrial worker scenario non-cancer hazard estimates (both MDC- and EPC-based) were below the threshold of 0.5.

7.2 ECOLOGICAL RISK SCREENING

A SLERA was performed at Army Reserve Small Arms Range as part of the SSP. COPECs identified in soil at Army Reserve Small Arms Range for preliminary ecological risk estimates are the following:

- Terrestrial plant COPECs with refined HQs greater than 1 included: antimony, arsenic, chromium, and lead. Soil invertebrates and microbial processes COPECs with a refined HQ greater than 1 included chromium. However, chromium concentrations were below background point estimates therefore, chromium is not considered site-related.
- The refined risk characterization for wildlife resulted in the identification of lead for the American robin with a LOAEL-based HQ greater than 1.

After consideration of spatial distribution of data at site, the results of the SLERA, background concentrations, and the nature of the site, the SMDP is the following: *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.*

7.3 RECOMMENDATION FOR ACTION

Based on the results of the SSP evaluation which includes a supplemental HHRA and SLERA, further action is recommended at Army Reserve Small Arms Range MRS.

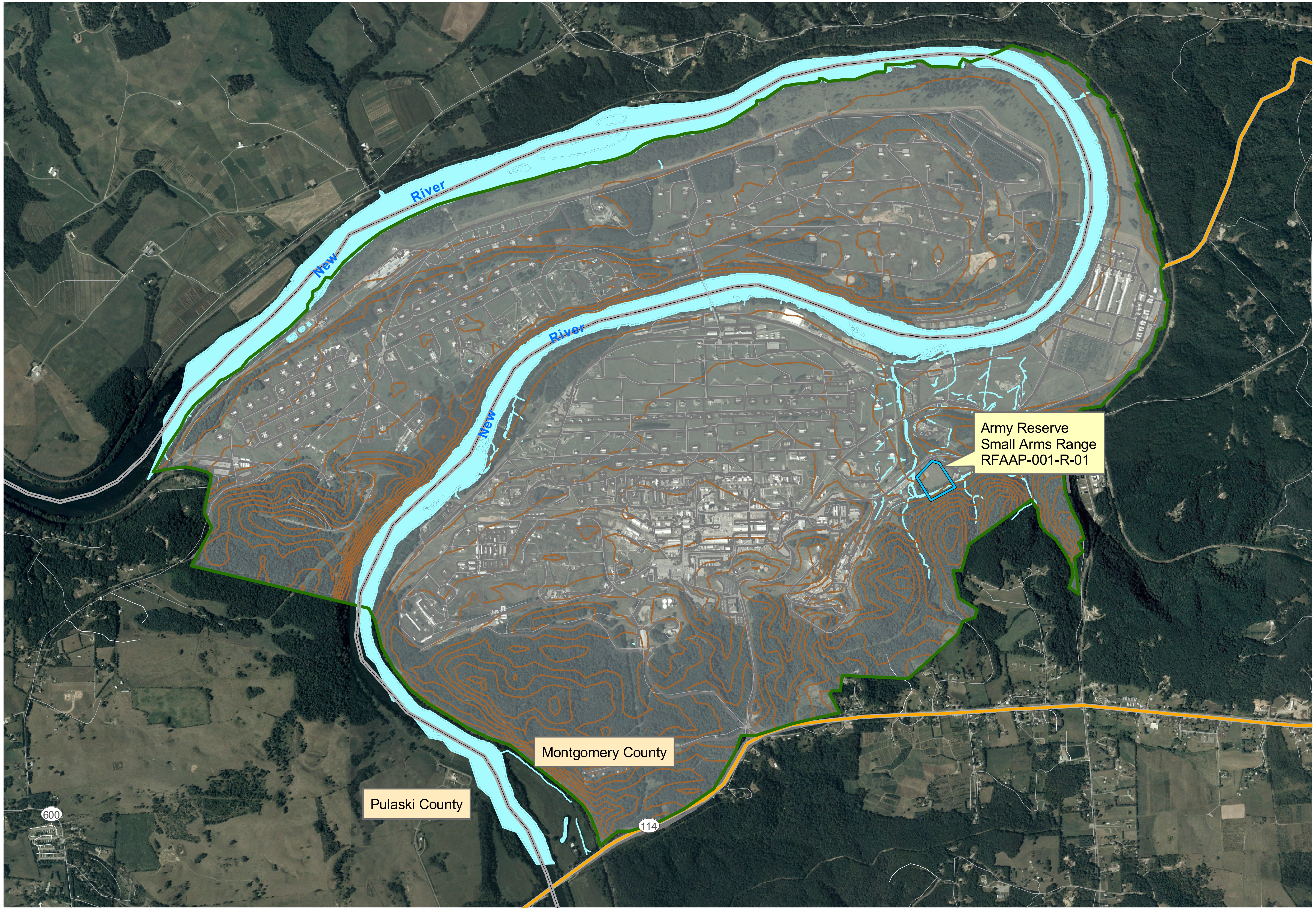
A summary of SSP findings and recommendations for the Army Reserve Small Arms Range is presented in Table 7-2. Since the Army Reserve Small Arms Range was only used for small arms training, NFA is recommended for MEC, as approved during the TPP2 meeting. Soil samples collected during the SSP indicated that lead, arsenic and antimony concentrations at the site are above the USEPA residential and industrial screening criterion, thus an RFI is recommended for MC. The Army Reserve Small Arms Range MRS received an initial MRSPP score of 7.

Table 7-2: Summary of SSP Findings and Recommendations

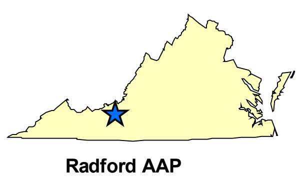
MRS (AEDB-R No.)	Acreage CTT/HRR/SSP	MRSPP Priority	Recommendations		Basis for Recommendation	
			MEC	MC	MEC	MC
Army Reserve Small Arms Range (RFAAP-001-R-01)	3/7.6/7.6	7	NFA	RFI	MEC not likely to be present; site was used only for small arms training.	Detected lead concentrations in the former berm were above screening criterion. Detected arsenic concentrations in the hillside were above screening criterion and facility wide background.

Main Manufacturing Area, RFAAP, VA
Army Reserve Small Arms Range MRS

URS
200 Orchard Ridge Drive
Gaithersburg, MD 20878



Installation Location



Legend

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

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

N
W E
S

1:25,000

0 250 500 Meters

0 1,000 2,000 Feet

File: G:\Projects\MMRP\Radford\Projects\Radford_7-1.mxd
Date: 12/3/2008
Created: KJM
Checked: SG
Senior: SG

Figure 7-1
MRS Boundary
AEDB-R Map
RFAAP, VA

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APPENDIX A

MRSPP WORKSHEETS

MRSPP Summary

Radford Army Ammunition Plant, Virginia

Munitions Response Site (MRS)	Module Priority Scores			**Overall Priority**
	Explosive Hazard Evaluation	Chemical Hazard Evaluation	Human Hazard Evaluation	
Army Reserve Small Arms Range (RFAAP-001-R-01)	No Known or Suspected Explosive Hazard	No Known or Suspected CWM Hazard	7	**7**

Preparer's Name: Sarah M. Gettier
Preparer's Organization: URS Corporation
Date Site Scored: 13-Jan-09

Table A

MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the **MRS Summary**, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental nonmunitions-related contaminants (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible, include a map of the MRS.

Munitions Response Site Name:	**Army Reserve Small Arms Area (RFAAP-001-R-01) : MRS Priority = 7**
Component:	US Army
Installation/Property Name:	**Radford Army Ammunition Plant**
Location (City, County, State):	Montgomery County, Virginia
Site Name/Project Name (Project No.):	MMRP SI (GS-10F-0105K Work Order W912DR-06-C-0028)

Date Information Entered/Updated:	26-Nov-2008
Point of Contact (Name/Phone):	Mr. Jim McKenna

Project Phase ("X" only one):		**PA**	X	**SI**		**RI**		**FS**		**RD**
		RA-C		**RIP**		**RA-O**		**RC**		**LTM**

Media Evaluated ("X" all that apply):		**Groundwater**		**Sediment (human receptor)**
	X	**Surface soil**		**Surface water (ecological receptor)**
		Sediment (ecological receptor)		**Surface water (human receptor)**

MRS Summary: The Army Reserve Small Arms Range MRS is a small arms firing range and is approximately 7.6 acres in size.

MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM, or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type:

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, as stated in Section 4.1, the range was used by both the National Guard and the Army Reserve for .30 caliber firing with M1s and M14s. The berm (200' by 10') is still present and the direction of fire was southeast. Interviews conducted during the HRR determined that the range was used for small arms training and that the targets were approximately 100 meters from the firing points and there were approximately 10 to 15 stations.

Description of Pathways for Human and Ecological Receptors:

As discussed in Section 4.1 (SSP Report), the SSP has confirmed presence of MC. Potential contact with MC includes ingestion, dermal contact, and inhalation contact with surface soil. MEC is not expected at this site; small arms are not MEC.

Description of Receptors (Human and Ecological):

Potential human receptors include authorized Installation Personnel, contractors, trespassers, and visitors. Ecological receptors include birds, terrestrial small mammals, invertebrates, and various plant species.

Table 1
EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Annotate the score(s) that correspond with **all** munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions*, *small arms ammunition*, *physical evidence*, and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Possible Score	Score
Sensitive	♦ UXO that are considered most likely to function upon any interaction with exposed persons (e.g., submunitions, 40mm high-explosive [HE] grenades, white phosphorous [WP] munitions, high-explosive antitank [HEAT] munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions). ♦ Hand grenades containing energetic filler. ♦ Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazard.	30	
High explosive (used or damaged)	♦ UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ♦ DMM containing a high-explosive filler that have: ■ Been damaged by burning or detonation ■ Deteriorated to the point of instability.	25	
Pyrotechnic (used or damaged)	♦ UXO containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). ♦ DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have: ■ Been damaged by burning or detonation ■ Deteriorated to the point of instability.	20	
High explosive (unused)	♦ DMM containing a high-explosive filler that have not been damaged by burning or detonation, or are not deteriorated to the point of instability.	15	
Propellant	♦ UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ♦ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are: ■ Damaged by burning or detonation ■ Dteriorated to the point of instability.	15	
Bulk secondary high explosives, pyrotechnics, or propellant	♦ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ♦ DMM that are bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard.	10	
Pyrotechnic (not used or damaged)	♦ DMM containing a pyrotechnic filler (i.e. red phosphorous), other than white phosphorous filler, that have not been damaged by burning or detonation, or are not deteriorated to the point of instability.	10	
Practice	♦ UXO that are practice munitions that are not associated with a sensitive fuze. ♦ DMM that are practice munitions that are not associated with a sensitive fuze and that have not: ■ Been damaged by burning or detonation ■ Deteriorated to the point of instability.	5	
Riot control	♦ UXO or DMM containing a riot control agent filler (e.g., tear gas).	3	
Small arms	♦ Used munitions or DMM that are categorized as small arms ammunition [Physical evidence or historical evidence that no other types of munitions [e.g., grenades, subcaliber training rockets, demolition charges] were used or are present on the MRS is required for selection of this category.].	2	2
Evidence of no munitions	♦ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0	0
MUNITIONS TYPE	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).		**2**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space provided.

A score of 2 is selected because this site was used historically for small arms training. As indicated in Section 4.2, of the HRR, the Army Reserve Small Arms Rangewas likely used for training with .30-caliber munitions by Army Reserve and National Guard personnel. Evidence of no munitions was chosen because there was no evidence of UXO or DMM present during the SSP field investigation.

Table 2

EHE Module: Source of Hazard Data Element Table

DIRECTIONS: Below are 11 classifications describing sources of explosive hazards. Annotate the score(s) that correspond with **all** sources of explosive hazards known or suspected to be present at the MRS.

Note: The terms *former range*, *practice munitions*, *small arms range*, *physical evidence*, and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Possible Score	Score
Former range	♦ The MRS is a former military range where munitions (including practice munitions with sensitive fuzes) have been used. Such areas include: impact or target areas and associated buffer and safety zones.	10	
Former munitions treatment (i.e. OB/OD) unit	♦ The MRS is a location where UXO or DMM (e.g., munitions, bulk explosives, bulk pyrotechnic, or bulk propellants) were burned or detonated for the purpose of treatment prior to disposal.	8	
Former practice munitions range	♦ The MRS is a former military range on which only practice munitions without sensitive fuzes were used.	6	
Former maneuver area	♦ The MRS is a former maneuver area where no munitions other than flares, simulators, smokes, and blanks were used. There must be evidence that no other munitions were used at the location to place an MRS into this category.	5	
Former burial pit or other disposal area	♦ The MRS is a location where DMM were buried or disposed of (e.g., disposed of into a water body) without prior thermal treatment.	5	
Former industrial operating facilities	♦ The MRS is a location that is a former munitions maintenance, manufacturing, or demilitarization facility.	4	
Former firing points	♦ The MRS is a firing point, where the firing point is delineated as an MRS separate from the rest of a former military range.	4	
Former missile or air defense artillery emplacements	♦ The MRS is a former missile defense or air defense artillery (ADA) emplacement not associated with a military range.	2	
Former storage or transfer points	♦ The MRS is a location where munitions were stored or handled for transfer between different modes of transportation (e.g., rail to truck, truck to weapon system).	2	
Former small arms range	♦ The MRS is a former military range where only small arms ammunition was used (There must be evidence that no other types of munitions [e.g., grenades] were used or are present to place an MRS iinto this category.)	1	1
Evidence of no munitions	♦ Following investigation of the MRS, there is physical evidence that no UXO or DMM are present, or there is historical evidence indicating that no UXO or DMM are present.	0	0
SOURCE OF HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).		**1**

DIRECTIONS: Document any MRS-specific data used in selecting the **Source of Hazard** classifications in the space provided.

As described in Section 4.2 of the HRR, the Army Reserve Small Arms Range was used as a small arms range and justifies a score a 1. Evidence of no munitions was chosen because there was no evidence of UXO or DMM present during the SSP field investigation.

Table 3
EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Annotate the score(s) that correspond with **all** locations where munitions are located or suspected of being found at the MRS.

Note: The terms *confirmed, surface*, *subsurface, small arms ammunition, physical evidence*, and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Possible Score	Score
Confirmed surface	♦ Physical evidence indicates that there are UXO or DMM on the surface of the MRS. ♦ Historical evidence (i.e., a confirmed incident report such as an explosive ordnance disposal [EOD], police, or fire department report that an incident or accident that invovled UXO or DMM occured) indicates there are UXO or DMM on the surface of the MRS.	25	
Confirmed subsurface, active	♦ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS; and, the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM. ♦ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS; and, the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM.	20	
Confirmed subsurface, stable	♦ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS; and, the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed. ♦ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS; and, the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed.	15	
Suspected (physical evidence)	♦ There is physical evidence (e.g., munitions debris such as fragments, penetrators, projectiles, shell casings, links, fins), other than the documented presence of UXO or DMM, indicating that UXO or DMM may be present at the MRS.	10	
Suspected (historical evidence)	♦ There is historical evidence indicating that UXO or DMM may be present at the MRS.	5	
Subsurface, physical constraint	♦ There is physical or historical evidence indicating that UXO or DMM may be present in the subsurface, but there is a physical constraint (e.g., pavement, water depth over 120 feet) preventing direct access to the UXO or DMM.	2	
Small arms (regardless of location)	♦ The presence of small arms ammunition is confirmed or suspected, regardless of other factors such as geological stability. (There must be evidence that no other types of munitions [e.g., grenades] were used or are present at the MRS to place an MRS into this category.)	1	1
Evidence of no munitions	♦ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0	0
LOCATION OF MUNITIONS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 25).		**1**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Location of Munitions*** classifications in the space provided.

As described in Section 4.2 of the HRR, the Army Reserve Small Arms Range was used as a small arms range and justifies a score a 1. Evidence of no munitions was chosen because there was no evidence of UXO or DMM present during the SI field investigation.

Table 4

EHE Module: Ease of Access Data Element Table

DIRECTIONS: Below are four classifications of barrier types that can surround an MRS and their descriptions. The barrier type is directly related to the ease of public access to the MRS. Annotate the score that corresponds with the ease of access to the MRS.

Note: The term *barrier* is defined in Appendix C of the Primer.

Classification	Description	Possible Score	Score
No barrier	♦ There is no barrier preventing access to any part of the MRS (i.e. all parts of the MRS are accessible).	10	
Barrier to MRS access is incomplete	♦ There is a barrier preventing access to parts of the MRS, but not the entire MRS.	8	8
Barrier to MRS access is complete but not monitored	♦ There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5	
Barrier to MRS access is complete and monitored	♦ There is a barrier preventing access to all parts of the MRS, and there is active, continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0	
EASE OF ACCESS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).		**8**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ease of Access*** classification in the space provided.

As per section 5.1.3.10 of this SSP report, the Army Reserve Small Arms Range is surrounded by an unlocked fenced, and is accessible to all authorized personnel and visitors that are allowed on the installation. Access to the installation is limited by a guarded main security gate.

Table 5

EHE Module: Status of Property Data Element Table

DIRECTIONS: Below are three classifications of the status of a property within the Department of Defense (DoD) and their descriptions. Annotate the score that corresponds with the status of property at the MRS.

Classification	Description	Possible Score	Score
Non-DoD control	♦ The MRS is at a location that is no longer owned by, leased to, or otherwise possessed or used by DoD. Examples are privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and, land or water bodies managed by other federal agencies.	5	
	♦ The MRS is at a location that is owned by DoD, but that DoD has leased to another entity and for which DoD does not control access 24 hours per day.		
Scheduled for transfer from DoD control	♦ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD, and DoD plans to transfer that land or water body to the control of another entity (e.g., a state, tribal, or local government; a private party; another federal agency) within 3 years from the date the Protocol is applied.	3	
DoD control	♦ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year.	0	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).		**0**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Status of Property*** classification in the space provided.

As indicated in Section 5.3.3 of the SSP Report, the Army Reserve Small Arms Range MRS is owned by DoD and is expected to continue to be active military.

Table 6
EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications of population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Annotate the most appropriate score.

Note: Use the U.S. Census Bureau tract data available to capture the **highest** population density within a two-mile radius of the perimeter of the MRS.

Classification	Description	Possible Score	Score
> 500 persons per square mile	♦ There are more than 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	5	
100 - 500 persons per square mile	♦ There are 100 to 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	3	3
< 100 persons per square mile	♦ There are fewer than 100 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	1	
POPULATION DENSITY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).		**3**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Density*** classification in the space provided.

Montgomery County, Virginia 2000 census data: 215.5 persons/sq mile. Source: U.S. Census Bureau, Census 2000. www.FedStats.gov

Table 7
EHE Module: Population Near Hazard Data Element Table

DIRECTIONS: Below are six classifications describing the number of inhabited structures near the MRS. The number of inhabited buildings relates to the potential population near the hazard. Determine the number of inhabited structures within two miles of the MRS boundary and annotate the score that corresponds with the number of inhabited structures.

Note: The term *inhabited structures* is defined in Appendix C of the Primer.

Classification	Description	Possible Score	Score
26 or more inhabited structures	♦ There are 26 or more inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	5	5
16 to 25 inhabited structures	♦ There are 16 to 25 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	4	
11 to 15 inhabited structures	♦ There are 11 to 15 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	3	
6 to 10 inhabited structures	♦ There are 6 to 10 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	2	
1 to 5 inhabited structures	♦ There are 1 to 5 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	1	
0 inhabited structures	♦ There are no inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	0	
POPULATION NEAR HAZARI	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).		**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Near Hazard*** classification in the space provided.

Aerial photographs (source: 2005 USDA-NAIP Aerial Photograph) of the area indicate suburban areas are present within a 2 mile radius of the MRS.

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures and their descriptions. Review the types of activities that occur and/or structures that are present within two miles of the MRS and annotate the score(s) that correspond with **all** the activities/structure classifications at the MRS.

Note: The term *inhabited structures* is defined in Appendix C of the Primer.

Classification	Description	Possible Score	Score
Residential, educational, commercial, or subsistence	♦ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with any of the following purposes: residential, educational, child care, critical assets (e.g., hospitals, fire and rescue, police stations, dams), hotels, commercial, shopping centers, playgrounds, community gathering areas, religious sites, or sites used for subsistence hunting, fishing, and gathering.	5	5
Parks and recreational areas	♦ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with parks, nature preserves, or other recreational uses.	4	4
Agricultural, forestry	♦ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with agriculture or forestry.	3	3
Industrial or warehousing	♦ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with industrial activities or warehousing.	2	2
No known or recurring activities	♦ There are no known or recurring activities occurring up to two miles from the MRS's boundary or within the MRS's boundary.	1	
TYPES OF ACTIVITIES/STRUCTURES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).		**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Types of Activities/Structures*** classifications in the space provided.

As per section 5.2.2 of the SSP report, the former small arms range contains structures that include a berm that served as a backstop during firing and is located along the southeast side of the site. Two deteriorating baseball backstops are present. Suburban residential areas exist within a 2 mile radius of the MRS. Aerial photographs (source: 2005 USDA-NAIP Aerial Photograph) of the area indicate that agricultural and industrial areas are also present within a 2 mile radius of the MRS.

Table 9

EHE Module: Ecological and/or Cultural Resources Data Element Table

DIRECTIONS: Below are four classifications of ecological and/or cultural resources and their descriptions. Review the types of resources present and annotate the score that corresponds with the ecological and/or cultural resources present on the MRS.

Note: The terms *ecological resources* and *cultural resources* are defined in Appendix C of the Primer.

Classification	Description	Possible Score	Score
Ecological and cultural resources present	There are both ecological and cultural resources present on the MRS.	5	
Ecological resources present	There are ecological resources present on the MRS.	3	
Cultural resources present	There are cultural resources present on the MRS.	3	
No ecological or cultural resources present	There are no ecological resources or cultural resources present on the MRS.	0	0
ECOLOGICAL AND/OR CULTURAL RESOURCES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).		**0**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ecological and/or Cultural Resources*** classification in the space provided.

As per section 5.1.3 of the HRR. The Army Reserve Small Arms Range occupies a 7.6-acre area on the southeastern boundary of the RFAAP installation. On its own, the Army Reserve Small Arms Range does not provide habitat that is more attractive than other, more remote locations at the installation.

Table 10

Determining the EHE Module Rating

DIRECTIONS:

1. From Tables 01 - 09, record the data element scores in the **Score** boxes to the right.

2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.

3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.

4. Circle the appropriate range for the **EHE Module Total** below.

5. Circle the **EHE Module Rating** that corresponds to the range selected and record this value in the **EHE Module Rating** box found at the bottom of this table.

NOTE: An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	**Score**	**Value**
Explosive Hazard Factor Data Elements			
Munitions Type	Table 1	2	3
Source of Hazard	Table 2	1	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	1	9
Ease of Access	Table 4	8	
Status of Property	Table 5	0	
Receptor Factor Data Elements			
Population Density	Table 6	3	13
Population Near Hazard	Table 7	5	
Types of Activities/Structures	Table 8	5	
Ecological and/or Cultural Resources	Table 9	0	
		EHE MODULE TOTAL	**25**

EHE Module Total	**EHE Module Rating**
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	[✓ No Known or Suspected Explosive Hazard]
EHE MODULE RATING	**No Known or Suspected Explosive Hazard***

*As per Army Guidance, if the site is a small arms range and the score is less than 38, the final score for the EHE module rating is "No Known or Suspected Explosive Hazard'

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Annotate the score(s) that correspond to **all** CWM configurations known or suspected to be present at the MRS.

Note: The terms *CWM/UXO*, *CWM/DMM*, *physical evidence*, and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Possible Score	Score
CWM, that are either UXO, or explosively configured, damaged DMM	The CWM known or suspected of being present at the MRS are: ♦ CWM that are UXO (i.e. CWM/UXO) ♦ Explosively configured CWM that are DMM (i.e. CWM/DMM) that have been damaged.	30	
CWM mixed with UXO	♦ The CWM known or suspected of being present at the MRS are undamaged CWM/DMM or CWM not configured as a munition that are commingled with conventional munitions that are UXO.	25	
CWM, explosive configuration that are undamaged DMM	♦ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20	
CWM/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS are: ♦ Nonexplosively configured CWM/DMM either damaged or undamaged ♦ Bulk CWM (e.g., ton container).	15	
CAIS K941 and CAIS K942	♦ The CWM/DMM known or suspected of being present at the MRS is CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12	
CAIS (chemical agent identification sets)	♦ CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10	
Evidence of no CWM	♦ Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	0	0
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).		**0**

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space provided.

The historical data indicate that only small arms were used at this site. There is no evidence that CWM exists at this site.

Tables 12 through 19 are intentionally omitted according to Active-Army Guidance because there is evidence of no CWM at this MRS.

Table 20

Determining the CHE Module Rating

		Source	Score	Value
DIRECTIONS:	**CWM Hazard Factor Data Elements**			
	CWM Configuration	Table 11	0	
1. From Tables 11 - 19, record the data element scores in the **Score** boxes to the right.	Sources of CWM	Table 12	0	
	Accessibility Factor Data Elements			
	Location of CWM	Table 13	0	
	Ease of Access	Table 14	0	
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.	Status of Property	Table 15	0	
	Receptor Factor Data Elements			
	Population Density	Table 16	0	
	Population Near Hazard	Table 17	0	
3. Add the three **Value** boxes and record this number in the **CHE Module Total** box below.	Types of Activities/Structures	Table 18	0	
	Ecological and/or Cultural Resources	Table 19	0	
	CHE MODULE TOTAL			

	CHE Module Total	**CHE Module Rating**
4. Circle the appropriate range for the **CHE Module Total** below.	92 to 100	A
	82 to 91	B
	71 to 81	C
	60 to 70	D
5. Circle the **CHE Module Rating** that corresponds to the range selected and record this value in the **CHE Module Rating** box found at the bottom of this table.	48 to 59	E
	38 to 47	F
	less than 38	G
NOTE: An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.	Alternative Module Ratings	Evaluation Pending No Longer Required [✓ No Known or Suspected CWM Hazard]
	CHE MODULE RATING	**No Known or Suspected CWM Hazard**

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's groundwater and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional groundwater contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Contaminant [CAS No.]	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
		Total from Table 27	
		Sum the Ratios	

CHF Scale	**CHF Value**
CHF > 100	**H (High)**
100 > CHF >2	**M (Medium)**
2 > CHF	**L (Low)**

CHF = $\sum$ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Annotate the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to geological structures or physical controls).	L

MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Annotate the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only).	L

RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Place an "X" in the box to the right if there is no known or suspected Groundwater MC Hazard	**X**

Table 22

HHE Module: Surface Water - Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional surface water contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard with human endpoints present in the surface water, select the box at the bottom of the table.

Contaminant [CAS No.]	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
		Total from Table 27	
		Sum the Ratios	

CHF Scale	CHF Value
CHF > 100	H (High)
100 > CHF >2	M (Medium)
2 > CHF	L (Low)

CHF = ∑ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Annotate the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L

MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Annotate the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L

RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Place an "X" in the box to the right if there is no known or suspected Surface Water (Human Endpoint) MC Hazard	**X**

Table 23

HHE Module: Sediment - Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's sediment and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional sediment contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant [CAS No.]	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
		Total from Table 27	
		Sum the Ratios	

CHF Scale	**CHF Value**	
CHF > 100	**H (High)**	
100 > CHF >2	**M (Medium)**	**CHF = ∑ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])**
2 > CHF	**L (Low)**	

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Annotate the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	**Description**	**Value**
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Annotate the value that corresponds most closely to the sediment receptors at the MRS.

Classification	**Description**	**Value**
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Place an "X" in the box to the right if there is no known or suspected Sediment (Human Endpoint) MC Hazard	**X**

Table 24

HHE Module: Surface Water - Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional surface water contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the surface water, select the box at the bottom of the table.

Note: Use either dissolved or total metals analyses.

Contaminant [CAS No.]	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
		Total from Table 27	
		Sum the Ratios	

CHF Scale	CHF Value
CHF > 100	**H (High)**
100 > CHF >2	**M (Medium)**
2 > CHF	**L (Low)**

CHF = ∑ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Annotate the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L

MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Annotate the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L

RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Place an "X" in the box to the right if there is no known or suspected Surface Water (Ecological Endpoint) MC Hazard	**X**

Table 25

HHE Module: Sediment - Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's sediment and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the**ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** together, including any additional sediment contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the sediment, select the box at the bottom of the table.

Contaminant [CAS No.]	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
		Total from Table 27	
		Sum the Ratios	

CHF Scale	**CHF Value**
CHF > 100	**H (High)**
100 > CHF >2	**M (Medium)**
2 > CHF	**L (Low)**

CHF = $\sum$ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Annotate the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L

MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Annotate the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L

RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	

Place an "X" in the box to the right if there is no known or suspected Sediment (Ecological Endpoint) MC Hazard	**X**

Table 26

HHE Module: Surface Soil - Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface soil and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional surface soil contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the surface soil, select the box at the bottom of the table.

Contaminant [CAS No.]	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
Lead [7439-92-1]	1,630.00	400.00	4
Arsenic [7440-38-2]	49.20	22.00	2
		Total from Table 27	
		Sum the Ratios	6

CHF Scale	**CHF Value**
CHF > 100	**H (High)**
100 > CHF >2	**M (Medium)**
2 > CHF	**L (Low)**

CHF = ∑ ([Max Conc of Contaminant] / [Comparison Value for Contaminant])

CONTAMINANT HAZARD FACTOR	Directions: Record **the CHF Value** from above in the box to the right (maximum value = H).	**M**

Migratory Pathway Factor

DIRECTIONS: Annotate the value that corresponds most closely to the surface soil migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface soil has moved only slightly beyond the source (i.e. tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L

MIGRATORY PATHWAY FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Receptor Factor

DIRECTIONS: Annotate the value that corresponds most closely to the surface soil receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface soil to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface soil to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface soil to which contamination has moved or can move.	L

RECEPTOR FACTOR	Directions: Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Place an "X" in the box to the right if there is no known or suspected Surface Soil MC Hazard ☐

Table 27

HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Only use this table if there are more than five contaminants in any given medium present at the MRS. This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the **media** in which these contaminants are present. Then record all **contaminants**, their **maximum concentrations** and their **comparison values** (from Appendix B of the Primer) in the table below. Calculate and record the **ratio** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** for each medium on the appropriate media-specific tables.

Note: Do not to add ratios from different media.

Media	Contaminant [CAS No.]	Maximum Concentration	Units	Comparison Value	Units	Ratios
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
Surface soil			mg/kg		mg/kg	
				SUBTOTAL FOR SURFACE SOIL		0
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
Sediment			mg/kg		mg/kg	
				SUBTOTAL FOR SEDIMENT		0
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
Surface water			μg/L		μg/L	
				SUBTOTAL FOR SURFACE WATER		0
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
Groundwater			μg/L		μg/L	
				SUBTOTAL FOR GROUNDWATER		0

Table 28

Determining the HHE Module Rating

DIRECTIONS:

1. Record the letter values (H, M, L) for the **Contaminant Hazard**, **Migration Pathway**, and **Receptor Factors** for the media (from Tables 21 - 26) in the corresponding boxes below.
2. Record the media's three-letter combinations in the **Three-Letter-Combination** boxes below (three-letter combinations are arranged from Hs to Ms to Ls).
3. Using the HHE ratings provided below, determine each medium's rating (A - G) and record the letter in the corresponding **Media Rating** box below.

Medium (Source)	Contaminant Hazard Factor Value	Migratory Pathway Factor Value	Receptor Factor Value	Three-Letter Combination (Hs-Ms-Ls)	Media Rating (A - G)
Table 21 - Groundwater					
Table 22 - Surface Water (Human Endpoint)					
Table 23 - Sediment (Human Endpoint)					
Table 24 - Surface Water (Ecological Endpoint)					
Table 25 - Sediment (Ecological Endpoint)					
Table 26 - Surface Soil	M	L	L	MLL	F

HHE MODULE RATING **F**

DIRECTIONS (Continued):

4. Select the single highest **Media Rating** (A is the highest; G is the lowest) and enter the letter in the **HHE Module Rating** box below.

HHE Ratings (for reference only)

HHH	A
HHM	B
HHL	C
HMM	
HML	D
MMM	
HLL	E
MML	
[✓ MLL]	[✓ F]
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

NOTE: An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more media, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

Table 29

MRS Priority

DIRECTIONS: In the chart below, enter the letter **rating** for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Enter the corresponding numerical **priority** for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS priority is the single highest priority; record this relative priority in the **MRS Priority or Alternative MRS Rating** at the bottom of the table.

NOTE: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

EHE Rating	Priority	CHE Rating	Priority	HHE Rating	Priority
		A	1		
A	2	B	2	A	2
B	3	C	3	B	3
C	4	D	4	C	4
D	5	E	5	D	5
E	6	F	6	E	6
F	7	G	7	[✓ **F**]	[✓ **7**]
G	8			G	8
Evaluation Pending		Evaluation Pending		Evaluation Pending	
No Longer Required		No Longer Required		No Longer Required	
[✓ **No Known or Suspected Explosive Hazard**]		[✓ **No Known or Suspected CWM Hazard**]		No Known or Suspected MC Hazard	

Reference Table 10:		**Reference Table 20:**		**Reference Table 28:**	
EHE Module Rating	**Priority**	**CHE Module Rating**	**Priority**	**HHE Module Rating**	**Priority**
No Known or Suspected Explosive Hazard*	**No Known or Suspected Explosive Hazard**	**No Known or Suspected CWM Hazard**	**No Known or Suspected CWM Hazard**	**F**	**7**

MRS Priority or Alternative MRS Rating	**7**

APPENDIX B

SSP GUIDANCE DOCUMENT

1.0 INTRODUCTION

The Radford Army Ammunition Plant (RFAAP) is an active military installation located in the mountains of southwest Virginia, and covers approximately 4,080 acres in Montgomery and Pulaski County, Virginia.

The United States Environmental Protection Agency (USEPA) issued a RCRA Corrective Action Permit to Alliant Ammunition and Powder Company (Alliant) and the U.S. Department of the Army (Army) on October 31, 2000. Within the RCRA Corrective Action permit is a listing of 31 identified Site Screening Areas (SSAs) which are to be investigated in accordance with this EPA approved Site Screening Process (SSP). Should additional SSAs be identified at RFAAP, a site screening will need to be completed in accordance with this SSP.

This SSP has been developed as the central document describing how site screening will be applied to the RFAAP. Overall, the SSP is devised to expedite investigations of SSAs at RFAAP to determine what level of evaluation is appropriate for these identified areas. The SSP will help determine whether there have been releases of hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents to the environment from an SSA, and determine whether an SSA should proceed further through the RFI process, be the subject of an interim removal action or be considered for no further action.

Once a SSA is identified, the following five distinct tasks will be undertaken:

- Performance of a Desktop Audit and site visit to determine the scope of the SSP site-specific Work Plan(s);
- Development of an SSP site-specific Work Plan outlining a Sampling and Analysis Plan as well as a risk screening plan (human health and ecological, as appropriate) for EPA approval;
- Performance of SSP field work in accordance with the approved SSP Work Plan;
- Evaluation of SSP data and completion of pre-remedial risk screening; and
- Determination of the need for further investigation of the SSA, an interim removal action at the SSA or preparation of a No Further Action Decision Document, per the RCRA Corrective Action permit, based on results of the SSP and risk screening.

The following sections detail these SSP tasks.

2.0 SITE VISIT AND DESKTOP AUDIT

The purpose of the Desktop Audit is to evaluate and document, through review of existing information, if operations at the SSA(s) have resulted in the release of hazardous substances, pollutants, contaminants, hazardous wastes or hazardous constituents to the environment. The Desktop Audit process includes a search of all documents related to operations at the SSA as well as interviews with personnel knowledgeable about the site. Available information for each SSA, including location and a site map, description of past and current land uses, and a description of releases and associated cleanups, will form the basis for the Desktop Audit. Other information sources will include the administrative record and other local, state and federal documentation containing information pertinent to the site.

Typical existing information that will be examined during the Desktop Audit will include site use, ownership and operational history, groundwater and surface water use and characteristics, soil exposure characteristics, and air exposure pathways. This information can be obtained from maps, publications by the United States Geological Survey (USGS) and state geological surveys, regional databases and geographic information systems, and aerial photography. On the basis of information collected during the Desktop Audit, a list of chemicals potentially stored, handled, released, or disposed at each SSA will be compiled.

In addition to the Desktop Audit, a site visit will be conducted at each SSA. The site visit will include a visual inspection of the SSA to aid in site characterization, including identifying potential contaminant sources; chemical migration pathways; potential human and ecological receptors; and receptor exposure pathways. Additionally, potential media to be sampled and sampling locations will be identified for the SSP.

Results of the Desktop Audit and site visit will be presented in a summary report. Included in the report will be an SSA-specific Conceptual Site Model (CSM) depicting potential contaminant sources, environmental and exposure pathways of concern, and potential human and ecological receptors. The CSM will maximize the usability of analytical data derived from site characterization efforts for subsequent risk assessments, and will form the basis for any additional data collection to support the human health and ecological risk screening. These results will be used in formulating the SSP Work Plan, including the need for human health and ecological risk screening.

3.0 DEVELOPMENT OF SITE SCREENING INSPECTION SAMPLING AND ANALYSIS STRATEGY

A site-specific Work Plan will be developed for each SSA investigated under the SSP. The Work Plans will reference the Desktop Audit Summary, providing a detailed description of historical information, SSA conditions, results of previous investigative work and results of the site visit. The Work Plans will also present a Sampling and Analysis Plan (SAP) that describes the number, types and locations of samples to be collected, sample analyses, and the rationale for the sampling plan. The purpose of sample collection and analysis will be to assess the presence or absence of hazardous substances, contaminants, hazardous wastes, or hazardous constituents, and to provide data for performing human health and ecological risk screening in order to evaluate if there is a potential threat to human health or the environment at the SSA.

Media sampled during the SSP will be identified based upon Desktop Audit and site visit findings, and approval of the USEPA Region III.

Potential media of interest in the SSP may include surface soil (0 to 1 feet below ground surface [bgs] 0-6 inches for constituents other than VOCs, 6-12 inches for VOCs), subsurface soil, groundwater, surface water, sediment, and animal and plant tissue (e.g., fish). Where appropriate, geophysical techniques will be used to aid in placement of groundwater and soil sample locations and to confirm and delineate suspected buried waste material identified during the Desktop Audit and site visit. Field screening for explosives using immunoassay-type sampling kits can be performed at SSAs (a complete list of all explosive compounds and respective detection limits using this method will be included in the Work Plan). However, immunoassay-type analytical data cannot be used for risk screening, unless it can be shown through confirmation sampling and analysis that the results of the field test kits are of equivalent precision and accuracy to standard methods of analysis.

Groundwater samples collected during SSP investigations may be obtained via direct push techniques (DPT) or from groundwater monitoring wells, depending on site conditions and data needs. For groundwater samples collected from monitoring wells, only unfiltered organic and metals results will be considered in the assessments (except in circumstances where monitoring wells do not produce samples with sufficiently low solids for a reasonable risk screening to be performed). For DPT groundwater samples, only the filtered metals and unfiltered organic results will be considered in the assessment. Groundwater parameters measured during field activities should include pH, Eh, dissolved oxygen, specific conductance, temperature, salinity, and turbidity, as appropriate, depending on the medium- and SSA-specific conditions.

All environmental media samples collected during the SSP will be analyzed for the full suite of Contract Laboratory Procedure (CLP) constituents and other constituents based on the findings of the Desktop Audit including additional analytes requested by EPA. The analytical target list will include Target Compound List (TCL) volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs) and dioxins, and Target Analyte List (TAL) inorganic chemicals, including cyanide. Based on past uses of specific SSAs for explosives treatment, and the results of field screening immunoassay methods, it may be necessary to analyze specific samples for nitramine/nitroaromatic compounds. Depending on the history of the SSA and other available information, it may be necessary to analyze specific samples for perchlorates. Soil samples should be analyzed for physical properties (e.g., bulk density, grain size, specific gravity, percent moisture, and total organic carbon [TOC]), as necessary.

Analytical methods used in the SSP will generally be USEPA CLP/Standard Methods and/or SW-846 Methods. Polynuclear aromatic hydrocarbons (PAHs) and pesticides/PCBs may be analyzed using low detection methods. For example, the National Oceanographic and Atmospheric Administration (NOAA) Status and Trends Methods (USEPA Method No. 1668 [GC/MS, congener standards]; USEPA, 1995d) will be used to meet PCB method detection limits (MDLs) required for the human health and ecological risk screening. An analysis of risk-based concentrations (RBCs) and Biological Technical Assistance Group (BTAG) screening levels relative to analytical reporting limits (RLs) will be conducted as part of Work Plan preparation to ensure that RLs do not exceed screening concentrations (to the greatest extent practicable).

CLP laboratory analytical data will be subjected to data validation in accordance with the Innovative Approaches for Validation of Organic and Inorganic Data, as amended by USEPA Region III (USEPA, 1995a). Section 5 describes the data validation and data evaluation process that will be used in the SSP.

4.0 PERFORMANCE OF FIELD WORK

All SSP field work at SSAs will be performed in accordance with the Master Project Plans for RFAAP and the SSA-specific SSP Work Plan described in Section 3.0 above. The Master Project Plan, including a Field Sampling Plan, Quality Assurance Project Plan, and Health and Safety Plan, addresses the full range of potentially applicable activities that could be required throughout the SSP.

5.0 DATA VERIFICATION, VALIDATION AND USABILITY ASSESSMENT

5.1 Data Verification

Data will be verified in accordance with USEPA Region III Innovative Approaches for Data Validation (USEPA, 1995). Verification for organic data will be performed at Manual Level M2 and the verification for inorganic data will be performed at Manual Level IM1 (if a determination is made that an SSA does require a RFI and formal baseline risk assessment, the existing SSP data will be re-validated at the M3 and IM2 level, respectively). Particular emphasis will be placed on holding time compliance, equipment calibration, spike recoveries, and blank results, although all required elements of the verification process will be considered. The analytical results for nonCLP parameters will be verified based on the Region III Modifications to the National Functional Guidelines further modified to reflect the acceptance specifications of the referenced method to the extent that those specifications differ from those in the Region III Modifications to the National Functional Guidelines. Data qualifiers will be assigned based on the results of verification findings. Laboratory deliverable packages will be equivalent to USEPA CLP deliverable packages, containing complete quality control (QC) summary reports, quality assurance (QA) documentation, and raw data.

Data qualifiers provide information pertaining to the degree of confidence to be considered relative to the presence (or absence) of reported chemicals, and also identify numerical results considered to be less accurate and/or precise than is normal for the method. A list of the data qualifiers that may be applied during the verification effort and their definitions are presented below.

Data Qualifier Codes	
J	The analyte was positively identified. The associated result is the approximate concentration of the analyte in the sample.
K	The analyte was detected. Reported value may be biased high.
R	Serious analytical problems were encountered and quality control criteria were not met. The data point is rejected. The analyte may or may not be present in the sample.
N	Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling efforts
L	The analyte was detected. Reported value may be biased low.
U	The analyte was analyzed for, but not detected above the reported quantitation limit.
UL	The analyte was not detected. The reported quantitation limit is approximate and may be lower.
UJ	The analyte was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
B	The analyte was analyzed for, but was not detected substantially above the level reported in the laboratory or field blanks.

Data tables must report non-detects with the following format: < xx, where xx is the sample reporting limit (but not the method detection limit, the instrument detection limit, the contract detection limit, etc.). Thus, all data tables will have either a blank to show that a constituent was not analyzed, a number to show the numeric value of the detected constituent, or a less than symbol followed by the sample reporting limit. The usual data qualifiers will be added as necessary. A data validation report with hand annotated Form 1s will be prepared to present data validation findings.

5.2 Data Validation and Usability Assessment

Data that are compliant with the minimum specifications of the subject analytical methods, still may not provide sufficient qualitative and/or quantitative quality to make decisions at the requisite statistical confidence. To assess risks associated with chemicals of potential concern (COPCs) at a SSA, data of known quality must be used (USEPA, 1992a). An understanding of analytical data quality is necessary for evaluation of uncertainties related to the data, and consideration of these uncertainties in the decision-making process for the SSAs. To facilitate this goal, data from the SSPs will be evaluated for quality and usability prior to its use in the human health and ecological risk screening.

Guidance such as Guidance for the Data Quality Objective Process (EPA QA/G-4, 1994), Guidance for the Data Quality Assessment Process (EPA QA/G-9, 2000), Risk Assessment Guidance for Superfund, Volume I (USEPA, 1989), and Guidance for Data Usability in Risk Assessment (USEPA, 1992a) will be used to evaluate data for usability in the human health and ecological risk screening. Data will be evaluated for quality based on information in the data verification report. Specifically, data will be evaluated for appropriateness of analytical methods and qualifiers, significant blank contamination, and tentatively identified compounds (TICs). Further, and perhaps more importantly, biases and variability inherent in the data will be assessed in relation to the relative interval between the risk screening level and the reported concentration. Additionally, given that a statistical relationship can be defined between variability, the number of samples in a given data set, and the statistical confidence with which a given conclusion may be drawn, the sampling plan and reported results will be evaluated in relationship to the DQOs established during the planning process.

All validated data that is not qualified and data that is qualified with J, L, K, U, UL, UJ, and B will be used to identify COPCs in the risk screening process, unless the inherent limitations of the analytical method and/or matrix effects obviate this use. Data qualified as rejected (i.e., R) will not be used in COPC identification.

Analytical results for the essential nutrients, calcium, sodium, potassium, and magnesium, in both solid and aqueous media, will not be considered in the assessments. All other metals, including iron, and all organic chemicals, including laboratory contaminants not disqualified in the data verification and validation processes, will be considered in the COPC identification process if detected at least once in environmental samples at an SSA.

5.3 Tentatively Identified Compounds

Chemical analysis to identify and quantify organic compounds is performed with gas chromatography-mass spectrometry (GC-MS) methods. The GC-MS instrument is calibrated for a series of target analytes using chemical standards of known concentration and purity. Quantification of these target analytes is performed against specific internal standards as identified in the respective method. Identification of these target analytes is based on a comparison of the unknown analyte to the chemical standards used during calibration based on the analyte's retention time and mass spectra.

Chromatographic peaks in volatile/semivolatile fractions analyses that are not target analytes, surrogates, or internal standards are potential Tentatively Identified Compounds (TICs). TICs must be qualitatively identified by a National Institute of Standards and Technology (NIST) mass spectral library search and the identification assessed by the data reviewer. For each sample, the laboratory conducts a mass spectral search of the NIST library and report the possible identity for the 10 VOC and/or 20 SVOC largest fraction peaks that are not surrogates, internal standards, or target compounds, but that have an area or height greater than 10 percent of the area or height of the nearest internal standard. TIC results are reported for each sample on the Organic Analyses Data Sheet (Form I - VOC-TIC or SVOC -TIC)

TICs will be reported and included in the COPC identification based upon the degree of match, evidence of similar pattern, analyst professional judgment, availability of toxicity data (e.g., IRIS, HEAST, or NCEA reference doses and/or slope factors), and consultation with EPA Region III (see Section 6.1.1.1). The top 20 TICs will be reported by name and CAS Registry number and may be quantified. Quantification of TICs will be based on input from EPA staff. Positive identification and quantification of TICs will be accomplished by acquiring the appropriate standards and calibrating the GC-MS for the tentatively identified compounds. TICs that lack toxicity data will be discussed in the uncertainty section of the screening risk assessment results.

6.0 SCREENING PROCEDURES

Human health and ecological screening procedures will be performed as a part of the SSP. Section 6.1 presents the methodology for the human health screening procedures and Section 6.2 presents the methodology for the ecological risk screening .

6.1 Human Health Screening Procedures

Human health screening procedures will be conducted in accordance with the USEPA Risk Assessment Guidance for Superfund (RAGS) (USEPA, 1989 and 1991b) and USEPA Region III guidance (USEPA, 1991c, 1993a, and 1998a) with modifications. The purpose of the screening step is to evaluate site data with respect to conservative criteria so that sites requiring no further action can be eliminated from further consideration. This process will also be used to identify sites requiring further evaluation to proceed through additional steps. The conceptual site model (CSM) developed in Section 2.0 will be used to identify those media that are associated with identified exposure pathways. If potential current and future exposure pathways associated with a particular medium are determined to be incomplete, then it may not be necessary to carry that medium through the screening process, given approval by EPA.

The screening procedure will involve the following steps:

1. Identification of COPCs and Cumulative Risk Screening

2. Chemical-Specific Screening for Lead and Iron

3. Comparison to Soil Screening Levels (SSLs)

4. Comparison to ARARs

5. Background Comparisons

These steps are described in the following sections.

6.1.1 Identification of COPCs and Cumulative Risk Screening

6.1.1.1 Identification of COPCs for Human Health Cumulative Risk Screening

As stated previously, chemicals detected at least once in environmental samples at an SSA will be evaluated in the COPC identification stage of the human health screening. The essential nutrients calcium, sodium, potassium, and magnesium; chemicals disqualified in the validation process; and TICs not positively identified, will be eliminated as COPCs.

COPCs will be identified by comparing maximum detected concentrations (MDCs) in a specific medium with chemical-specific risk-based screening criteria, unless the data display the statistical properties required to calculate a valid 95% upper confidence limit (UCL). If this is the case, then the 95% UCL will be employed. Chemicals with MDCs exceeding risk-based criteria will be identified as COPCs and will be carried through to the cumulative risk screening step of the assessment.

Soil and Sediment. COPCs in surface and subsurface soil and sediment will be identified by comparing MDCs (or a 95% UCL if appropriate) in these media to Risk-Based Concentrations (RBCs) in the most recent version of the USEPA Region III Risk-Based Concentration Table for soil ingestion using the residential and industrial scenarios (USEPA 2000).

For soils and sediments that are exposed a significant portion of the year (i.e., > 6 months/year), screening levels shall correspond, or be adjusted to correspond, to an increased cancer risk of 1 x 10-6 and a noncancer Hazard Quotient (HQ) of 0.1. COPCs can be identified if the MDCs (or a 95% UCL if appropriate) are greater than the screening values for the ingestion and/or inhalation pathways. For sediments that are not exposed, comparisons to adjusted soil screening levels may be used to decide on the need for further evaluation (e.g., quantitative risk assessment), further investigation or response action.

Groundwater and Surface Water. COPCs in groundwater and surface water will be identified by comparing MDCs (or a 95% UCL if appropriate) of chemicals in these media to RBCs in the most recent version of the USEPA Region III Risk-Based Concentration Table for tap water (USEPA 2000), and to federal and state Maximum Contaminant Levels (MCLs) for groundwater and surface water used as a source of drinking water.

For groundwater, as well as surface water that may be a source of drinking water, RBC screening levels shall correspond, or be adjusted to correspond, to an increased cancer risk of 1 x 10-6 and a noncancer Hazard Quotient (HQ) of 0.1. For other surface water, comparisons to adjusted groundwater screening levels may be used to decide on the need for further evaluation (e.g., quantitative risk assessment), further investigation, or response action. Note that all ground water is considered a source of drinking water unless deemed non-potable (i.e., Class III).

Fish. COPCs in fish will be identified by comparing MDCs (or a 95% UCL if appropriate) of chemicals in fish tissue samples to screening level RBCs for fish in the USEPA Region III Risk-Based Concentration Table (USEPA, 2000). Screening levels shall correspond, or be adjusted to correspond, to an increased cancer risk of 1 x 10-6 and a noncancer Hazard Quotient (HQ) of 0.1.

Chemicals Lacking RBCs

For chemicals lacking Region III published RBCs, but having available associated toxicity data that are peer-reviewed, risk assessors will obtain information from the following sources, which are listed in order of preference: USEPA's Integrated Risk Information System (IRIS), Health Effects Assessment Summary Tables (HEAST), and provisional values from the National Center for Environmental Assessment (NCEA). From these sources, the Army will make a good faith effort to propose alternative screening values, for EPA concurrence.

Summary. In summary, a detected chemical will be retained as a COPC for a specific medium if the MDC (or a 95% UCL if appropriate) is greater than the corresponding screening criteria described above.

6.1.1.2 Cumulative Risk Screening

The cumulative risk screening process will consist of calculating ratios between the maximum exposure point concentrations (EPCs) of COPCs in an environmental medium and the corresponding USEPA Region III residential and industrial RBCs. COPCs are those chemicals brought forward from the COPC identification step (see Section 6.1.1.1). Carcinogenic and noncarcinogenic effects will be evaluated for exposure to chemicals in each environmental medium sampled.

6.1.1.2.1 Estimation of Exposure Point Concentrations

For purposes of this screening process, maximum detected concentrations (MDCs) (or a 95% UCL if appropriate) will be considered in the cumulative risk screening as representative exposure point concentrations (EPCs) for the SSA as a conservative measure. The selection of the MDC for the exposure point concentration in most cases is motivated by the recognition that in many cases when the number of samples is small, the alternative approach reverts to the maximum detected concentration because the calculated 95% UCL exceeds the MDC.

6.1.1.2.2 Human Health Effects - Carcinogens

The potential for carcinogenic risk will be evaluated by estimating excess cancer risk for each COPC. Using the maximum EPC and the respective screening level RBC value, excess residential and industrial cancer risk can be estimated using the following formula:

$$Excess\,Cancer\ Risk = TR\frac{Max.EPC_i}{RBC_i}$$

Where: TR = The target lifetime cancer risk of 1x10-6
EPCi = EPC of COPCi detected in soils and fish (mg/kg) or water (g/L)
RBCi = RBC for COPCi in soils and fish (mg/kg) or water (g/L) based on carcinogenic effects at the TR stated above

Finally, the cumulative residential and industrial excess cancer risk is estimated for each SSA. The cumulative excess cancer risk for exposure to multiple COPCs is estimated using the following equation:

$$Cumulative\ Excess\ Cancer\ Risk = \sum \left[TR\ x \frac{Max.EPC_i}{RBC_i} \right]$$

In accordance with 40 Code of Federal Regulations (C.F.R.) 300.430, carcinogenic risk within the benchmark range of 1x10-4 (1 cancer case in 10,000) to 1x10-6 (1 cancer case in 1,000,000) is generally considered acceptable. The following statement is from 40 C.F.R. 300.430 (2000): "For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10-4 to 10-6 using information on the relationship between dose and response. The 10-6 risk level shall be used as the point of departure for determining remediation goals for alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure."

Multiplying the EPC/RBC ratio by USEPA's point of departure risk level, 10-6, results in an excess cancer risk estimate for the COPC. Excess cancer risk estimates for all COPCs will be summed to account for potential carcinogenic effects associated with multiple chemical exposures (USEPA, 1989) for each medium. The results of cumulative risk screening will be evaluated as follows:

- If the calculated cumulative excess cancer risk is greater than or equal to 1 x 10^{-5} for any of the medium, then a quantitative risk assessment would be performed for the SSA, or

- If the calculated cumulative excess cancer risk is: 1) below 1 x 10^{-5} for all media; and 2) no other screening criteria, as defined by this document, have been exceeded, then no further action (NFA) would be recommended for the SSA.

6.1.1.2.3 Human Health Effects - Noncarcinogens

The potential for adverse noncarcinogenic health effects will be evaluated by calculating a residential and industrial HQ for each COPC. Using the maximum EPC and a respective noncarcinogenic RBC, a residential or industrial HQ can be estimated with the following formula:

$$HQ = THQ \frac{Max.EPC_i}{RBC_i}$$

Where: THQ = The target HQ of 0.1
EPCi = EPC of COPCi detected in soils and fish (mg/kg) or groundwater (g/L)
RBCi = RBC for COPCi in soils and fish (mg/kg) or Groundwater (g/L) based on noncarcinogenic effects at the THQ stated above.

Finally, the cumulative residential and industrial non-carcinogenic hazard index (HI) for exposure to multiple COPCs is estimated as follows:

$$Cumulative\ Noncarcinogenic\ HI = \sum \left[THQ\ x \frac{Max.EPC_i}{RBC_i} \right]$$

Per USEPA guidance for a Baseline Risk Assessment, when the HI exceeds 1, there is a potential for adverse noncarcinogenic health effects (USEPA, 1989). Generally, the more the HI exceeds unity, the greater the potential for adverse health effects. Additionally, when the HI exceeds 1, and multiple chemicals contribute to the exceedance, the HI is segregated on the basis of toxic effects and target organs (i.e., hepatic, renal, respiratory, cardiovascular, gastrointestinal, hematological, musculoskeletal, dermal, ocular effects, neurological, reproductive, developmental, and immune system).

For the cumulative risk screening procedure, HI segregation will involve obtaining the most recent and reliable noncarcinogenic health effects data for COPCs, such as data in the Integrated Risk Information System database (EPA) and databases developed by the Agency for Toxic Substances and Disease Registry (ATSDR). Health effects will be considered for only chronic exposure to COPCs. For COPCs with multiple target organs, the organ that the chemical primarily targets will be considered in hazard segregation.

The results of the cumulative hazard screening will be evaluated as follows:

- In accordance with Region III guidance for risk screening, if the cumulative noncarcinogenic HI for a SSA, computed by this method, is greater or equal than 0.5 for any target organ, then a quantitative risk assessment would be performed for the SSA, or

- If the cumulative noncarcinogenic HI for an SSA, computed by this method, is: 1) less than 0.5 for all target organs; and 2) no other screening criteria, as defined by this document, have been exceeded, then NFA would be recommended for the SSA.

6.1.1.3 Uncertainty Analysis

Uncertainties associated with the cumulative risk screening will be qualitatively evaluated to determine the accuracy of the approach. Factors that may contribute to uncertainty include the use of RBC age-adjusted ingestion and inhalation rates, the use of toxicity information provided by NCEA when RBCs are not available, and the level of uncertainty due to a lack of dermal risk estimates. Uncertainty in the assessment could also arise if health-based RBCs are less than analytical method detection limits.

Uncertainty is associated with the use of RBCs and SSLs because they do not consider dermal uptake. The Site Screening Process is geared towards a risk-based identification of COPCs and preliminary assessment of human and ecological risks that is objective and quantitative. As such, it hinges on the availability of appropriate, risk-based screening levels. No such levels have been identified for dermal exposures to soil, sediment, water or air. Given the conservative nature of the screening process (e.g., use of MDC for exposure point concentrations, use of residential screening level RBCs for soil and groundwater), it is considered very unlikely that omission of dermal exposures in the risk screening process will result in failure to identify a SSA that would require further investigation or response. To guard against this possibility, contaminant concentrations at all SSAs that pass the risk screening will be scrutinized for the occurrence of contaminants that are known to be easily absorbed through the skin, and if necessary, dermal risks for selected contaminants will be calculated in accordance with USEPA's Dermal Exposure Guidance (USEPA, 1992c, 1997a). These dermal risks may be added to the Cumulative Excess Cancer Risk or Cumulative Noncarcinogenic HI computed above.

6.1.2 Chemical-Specific Screening for Lead and Iron

6.1.2.1 Lead

If lead concentrations in soil are greater than 400 mg/kg (USEPA, 1994a), or lead concentrations in groundwater or surface water are greater than 15 g/L (USEPA 1996b), then potential risk associated with lead will be evaluated using the IEUBK model (USEPA, 1994b). The model will be run using site-specific input parameters based on SSP findings and consultation with USEPA Region III. If the percentage of children expected to have blood lead levels of 10 micrograms per deciliter (μg/dL) or greater exceeds 5%, then further investigation or response action will be required for the SSA.

6.1.2.2 Iron

If iron concentrations in soil or water result in an HQ of 0.5 or greater, then a “margin of exposure” evaluation will be performed. Risks from exposure to iron will be characterized by comparing estimated iron intake to the recommended dietary allowance (RDA) and concentrations known to cause adverse effects in children (NCEA, 1996).

6.1.3 Comparison to Soil Screening Levels (SSLs)

USEPA’s Soil Screening Guidance (USEPA, 1996a) will be used as the source of information for three types of SSLs, which address:

- Chemical migration of VOCs from subsurface soil to air;
- Chemical migration of contaminants from soil to air via fugitive dust; and
- Chemical migration of contaminants from soil to groundwater.

MDCs (or a 95% UCL if appropriate) of chemicals found in soil and sediment will be compared to screening levels for leaching of contaminants to groundwater, i.e., soil-to-groundwater screening levels (USEPA, 1996a). Many soil-to-groundwater screening values can be found in the USEPA Region III RBC Tables. A dilution attenuation factor (DAF) of 20 may be used unless groundwater is considered to be shallow. In this case, a site-specific DAF should be calculated. Chemicals found at concentrations exceeding soil-to-groundwater screening levels will be evaluated in a qualitative manner to assess the need for further assessment, investigation, or response action. Geotechnical information such as Total Organic Carbon (TOC), pH, groundwater characteristics, etc., will be an integral part of the qualitative evaluation. In particular, the SSL comparison will be evaluated with respect to its application to site conditions, such as the karst environment which is present throughout RFAAP. Based on the qualitative evaluation, and other relevant information, a recommendation will be made as to whether further evaluation, investigation, or response action should take place for the SSA.

6.1.4 Comparison to ARARs

MDCs (or a 95% UCL if appropriate) of chemicals found at each SSA will be compared to Applicable or Relevant and Appropriate Requirements (ARARs), including, but not limited to: federal and Virginia Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act, federal Ambient Water Quality Standards under the Clean Water Act, Virginia Water Quality Criteria, Virginia AST/UST TPH guidance level for soil (100 mg/kg) and Virginia AST/UST TPH guidance level for groundwater (1 mg/L) (VDEQ, 1995). Chemicals which are found at concentrations greater than ARARs will be identified. If an MDC (or a 95% UCL if appropriate) is greater than one or more ARARs, a recommendation will be made as to whether further evaluation, investigation, or response action should take place for the SSA. EPA may decide that further evaluation, investigation or response action is required at a SSA, based upon consultation with the Commonwealth if State ARARs are involved.

6.1.5 Background Comparison

As a final step in the human health screening process, MDCs of chemicals identified as COPCs will be compared to the EPA-approved site-specific background concentrations shown in the following table. This table includes inorganic chemicals whose 95% upper tolerance limit (UTL) are greater than residential RBC values and are based on the inorganic background data collected at RFAAP.

Facility-Wide Point Estimates for Soil

[Units in mg/kg]

Chemical	Minimum Concentration	Maximum Concentration	95% UTL of the Mean
Aluminum	3,620	47,900	40,041
Arsenic	1.2	35.9	15.8
Chromium	6.3	75.8	65.3
Iron	7,250	67,700	50,962
Manganese	16.7	2,040	2,543
Thallium	1.3	5	2.11
Vanadium	12.2	114	108

Based on the background comparison, and other relevant information, a recommendation will be made as to whether further investigation or response action is warranted at each SSA.

6.1.6 Summary of Human Health Risk Screening Procedures

The results of each screen will be summarized. If COPCs have been identified, in a particular medium, the SSA will be subject to further evaluation, such as a quantitative risk assessment. The results of the SSP will also be used to further refine the CSM.

6.2 Ecological Risk Screening Procedures

The USEPA Risk Assessment Forum (1992) recommended a general framework for conducting ecological risk assessments (ERAs). The Forum framework is presented in Figure 6-1. USEPA has since refined the framework and prepared ERA guidance (USEPA 1997). The approach taken for the SSA ecological screening at RFAAP follows the ERA eight-step approach in the USEPA guidance. Other guidance documents which may be consulted during the ecological risk screening process include the USEPA Region III BTAG ERA guidelines (USEPA 1995b), and the Tri-Service Procedural Guidelines for ERAs, Volume 1 (Wentsel et al, 1996).

The eight-step process is summarized in Figure 6-2. Since this is an ecological risk screen, the process focuses on Steps 1 and 2. These steps are intended to provide a foundation of information pertaining to ecological resources and potential interactions with site-related contamination in order that risk managers can make conservative decisions regarding ecological risks at individual SSAs.

Site Screening Process

The following steps will be followed for the ecological risk screening :

Site Reconnaissance

Problem Formulation

Exposure Assessment

Ecological Effects Assessment

Risk Characterization

Figure 6-1 **Ecological Risk Assessment Framework (USEPA, 1997)**

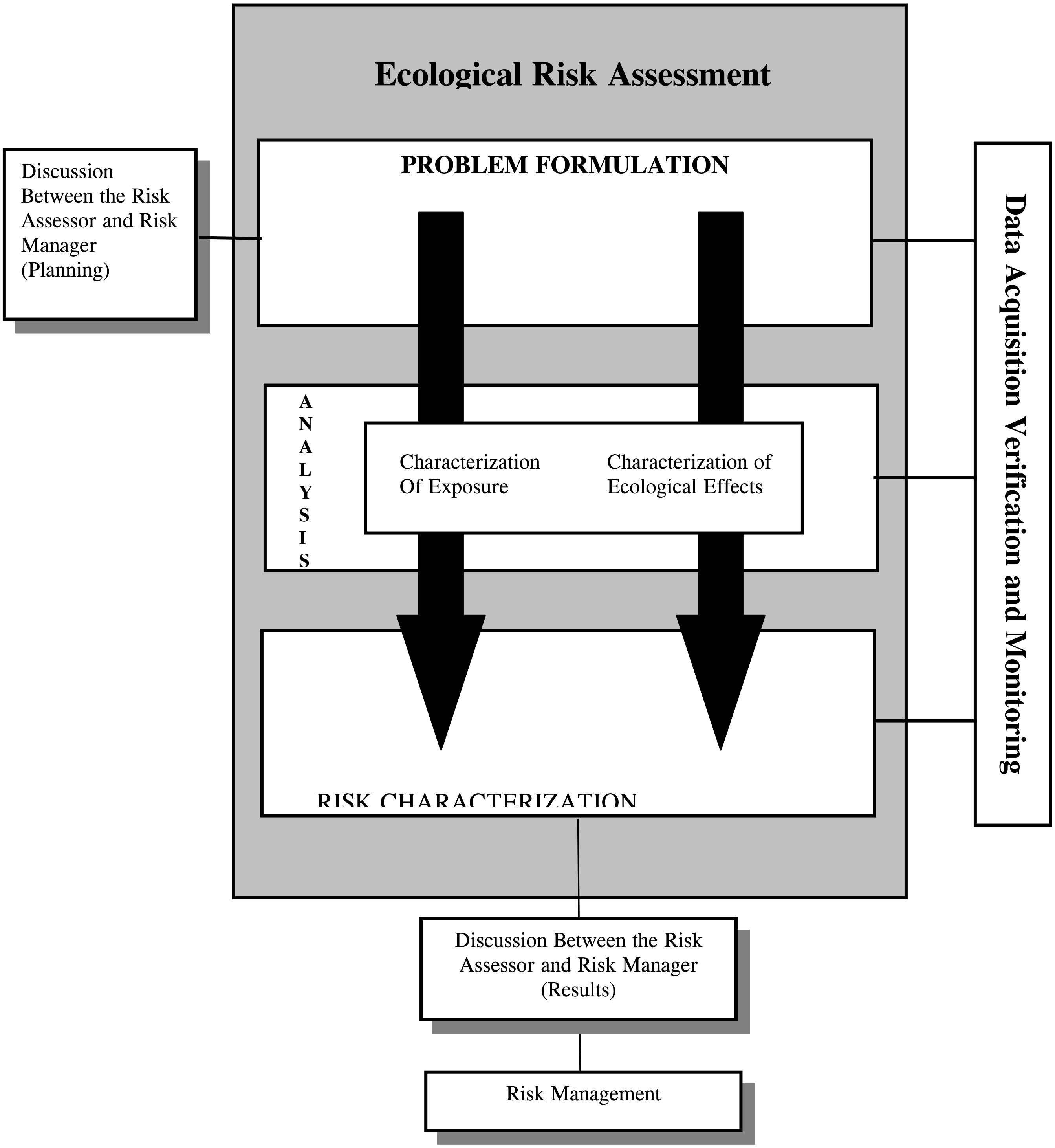
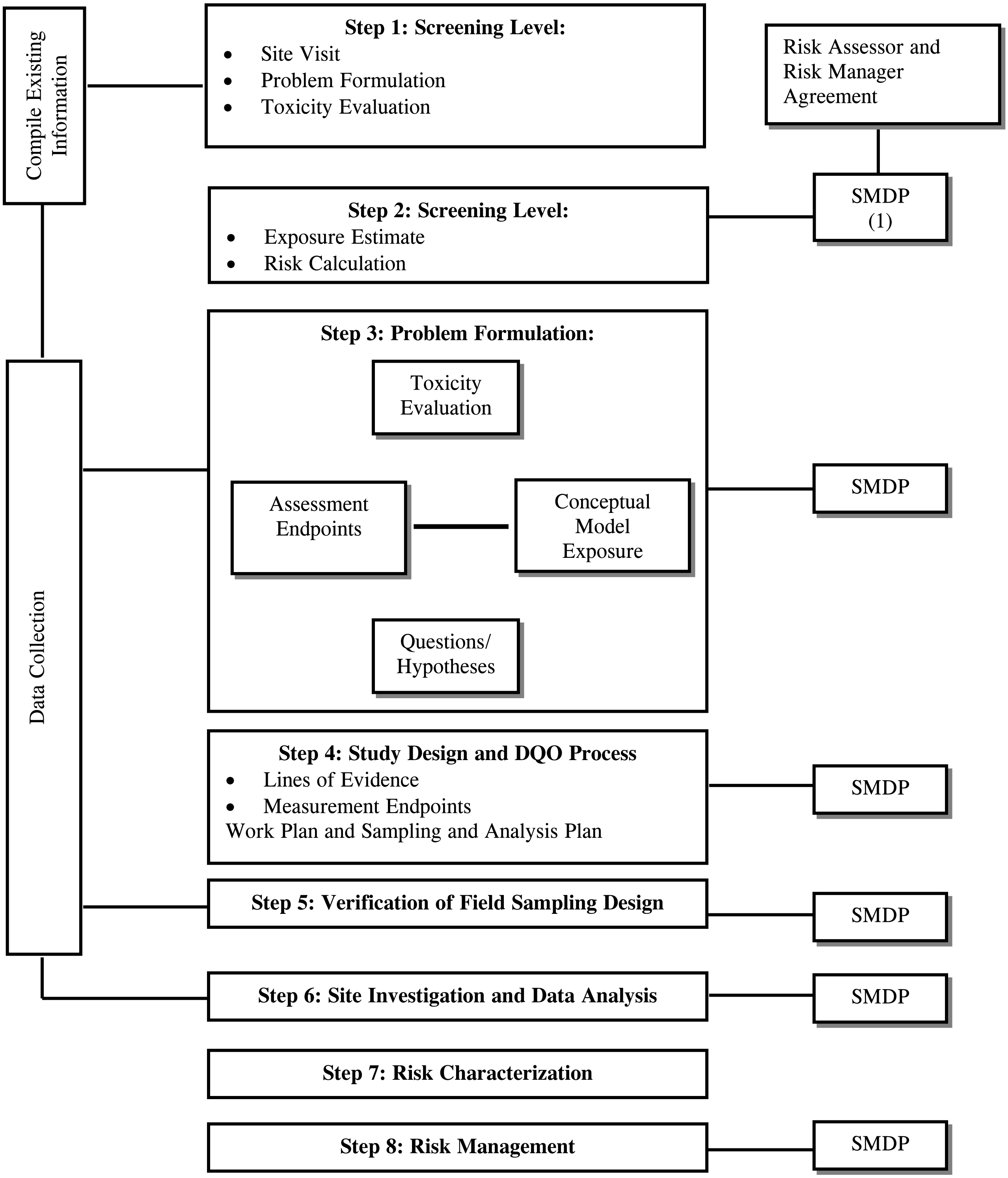


Figure 6-2 Eight-Step Ecological Risk Assessment Process for Superfund (USEPA, 1997)



The ecological risk screening will provide conclusions and recommendations regarding ecological risk at the site. The Army will use these data to make ecological risk management recommendations for each SSA. The scientific/management decision point reached from the ecological risk screening will include one of the following:

- There is adequate information to conclude that ecological risks are negligible and therefore there is no need for further action at the SSA 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.

6.2.1 Problem Formulation

Problem formulation is the first phase of a ecological risk screening and discusses the goals, breadth, and focus of the screening. It involves the collection and analysis of existing data to the greatest extent possible. Problem formulation includes general descriptions of RFAAP SSAs, with emphasis on size of the SSAs, proximity to operational areas and/or sensitive habitats, and the habitats and ecological receptors present. This phase also involves characterization of site contaminants, contaminant sources, migration routes, and an evaluation of complete routes of contaminant exposure to important ecological receptors. Assessment and measurement endpoints that will be evaluated are also selected. Finally, a conceptual model is developed that describes how contaminants associated with the sites in question may come into contact with ecological receptors. Much of this step will have been completed during the site reconnaissance, the review of historical information, and the development of the work plan, as discussed in Sections 2.0 and 3.0, respectively.

The following sections provide more detailed descriptions of the steps involved in the development of the problem formulation component of the ecological risk screening.

6.2.1.1 Site Characterization

The objectives of this step are to initially identify and characterize the site(s) ecological resources, and to preliminarily describe the nature and extent of chemical contamination at the site(s) in question. Information pertaining to site land-use (past, current and future), size, proximity to operable areas and/or sensitive habitats, and habitats and ecological resources will be developed during the site characterization. The SSP is a screening level process that will be used to determine if a site should proceed further through the RFI stage. As such, detailed field sampling and quantitative analysis of biota will not be performed during the SSP. If contamination is identified which may impact ecological receptors, a recommendation in the SSP report would include biota sampling.

This step will actually begin with the site visit discussed in Section 2.0. Information about local ecological resources (including threatened and endangered species) will also be obtained from maps of the study area, available scientific literature, and federal and state agencies (e.g., U.S.

Fish and Wildlife Service, Virginia Department of Game and Inland Fisheries, Department of Natural Heritage database, etc.). The site characterization will also describe likely contaminant sources, release mechanisms, complete migration pathways, the fate of chemicals resulting from site-related activities, as well as important ecological resources that could be adversely affected by these chemicals.

6.2.1.2 Identification of Chemicals of Potential Ecological Concern

COPCs will be identified by comparison of maximum site concentrations to approved Region III BTAG screening values and/or by simple food-web modeling. Initial screening of analytical data will be conducted using general screening values considered protective of all wildlife. Chemicals with MDCs (or a 95% UCL if appropriate) exceeding screening values and/or chemicals for which no screening values are available will be initially identified as COPCs to be carried through to the risk characterization step of the ecological risk screening. Values may be derived from sources such as, Federal and state standard Ambient Water Quality Criteria, Ontario Ministry of the Environment LEL values for freshwater habitats (Ontario Ministry of Environment and Energy, 1993), Great Lakes Research TEL values (Smith et al., 1996) for freshwater habitats, and EPA and ORNL surface soil screening levels (USEPA, 2000b and Will and Suter, 1995a).

6.2.1.3 Identification of Exposure Pathways and Potential Receptors for Analysis

The pathways by which ecological receptors may be exposed to COPCs at the site(s) will be identified along with the receptor groups that could be adversely affected by these chemicals. Several potential exposure pathways may exist at the site(s). For example, terrestrial vegetation may be exposed to contaminants via direct aerial deposition and root translocation, although aerial deposition is highly variable and difficult to quantify. Terrestrial animals may be exposed to soil contaminants through ingestion of contaminated food items and by incidentally ingesting soil while grooming fur, preening feathers, digging, grazing close to the soil, or feeding on items to which soil has adhered (such as roots and tubers). Terrestrial animal receptors may also come into contact with contaminants in surface water by using surface water for drinking water, although this exposure route represents a negligible portion of total exposure for most receptors.

Aquatic and semi-aquatic organisms at the RFAAP may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Aquatic and semi-aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water.

For purpose of the SSA ecological risk screening, exposure pathways representing important and likely meaningful routes of contaminate uptake will be assessed for appropriate receptor groups. If sufficient information exists to examine more obscure exposure routes (e.g. aerial deposition or inhalation) or if the assessment of an exposure route will substantially contribute to the risk understanding (e.g. drinking water) it will be examined to assess whether it warrants the evaluation.

Site Screening Process

Based on the identification of site-specific habitats, food webs, COPCs, and exposure pathways, recommendations will be made for species or species groups to be selected for evaluation in the risk screening. These may include the following receptor groups:

- For terrestrial systems: terrestrial plants, terrestrial invertebrates, reptiles and amphibians, invertebrate-eating birds (e.g., robin), invertebrate-eating mammals (e.g., shrew), carnivorous mammals (e.g. red fox), and carnivorous birds (e.g., red-tailed hawk) may be included. In addition, plant-eating mammals (e.g., rabbit), and omnivorous mammals (e.g. raccoon) may be included.

- For aquatic systems: aquatic plants, benthic invertebrates, fish, reptiles and amphibians, fish-eating birds (e.g. great blue heron), and fish-eating mammals (e.g. mink) may be included.

6.2.1.4 Identification of Assessment and Measurement Endpoints

One of the major tasks in screening problem formulation is the selection of assessment and measurement endpoints. An assessment endpoint is defined as “an explicit expression of actual environmental values that are to be protected” (USEPA, 1992d). Measurement endpoints are “measurable ecological characteristics that are related to the valued characteristic chosen as the assessment endpoint” (USEPA 1992d). Measurement endpoints serve as tools for ranking and evaluating environmental values that are to be protected. While declines in populations and shifts in community structure can be quantified, studies of this nature are generally time-consuming and difficult to interpret. However, measurement endpoints indicative of observed effects on individuals are relatively easy to measure in laboratory toxicity studies and can be related to the site specific assessment endpoint.

Toxicity data and assessment endpoints shall be discussed with BTAG, and agreed upon, in accordance with the USEPA Guidance (USEPA 1997). This step also includes the development of a conceptual site model (CSM) and identification of the specific objectives and scope of the ecological risk screening. The CSM is designed to diagrammatically identify potentially exposed receptor populations and applicable exposure pathways, based on the physical nature of the site and the potential contaminant source areas. Generally, a separate CSM will be developed for each SSA because the contaminant source, migration pathways, assessment and measurement endpoint, and exposure pathways are site-specific. However, in appropriate cases, more than one SSA can be included in a single CSM if, for example, there are common exposure and/or migration pathways.

6.2.2 Exposure Assessment

This section of the ecological risk screening includes identification of contaminant concentration data used to represent ecological exposure in various media. For each exposure pathway selected for quantitative evaluation, conservative exposure point concentrations (EPCs) will be used and the receptor specific exposure will be quantified. EPCs will be estimated using environmental sampling data either alone or in conjunction with simple environmental fate and transport models.

The food chain modeling will be performed in accordance with current USEPA CERCLA guidance for ecological risk assessment, and use conservative exposure parameter values (maximum ingestion rate, minimum body weight, 100% bioavailability) (USEPA, 1993b). The ecological exposure assessment will consist of two phases. The first, most conservative, phase will be based on conservative exposure assumptions such as:

Maximum analytical results for each medium of concern used as EPCs; and

Site use factor equals 1

The second phase will be based on conservative yet more realistic exposure assumptions such as:

- Site use factor determined based on the size of the SSA, proximity to operational areas and/or sensitive habitats, the quality of habitat present, and behavior of important ecological receptors; and

- Use of average body weight and average intake for selected wildlife receptors.

6.2.3 Ecological Effects Assessment

This step in the ecological risk screening develops toxic reference values (TRVs) for ecological receptors, to be used in the risk characterization. Acknowledging that data pertaining to ecological risk characterization is continually being updated, the Army shall consult with EPA on the most-up-to-date and appropriate data sources, when reaching this stage in the screening process. The toxicity of COPCs to terrestrial and aquatic organisms will be summarized using relevant toxicity data for the selected receptor species. The TRVs to be used in the evaluation of potential adverse effects to terrestrial and aquatic species will be derived from the literature, where possible.

In food web modeling, calculated doses will be compared to toxicological thresholds (no observed adverse effect levels [NOAELs] and lowest observed adverse effect levels [LOAELs]). The Army shall develop TRVs for wildlife receptors derived from NOAELs and LOAELs taken from various literature sources. BTAG will review these values and may provide technical assistance in selecting wildlife derived NOAELs and LOAELs. Only EPA and BTAG approved TRVs will be used in identifying COPCs at SSAs.

6.2.4 Risk Characterization

This step compares exposure point contaminant concentrations with benchmark concentrations protective of ecological receptors. The ratio of the maximum contaminant concentration to the benchmark value is called the HQ or Ecological Effects Quotient (EEQ), and is defined as follows:

$$EEQ = Emax/TRV$$

Where: EEQ = Ecological Effects Quotient for contaminant (unitless)

Emax = Maximum Concentration for contaminant (mg/L or mg/kg)

TRV = Toxicity Reference Value for contaminant (mg/L or mg/kg)

When the ratio of the maximum concentration to its respective benchmark value exceeds 1.0, further assessment may be needed. The EEQ value should not be construed as being probabilistic; rather, it is a numerical indicator of the extent to which a maximum concentration exceeds or is less than a benchmark. When EEQ values exceed 1.0, it is an indication that ecological receptors are potentially at risk based on conservative exposure assumptions.

The preliminary risk characterization will be based on the conservative preliminary exposure assumptions. A major part of the risk characterization is the interpretation of the preliminary estimates of risk in light of the conservative assumptions and uncertainties (see Section 6.2.5).

Additional evaluation of site-specific data may be necessary to confirm with greater certainty whether ecological receptors are actually at risk at the site, especially since most benchmarks are based on conservative exposure assumptions. A refined estimate of EEQs will be made using the refined exposure factors (Section 6.2.2). The results of the conservative and refined risk estimates will be evaluated in light of the uncertainties of the risk assessment process (Section 6.2.5). Furthermore, other factors, such as low frequency of detection, may mitigate potential risks for a COPC with an elevated EEQ value.

6.2.5 Uncertainty Analysis

When the above steps are completed, the results are interpreted and the uncertainties associated with the ecological risk screening are addressed. General uncertainties associated with the ecological risk screening will be qualitatively evaluated to determine the conservatism of the approach. For example, uncertainty in this site screening could arise if ecological based criteria are less than analytical method detection limits. In addition, background screening will be performed at this stage to aid in risk management decisions. Maximum detected concentrations of inorganic constituents may be compared to background values (see Section 6.1.4) to assist in assessing whether or not potential ecological risk is associated with site-related conditions.

7.0 SITE SCREENING PROCESS REPORT

Results of the desktop audit, nature and extent determination (if available), and the human health and ecological screening procedures will be presented in an SSP Report for each SSA with a recommendation for future action. The EPA will review the SSP Report for each SSA and based on results of the screening procedures, a decision will be made as to whether each SSA should be recommended for no further action, or for further action. A need for further action will be based on but not limited to the following: historical use of the SSA, history of documented release (if any), analytical data from the SSA, and the overall weight of the evidence. In general, further action at an SSA may be required under the following circumstances:

- Cumulative Excess Cancer Risk (CECR) greater than 1x10-5
- HI greater than 0.5 per target organ
- Maximum Detected Concentration > SSL for chemical migration from soil to ground water or other screening values (e.g., Virginia AST/UST TPH guidance level for soil; Virginia State and Federal MCLs, Virginia AST/UST TPH guidance level for ground water; or Federal and State Ambient Water Quality Criteria for surface water)
- Ecological risk considerations per Section 6.2

If none of the above circumstances occur, EPA may recommend no further action and memorialize this recommendation in a Decision Document.

If any of the above circumstances occur, further action may be required. Further action may consist of one or more of the following:

- Interim Removal Action, followed by sampling to confirm that risks have been reduced to acceptable levels
- Focused RFI (including additional sampling)
- RFI/CMS

8.0 DISPUTE RESOLUTION

Disputes arising during the course of the SSP shall be resolved using the dispute resolution procedures of the RCRA Corrective Action Permit, Part I, C.

9.0 REFERENCES

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APPENDIX C

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.

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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.

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

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 semicircular 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 D

SSP INVESTIGATION DOCUMENTATION

APPENDIX D.1

PHOTOGRAPHIC LOGS

RFAAP Small Arms Firing Range

URS Project No. 15299885

Photograph 1 – Looking west along the front of the berm

Photograph 2 – Bullet fragment and soil sample location on front side of berm

Photograph 3 – Bullets and fragments found within berm approximately 3 to 4 inches bgs

Photograph 4 – Metal debris found just below the surface of the berm

Photograph 5 – Metal debris found just below the surface of the berm

Photograph 6 - Construction debris pile

Photograph 7 – Soil sample location at the construction debris pile

Photograph 8 – Substance found within the construction debris pile

Photograph 9 – Backside of the berm and Stroubles Creek

Photograph 10 – Hill side behind berm adjacent to Stroubles Creek

APPENDIX D.2

FIELD NOTES

Location Rockford Date 10/7/08

Project / Client RFAAP MMRP

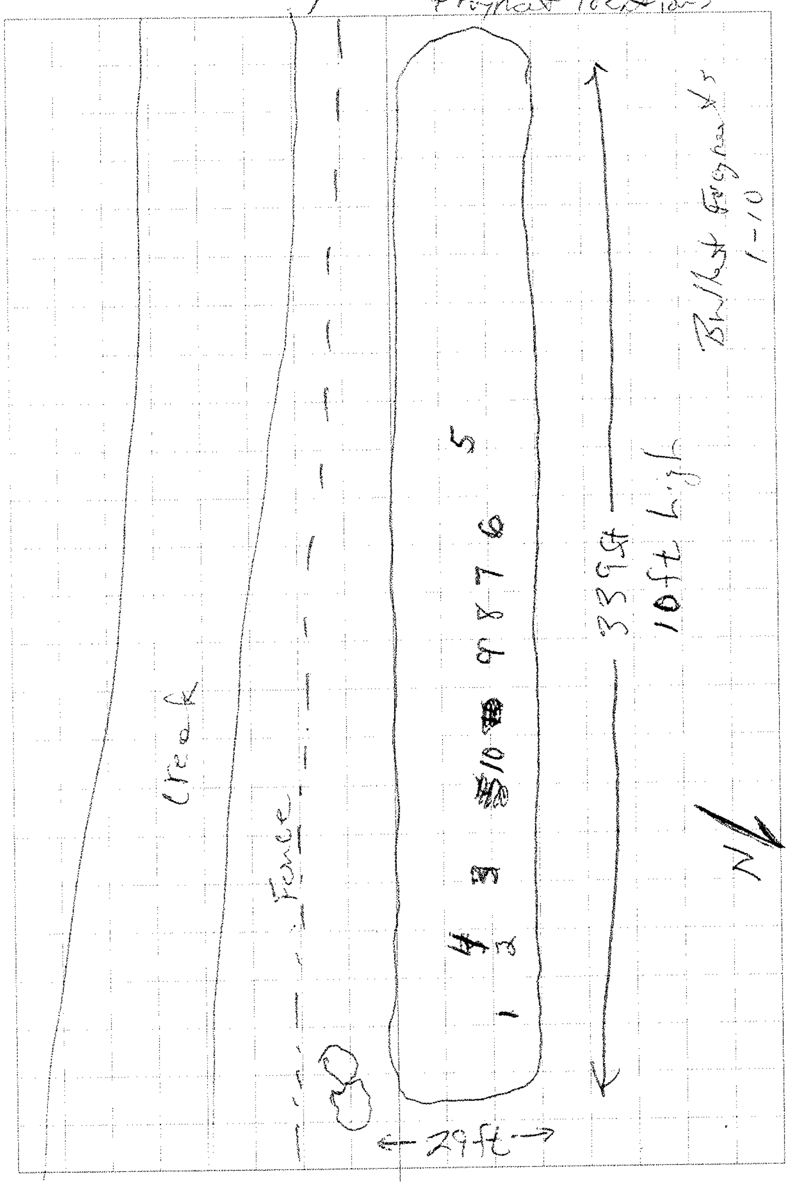
- 1030 - Visitor's center
  - Badging
- 1100 - on site to get area entry permit.

1130 - Start sweeping the area w/ metal detector

- East side of Berm found bullet fragments ranging from 4 to 6 inches deep on front side of Berm.
- Found nothing on west side of berm on front or back.
- GPS Fragment locations and Sample locations.
  Fragments (1-10) - on sketch
  Sample locations - RRSARSS-1-6
- R100718A - Rover File

Location Date

Project / Client Sketch / Sample locations
Fragment locations



Location Radford Date 10/7/08
Project / Client RFAAP MMRP

Sample Data - 10/7/08

ARSAR551 - 1450 Composite
ARSAR552 - 1500 "
ARSAR553 - 1508 "
ARSAR554 - 1513 "
ARSAR555 - 1517 "
ARSAR556 - 1519 "

Dup - 1 - Collected @ 551
MS/MSD - Collected @ 552

Andrea Sunsom info
D 410 487 8955
M 410 859 5049 155
Fax 410 8595202

Construction Debris pile -
Contents include
Tire, fencing, wood
post, rock, concrete.
Green hard chalky material
Found no flooring material.

Location RFAAP Date 10/7/08
Project / Client MMRP

Con. Debris Pile Sample Data
ARSAR14 - 1610
ARSAR15 - 1615

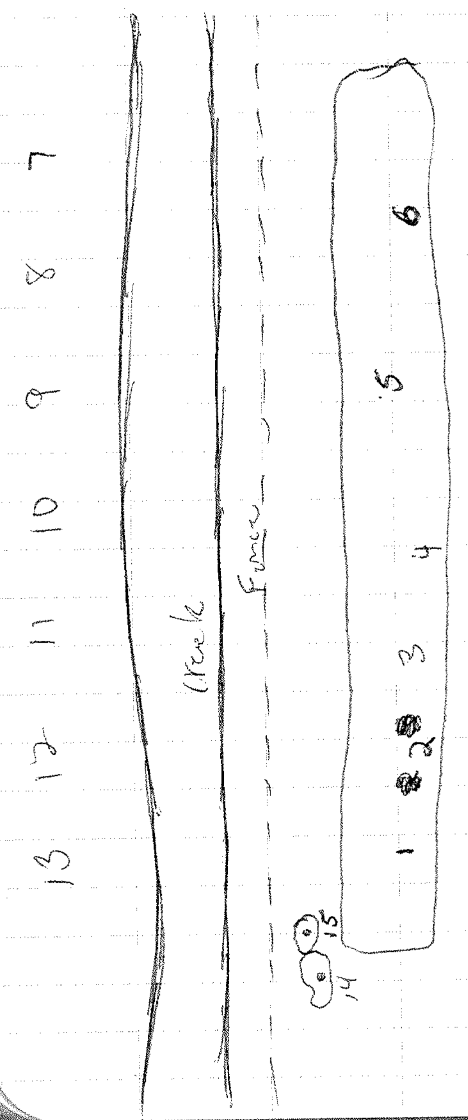
Dup-2 collected on ARSAR14
MS/MSD collected on ARSAR15

44

Location RFAAP Date 10/7/08

Project / Client MMRP

Sketch Sample Locations



Location RFAAP Date 10/8/08 45

Project / Client MMRP

- Swept hill side w/ metal detector, found nothing.
- ~~Randomly~~ Evenly space 7 sample locations across hill side the width of the berm. around rock outcrops.

Sample Data -

ARSARSS7 -	945	composite
ARSARSS8 -	950	"
ARSARSS9 -	955	"
ARSARSS10 -	1000	"
ARSARSS11 -	1005	"
ARSARSS12 -	1010	"
ARSARSS13 -	1015	"

APPENDIX D.3

FIELD SAMPLING FORMS

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ______ FILE NAME ______

SAMPLE MATRIX CODE S SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER ARSARSS1

DATE (MM/DD/YY) 10/7/08 TIME 1450 AM [✓ PM] SAMPLE PROGRAM

DEPTH (TOP) 2" DEPTH INTERVAL 2-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz glass		

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Berm - hillside w/ trees + shrubs

SAMPLE FORM soil/silt COLOR strong brown ODOR None
PID (HNu) —— UNUSUAL FEATURES ______

WEATHER/TEMPERATURE Clear / 72°
SAMPLER BP

Note: Dup-1 collected here

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ______ FILE NAME ______

SAMPLE MATRIX CODE 5 SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER AESAP552

DATE (MM/DD/YY) 10/7/08 TIME 1500 AM [✓ PM] SAMPLE PROGRAM

DEPTH (TOP) 2 DEPTH INTERVAL 2-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass		As, Antimony, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Berm-hillside w/ trees + shrubs

SAMPLE FORM Soil/silt COLOR Ltr brown ODOR None
PID (HNu) — UNUSUAL FEATURES —

WEATHER/TEMPERATURE clear/72°
SAMPLER

Note: MS/MSD samples collected here

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ____ FILE NAME ____

SAMPLE MATRIX CODE S SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER ARSAR5528

DATE (MM/DD/YY) 10/7/08 TIME 1508 AM [✓ PM] SAMPLE PROGRAM

DEPTH (TOP) 2 DEPTH INTERVAL 2-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass		As, Sb, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Berm - hill side w/ trees + shrubs

SAMPLE FORM silt loam COLOR dark brown ODOR None
PID (HNu) ———— UNUSUAL FEATURES ————

WEATHER/TEMPERATURE clear/72°
SAMPLER

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ______ FILE NAME ______

SAMPLE MATRIX CODE S SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER ARSARJ54

DATE (MM/DD/YY) 10/7/08 TIME 1513 AM [✓ PM] SAMPLE PROGRAM

DEPTH (TOP) 2 DEPTH INTERVAL 2-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Sb, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Berm. hillside w/ trees + shrubs

SAMPLE FORM silt loam COLOR dark brown ODOR None
PID (HNu) ______ UNUSUAL FEATURES ______

WEATHER/TEMPERATURE Clear/72°
SAMPLER

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ______ FILE NAME ______

SAMPLE MATRIX CODE S SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER ARSAP554

DATE (MM/DD/YY) 10/7/08 TIME 1517 AM [✓ PM] SAMPLE PROGRAM

DEPTH (TOP) 2 DEPTH INTERVAL 2-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Sb, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Berm. hillside w/ trees & shrubs

SAMPLE FORM silt COLOR str. brown ODOR —
PID (HNu) — UNUSUAL FEATURES —

WEATHER/TEMPERATURE clear/72°
SAMPLER BP

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ______ FILE NAME ______

SAMPLE MATRIX CODE S SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER ARSAR556

DATE (MM/DD/YY) 11/7/08 TIME 1519 AM [✓ PM] SAMPLE PROGRAM

DEPTH (TOP) 2 DEPTH INTERVAL 2-6 UNIT inches

SAMPLING METHOD:

SPLIT SPOON ___ AUGER ___ SHELBY TUBE ___ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Sb, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Berm - hillside w/ trees + shrubs

SAMPLE FORM Silt COLOR brown ODOR —
PID (HNu) — UNUSUAL FEATURES —

WEATHER/TEMPERATURE Clear 72°
SAMPLER BP

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ______ FILE NAME ______

SAMPLE MATRIX CODE S SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER ARSARSS7

DATE (MM/DD/YY) 6/8/06 TIME 945 [✓ AM] ~~PM~~ SAMPLE PROGRAM

DEPTH (TOP) 0 DEPTH INTERVAL 0-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Sb, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Mountain Side w/ rock & trees

SAMPLE FORM Silt COLOR Lt Grayish brown ODOR None
PID (HNu) — UNUSUAL FEATURES —

WEATHER/TEMPERATURE Overcast/65°
SAMPLER TSP

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ______ FILE NAME ______

SAMPLE MATRIX CODE S SITE ID MMRP

ENV. FIELD SAMPLE IDENTIFIER ARSARS58

DATE (MM/DD/YY) 10/8/08 TIME 950 [✓ AM] PM SAMPLE PROGRAM

DEPTH (TOP) 0 DEPTH INTERVAL 0-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Sb, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Mountainside w/ rock + trees

SAMPLE FORM Silt COLOR Grayish brown ODOR None

PID (HNu) —— UNUSUAL FEATURES ——

WEATHER/TEMPERATURE Overcast/65°

SAMPLER YSP

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ______ FILE NAME ______

SAMPLE MATRIX CODE 5 SITE ID MMRP

ENV. FIELD SAMPLE IDENTIFIER ARSAR559

DATE (MM/DD/YY) 10/8/08 TIME 955 [✓ AM] PM SAMPLE PROGRAM

DEPTH (TOP) 0 DEPTH INTERVAL 0 - 6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Sb, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Mountain side w/ rock & trees

SAMPLE FORM Silt COLOR dark brown ODOR None

PID (HNu) — UNUSUAL FEATURES —

WEATHER/TEMPERATURE Overcast/65°

SAMPLER BP

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ____ FILE NAME ____

SAMPLE MATRIX CODE S SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER ARSARSS1D

DATE (MM/DD/YY) 10/8/08 TIME 1000 [✓ AM] PM SAMPLE PROGRAM

DEPTH (TOP) 0 DEPTH INTERVAL 0-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Sb, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Mountain side w/ rock + trees

SAMPLE FORM Silt COLOR Dark brown ODOR None
PID (HNu) —— UNUSUAL FEATURES ——

WEATHER/TEMPERATURE overcast/65°
SAMPLER RP

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ______ FILE NAME ______

SAMPLE MATRIX CODE S SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER ARSARS011

DATE (MM/DD/YY) 10/8/08 TIME 1005 [✓ AM] PM SAMPLE PROGRAM

DEPTH (TOP) 0 DEPTH INTERVAL 0-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Pb, Sb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Mountain side w/ rock + trees

SAMPLE FORM Silt COLOR dark brown ODOR None
PID (HNu) —— UNUSUAL FEATURES ——

WEATHER/TEMPERATURE overcast/65°
SAMPLER BP

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ____ FILE NAME ____

SAMPLE MATRIX CODE S SITE ID MMRP

ENV. FIELD SAMPLE IDENTIFIER ARSARSS12

DATE (MM/DD/YY) 6/8/08 TIME 1010 [✓ AM] PM SAMPLE PROGRAM

DEPTH (TOP) 0 DEPTH INTERVAL 0-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Sb, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Mountain side w/ rock & trees

SAMPLE FORM Silt COLOR Dark brown ODOR None

PID (HNu) — UNUSUAL FEATURES —

WEATHER/TEMPERATURE Overcast/65°

SAMPLER BP

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ______ FILE NAME ______

SAMPLE MATRIX CODE ______ SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER ARSAR5513

DATE (MM/DD/YY) 0/8/08 TIME 1015 [✓ AM] PM SAMPLE PROGRAM

DEPTH (TOP) 0 DEPTH INTERVAL 0-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Pb, Sb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Mountain side w/ rock & trees

SAMPLE FORM Silt COLOR Dark brown ODOR None

PID (HNu) —— UNUSUAL FEATURES ——

WEATHER/TEMPERATURE overcast / 65°

SAMPLER BP

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ____ FILE NAME ____

SAMPLE MATRIX CODE 5 SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER ARSAR14

DATE (MM/DD/YY) 10/7/08 TIME 1610 AM [✓ PM] SAMPLE PROGRAM

DEPTH (TOP) 0 DEPTH INTERVAL 0-6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Cr, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Construction Debris Pile - small area under trees, contents include, tire, fence, wood, rock, concrete, and a green chalky material.

SAMPLE FORM silty topsoil COLOR Black ODOR None

PID (HNu) —— UNUSUAL FEATURES ——

WEATHER/TEMPERATURE clear/72°

SAMPLER BF

Note: Collected Dup-2 here

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

HIGH CONCENTRATION EXPECTED? No HIGH HAZARD? No

INSTALLATION/SITE RFAAP AREA MMRP

INST NAME ____ FILE NAME ____

SAMPLE MATRIX CODE S SITE ID MMRP
ENV. FIELD SAMPLE IDENTIFIER ARSAR15

DATE (MM/DD/YY) 10/7/08 TIME 1615 AM [✓ PM] SAMPLE PROGRAM

DEPTH (TOP) 0 DEPTH INTERVAL 0 - 6" UNIT inches

SAMPLING METHOD:

SPLIT SPOON __ AUGER __ SHELBY TUBE __ SCOOP ✓ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS
	6010B	4oz. Glass	1	As, Cr, Pb

TOTAL NUMBER OF CONTAINERS FOR SAMPLE 1

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION: Construction Debris pile: Small mound contents include rock & concrete,

SAMPLE FORM Dry silty loam COLOR Brown ODOR none
PID (HNu) — UNUSUAL FEATURES —

WEATHER/TEMPERATURE Clear / 72°
SAMPLER RP

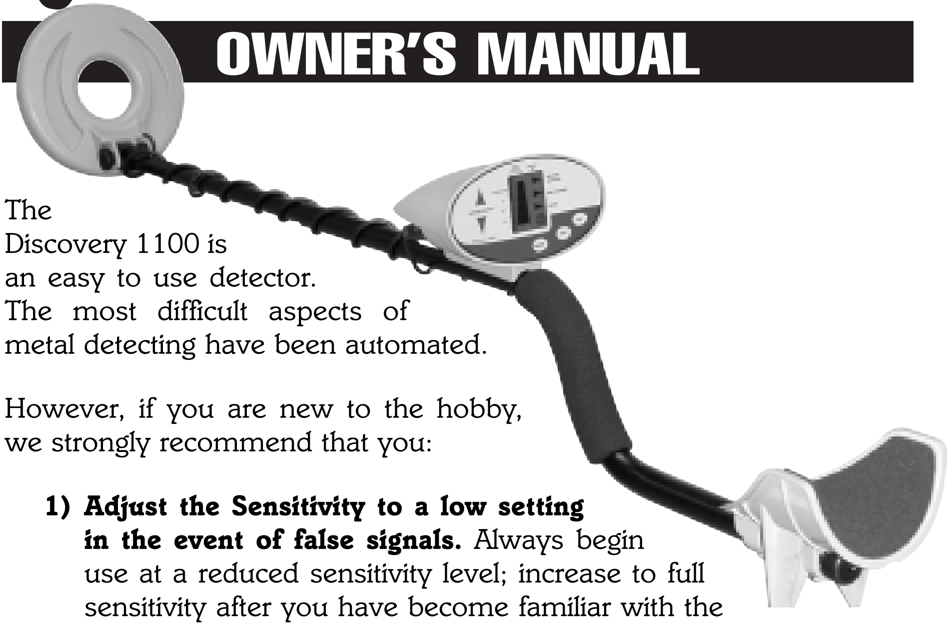
APPENDIX D.4

METAL DETECTOR SPECIFICATIONS

Discovery™ 1100

by BOUNTY HUNTER®

OWNER'S MANUAL



The Discovery 1100 is an easy to use detector. The most difficult aspects of metal detecting have been automated.

However, if you are new to the hobby, we strongly recommend that you:

1) **Adjust the Sensitivity to a low setting in the event of false signals.** Always begin use at a reduced sensitivity level; increase to full sensitivity after you have become familiar with the detector.

2) **Do not use indoors.** This detector is for outdoor use only. Many household appliances emit electromagnetic energy, which can interfere with the detector. If conducting an indoor demonstration, turn the sensitivity down and keep the search coil away from appliances such as computers, televisions and microwave ovens. If your detector beeps erratically, turn off appliances and lights (especially those with dimmer switches).

   Also keep the search coil away from objects containing metal, such as floors and walls.

3) Read this manual. Most importantly, review the **Quick-Start Demo** (p.7) and **Basic Operation** (pp. 9-12).

4) Use 9-volt **ALKALINE** batteries only. Do not use Heavy Duty Batteries.

TABLE OF CONTENTS

TERMINOLOGY

The following terms are used throughout the manual, and are standard terminology among detectorists.

ELIMINATION

Reference to a metal being "eliminated" means that the detector will not emit a tone, nor light up an indicator, when a specified object passes through the coil's detection field.

DISCRIMINATION

When the detector emits different tones for different types of metals, and when the detector "eliminates" certain metals, we refer to this as the detector "discriminating" among different types of metals.

Discrimination is an important feature of professional metal detectors. Discrimination allows the user to ignore trash and otherwise undesirable objects.

RELIC

A relic is an object of interest by reason of its age or its association with the past. Many relics are made of iron, but can also be made of bronze or precious metals.

IRON

Iron is a common, low-grade metal that is an undesirable target in certain metal detecting applications. Examples of undesirable iron objects are old cans, pipes, bolts, and nails.

Sometimes, the desired target is made of iron. Property markers, for instance, contain iron. Valuable relics can also be composed of iron; cannon balls, old armaments, and parts of old structures and vehicles can also be composed of iron.

FERROUS

Metals which are made of, or contain, iron.

PINPOINTING

Pinpointing is the process of finding the exact location of a buried object. Long-buried metals can appear exactly like the surrounding soil, and can therefore be very hard to isolate from the soil.

PULL-TABS

Discarded pull-tabs from beverage containers are the most bothersome trash items for treasure hunters. They come in many different shapes and sizes. Most pull-tabs can be eliminated with the Mode Control, but some other valuable objects can have a magnetic signature similar to pull-tabs, and will also be eliminated when discriminating out pull-tabs.

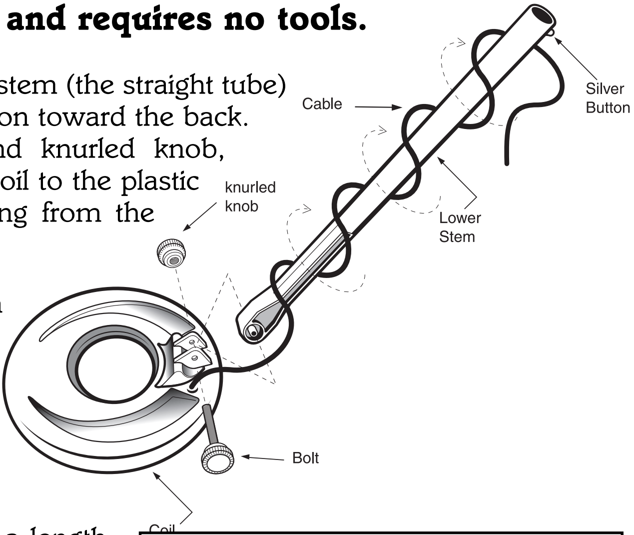
GROUND BALANCE

Ground Balancing is the ability of the detector to ignore, or "see through," the earth's naturally occurring minerals, and only sound a tone when a metal object is detected.

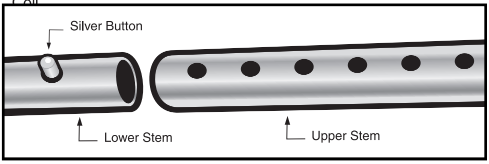
ASSEMBLY

Assembly is easy and requires no tools.

❶ Position the lower stem (the straight tube) with the silver button toward the back. Using the bolt and knurled knob, attach the search coil to the plastic extension protruding from the lower stem.



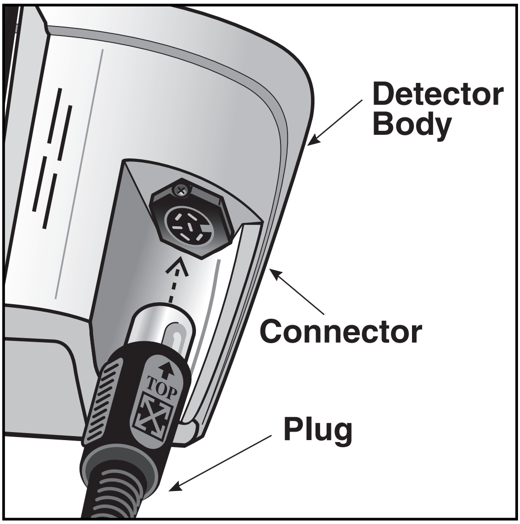
❷ Press the button on the upper end of the lower stem, and slide the lower stem into the upper stem.



Adjust the stem to a length that lets you maintain a comfortable upright posture, with your arm relaxed at your side, and the search coil parallel to the ground in front of you.

❸ Wind the cable securely around the stem.

❹ Insert the plug into the matching connector on the right underside of the detector body. Be sure that the key-way and pins line up correctly.



Caution: Do not force the plug in. Excess force will cause damage.
To disconnect the cable, pull on the plug.

Do not pull on the cable.

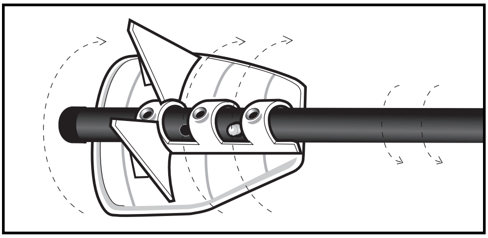
ASSEMBLY

Adjusting the Arm Rest

Most people will find the standard position of the armrest very comfortable. Very large forearms and short forearms (particularly children's arms), can be accommodated by moving the armrest forward.

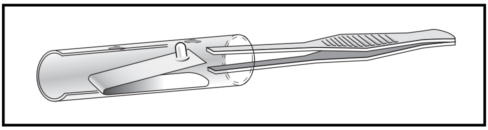
The armrest is adjustable to three positions.

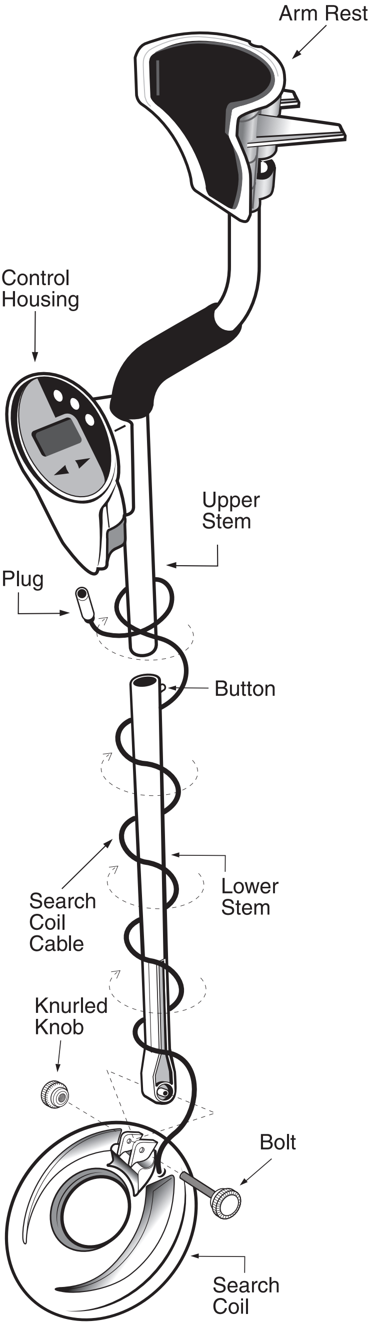
To adjust, press the silver button on the underside, and move the armrest to one of the alternate positions. If you cannot fully depress the button with your finger, use a narrow object, such as the blunt end of a ballpoint pen. The armrest must be twisted with moderate force to move it to an alternate position; this adjustment is usually made infrequently.



If desired for added stability, re-install the screw. The screw is not re-installed in the furthest forward position.

If the button becomes disengaged inside of the tube, remove the plastic cap at the end of the tube to access the clip inside. With a pair of needle-nose pliers, reengage the button. Then replace the plastic cap.

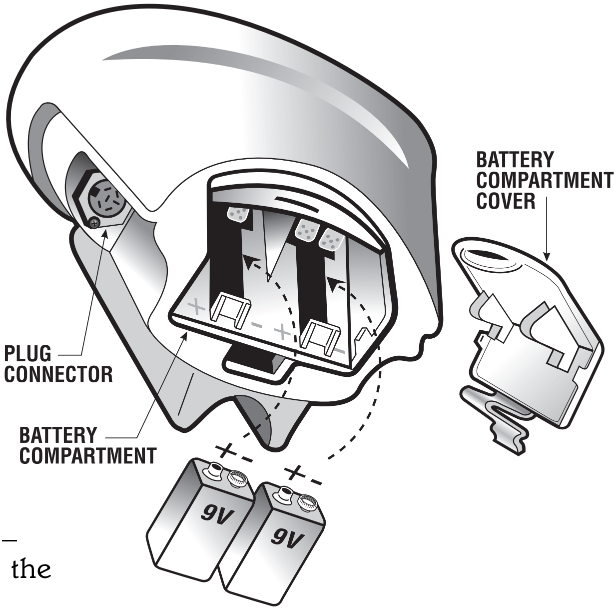




BATTERIES

Use **ALKALINE** batteries only.

To install the batteries:



❶ Remove the battery cover by disengaging the clip at the back.

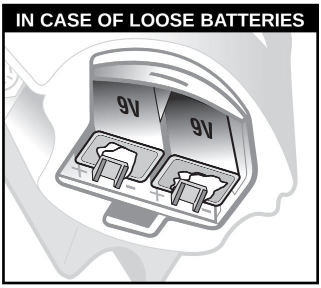
❷ Align the polarity of the batteries correctly, with the positive "+" toward the coil plug connection, as indicated by the + and – indicators on the housing.

❸ Insert (2) 9-Volt **ALKALINE** batteries, with the contacts pointed inward, and press down on the back of the batteries to snap them into place.

Some brands of batteries will require moderate force to clear the retaining tabs.

If the batteries fit loosely, and you want to guarantee a very secure electrical contact, insert a piece of paper or thin cardboard between the back of the battery and the supporting post.

IN CASE OF LOOSE BATTERIES



❹ Replace the battery door.

The Low Battery Indicator will come on and stay on if the batteries need to be replaced.

Most metal detector problems are due to improperly installed batteries, or the use of non-alkaline or discharged batteries. **If the detector does not turn on, please check the batteries.**

If the detector does not turn on, check to see that the batteries fit tightly. If the batteries are loose, press them forward while pressing the ON touchpad. To tighten up a loose battery, wedge a piece of paper or thin cardboard between the back of the battery and the supporting post, as illustrated above.

QUICK-START DEMONSTRATION

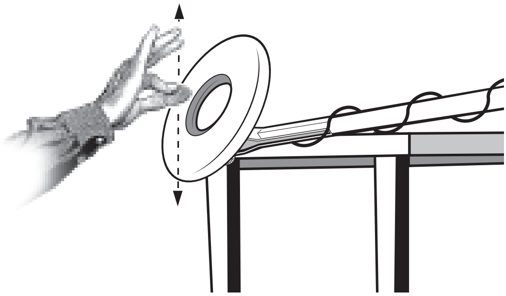
I. Supplies Needed

- A Nail
- A Pull-Tab from a beverage can
- A Quarter
- A Zinc Penny (dated after 1982)

II. Position the Detector

a. Place the detector on a table, with the search coil hanging over the edge. (or better, have a friend hold the detector, with the coil off the ground)

b. Keep the search coil away from walls, floors, and metal objects.



c. Remove watches, rings and other jewelry or metal objects from hands and wrists.

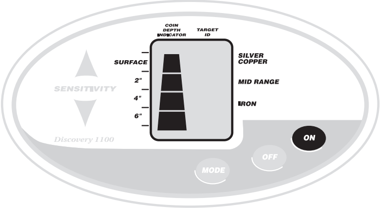
d. Turn off appliances or lights that cause electromagnetic interference.

e. Pivot search coil back toward the detector body.

III. Power Up

Press the ON touchpad.

The detector will beep twice and the full sensitivity setting will be indicated on the left of the display.



IV. Wave each Object over the Search Coil

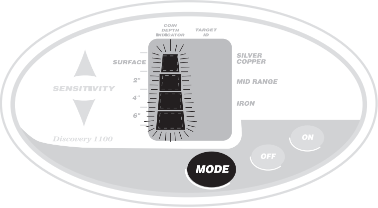
a. Notice a different tone for each object.

Low Tone:	Nail
Medium Tone:	Pull-tab & Zinc Penny
High Tone:	Quarter

b. Motion is required. Objects must be in motion over the search coil to be detected.

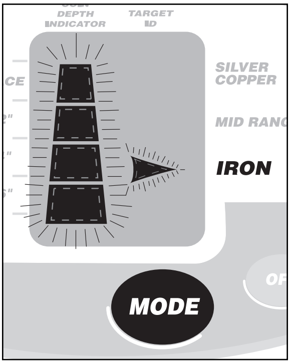
V. Press the MODE touchpad(*)

The detector will beep twice and the sensitivity setting will flash on the left side of the display.



Quick-Start Demo continued on next page

QUICK-START DEMONSTRATION (continued)



VI. Press the MODE touchpad again.(*)

a. A flashing indicator will point toward IRON.

b. The flashing indicator tells us that Iron has been eliminated from detection.

VII. Wave the Nail over the Search Coil

a. The Nail will not be detected.

b. The Nail has been "Discriminated Out."

VIII. Wave the Quarter, Penny, and Pull-Tab over the Search Coil

These non-ferrous objects will be detected with their own distinctive tones.

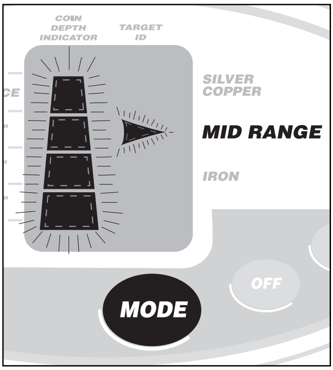
IX. Press the MODE touchpad again.(*)

a. The detector will beep twice and the sensitivity setting will flash on the left side of the display.

b. Notice the flashing arrow pointing toward Iron.
The flashing arrow indicates that this target category is currently "Discriminated Out."

X. Press the MODE touchpad again.(*)

The flashing arrow will now point toward MID-RANGE.



XI. Wave all objects over the Search Coil

The Pull-Tab and Zinc Penny will not be detected.

The other objects will be detected with their own distinctive tones.

XII. Toggle modes by pressing the MODE touchpad again.(*)

a. Press once to see the current discrimination status of the detector (Mid-Range Eliminated).

b. Then press again to toggle to the third discrimination setting.
   - i. Iron is eliminated.
   - ii. Mid-Range Metals are eliminated.
   - iii. Only high-tone metals like silver and copper will be detected.

(*)Note: The mode status will flash for 10 seconds. After 10 seconds, mode status will time-out and stop flashing.

BASIC OPERATION

POWERING UP

Press the ON touchpad.

All display indicators will illuminate momentarily.

The 4-segment pyramid-shaped Sensitivity Indicator will illuminate on the left side of the display. The 4-segment pyramid indicates that the detector is at full sensitivity.

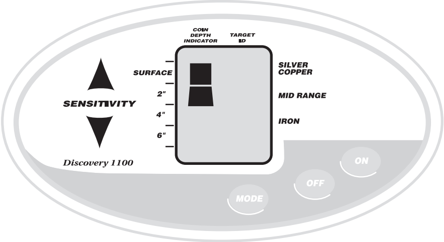
When an object is detected, the object will be identified by a tone, a display indicator, and a depth indication.

A two-minute "warm-up" is required before the detector reaches full sensitivity.

UNDERSTANDING THE DISPLAY

The LEFT SIDE of the display has a dual purpose:

❶ SENSITIVITY LEVEL

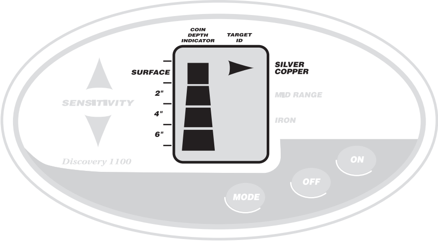


Upon power-up, and after pressing either the up- or down-sensitivity pads, the pyramid-shaped display indicates the detector's **sensitivity level.**

The sensitivity level can be changed using the up- and down-pads.

At maximum sensitivity, the unit can detect a coin-sized metal object buried about 6" beneath the surface; larger objects can be detected much deeper.

❷ DEPTH INDICATION



After detecting an object, the pyramid-shaped display indicates the approximate **depth** of buried, coin-sized objects.

Objects at or near the surface will illuminate the single segment at the top of the scale.

More deeply buried objects will illuminate more segments, indicating depths of 2, 4, or 6 inches, as identified to the left of the display.

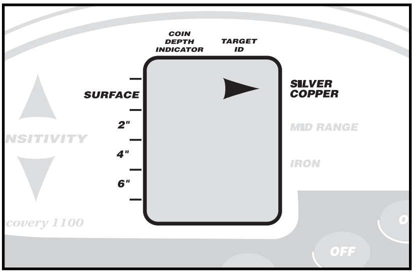
The depth indicator is not accurate for large, or irregularly shaped, objects. However, the scale will provide relative depth indications for larger objects; a given object will induce deeper readings the farther it is from the search coil.

BASIC OPERATION (continued)

The RIGHT SIDE of the display classifies objects into three categories.

Silver/Copper:

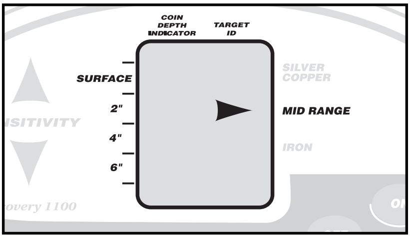
Objects composed of silver and cooper will illuminate this arrow. Buried and heavily oxidized metal objects, such as old tin cans, can also fall into this category. Larger aluminum objects, like beverage cans, will sometimes fall into this category.



Mid-Range:

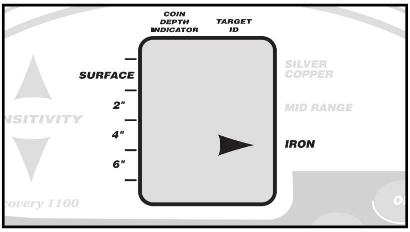
Mid-range objects cover a large variety of metals.

Among them are: pull-tabs from beverage containers, nickels, medium-sized gold objects, some types of aluminum, and zinc.

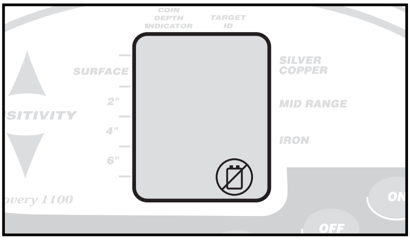


Iron:

All ferrous objects, and some smaller aluminum objects, fall into the iron category. Small gold objects can also fall into this range.



The BOTTOM RIGHT SIDE of the display will illuminate a Low Battery Indicator symbol if the batteries are discharged. The indicator illuminates, and remains illuminated, when the 9-volt batteries have discharged to a level of 7.35 volts.



Reading the Display IN THE FIELD

With the detector in use in the field, the display will indicate both the DEPTH and the TARGET IDENTIFICATION of each object detected. After a target is detected, these indicators will remain illuminated with this information until the next target has been detected. If uncertain about the target's identification, try sweeping the coil at a faster speed. A more rapid sweep over a target will generally provide a more accurate target identification.

The MODE CONTROL

The MODE touchpad allows for the elimination from detection of unwanted metal objects.
By pressing MODE, the user toggles among four different discrimination settings.

During MODE (or discrimination) selection, the SENSITIVITY INDICATOR on the left of the display will flash continually. The detector will remain in this discrimination selection mode for 10 seconds until a metal object has been detected.

> *If an object is detected during mode selection, the detector will exit mode selection. If this happens, you will need to press MODE again and begin mode selection over again. To avoid this, keep the detector stationary and reduce sensitivity before pressing MODE.*

The MODE touchpad has two functions:
Each first press of MODE will be followed by.

❶ A distinctive tone or tones, indication the detector's stored discriminating setting.

HIGH TONE - no object eliminated.
LOW TONE - iron eliminated.
MEDIUM TONE - mid-range metals eliminated.
LOW & MEDIUM TONE - irons and mid-range metals both eliminated.

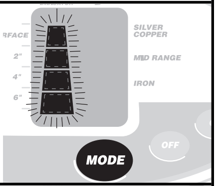
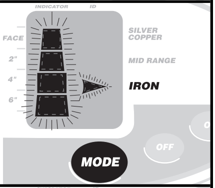
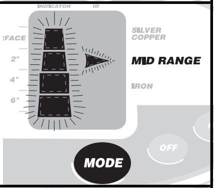
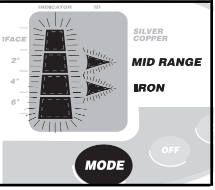
❷ Flashing target and sensitivity indicators. The flashing target indicators point to the targets eliminated.

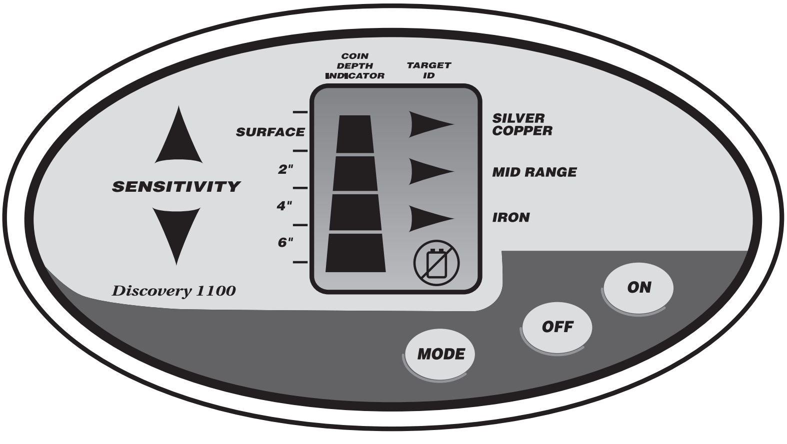
Each **subsequent** press of MODE will toggle between discrimination settings. The flashing arrow indicates the target category eliminated.

The detector will store the current discrimination setting until the power is turned off.

BASIC OPERATION (continued)

Discrimination Settings are as follows:

Mode	Metals Eliminated	Status Tones	Display (During discrimination selection)
All-Metal	None	High	No Target Indicators Flashing 
Iron Discrimination	Ferrous only	Low	Iron Indicator Flashing 
Mid-Range Discrimination	Pull-tabs, Screw Caps, some Foil, medium Gold, Zinc, Nickels	Medium	Mid-Range Indicator Flashing 
Full Discrimination	Ferrous and Mid-Range metals	Low & Medium	Iron and Mid-Range Indicators Flashing 



AUDIO TARGET IDENTIFICATION

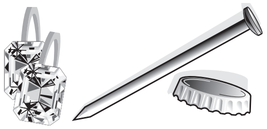
While the LCD (Liquid Crystal Display) is very accurate in identifying buried objects, the user in the field does not always maintain the display screen in his field of vision. Therefore, we have incorporated an audio feedback mechanism to alert the user to the nature of buried objects. This audio feedback system first alerts the user to the presence and classification of objects, whose nature and location can be confirmed using the LCD display.

The detector will sound three different tones. These three tones correspond to the three target categories depicted on the LCD display.

LOW TONE
Ferrous objects, such as iron and steel, will induce a low tone. Small gold objects can also induce a low tone.

MEDIUM TONE
Pull-tabs, newer pennies (post-1982), larger gold objects, zinc, small brass objects, and most bottle screw caps will induce medium tones. Many recent vintage foreign currencies will induce medium tones, including loonies & toonies.

HIGH TONE
Silver and copper coins, larger brass objects, older pennies (pre-1982), and highly oxidized metals will induce high tones. Quarters, dimes and other precious coins fall into this category.

LOW TONE	MEDIUM TONE	HIGH TONE
 Nails, Bottle Caps, & Small Gold	 Old & New Pull Tabs, Zinc US Pennies (Post 1982), Nickel, Larger Gold Objects, Pennies, Loonies & Toonies.	 Copper, Silver & Brass Copper Pennies (Pre 1982)

Audio Target Identification (ATI) classifies metals into three categories.

SENSITIVITY ADJUSTMENT

Upon power-up, the detector defaults to 3/4 sensitivity. To increse to full sensitivity, press the Sensitivity ▲ touch pad.

ELECTROMAGNETIC INTERFERENCE

The principle use for the Sensitivity Control is to eliminate Electromagnetic Interference (EMI).
A hobby metal detector is an extremely sensitive device; the search coil creates its own magnetic field and acts like an antenna. If your detector beeps erratically when the search coil is motionless, the unit is probably detecting another magnetic field.

Common sources of EMI are electric power lines, both suspended and buried, motors, and household appliances like computers and microwave ovens. Some indoor electronic devices, such as dimmer switches used on household lighting, produce severe EMI and will cause the detector to beep erratically. Other metal detectors also produce their own electromagnetic fields, so if detecting with a friend, keep two metal detectors at least 20 feet apart.

If the detector beeps erratically, REDUCE THE SENSITIVITY by pressing the Down-Sensitivity Arrow ▼ on the left of the control panel.

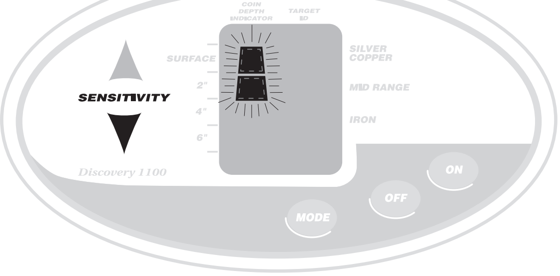
SEVERE GROUND CONDITIONS

A secondary use for the Sensitivity Control is to reduce false detection signals caused by severe ground conditions. While your Discovery 1100 contains circuitry to eliminate the signals caused by most naturally occurring ground minerals, 100% of all ground conditions cannot be anticipated. Highly magnetic soils found in mountainous and gold-prospecting locations can cause the detector to emit tones when metal objects are not present. High saline content soils and sands can also cause the detector to false.

If the detector emits false, non-repeatable, signals, REDUCE THE SENSITIVITY.

MULTIPLE TARGETS

If you suspect the presence of deeper targets beneath a shallower target, reduce the sensitivity to eliminate the detection of the deeper targets, in order to properly locate and identify the shallower target.

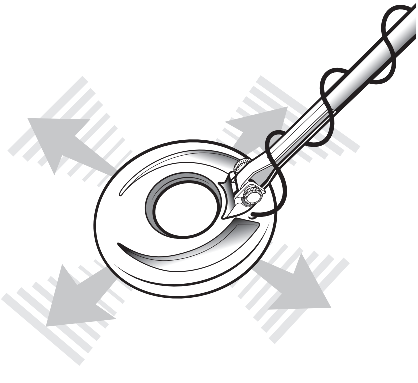


IN THE FIELD TECHNIQUES

PINPOINTING

Accurate pinpointing takes practice and is best accomplished by "X-ing" the target area.

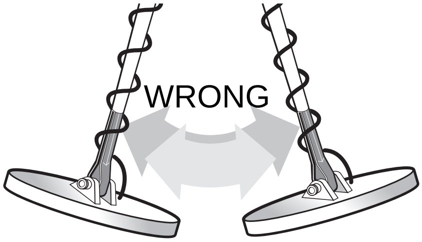
1. Once a buried target is indicated by a good tone response, continue sweeping the coil over the target in a narrowing side-to-side pattern.
2. Take visual note of the place on the ground where the "beep" sounds.
3. Stop the coil directly over this spot on the ground.
4. Now move the coil straight forward and straight back towards you a couple of times.
5. Again make visual note of the spot on the ground at which the "beep" sounds.
6. If needed, "X" the target at different angles to "zero in" on the exact spot on the ground at which the "beep" sounds.

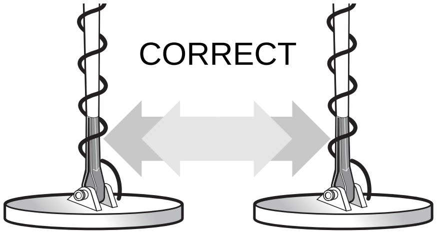


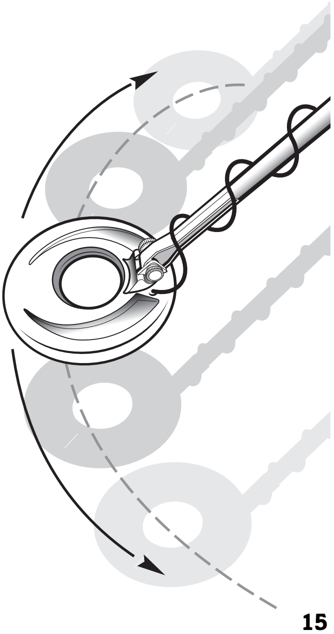
When pinpointing a target, try drawing an "X", as illustrated, over where the tone is induced.

COIL MOVEMENT

When swinging the coil, be careful to keep it level with the ground about one inch from the surface. Never swing the coil like a pendulum.

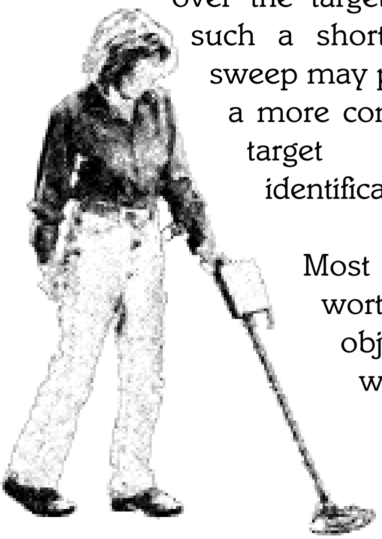






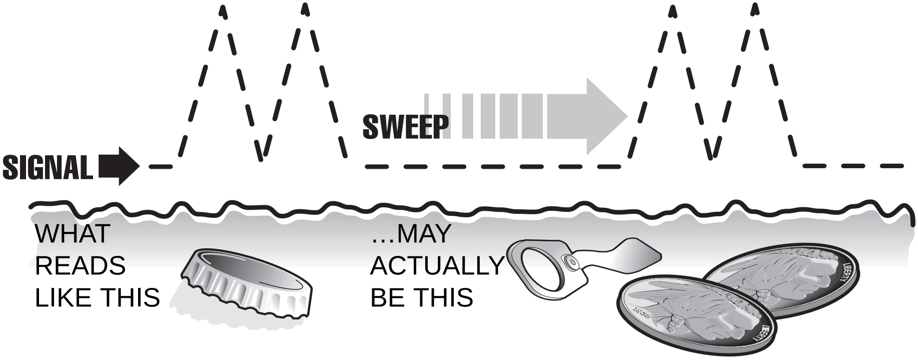
IN THE FIELD TECHNIQUES (continued)

Swing the search coil slowly, overlapping each sweep as you move forward. It is important to sweep the coil at a consistent speed over the ground as you search. After identifying a target, your sweep technique can help in identifying both the location and the nature of the target. If you encounter a weak signal, try moving the coil in short, rapid sweeps over the target zone; such a short rapid sweep may provide a more consistent target identification.



Most worthwhile objects will respond with a repeatable tone. If the signal does not repeat after sweeping the coil directly over the suspected target a few times, it is more than likely trash metal.

Crossing the target zone with multiple intersecting sweeps at multiple angles is another way to verify the repeatability of the signal, and the potential of the buried target. To use this method, walk around the target area in a circle, sweeping the coil across the target repeatedly, every 30 to 40 degrees of the circle, about ten different angles as you walk completely around the target. If a high-tone target completely disappears from detection at a given angle, chances are that you are detecting oxidized ferrous metals, rather than a silver or copper object. If the tone changes a different angles,

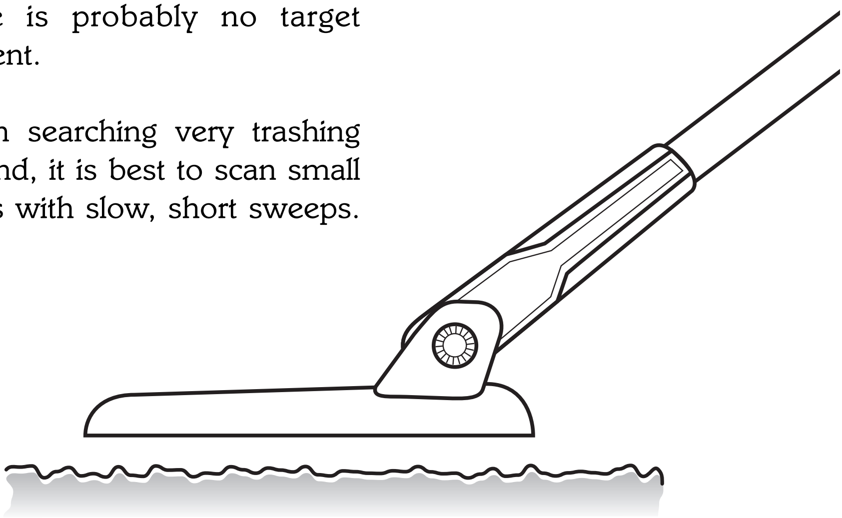


you many have encountered multiple objects. If you are new to the hobby, you may want to dig all targets at first. With practice in the field, you will learn to better discern the nature of buried objects by the nature of the detector's response.

You may encounter some false signals as you proceed. False signals occur when the detector beeps, but no metal target is present. False signals can be induced by electromagnetic interference, oxidation, or highly mineralized ground soils. If the detector beeps once, but does not repeat the signal with several additional sweeps over the same spot, there is probably no target present.

When searching very trashing ground, it is best to scan small areas with slow, short sweeps. You will be surprised just how much trash metal and foil you will find in some areas. The trashiest areas have been frequented by the most people, and frequently hold the most promise for finding the most lost valuables.

Also maintain the search coil positioned just above the surface of the ground, without making contact with the ground. Making contact with the ground can cause false signals.



TROUBLE SHOOTING GUIDE

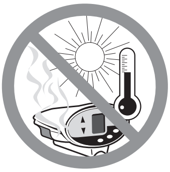
SYMPTOM	**CAUSE**	**SOLUTION**
Detector chatters or beeps erratically	• Using detector indoors • Using detector near power lines • Using 2 detectors in close proximity • Highly oxidized buried object • Environmental electromagnetic interference	• Use detector outdoors only • Move away from power lines • Keep 2 detectors at least 20' apart • Only dig up repeatable signals • Reduce sensitivity until erratic signals cease
Constant low tone or constant repeating tones	• Discharged batteries • Wrong type of batteries	• Replace batteries • Use only 9V **alkaline** batteries
LCD does not lock on to one target ID or detector emits multiple tones	• Multiple targets present • Highly oxidized target • Sensitivity set too high	• Move coil slowly at different angles • Reduce sensitivity
No power, no sounds	• Dead batteries • Poor battery contact • Cord not connected securely	• Replace batteries • Push batteries in tighter • Insert paper spacers (see page 6) • Check connections

CARE AND MAINTENANCE

Your Discovery 1100 Metal Detector is an example of superior design and craftsmanship. The following suggestions will help you care for your metal detector so you can enjoy it for years to come.

Keep the detector's chassis dry and do not let water enter it. If the chassis gets wet, wipe it dry immediately. Liquids might contain minerals that can corrode the electronic circuits.

Use and store the detector only in normal temperature environments. Temperature extremes can shorten the life of electronic devices, damage batteries, and distort or melt plastic parts.



Keep the detector away from dust and dirt, which can cause premature wear of parts.

Handle the detector gently and carefully. Dropping it can damage circuit boards and cases and can cause the detector to work improperly.

Use only fresh batteries of the required size and type. Old batteries can leak chemicals that damage your detector's electronic parts.

Wipe the detector with a damp cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean it.

Modify or tampering with the detector's internal components can cause a malfunction and might invalidate it's warranty.

The searchcoil supplied with the detector is waterproof however, and may be submerged in either fresh or salt water. After using the searchcoil in salt water, rinse it with fresh water to prevent corrosion of the metal parts.

TREASURE HUNTER'S CODE OF ETHICS:

1. Respect the rights and property of others.
2. Observe all laws, whether national, state or local.
3. Never destroy historical or archaeological treasures.
4. Leave the land and vegetation as it was. Fill in the holes.
5. All treasure hunters may be judged by the example you set. Always obtain permission before searching any site. Be extremely careful while probing, picking up, or discarding trash items. And ALWAYS COVER YOUR HOLES!

First Texas Products, L.P.
Five Year Limited Warranty

Bounty Hunter Metal Detectors are warranted against defects in workmanship or materials under normal use for five years from date of purchase to the original user. Liability in all events is limited to the purchase price paid. Liability under this Warranty is limited to replacing or repairing, at our option, any Bounty Hunter Detector returned, shipping cost prepaid, to First Texas Products, L.P. Damage due to neglect, accidental damage or misuse of this product is not covered by this warranty.

Published by First Texas Products, L.P.

www.detecting.com

BOUNTY HUNTER®
METAL DETECTORS

First Texas Products, LP
1465-H Henry Brennan
El Paso, TX 79936
(915) 633-8354

APPENDIX E

HUMAN HEALTH RISK SCREEN

APPENDIX E.1

IEUBK LEAD MODEL RESULTS

```
                  LEAD MODEL FOR WINDOWS Version 1.0

     ==================================================================================
     Model Version: 1.0 Build 264
     User Name: Tina Devine
     Date: 11/13/2008
     Site Name: RFAAP
     Operable Unit: MMRP
     Run Mode: Site Risk Assessment
     ----------------------------------------------------------------------------------

# Soil/Dust Data
Mean Concentration of Lead in Soil
     ==================================================================================
     The time step used in this model run: 1 - Every 4 Hours (6 times a day).

     ****** Air ******

     Indoor Air Pb Concentration: 30.000 percent of outdoor.
     Other Air Parameters:

     Age        Time        Ventilation          Lung          Outdoor Air
              Outdoors          Rate          Absorption         Pb Conc
              (hours)        (m^3/day)            (%)          (ug Pb/m^3)
     ----------------------------------------------------------------------
     .5-1      1.000           2.000            32.000           0.100
     1-2       2.000           3.000            32.000           0.100
     2-3       3.000           5.000            32.000           0.100
     3-4       4.000           5.000            32.000           0.100
     4-5       4.000           5.000            32.000           0.100
     5-6       4.000           7.000            32.000           0.100
     6-7       4.000           7.000            32.000           0.100

     ****** Diet ******

     Age     Diet Intake(ug/day)
     -----------------------------------
     .5-1      2.260
     1-2       1.960
     2-3       2.130
     3-4       2.040
     4-5       1.950
     5-6       2.050
     6-7       2.220

     ****** Drinking Water ******

     Water Consumption:
     Age     Water (L/day)
     -----------------------------------
     .5-1      0.200
     1-2       0.500
     2-3       0.520
     3-4       0.530
     4-5       0.550
     5-6       0.580
     6-7       0.590

     Drinking Water Concentration: 4.000 ug Pb/L

     ****** Soil & Dust ******

     Multiple Source Analysis Used
     Average multiple source concentration: 257.100 ug/g
```

```
Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age          Soil (ug Pb/g)       House Dust (ug Pb/g)
--------------------------------------------------------
.5-1              353.000              257.100
1-2               353.000              257.100
2-3               353.000              257.100
3-4               353.000              257.100
4-5               353.000              257.100
5-6               353.000              257.100
6-7               353.000              257.100

****** Alternate Intake ******

Age      Alternate (ug Pb/day)
-----------------------------------
.5-1     0.000
1-2      0.000
2-3      0.000
3-4      0.000
4-5      0.000
5-6      0.000
6-7      0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 2.500 ug Pb/dL

*****************************************
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
*****************************************

Year          Air                  Diet                 Alternate       Water
           (ug/day)              (ug/day)               (ug/day)      (ug/day)
--------------------------------------------------------------------------------
.5-1         0.021                1.027                0.000          0.363
1-2          0.034                0.876                0.000          0.894
2-3          0.062                0.966                0.000          0.944
3-4          0.067                0.938                0.000          0.975
4-5          0.067                0.921                0.000          1.039
5-6          0.093                0.977                0.000          1.106
6-7          0.093                1.064                0.000          1.131

 Year      Soil+Dust             Total                Blood
           (ug/day)             (ug/day)              (ug/dL)
----------------------------------------------------------------
.5-1         6.958                8.369                4.5
1-2         10.872               12.677                5.2
2-3         11.034               13.007                4.8
3-4         11.183               13.163                4.6
4-5          8.505               10.530                3.8
5-6          7.729                9.906                3.2
6-7          7.338                9.626                2.8
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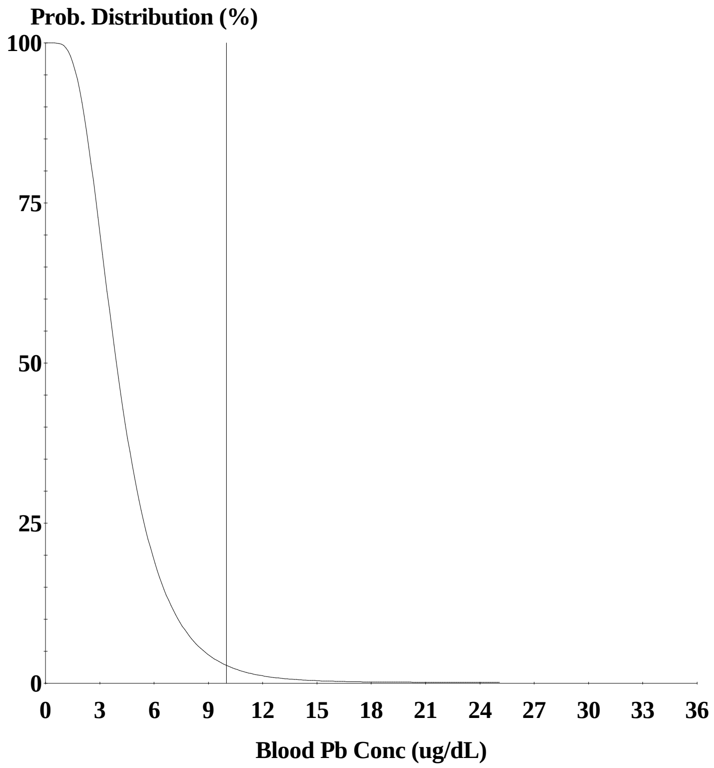

Cutoff = 10.000 ug/dl
Geo Mean = 4.105
GSD = 1.600
% Above = 2.909

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Site Risk Assessment

APPENDIX E.2

EXPOSURE POINT CONCENTRATION CALCULATIONS

Table E.2-1
EPC Calculation Results - Soil
ProUCL 4.0 for Full Data Sets
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

General UCL Statistics for Full Data Sets

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics			
Number of Valid Observations	15	Number of Distinct Observations	14
Raw Statistics		**Log-transformed Statistics**	
Minimum	4.03	Minimum of Log Data	1.394
Maximum	49.2	Maximum of Log Data	3.896
Mean	15.52	Mean of log Data	2.326
Median	6.01	SD of log Data	0.918
SD	15.04		
Coefficient of Variation	0.969		
Skewness	1.148		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.761	Shapiro Wilk Test Statistic	0.83
Shapiro Wilk Critical Value	0.881	Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.36	95% H-UCL	29.67
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	31.86
95% Adjusted-CLT UCL	23.14	97.5% Chebyshev (MVUE) UCL	39.14
95% Modified-t UCL	22.55	99% Chebyshev (MVUE) UCL	53.43
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.12	Data do not follow a Discernable Distribution (0.05)	
Theta Star	13.86		
nu star	33.59		
Approximate Chi Square Value (.05)	21.34	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0324	95% CLT UCL	21.91
Adjusted Chi Square Value	20.14	95% Jackknife UCL	22.36
		95% Standard Bootstrap UCL	21.65
Anderson-Darling Test Statistic	1.346	95% Bootstrap-t UCL	24.49
Anderson-Darling 5% Critical Value	0.757	95% Hall's Bootstrap UCL	21.76
Kolmogorov-Smirnov Test Statistic	0.273	95% Percentile Bootstrap UCL	21.94
Kolmogorov-Smirnov 5% Critical Value	0.226	95% BCA Bootstrap UCL	22.97
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	32.45
		97.5% Chebyshev(Mean, Sd) UCL	39.77
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	54.16
95% Approximate Gamma UCL	24.43		
95% Adjusted Gamma UCL	25.89		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	32.45

Table E.2-1
EPC Calculation Results - Soil
ProUCL 4.0 for Full Data Sets
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chromium

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Chromium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Table E.2-1
EPC Calculation Results - Soil
ProUCL 4.0 for Full Data Sets
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Lead

General Statistics			
Number of Valid Observations	15	Number of Distinct Observations	15
Raw Statistics		**Log-transformed Statistics**	
Minimum	16.6	Minimum of Log Data	2.809
Maximum	1630	Maximum of Log Data	7.396
Mean	353	Mean of log Data	5.045
Median	138	SD of log Data	1.32
SD	526.5		
Coefficient of Variation	1.491		
Skewness	2.16		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.613	Shapiro Wilk Test Statistic	0.966
Shapiro Wilk Critical Value	0.881	Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	592.5	95% H-UCL	1184
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	903.5
95% Adjusted-CLT UCL	657.7	97.5% Chebyshev (MVUE) UCL	1148
95% Modified-t UCL	605.1	99% Chebyshev (MVUE) UCL	1629
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.63	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	560.7		
nu star	18.89		
Approximate Chi Square Value (.05)	10.04	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0324	95% CLT UCL	576.6
Adjusted Chi Square Value	9.25	95% Jackknife UCL	592.5
		95% Standard Bootstrap UCL	572.4
Anderson-Darling Test Statistic	0.716	95% Bootstrap-t UCL	1164
Anderson-Darling 5% Critical Value	0.776	95% Hall's Bootstrap UCL	1852
Kolmogorov-Smirnov Test Statistic	0.175	95% Percentile Bootstrap UCL	591.6
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	698.7
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	945.6
		97.5% Chebyshev(Mean, Sd) UCL	1202
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1706
95% Approximate Gamma UCL	664.4		
95% Adjusted Gamma UCL	720.9		
Potential UCL to Use		Use 95% Approximate Gamma UCL	664.4

Table E.2-2
EPC Calculation Results - Soil
ProUCL 4.0 for Data Sets with Non-Detects
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet.wst	
Full Precision	OFF	
Confidence Coefficient	95%	
Number of Bootstrap Operations		2000

Antimony

General Statistics

Number of Valid Data	13	Number of Detected Data	7
Number of Distinct Detected Data	6	Number of Non-Detect Data	6
		Percent Non-Detects	46.15%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1.32	Minimum Detected	0.278
Maximum Detected	24.4	Maximum Detected	3.195
Mean of Detected	8.857	Mean of Detected	1.632
SD of Detected	9.305	SD of Detected	1.18
Minimum Non-Detect	1.13	Minimum Non-Detect	0.122
Maximum Non-Detect	1.45	Maximum Non-Detect	0.372

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	8
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	5
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	61.54%

Warning: There are only 7 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Table E.2-2
EPC Calculation Results - Soil
ProUCL 4.0 for Data Sets with Non-Detects
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.813	Shapiro Wilk Test Statistic	0.915
5% Shapiro Wilk Critical Value	0.803	5% Shapiro Wilk Critical Value	0.803
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	5.075	Mean	0.687
SD	7.834	SD	1.352
95% DL/2 (t) UCL	8.947	95% H-Stat (DL/2) UCL	7.742
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	0.37
		SD in Log Scale	1.669
		Mean in Original Scale	4.935
		SD in Original Scale	7.921
		95% Percentile Bootstrap UCL	8.934
		95% BCA Bootstrap UCL	9.951
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.692	Data appear Normal at 5% Significance Level	
Theta Star	12.79		
nu star	9.694		
A-D Test Statistic	0.37	**Nonparametric Statistics**	
5% A-D Critical Value	0.727	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.727	Mean	5.378
5% K-S Critical Value	0.319	SD	7.354
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	2.203
		95% KM (t) UCL	9.305
Assuming Gamma Distribution		95% KM (z) UCL	9.002
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	9.162
Minimum	1.32	95% KM (bootstrap t) UCL	16.7
Maximum	24.4	95% KM (BCA) UCL	10.62
Mean	8.517	95% KM (Percentile Bootstrap) UCL	9.428
Median	7.515	95% KM (Chebyshev) UCL	14.98
SD	6.605	97.5% KM (Chebyshev) UCL	19.14
k star	1.456	99% KM (Chebyshev) UCL	27.3
Theta star	5.849		
Nu star	37.86	**Potential UCLs to Use**	
AppChi2	24.77	95% KM (t) UCL	9.305
95% Gamma Approximate UCL	13.02	95% KM (Percentile Bootstrap) UCL	9.428
95% Adjusted Gamma UCL	13.86		

Note: DL/2 is not a recommended method.

Table E.2-3
Exposure Point Concentration Summary for Surface Soil
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Exposure Point	CAS No	Chemical of Potential Concern	Units	Arithmetic Mean of Detects	UCL	Maximum Concentration	Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Surface Soil	7440-36-0	Antimony	mg/kg	8.857	9.305	24.4	9.305	mg/kg	95% KM (t) UCL	ProUCL 4.0
	7440-38-2	Arsenic	mg/kg	15.52	32.45	49	32.450	mg/kg	95% KM (Chebyshev) UCL	ProUCL 4.0
	7439-92-1	Lead	mg/kg	353	664.4	1,630	664.4	mg/kg	95% Approximate Gamma UCL	ProUCL 4.0

Notes:

FOD = frequency of detection

UCL = Upper Confidence Limit

mg/kg = Milligram Per Kilogram

APPENDIX E.3

CUMULATIVE SCREENING-LEVEL HHRA TABLES

Table E.3-1
Cumulative Screening-Level HHRA Using MDCs
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

CAS #	Chemical	Units	Detection Frequency	MDC	RSL Residential	C/N	RSL Industrial	C/N	Non Carcinogenic HI (Residential)	Excess Cancer Risk (Residential)	Non Carcinogenic HI (Industrial)	Excess Cancer Risk (Industrial)	Noncarcinogenic Target Organ
	TAL Metals												
7440-36-0	Antimony	mg/kg	7/13	24.4	31	N	410	N	0.8	--	0.06	--	blood
7440-36-0	Arsenic (cancer) [1]	mg/kg	15/15	49.2	0.39	C	1.6	C	--	1.E-04	--	3.E-05	--
7440-38-2	Arsenic (non-cancer) [1]	mg/kg	15/15	49.2	22	N	260	N	2	--	0.2	--	skin/vascular
							Cumulative Risk/Hazard		3	1.E-04	0.2	3.E-05	
Target Organ Segregation							Total blood HI =		0.8		Total blood HI =	0.06	
							Total skin HI =		2		Total skin HI =	0.2	
							Total vascular HI =		2		Total vascular HI =	0.2	

Notes:
mg/kg = Milligram Per Kilogram
CAS = Chemical Abstracts Service
TAL = Target Analyte List
MDC = Maximum Detected Concentration
RSL = USEPA Risk-Based Screening Level from USEPA Regional Screening Table (September 2008)
A Hazard Quotient (HQ) of 1.0 is used for non-cancer RSLs for cumulative screening purposes
N = Noncarcinogenic per USEPA RSL Table (September 2008)
C = Carcinogenic per USEPA RSL Table (September 2008)
[1] = Arsenic has both cancer and non-cancer toxicity data available, therefore cancer and non-cancer health effects are evaluated in this cumulative screenining analysis.
HI = Hazard Index

Table E.3-2
Cumulative Screening-Level HHRA Using EPCs
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

CAS #	Chemical	Units	Detection Frequency	EPC	RSL Residential	C/N	RSL Industrial	C/N	Hazard (Residential)	Risk (Residential)	Hazard (Industrial)	Risk (Industrial)	Hazard Segregation Target Organ
	TAL Metals												
7440-36-0	Antimony	mg/kg	7/13	9.305	31	N	410	N	0.3	--	0.02	--	blood
7440-38-2	Arsenic (cancer) [1]	mg/kg	15/15	32.45	0.39	C	2	C	--	8.E-05	--	2.E-05	skin/ vascular
7440-38-2	Arsenic (non-cancer) [1]	mg/kg	15/15	32.45	22	N	260	N	1.5	--	0.1	--	skin/ vascular
							Cumulative Risk/Hazard		2	8.E-05	0.1	2.E-05	
Target Organ Segregation							Total blood HI =		0.3		Total blood HI =	0.02	
							Total skin HI =		1		Total skin HI =	0.1	
							Total vascular HI =		1		Total vascular HI =	0.1	

Notes:

mg/kg = Milligram Per Kilogram
CAS = Chemical Abstracts Service
TAL = Target Analyte List
EPC = Exposure Point Concentration
RSL = USEPA Risk-Based Screening Level from USEPA Regional Screening Table (September 2008)
A Hazard Quotient (HQ) of 1.0 is used for non-cancer RSLs for cumulative screening purposes
N = Noncarcinogenic per USEPA RSL Table (September 2008)
C = Carcinogenic per USEPA RSL Table (September 2008)
[1] = Arsenic has both cancer and non-cancer toxicity data available, therefore cancer and non-cancer health effects are evaluated in this cumulative screenining analysis.
HI = Hazard Index

APPENDIX F

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

APPENDIX F.1

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT PROCESS

APPENDIX F.1
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT PROCESS
MMRP SSP REPORT

TABLE OF CONTENTS

Section ***Page***

LIST OF ABBREVIATIONS AND ACRONYMS

%	Percent
ADD	Average Daily Dose
AF	Area Use Factor
BAF	Bioaccumulation Factor
BTAG	Biological Technical Assistance Group
BW	Body Weight
C_{TRV}	NOAEL- or LOAEL-based TRV concentration
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
DF	Dietary Fraction
DW:WW	Dry weight to wet weight
ECO-SSL	Ecological Soil Screening Level
EF	Extrapolation Factor
EPC	Exposure Point Concentration
HQ	Hazard Quotient
IR	Ingestion Rate
kg	Kilogram
LD_{50}	Lethal Dose to 50% of the test population
LOAEL	Lowest Observable Adverse Effects Level
MDC	Maximum Detected Concentration
mg	Milligram
mg/kg	Milligrams Per Kilogram
NOAEL	No Observable Adverse Effects Level
ORNL	Oak Ridge National Laboratory
PAH	Polynuclear Aromatic Hydrocarbon
SLERA	Screening Level Ecological Risk Assessment
TOC	Total Organic Carbon
TRV	Toxicity Reference Value
UF	Uncertainty Factor
UF_{plant}	Plant Uptake Factor
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USEPA	U.S. Environmental Protection Agency

1.0 INTRODUCTION

The purpose of this appendix is to present and describe development of exposure assessment models for the receptors presented in Section 4.3, the Screening Level Ecological Risk Assessment (SLERA) at the site. The following sections provide a summary of parameters used in the models and a detailed description of the direct contact and dose rate modeling approachs used in the SLERA. The complete SLERA for the site is presented in Appendix F.2.

2.0 MODEL PARAMETERS

The direct contact and dose rate models include parameters relating to receptor-specific exposure, chemical of potential concern (COPC) toxicity, and bioaccumulation rates. The following sections describe the estimation of these parameters and major assumptions of parameterization.

2.1 TOXICITY REFERENCE VALUES

MDCs for detected chemicals in soil are used as the preliminary exposure estimate to evaluate a conservative risk scenario for the direct contact pathway to soil invertebrates. Other potentially complete exposure pathways to soil invertebrate and microbial communities include direct ingestion of soil and biota. Due to insufficient information to quantify these pathways, likely secondary to the direct contact/absorption pathway, their omission should not substantially alter the risk characterization.

To evaluate the preliminary exposure estimates, the Toxicity Reference Values (TRVs) that were protective of terrestrial plants and soil invertebrate/microbial communities, were selected from a review of toxicological benchmarks for soil. TRVs for direct contact of soil to invertebrates/microbes and soil to plants were determined from the following guidance:

- USEPA Ecological Soil Screening Level (ECO-SSL): soil invertebrate and plant;
- Oak Ridge National Laboratory (ORNL): plant, microbial community, earthworm values (Efroymson *et al*. 1997a, Efroymson *et al*. 1997b, Efroymson *et al*. 1997c); and
- USEPA Region III Biological Technical Assistance Group (BTAG) soil screening values (USEPA 1995), BTAG freshwater screening benchmarks (USEPA 2006a), and BTAG freshwater sediment screening levels (USEPA 2006b)

Selected screening levels and sources are reported on Table F.2-3 for terrestrial plants and Table F.2-5 for soil invertebrates and microbial communities.

2.2 RECEPTOR-SPECIFIC EXPOSURE PARAMETERS

Wildlife receptors selected to characterize exposure at the site include:

- Herbivorous mammals: Meadow Vole (*Microtus pennsylvanicus*);
- Invertivorous mammals: Short-tailed Shrew (*Blarina brevicauda*);
- Invertivorous birds: American Robin (*Turdus migratorius*);
- Carnivorous birds: Red-tailed Hawk (*Buteo jamaicensis*); and
- Carnivorous mammals: Red Fox (*Vulpes vulpes*).

Exposure parameters used to derive TRV-based substrate concentrations for each receptor include body weight (kg), food ingestion rate (kg dry weight/day), dietary fraction, incidental substrate ingestion rate (kg dry weight/day), and area use factor. Both preliminary and refinement level exposure parameters are presented in Table F.2-7.

2.3 LITERATURE-BASED NOAEL AND LOAEL VALUES

The dose-response relationships for chemicals of potential concern are expressed as NOAELs and LOAELs for wildlife receptors, which are defined as a daily ingested amount (mg/kg body weight-day) that is associated with a specified effect. This process involves the determination of a "test species dose" for a critical endpoint from a particular experimental combination of exposure concentration, exposure duration, test species, and chemical. Endpoints may be based on growth, reproductive, developmental, and survival effects. Such effects are important because they may affect the abundance or reproductive success of receptor populations. The test-species dose from the selected study is then modified using extrapolation and uncertainty factors (EFs and UFs).

For this evaluation, EFs and UFs are used to modify laboratory study results, based on the methodology of Sample et al. (1996). This process involves the determination of a "test species dose" for a critical endpoint from a particular experimental combination of exposure concentration, exposure duration, test species, and chemical. The test-species dose from the selected study is then modified to account for the various extrapolations and uncertainties inherent in applying results from a controlled setting to an ecologically relevant setting, as in:

$$\text{NOAEL or LOAEL} = \frac{\text{Test-Species Dose}}{\text{Duration UF} \times \text{Endpoint UF}} \times \text{Body-Weight EF}$$

EFs and UFs are based on: (1) the duration of exposure, (2) the endpoint measured, and (3) differences in body weights among test and receptor species (Calabrese and Baldwin 1993, Ford et al. 1992, Opresko et al. 1994, Sample et al. 1996, USEPA 1996, Wentsel et al. 1994). EFs and UFs derivation and use is described in the following subsections. The use of surrogate chemical data is also discussed. NOAEL and LOAELs for COPCs are summarized in Table F.2-8.

2.3.1 The Test-Species Dose

Critical toxicological values are identified from carefully qualified primary and secondary literature references. The selection of particular studies and endpoints used for the derivation of NOAELs and LOAELs is based on the evaluation of the applicable studies and the dose-response data contained therein. In cases where preferred toxicological endpoints are not available, other toxicity values are used, but additional uncertainty factors may be incorporated. All toxicological values chosen for NOAEL and LOAEL derivation are presented on a mg chemical per kg body weight per day (mg/kg BW-day) basis. These units allow comparisons among organisms of different body sizes (Sample et al. 1996).

2.3.2 Duration Uncertainty Factors

Exposure durations of interest include (1) chronic, (2) subchronic, and (3) acute. Chronic studies occur over the lifetime or a majority of the lifespan of the test organism, generally longer than one year for mammals and 10 weeks for birds. Additionally, studies in which the test organism is dosed during a critical life stage (e.g., gestation) are included with chronic duration studies. Subchronic studies include exposures of two weeks to one year in duration that do not occur during a critical life stage. Acute studies typically have exposures of less than two weeks. NOAELs and LOAELs are usually reported from chronic and subchronic studies, with acute studies often reporting LD_{50} levels (LD_{50}; doses corresponding to the overt expression of a serious adverse effect such as mortality in 50% of test animals). Test-species doses from chronic studies are used preferentially over data from acute and subchronic studies. In cases where chronic data are not available as test-species doses, studies involving less-than-chronic exposures are used to in NOAEL and LOAEL derivation with the addition of a duration uncertainty factor.

For this study, duration uncertainty factors are applied according to USACHPPM 2000:

- Subchronic NOAEL to Chronic NOAEL: 10
- Subchronic LOAEL to Chronic NOAEL: 20

- Subchronic LOAEL to Chronic LOAEL: 4
- Acute NOAEL to Chronic NOAEL: 30
- Acute LOAEL to Chronic NOAEL: 50
- Acute LOAEL to Chronic LOAEL: 10

2.3.3 Endpoint Uncertainty Factors

Additional UFs are used to account for uncertainties in extrapolation between effect- and no-effect levels. Specifically, a NOAEL test-species dose may be estimated from a LOAEL (or LD_{50}) value, or a LOAEL may be estimated from a LD_{50}.

Extrapolation from a LOAEL or LD_{50t} *to a NOAEL:* Consistent with USACHPPM 2000, a UF of 10 is used with chronic LOAEL values to estimate the chronic NOAEL, which is considered conservative (Sample et al. 1996, USEPA 1996). When a LOAEL value is not available, a LD_{50} is used, although chronic NOAELs may range from 1/10 to 1/10,000 of the corresponding acute LD_{50} value (Opresko et al. 1994). For this report, an uncertainty factor of 100 is used to estimate a NOAEL value from a LD_{50} value (USACHPPM 2000).

Extrapolation from an LD_{50} *to a LOAEL:* Consistent with USACHPPM 2000, an UF of 20 is used conservatively to estimate a LOAEL value from a LD_{50} value (USACHPPM 2000).

2.3.4 Body-Weight Extrapolation Factor

This extrapolation is accomplished using a body weight-scaling factor to account for differences in body size (Sample et al. 1996). Numerous studies have shown that many physiological functions such as metabolic rates and responses to chemicals are a function of body size for mammals. Smaller mammals have higher metabolic rates and are usually more resistant to chemicals because of more rapid rates of detoxification. It has been shown that the best measure of body size is one based on body surface-area, which can be expressed in terms of body weight raised to a fractional power (Opresko et al. 1994, Sample et al. 1996, USEPA 1980). Dosimetric differences between the mammalian test species and wildlife receptors are accounted for using:

$$\mathrm{NOAEL}_w = \mathrm{NOAEL}_t \times \left(\frac{\mathrm{BW}_t}{\mathrm{BW}_w} \right)^{0.25}$$

where:

NOAEL_w = NOAEL for the mammalian wildlife receptor (mg/kg BW-day)

NOAEL_t = NOAEL for the mammalian test species (mg/kg BW-day)

BW_t = Test species body weight (kg)

BW_w = Wildlife receptor body weight (kg)

Scaling factors may not be appropriate for avian interspecies extrapolations. Information has shown that adjustment factors based on body size for interspecies extrapolation among avian species range from 0.63 to 1.55 (Sample et al. 1996). Therefore, a body-weight extrapolation factor is not used to derive avian NOAELs and LOAELs.

Mammalian wildlife receptor body weights are presented on Table F.2-7 and laboratory test species body weights are presented on Table F.2-8.

2.4 BIOACCUMULATION FACTORS

Bioaccumulation factors (BAFs) provide quantitative indicators of the tendency for a chemical to partition into terrestrial organisms, relative to the concentrations present in terrestrial exposure media. Exposure-point concentrations of chemicals in terrestrial prey (soil invertebrates and small mammals) and terrestrial plants are estimated using BAFs derived from the literature. The derivation of BAFs is described for organic and inorganic chemicals in the following subsections.

2.4.1 Terrestrial Plants

Exposure-point concentrations of chemicals in terrestrial plants are estimated using soil-to-plant bioaccumulation factors (uptake factors for plants, UF_{plant}) derived from the literature. UF_{plant} values are used to estimate wet-weight chemical concentrations in terrestrial plants using the same equation for invertebrates and a dry weight to wet weight conversion factor assuming plants are 80% water (Salisbury and Ross 1992). Table F.2-9 presents the uptake factors for plants.

Organic Chemicals: Organic chemicals may enter the plant by partitioning from soil to the roots and then translocating throughout the plant via the xylem tissue. Most bioaccumulative, lipophilic organic chemicals partition to the epidermis of the root or adhere to soil particles and are not drawn into the inner root or xylem (Paterson et al. 1990). Uptake factors for estimating concentrations of organic chemicals in plant tissues are derived from the following equation:

$$UF_{plant} = 10^{[1.588-(0.578\times \log K_{ow})]}$$

where:

UF_{plant} = Plant uptake factor (kg soil, dry weight / kg plant, dry weight)

Log K_{ow} = Logarithm of the octanol:water partition coefficient

This relationship is based on a linear regression of bioaccumulation factors for 29 organic chemicals (Travis and Arms 1988). The correlation coefficient for the regression is 0.73, indicating that a majority of the variability in bioaccumulation is explained by the log K_{ow}. UF_{plant} values are derived for organic chemicals using this equation.

Inorganic Chemicals: Concentrations of inorganic chemicals in plant tissues are estimated based on generalized soil-to-plant transfer coefficients reported in a literature review. The soil-to-plant transfer factors for inorganic chemicals are equivalent to UF_{plant} values for organic chemicals and represent the ratio of the dry weight concentrations in plant tissue to the dry weight concentration of the element in root-zone soils. Bechtel-Jacobs 1998 C_p regression equation: $C_p = e^{(slope*\ln(Cs) - intercept)}$

2.4.2 Terrestrial Prey

Organic Chemicals: BAFs for estimating concentrations of organic chemicals in prey tissues are derived from linear regression equations presented in Travis and Arms (1998) and Beyer and Stafford (1993). The dry weight to wet weight (DW:WW) conversion factor is 0.2 for soil invertebrates (kg soil invertebrate dry weight per soil invertebrate wet weight; assumes invertebrates are 80% water), based on data reported in USEPA (1993). No DW:WW conversion factor was applied for small mammals. The BAF values used in to estimate concentrations of organic chemicals in soil invertebrates and small mammals are shown in Tables F.2-10 and F.2-11.

Inorganic Chemicals: Inorganic bioaccumulation factors for terrestrial prey (Table F.2-11) are wet-weight-based and are used to predict concentrations in invertebrates and small mammals according to:

$$BAF_{si} = C_{si} / C_{soil}$$

where:

BAF_{si} = Soil invertebrate uptake factor for inorganic chemicals

C_{si} = Chemical concentration predicted in soil invertebrates (mg chemical / kg soil invertebrate, dry weight)

C_{soil} = Concentration of inorganic chemical in soil (mg chemical / kg soil, dry weight)

3.0 DIRECT CONTACT APPROACH

3.1 PRELIMINARY DIRECT CONTACT TOXICITY EVALUATION

Risk is assessed by comparing the preliminary exposure estimate (maximum detected concetrations - MDC) of each detected chemical to the established TRV (detailed in Section 2.1). The preliminary risk is characterized in terms of a hazard quotient (HQ), which is expressed as:

HQ = MDC/TRV

where:

HQ = Hazard Quotient for the constituent (unitless)
MDC = Maximum Detected Concentration for constituent (mg/kg)
TRV = Screening Level for constituent (mg/kg)

3.2 REFINED DIRECT CONTACT TOXICITY EVALUATION

For the refined evaluation, risk is assessed by comparing the exposure point concentration (EPC) of each detected chemical to the TRV (Section 4.3.6 details EPC development). The refined risk HQ is expressed as:

HQ = EPC/TRV

where:

HQ = Hazard Quotient for the constituent (unitless)
EPC = Calculated Exposure Point Concentration for constituent (mg/kg)
TRV = Screening Level for constituent (mg/kg)

An HQ of less than 1 indicates no or negligible risk. The potential for risk increases as the HQ increases above unity. However, this result should be considered in the context of other characteristics of the exposure area.

Results of the direct contact toxicity evaluation for the site are presented in Tables F.2-4 (terrestrial plants) and F.2-6 (soil and microbial communities).

4.0 DOSE RATE MODELING APPROACH

A simplified food web model is utilized to calculate TRVs for each chemical and wildlife receptor. TRVs quantify COPC concentrations in exposure media that may result in no observable adverse effects or low observable adverse effects. The NOAEL corresponds to the greatest exposure associated with no observed adverse effects on growth, reproduction, or survival. The LOAEL corresponds to the smallest exposure associated with observed adverse effects on growth, reproduction or survival. TRVs developed by dose rate models are used to evaluate ecological effects associated with COPEC concentrations in exposure media.

4.1 PRELIMINARY DOSE RATE MODEL

Preliminary risk characterization for wildlife receptors uses the conservative preliminary exposure estimate and ecological effects evaluation to characterize risk to potential terrestrial receptors.

The simplified food web model considers the ingestion of prey, the incidental ingestion of media, and the primary routes of exposure to wildlife receptors. Chemical concentrations in prey are expressed as a function of chemical concentrations in exposure media using BAFs for terrestrial prey items. Other important parameters in the model include receptor body weight and an estimate of receptor use. As shown in the equation below, literature-derived NOAEL and LOAEL values are input into the model as the ADD variable to calculate the concentration in exposure media (C_{TRV}) that would result in a dose equivalent to a NOAEL or LOAEL.

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food} \ (BAF_{food} \cdot DF) + IR_s \ )AF}$$

where:

C_{TRV} = NOAEL or LOAEL-based screening level (mg chemical/kg soil)

ADD = NOAEL or LOAEL (mg COPC/kg body weight-day)

BW = Minimum Body Weight of the receptor (kg)

IR_{food} = Maximum Ingestion Rate of food (kg food ingested per day, dry weight)

BAF_{food} = BAF of most contaminated dietary component used, specific to prey type and COPC (ratio of mg of COPC/kg fauna, wet weight to mg COPC/ kg substrate, dry weight)

DF = Dietary Fraction (most contaminated dietary component assumed to be 100% of diet)

IR_s = Maximum Incidental Ingestion Rate of soil (kg substrate ingested per day, dry weight)

AF = 100% Area Use Factor

Preliminary receptor parameters for the site are presented on Table F.2-7. The resulting risk is characterized in terms of an HQ and is presented for wildlife receptors in Appendix F.2 and summarized in Table F.2-22 for the site.

4.2 REFINED EXPOSURE ESTIMATE AND RISK CHARACTERIZATION

The refined exposure and risk characterization, Step 3a of the ecological risk assessment guidance (ERAGS), reviews and refines the conservative assumptions used in the risk calculation (USEPA 1997). In Step 3a, conservative assumptions used in the preliminary exposure and risk characterization are replaced with more environmentally realistic assumptions to evaluate risk posed by COPECs identified in the preliminary risk characterization. The addition of Step 3a focuses the outcome of the ecological screening, streamlines the review process and functions as the initial basis for ecological risk management decision-making at each site.

4.3 REFINED DOSE RATE MODEL

This step replaces the conservative assumptions used in the preliminary exposure estimate and ecological effects evaluation with more environmentally realistic assumptions including the use of average body weight, average food and substrate ingestion rates, and the use of realistic area use factor, resulting in a more realistic estimate of potential risk.

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food} \sum (BAF_{food} \cdot DF) + IR_s \ )AF}$$

where:

C_{TRV} = NOAEL or LOAEL-based screening level (mg chemical/kg soil)

ADD = NOAEL or LOAEL (mg COPC/kg body weight-day)

BW = Average Body Weight of the receptor (kg)

IR_{food} = Average Ingestion Rate of food (kg food ingested per day, dry weight)

BAF_{food} = BAF of dietary component used, specific to prey type and COPC (ratio of mg of COPC/kg fauna, wet weight to mg COPC/ kg substrate, dry weight)

DF = Dietary Fraction

IR_s = Average Incidental Ingestion Rate of soil (kg substrate ingested per day, dry weight)

$AF_{refined}$ = Refined Area Use Factor (detailed below)

In the refined model, a realistic area use factor ($AF_{refined}$) was used to calculate the ratio of the study area (1 acre) to the average home range of the receptor:

$$AF_{refined} = \text{Study Area/Home Range Area}$$

Other receptor parameters in the refined model remain conservative. The conservative assumptions are summarized as follows:

- Receptors assimilate 100% of COPECs detected in the food and soil; and
- Receptors forage in the site area 100% of the time.

Refined receptor parameters for the site are presented on Table F.2-7. The resulting risk is characterized in terms of an HQ and is presented for wildlife receptors in Appendix F.2 and summarized in Table F.2-224.

4.4 EXAMPLE C_{TRV} EQUATION CALCULATION – PRELIMINARY AND REFINED

The following example C_{TRV} equation details the arsenic NOAEL-based screening level (SL) calculated for the short-tailed shrew at the site (Tables F.2-14 and F.2-15) and resulting HQs:

Preliminary

- ADD = 0.15 mg/kg bw-day (NOAEL)
- BW = 0.0125 kg (minimum body weight)
- IR_{food} = 0.003 kg dw/day (maximum ingestion rate)
- BAF_{food} = 1.1 (for the most contaminated dietary component in this case plant)
- DF = 1 (100% most contaminated dietary component in this case 100% plants)
- IR_{soil} = 0.00039 kg dw/day (maximum soil ingestion rate)
- AF = 1 (default used)

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food}\ (BAF_{food}\ \cdot DF) + IR_s\ )AF} = \frac{0.15 \cdot 0.0125}{(0.003\,(1.1 \cdot 1) + 0.00039) \cdot 1} = \mathbf{5.08E\text{-}01\ mg/kg}$$

NOAEL HQ = MDC (mg/kg)/NOAEL-based SL (mg/kg) = $\frac{49}{5.08E-01}$ = **9.7E+01**

EPC NOAEL HQ = NOAEL HQ * (EPC (mg/kg) / MDC (mg/kg)) = 9.7E+01*($\frac{32.45}{49}$) = **6.4E+01**

Refined

- ADD = 0.15 mg/kg bw-day
- BW = 0.015 kg
- IR_{food} = 0.002 kg dw/day
- BAF_{plant} = 0.038

- BAF_{inv} = 0.0868
- DF_{plant} = 0.14
- DF_{inv} = 0.86
- IR_{soil} = 0.00026 kg dw/day
- $AF_{refined}$ = 1.0

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food} \sum (BAF_{food} \cdot DF_{food}) + IR_{s})AF}$$

$$= \frac{0.15 \cdot 0.015}{(0.002\,(0.038 \cdot 0.14 + 0.0868 \cdot 0.86) + 0.00026) \cdot 1.0} = \mathbf{5.35{+}00\ mg/kg}$$

NOAEL HQ = EPC (mg/kg)/NOAEL-based SL (mg/kg) = $\frac{32.45}{5.35E+00}$ = **6.1E+00**

Table F.2-22 provides a summary of preliminary and refined HQs developed for terrestrial receptors at the site.

5.0 SUMMARY

Receptor-specific exposure parameters are obtained from life history studies found in the literature. Important receptor-specific exposure parameters input into the model include: body weight, food ingestion rate, diet composition, incidental substrate ingestion rate, and area use factor.

The dose-response relationships for chemicals of potential interest are expressed as NOAELs and LOAELs for wildlife receptors, which are defined as a daily ingested amount (mg COPC/kg body weight-day) that is associated with a specified growth, reproductive, developmental, or survival effect. Extrapolation and uncertainty factors are applied to literature-based toxicological endpoints to account for differences in a controlled laboratory setting and an ecologically relevant setting. Extrapolation and uncertainty factors are based on: (1) the duration of exposure, (2) the endpoint measured, and (3) differences in body weights among test and receptor species.

Bioaccumulation accumulation factors provide quantitative indicators of the tendency for a chemical to partition into organisms, relative to the concentrations present in exposure media. Exposure-point concentrations of chemicals in terrestrial prey (soil invertebrates and small mammals) are estimated using several BAFs derived from the literature.

COPC concentrations in prey and media, receptor-specific exposure parameters, literature-based NOAEL and LOAEL values, and bioaccumulation factors are used in the model to calculate the concentration in exposure media (C_{TRV}) that would result in a dose equivalent to a NOAEL or LOAEL. The dose rate modeling approach is used to evaluate the potential mobility of COPCs through varying trophic associations.

6.0 REFERENCES

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APPENDIX F.2

SCREENING LEVEL ECOLOGICAL TABLES

Table F.2-1
SLERA Occurrence/Distribution - Surface Soil
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Units	Location of Maximum Concentration	Total Samples Analyzed	Detection Frequency	Min MDL	Max MDL	Range of Detection Limits	Concentration Used for Screening
TAL Metals											
Antimony	7440-36-0	1.32	24	mg/kg	ARSARSS3	13	7/13	1.1	1.45	1.1 - 1.45	24
Arsenic	7440-38-2	4.03	49.2	mg/kg	ARSARSS12	15	15/15	0.442	0.58	0.442 - 0.58	49.2
Chromium	7440-47-3	13	17.85	mg/kg	ARSARSS14 DUP AVG	2	2/2	0.227	0.252	0.227 - 0.252	17.85
Lead	7439-92-1	16.6	1,630	mg/kg	ARSARSS3	15	15/15	0.221	0.29	0.221 - 0.29	1,630

Notes:
CAS = Chemical Abstracts Service
mg/kg = Milligram Per Kilogram
TAL = Target Analyte List

Table F.2-2
Exposure Point Concentration Summary for Surface Soil
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Exposure Point	CAS No	Chemical of Potential Concern	Units	Arithmetic Mean of Detects	UCL	Maximum Concentration	Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Surface Soil	7440-36-0	Antimony	mg/kg	8.857	9.305	24.4	9.305	mg/kg	95% KM (t) UCL	ProUCL 4.0
	7440-38-2	Arsenic	mg/kg	15.52	32.45	49	32.450	mg/kg	95% KM (Chebyshev) UCL	ProUCL 4.0
	7440-47-3	Chromium*	mg/kg	--	--	17.9	17.90	mg/kg	--	--
	7439-92-1	Lead	mg/kg	353	664.4	1,630	664.4	mg/kg	95% Approximate Gamma UCL	ProUCL 4.0

Notes:

FOD = frequency of detection

UCL = Upper Confidence Limit

mg/kg = Milligram Per Kilogram

* Due to the number of samples (2 samples), a mean and UCL were not calculated.

Table F.2-3
Plant Screening Level Sources - Soil
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	Screening Level (mg/kg)	Source
TAL Metals			
Antimony	7440-36-0	5	ORNL-Plants
Arsenic	7440-38-2	18	ECO SSL
Chromium	7440-47-3	1	ORNL-Plants
Lead	7439-92-1	120	ECO SSL

Notes:
CAS = Chemical Abstract Service
mg/kg = Milligram per Kilogram
TAL = Target Analyte List

USEPA Eco SSL - Soil Invertebrates, Plants, Avian, Mammalian (http://www.epa.gov/ecotox/ecossl)
ORNL - Plants - Toxilogical Benchmarks for Screening Contaminants of Potential Concern for
Effects on Terrestrial Plants: 1997 Revision Efroymson et al.)

Table F.2-4
Plant Screening - Soil
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Ecological Concern	**CAS #**	**Maximum Soil Concentration (mg/kg)**	**Screening Level (mg/kg)**	**Hazard Quotient (unitless)**	**EPC (mg/kg)**	**EPC Hazard Quotient (unitless)**
Inorganics						
Antimony	7440-36-0	24	5	**4.9E+00**	9	**1.9E+00**
Arsenic	7440-38-2	49	18	**2.7E+00**	32	**1.8E+00**
Chromium	7440-47-3	17.9	1	**1.8E+01**	18	**1.8E+01**
Lead	7439-92-1	1630	120	**1.4E+01**	664	**5.5E+00**

Notes:
CAS = Chemical Abstract Service
mg/kg = Milligram per Kilogram
TCL = Target Compound List
Hazard Quotient = Soil Concentration/Screening Level
EPC = Exposure Point Concentration (see Table F.2-2)

Table F.2-5
Invertebrate and Microbial Screening Level Sources - Soil
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	Screening Level (mg/kg)	Source
TAL Metals			
Antimony	7440-36-0	78	ECO SSL
Arsenic	7440-38-2	60	ORNL-Earthworm
Chromium	7440-47-3	0.4	ORNL-Earthworm
Lead	7439-92-1	1700	ECO SSL

Notes:

CAS = Chemical Abstract Service
mg/kg = Milligram per Kilogram
TAL = Target Analyte List
USEPA Eco SSL - Soil Invertebrates, Plants, Avian, Mammalian (http://www.epa.gov/ecotox/ecossl)
ORNL - Earthworms - (Toxilogical Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision, Efroymson et al.)

Table F.2-6
Invertebrate and Microbial Screening - Soil
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Constituent of Potential Ecological Concern	CAS #	Maximum Soil Concentration (mg/kg)	Screening Level (mg/kg)	Hazard Quotient (unitless)	EPC (mg/kg)	EPC Hazard Quotient (unitless)
TAL Metals						
Antimony	7440-36-0	24	78	3.1E-01	NC	NC
Arsenic	7440-38-2	49	60	8.2E-01	NC	NC
Chromium	7440-47-3	17.9	0.4	**4.5E+01**	17.9	**4.5E+01**
Lead	7439-92-1	1,630	1,700	9.6E-01	NC	NC

Notes:
CAS = Chemical Abstract Service
mg/kg = Milligram per Kilogram
TAL = Target Analyte List
NC = Not Calculated
Hazard Quotient = Soil Concentration/Screening Level
EPC = Exposure Point Concentration (see Table F.2-2)

Table F.2-7
Wildlife Profiles
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

							Preliminary Assessment					Refined Assessment					
Representative Species			**Composition of Diet [1] (%)**				**Minimum Body Weight [1]**	**Maximum Body Weight [1]**	**Maximum Food Ingestion Rate[2]**	**Maximum Substrate Ingestion Rate [3]**		**Average Body Weight [1]**	**Average Food Ingestion Rate [2]**	**Average Substrate Ingestion Rate [3]**	**Home Range (ha)**	**Proportion of Year Species Active**	**AFs**
Food-web Classification	**Common Name**	**Scientific Name**	**Plants (incl. fungi)**	**Inverte-brates**	**Small mammals**	**Fish**	**kg**	**kg**	**kg dw/day**	**% of dry intake**	**kg dry wt./day**	**kg**	**kg dw/day**	**kg dry wt./day**			**Study Area (0.405) hectares**
Birds																	
soil-probing invertivore	American robin	*Turdus migratorius*	62%	38%			0.0635	0.103	0.02	5%	0.001	0.077	0.016	0.0008	0.48	1	0.84
large carnivore	Red-tailed hawk	*Buteo jamaicensis*			100%		0.957	1.235	0.063	0%	0	1.134	0.059	0	250	1	0.0016
Mammals																	
small herbivore	Meadow vole	*Microtus pennsylvanicus*	100%				0.017	0.0524	0.01	2.4%	0.00024	0.037	0.008	0.00019	0.037	1	1
medium carnivore	Red fox	*Vulpes vulpes*	17%	4%	79%		2.95	7.04	0.342	2.8%	0.0096	4.53	0.238	0.0067	96	1	0.0042
small invertivore	Short-tailed shrew	*Blarina brevicauda*	14%	86%			0.0125	0.0225	0.003	13%	0.00039	0.015	0.002	0.00026	0.39	1	1.00

Notes:
kg = Kilogram
kg dw/day = Kilogram Dry-weight per Day
L/day = Liter per Day
ha = Hectares
AF = Area Use Factor

[1] Wildlife Exposure Factors Handbook. U.S. Environmental Protection Agency (EPA). 1993. Office of Research and Development. 2 Volumes. EPA/600/R93/187a&b. December.

[2] Estimated food intake rate (kg [dw]/day) calculated as follows:
FI ((kg/day) = 0.0687 Wt.$^{0.882}$ for mammals (red fox and short-tailed shrew)
FI ((g/day) = 0.577 Wt.$^{0.727}$ for herbivores (meadow vole)
FI ((g/day) = 0.301 Wt.$^{0.751}$ for non-passerine birds (red-tailed hawk)
FI ((g/day) = 0.398 Wt.$^{0.850}$ for passerine birds (american robin)

[3] Estimating Exposure to Terrestrial Wildlife to Contaminants. Sample and Sutter. 1994. ES/ER/TM-125.
The soil ingestion rate for the american robin set equal to 38% of the american woodcock value (0.34*10.4%=4%), based on a robin diet of 38% invertbrates.

Table F.2-8
Wildlife TRVs
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	AVIAN TEST SPECIES				MAMMALIAN TEST SPECIES					AVIAN RECEPTORS				MAMMALIAN RECEPTORS					
											American Robin		Red-tailed Hawk		Meadow Vole		Red Fox		Short-tailed Shrew	
		Chronic LOAEL	Chronic NOAEL	Test Animal	Source	Chronic LOAEL	Chronic NOAEL	Test Animal	Test Animal Body Weight (kg)	Source	Chronic LOAEL	Chronic NOAEL	Chronic LOAEL	Chronic NOAEL	Chronic LOAEL	Chronic NOAEL	Chronic LOAEL	Chronic NOAEL	Chronic LOAEL	Chronic NOAEL
		(mg/kg-bw/d)				(mg/kg-bw/d)					(mg/kg-bw/d)		(mg/kg-bw/d)		(mg/kg-bw/d)		(mg/kg-bw/d)		(mg/kg-bw/d)	
Arsenic	7440-38-2	1.28E+01	5.14E+00	mallard duck	ORNL 1996	1.26	0.126	mouse	0.03	ORNL 1996	1.28E+01	5.14E+00	1.28E+01	5.14E+00	1.20E+00	1.20E-01	3.59E-01	3.59E-02	1.50E+00	1.50E-01
Chromium	7440-47-3	5.00E+00	1.00E+00	black duck	ORNL 1996	32.8	3.28	rat	0.35	ORNL 1996	5.00E+00	1.00E+00	5.00E+00	1.00E+00	5.75E+01	5.75E+00	1.73E+01	1.73E+00	7.21E+01	7.21E+00
Lead	7439-92-1	1.13E+01	1.13E+00	Japanese quail	ORNL 1996	80	8	rat	0.35	ORNL 1996	1.13E+01	1.13E+00	1.13E+01	1.13E+00	1.40E+02	1.40E+01	4.22E+01	4.22E+00	1.76E+02	1.76E+01

Notes:

CAS = Chemical Abstract Service
TRV = Toxic Reference Value
NOAEL = No observable adverse effects level
LOAEL = Lowest observable adverse effects level
mg/kg = Milligram Per Kilogram
bw/d = Body Weight Per Day
kg = kilogram
ORNL = Oak Ridge National Laboratory

Sources:

ORNL 1996. Sample, B.E., D.M. Opresko and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. ES/ER/TM-86/R3. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Table F.2-9
Soil Biocaccumulation/Bioconcentration Factors- Soil to Plant Pathway
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

					Preliminary Assessment		Refined Assessment			
Chemical	**CAS**	**Log K_{ow} Range**	**Selected K_{ow}**	**Source**	**BAF**	**Basis**	**C_s EPC (mg/kg)**	**BAF[1]**	**Basis**	**Source**
Inorganics										
ARSENIC	7440-38-2	-- - --	--	--	1.103	90th percentile	32.450	0.0375	Median	Bechtel Jacobs 1998
CHROMIUM	7440-47-3	-- - --	--	--	0.084	90th percentile	17.90	0.0410	Median	Bechtel Jacobs 1998
LEAD	7439-92-1	-- - --	--	--	0.468	90th percentile	664.4	0.0153	$C_p = e^{(0.561*\ln(Cs) - 1.328)}$	Bechtel Jacobs 1998

Notes:
CAS = Chemical Abstract Services
BAF = Bioaccumulation Factor
K_{ow} = Chemical octanol-water coefficient
NC = Not Calculated
C_s = Chemical Concentration in Soil
C_p = Chemical Concentration in Plant Matter (dry weight)
[1] = BAFs for chemical using Cp regression equation calculated by as follows: BAF = C_p/C_s

Source(s):
Bechtel Jacobs 1998: Bechtel Jacobs Company. September 1998. Emperical Models for the Uptake of Inorganic Chemical from Soil by Plants.

Table F.2-10
Soil Biocaccumulation/Bioconcentration Factors - Soil to Invertebrate Pathway
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

							Preliminary Assessment		Refined Assessment			
Chemical	**CAS**	**Log K_{ow} Range**	**Selected Log K_{ow}**	**Reference**	**K_{oc}**	**Reference**	**Value**	**Basis**	**C_s EPC (mg/kg)**	**BAF[1]**	**Basis**	**Source**
Inorganics												
ARSENIC	7440-38-2	-- - --	--	--	--	--	0.523	90th percentile	32.45	0.0868	$C_e = e^{(0.706*\ln(Cs) - 1.421)}$	Sample et al. 1998
CHROMIUM	7440-47-3	-- - --	--	--	--	--	3.162	90th percentile	17.9	0.31	Median	Sample et al. 1998
LEAD	7439-92-1	-- - --	--	--	--	--	1.522	90th percentile	664.4	0.2294	$C_e = e^{(0.807*\ln(Cs) - 0.218)}$	Sample et al. 1998

Notes:
CAS = Chemical Abstract Services
C_s = Chemical Concentration in Soil
C_e = Chemical Concentration in Earthworm (dry weight)
K_{ow} = Chemical octanol-water coefficient
K_{oc} = Chemical water to soil partitioning coefficient
[1] = BAFs for chemical using Ce regression equation calculated by as follows: BAF = C_e/C_s

Source(s):
Sample et al. 1998: Sample, B.E., Beauchamp, J.J., Efroymson, R.A., Sutter, G.W., Ashwood, T.L., February 1998. Development and Validation of Bioaccumulation Models for Earthworms.

Table F.2-11
Soil Bioaccumulation/Bioconcentration Factors - Soil to Mammal Pathway
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	**CAS**	**Log K_{ow} Range**	**Selected K_{ow}**	**Reference**	**Preliminary Assessment**		**Refined Assessment**			
					Value	**Basis**	**C_s (mg/kg)**	**BAF[1]**	**Basis**	**Source**
Inorganics										
ARSENIC	7440-38-2	-- - --	--	--	0.0149	90th percentile	32.45	0.0042	$C_m = e^{(0.819*\ln(Cs) - 4.847)}$	Sample et al. 1998
CHROMIUM	7440-47-3	-- - --	--	--	0.333	90th percentile	17.9	0.1078	$C_m = e^{(0.734*\ln(Cs) - 1.46)}$	Sample et al. 1998
LEAD	7439-92-1	-- - --	--	--	0.286	90th percentile	664.4	0.0288	$C_m = e^{(0.442*\ln(Cs) + 0.0761)}$	Sample et al. 1998

Notes:
CAS = Chemical Abstract Services
C_s = Chemical Concentration in Soil
C_d = Chemical Concentration in Prey (assumed to be 100% earthworms (dry weight))
C_m = Chemical Concentration in Mammal (dry weight)
K_{ow} = Chemical octanol to water partitioning coefficient
[1] = BAFs for chemical using Ce regression equation calculated by as follows: BAF = C_m/C_s

Source(s):
Sample et al. 1998: Sample et al. 1998. Development and Validation of Bioaccumulation Models for Small Mammals.

Table F.2-12
Preliminary Wildlife Risk Characterization - Meadow Vole
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

				Preliminary Assessment										
				Soil										
Chemical	**CAS #**	**NOAEL (mg/kg bw-day)**	**LOAEL (mg/kg bw-day)**	**Maximum Detected Concentration (mg/kg)**	**Plant BAF (unitless)**	**Plant Concentration (mg/kg)**	**Calculated NOAEL-Based Screening Level[a] (mg/kg)**	**Calculated LOAEL-Based Screening Level[a] (mg/kg)**	**NOAEL HQ (unitless)**	**LOAEL HQ (unitless)**	**NOAEL HQ >1 (Y/N)**	**EPC (mg/kg)**	**EPC NOAEL HQ (unitless)**
Inorganics													
Arsenic	7440-38-2	1.20E-01	1.20E+00	49	1.1E+00	5.4E+01	1.8E-01	1.8E+00	**2.72E+02**	**2.7E+01**	**Y**	32.45	**1.8E+02**
Chromium	7440-47-3	5.75E+00	5.75E+01	17.9	8.4E-02	1.5E+00	9.1E+01	9.1E+02	1.98E-01	2.0E-02	N	--	--
Lead	7439-92-1	1.40E+01	1.40E+02	1630	4.7E-01	7.6E+02	4.8E+01	4.8E+02	**3.36E+01**	**3.4E+00**	**Y**	664.4	**1.4E+01**

Notes:

CAS = Chemical Abstract Services

C_{TRV}= NOAEL-based screening level (mg chemical/kg soi)

ADD = NOAEL or LOAEL (mg chemical/kg body weight-day) from Table F.2-8

BW = Minimum Body Weigth of Receptor (kg)

IR_{food} = Maximum Ingestion Rate for Food

BAF_{food} = Bioaccumulation factor (dietary component with highest concentration BSAF was used)

DF = Dietary fraction (Dietary component with highest concentration assumed to be 100% of diet)

IRs = Incidental Ingestion Rate of soil (kg soil ingested per day, dry weight)

AF = 100% Area Use Factor

NOAEL = No observable adverse effects level

LOAEL = Lowest observable adverse effects level

mg/kg = Milligram Per Kilogram

bw - day = Body Weight - Day

HQ = Hazard Quotient

TRV = Toxicity Reference Value

EPC = Exposure Point Concentration

Meadow Vole Specific Data from Table F.2-7

BW=	0.017	kg
IR_{food} =	0.010	kg dw/day
BAF_{food}=	Chem Specific	unitless
IR_{soil} =	0.00024	kg dw/day
AF =	1	unitless

[a] = The following equation was used to calculate screening levels:

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food}(BAF_{food} \cdot DF) + IR_{s})AF}$$

See Appendix F.1 for an example C_{TRV} calculation.

NOAEL HQ = Maximum Detected Concentration/Calculated NOAEL-Based Concentration

LOAEL HQ = Maximum Detected Concentration/Calculated LOAEL-Based Concentration

EPC NOAEL HQ = NOAEL HQ * (EPC/Maximum Detected Concentration)

Table F.2-13
Refined Wildlife Risk Characterization - Meadow Vole
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	NOAEL (mg/kg bw-day)	LOAEL (mg/kg bw-day)	Refined Assessment						
				Soil						
				EPC (mg/kg)	Plant BAF (unitless)	Plant Concentration (mg/kg)	Calculated NOAEL-Based Screening Level[a] (mg/kg)	Calculated LOAEL-Based Screening Level[a] (mg/kg)	NOAEL HQ (unitless)	LOAEL HQ (unitless)
Inorganics										
Arsenic	7440-38-2	1.20E-01	1.20E+00	32.45	3.8E-02	1.2E+00	9.0E+00	9.0E+01	**3.6E+00**	3.6E-01
Lead	7439-92-1	1.40E+01	1.40E+02	664.4	1.5E-02	1.0E+01	1.7E+03	1.7E+04	4.0E-01	4.0E-02

Notes:

CAS = Chemical Abstract Services
C_{TRV}= NOAEL-based screening level (mg chemical/kg soi)
ADD = NOAEL or LOAEL (mg chemical/kg body weight-day) from Table F.2-8
BW = Average Body Weigth of Receptor (kg)
IR_{food} = Average Ingestion Rate for Food
BAF_{food} = Bioaccumulation factor, specific to prey type and chemical
DF = Dietary fraction
IRs = Incidental Ingestion Rate of soil (kg soil ingested per day, dry weight)
AF = Area Use Factor
NOAEL = No observable adverse effects level
LOAEL = Lowest observable adverse effects level
mg/kg = Milligram Per Kilogram
bw - day = Body Weight - Day
HQ = Hazard Quotient
TRV = Toxicity Reference Value
BDL = Below Detection Limit
EPC = Exposure Point Concentration

Meadow Vole Specific Data from Table F.2-7

BW=	0.037	kg
IR_{food} =	0.008	kg dw/day
BAF_{food}=	Chem Specific	unitless
DF_{plants} =	1.00	unitless
IR_{soil} =	0.00019	kg dw/day
AF =	1	unitless

[a] = The following equation was used to calculate screening levels:

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food}\sum(BAF_{food} \cdot DF) + (IR_s)) \cdot AF}$$

See Appendix F.1 for an example C_{TRV} calculation.

NOAEL HQ = EPC/Calculated NOAEL-Based Screening Level
LOAEL HQ = EPC/Calculated LOAEL-Based Screening Level

Table F.2-14
Preliminary Wildlife Risk Characterization - Short-tailed Shrew
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

				Preliminary Assessment													
				Soil													
Chemical	**CAS #**	**NOAEL (mg/kg bw-day)**	**LOAEL (mg/kg bw-day)**	**Maximum Detected Concentration (mg/kg)**	**Plant BAF (unitless)**	**Plant Concentration (mg/kg)**	**Invertebrate BAF (unitless)**	**Invertebrate Concentration (mg/kg)**	**Dietary Component with Highest Concentration**	**Calculated NOAEL-Based Screening Level[a] (mg/kg)**	**Calculated LOAEL-Based Screening Level[a] (mg/kg)**	**NOAEL HQ (unitless)**	**LOAEL HQ (unitless)**	**NOAEL HQ >1 (Y/N)**	**EPC (mg/kg)**	**EPC NOAEL HQ (unitless)**
Inorganics																
Arsenic	7440-38-2	1.50E-01	1.50E+00	49	1.1E+00	5.4E+01	5.2E-01	2.6E+01	Plant	5.1E-01	5.1E+00	**9.7E+01**	**9.7E+00**	**Y**	32.45	**6.4E+01**
Chromium	7440-47-3	7.21E+00	7.21E+01	17.9	8.4E-02	1.5E+00	3.2E+00	5.7E+01	Invertebrate	9.1E+00	9.1E+01	**2.0E+00**	2.0E-01	**Y**	17.9	**2.0E+00**
Lead	7439-92-1	1.76E+01	1.76E+02	1630	4.7E-01	7.6E+02	1.5E+00	2.5E+03	Invertebrate	4.4E+01	4.4E+02	**3.7E+01**	**3.7E+00**	**Y**	664.4	**1.5E+01**

Notes:

CAS = Chemical Abstract Services

C_{TRV}= NOAEL-based screening level (mg chemical/kg soil)

ADD = NOAEL or LOAEL (mg chemical/kg body weight-day) from Table F.2-8

BW = Minimum Body Weigth of Receptor (kg)

IR_{food} = Maximum Ingestion Rate for Food

BAF_{food} = Bioaccumulation factor (dietary component with highest concentration BSAF was used)

DF = Dietary fraction (Dietary component with highest concentration assumed to be 100% of diet)

IRs = Incidental Ingestion Rate of soil (kg soil ingested per day, dry weight)

AF = 100% Area Use Factor

NOAEL = No observable adverse effects level

LOAEL = Lowest observable adverse effects level

mg/kg = Milligram Per Kilogram

bw - day = Body Weight - Day

HQ = Hazard Quotient

TRV = Toxicity Reference Value

EPC = Exposure Point Concentration

[a] = The following equation was used to calculate soil screening levels:

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food}(BAF_{food} \cdot DF) + IR_s)AF}$$

See Appendix F.1 for an example C_{TRV} calculation.

NOAEL HQ = Maximum Detected Concentration/Calculated NOAEL-Based Screening Level

LOAEL HQ = Maximum Detected Concentration/Calculated LOAEL-Based Screening Level

EPC NOAEL HQ = NOAEL HQ * (EPC/Maximum Detected Concentration)

Short-tailed Shrew Specific Data from Table F.2-7

BW=	0.0125	kg
IR_{food} =	0.003	kg dw/day
BAF_{food}=	Chem Specific	unitless
IR_{soil} =	0.00039	kg dw/day
AF =	1	unitless

Table F.2-15
Refined Wildlife Risk Characterization - Short-tailed Shrew
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	NOAEL (mg/kg bw-day)	LOAEL (mg/kg bw-day)	Refined Assessment								
				Soil								
				EPC (mg/kg)	Plant BAF (unitless)	Plant Concentration (mg/kg)	Invertebrate BAF (unitless)	Invertebrate Concentration (mg/kg)	Calculated NOAEL-Based Screening Level[a] (mg/kg)	Calculated LOAEL-Based Screening Level[a] (mg/kg)	NOAEL HQ (unitless)	LOAEL HQ (unitless)
Inorganics												
Arsenic	7440-38-2	1.50E-01	1.50E+00	32.45	3.8E-02	1.2E+00	8.68E-02	2.8E+00	5.4E+00	5.4E+01	**6.1E+00**	6.1E-01
Chromium	7440-47-3	7.21E+00	7.21E+01	17.9	4.1E-02	7.3E-01	3.06E-01	5.5E+00	1.4E+02	1.4E+03	1.3E-01	1.3E-02
Lead	7439-92-1	1.76E+01	1.76E+02	664.4	1.5E-02	1.0E+01	2.29E-01	1.5E+02	4.0E+02	4.0E+03	**1.7E+00**	1.7E-01

Notes:

CAS = Chemical Abstract Services
C_{TRV}= NOAEL-based screening level (mg chemical/kg soil)
ADD = NOAEL or LOAEL (mg chemical/kg body weight-day) from Table F.2-8
BW = Average Body Weigth of Receptor (kg)
IR_{food} = Average Ingestion Rate for Food
BAF_{food} = Bioaccumulation factor, specific to prey type and chemical
DF = Dietary fraction
IRs = Incidental Ingestion Rate of soil (kg soil ingested per day, dry weight)
AF = Area Use Factor
NOAEL = No observable adverse effects level
LOAEL = Lowest observable adverse effects level
mg/kg = Milligram Per Kilogram
bw - day = Body Weight - Day
HQ = Hazard Quotient
TRV = Toxicity Reference Value
BDL = Below Detection Limit
EPC = Exposure Point Concentration

[a] = The following equation was used to calculate soil screening levels:

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food} \sum (BAF_{food} \cdot DF) + (IR_s)) \cdot AF}$$

See Appendix F.1 for an example C_{TRV} calculation.

NOAEL HQ = EPC/Calculated NOAEL-Based Screening Level
LOAEL HQ = EPC/Calculated LOAEL-Based Screening Level

Short-tailed Shrew Specific Data from Table F.2-7

BW=	0.015	kg
IR_{food} =	0.002	kg dw/day
BAF_{food}=	Chem Specific	unitless
DF_{plants} =	0.14	unitless
DF_{inv} =	0.86	unitless
IR_{soil} =	0.00026	kg dw/day
AF =	1.000	unitless

Table F.2-16
Preliminary Wildlife Risk Characterization - Red Fox
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	NOAEL (mg/kg bw-day)	LOAEL (mg/kg bw-day)	Preliminary Assessment														
				Soil														
				Maximum Detected Concentration (mg/kg)	Plant BAF (unitless)	Plant Concentration (mg/kg)	Invertebrate BAF (unitless)	Invertebrate Concentration (mg/kg)	Mammal BAF (unitless)	Mammal Concentration (mg/kg)	Dietary Component with Highest Concentration	Calculated NOAEL-Based Screening Level[a] (mg/kg)	Calculated LOAEL-Based Screening Level[a] (mg/kg)	NOAEL HQ (unitless)	LOAEL HQ (unitless)	NOAEL HQ >1 (Y/N)	EPC (mg/kg)	EPC NOAEL HQ (unitless)
Inorganics																		
Arsenic	7440-38-2	3.59E-02	3.59E-01	49	1.1E+00	5.4E+01	5.2E-01	2.6E+01	1.5E-02	7.3E-01	Plant	2.7E-01	2.7E+00	**1.8E+02**	**1.8E+01**	**Y**	32.45	**1.2E+02**
Chromium	7440-47-3	1.73E+00	1.73E+01	17.9	8.4E-02	1.5E+00	3.2E+00	5.7E+01	3.3E-01	6.0E+00	Invertebrate	4.7E+00	4.7E+01	**3.8E+00**	3.8E-01	**Y**	17.9	**3.8E+00**
Lead	7439-92-1	4.22E+00	4.22E+01	1630	4.7E-01	7.6E+02	1.5E+00	2.5E+03	2.9E-01	4.7E+02	Invertebrate	2.3E+01	2.3E+02	**6.9E+01**	**6.9E+00**	**Y**	664.4	**2.8E+01**

Notes:

CAS = Chemical Abstract Services

C_{TRV}= NOAEL-based screening level (mg chemical/kg soil)

ADD = NOAEL or LOAEL (mg chemical/kg body weight-day) from Table F.2-8

BW = Minimum Body Weigth of Receptor (kg)

IR_{food} = Maximum Ingestion Rate for Food

BAF_{food} = Bioaccumulation factor (dietary component with highest concentration BSAF was used)

DF = Dietary fraction (Dietary component with highest concentration assumed to be 100% of diet)

IRs = Incidental Ingestion Rate of soil (kg soil ingested per day, dry weight)

AF = 100% Area Use Factor

NOAEL = No observable adverse effects level

LOAEL = Lowest observable adverse effects level

mg/kg = Milligram Per Kilogram

bw - day = Body Weight - Day

HQ = Hazard Quotient

TRV = Toxicity Reference Value

EPC = Exposure Point Concentration

Red FoxSpecific Data from Table F.2-7

BW=	2.9500	kg
IR_{food} =	0.342	kg dw/day
BAF_{food}=	Chem Specific	unitless
IR_{soil} =	0.00960	kg dw/day
AF =	1	unitless

[a] = The following equation was used to calculate screening levels:

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food}(BAF_{food} \cdot DF) + IR_s)AF}$$

See Appendix F.1 for an example C_{TRV} calculation.

NOAEL HQ = Maximum Detected Concentration/Calculated NOAEL-Based Screening Level

LOAEL HQ = Maximum Detected Concentration/Calculated LOAEL-Based Screening Level

EPC NOAEL HQ = NOAEL HQ * (EPC/Maximum Detected Concentration)

Table F.2-17
Refined Wildlife Risk Characterization - Red Fox
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	NOAEL (mg/kg bw-day)	LOAEL (mg/kg bw-day)	Refined Assessment										
				Soil										
				EPC (mg/kg)	Plant BAF (unitless)	Plant Concentration (mg/kg)	Invertebrate BAF (unitless)	Invertebrate Concentration (mg/kg)	Mammal BAF (unitless)	Mammal Concentration (mg/kg)	Calculated NOAEL-Based Screening Level[a] (mg/kg)	Calculated LOAEL-Based Screening Level[a] (mg/kg)	NOAEL HQ (unitless)	LOAEL HQ (unitless)
Inorganics														
Arsenic	7440-38-2	3.59E-02	3.59E-01	32.45	3.8E-02	1.2E+00	8.7E-02	2.8E+00	4.2E-03	1.4E-01	3.9E+03	3.9E+04	8.2E-03	8.2E-04
Chromium	7440-47-3	1.73E+00	1.73E+01	17.9	4.1E-02	7.3E-01	3.1E-01	5.5E+00	1.1E-01	1.9E+00	5.9E+04	5.9E+05	3.0E-04	3.0E-05
Lead	7439-92-1	4.22E+00	4.22E+01	664.4	1.5E-02	1.0E+01	2.3E-01	1.5E+02	2.9E-02	1.9E+01	3.1E+05	3.1E+06	2.2E-03	2.2E-04

Notes:

CAS = Chemical Abstract Services

C_{TRV}= NOAEL-based screening level (mg chemical/kg soil)

ADD = NOAEL or LOAEL (mg chemical/kg body weight-day) from Table F.2-8

BW = Average Body Weigth of Receptor (kg)

IR_{food} = Average Ingestion Rate for Food

BAF_{food} = Bioaccumulation factor, specific to prey type and chemical

DF = Dietary fraction

IRs = Incidental Ingestion Rate of soil (kg soil ingested per day, dry weight)

AF = Area Use Factor

NOAEL = No observable adverse effects level

LOAEL = Lowest observable adverse effects level

mg/kg = Milligram Per Kilogram

bw - day = Body Weight - Day

HQ = Hazard Quotient

TRV = Toxicity Reference Value

BDL = Below Detection Limit

EPC = Exposure Point Concentration

Red FoxSpecific Data from Table F.2-7

BW=	4.5300	kg
IR_{food} =	0.238	kg dw/day
BAF_{food}=	Chem Specific	unitless
DF_{plants} =	0.17	unitless
DF_{inv} =	0.04	unitless
DF_{mam} =	0.79	unitless
IR_{soil} =	0.00670	kg dw/day
AF =	0.0042	unitless

[a] = The following equation was used to calculate screening levels:

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food} \sum (BAF_{food} \cdot DF) + (IR_s)) \cdot AF}$$

See Appendix F.1 for an example C_{TRV} calculation.

NOAEL HQ = EPC/Calculated NOAEL-Based Screening Level

LOAEL HQ = EPC/Calculated LOAEL-Based Screening Level

Table F.2-18
Preliminary Wildlife Risk Characterization - American Robin
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	NOAEL (mg/kg bw-day)	LOAEL (mg/kg bw-day)	Preliminary Assessment												
				Soil												
				Maximum Detected Concentration (mg/kg)	Plant BAF (unitless)	Plant Concentration (mg/kg)	Invertebrate BAF (unitless)	Invertebrate Concentration (mg/kg)	Dietary Component with Highest Concentration	Calculated NOAEL-Based Screening Level[a] (mg/kg)	Calculated LOAEL-Based Screening Level[a] (mg/kg)	NOAEL HQ (unitless)	LOAEL HQ (unitless)	NOAEL HQ >1 (Y/N)	EPC (mg/kg)	EPC NOAEL HQ (unitless)
Inorganics																
Arsenic	7440-38-2	5.14E+00	1.28E+01	49	1.1E+00	5.4E+01	5.2E-01	2.6E+01	Plant	1.4E+01	3.5E+01	**3.5E+00**	**1.4E+00**	**Y**	32.45	**2.3E+00**
Chromium	7440-47-3	1.00E+00	5.00E+00	17.9	8.4E-02	1.5E+00	3.2E+00	5.7E+01	Invertebrate	9.9E-01	4.9E+00	**1.8E+01**	**3.6E+00**	**Y**	17.9	**1.8E+01**
Lead	7439-92-1	1.13E+00	1.13E+01	1630	4.7E-01	7.6E+02	1.5E+00	2.5E+03	Invertebrate	2.3E+00	2.3E+01	**7.1E+02**	**7.1E+01**	**Y**	664.4	**2.9E+02**

Notes:

CAS = Chemical Abstract Services

C_{TRV}= NOAEL-based screening level (mg chemical/kg soil)

ADD = NOAEL or LOAEL (mg chemical/kg body weight-day) from Table F.2-8

BW = Minimum Body Weigth of Receptor (kg)

IR_{food} = Maximum Ingestion Rate for Food

BAF_{food} = Bioaccumulation factor (dietary component with highest concentration BSAF was used)

DF = Dietary fraction (Dietary component with highest concentration assumed to be 100% of diet)

IRs = Incidental Ingestion Rate of soil (kg soil ingested per day, dry weight)

AF = 100% Area Use Factor

NOAEL = No observable adverse effects level

LOAEL = Lowest observable adverse effects level

mg/kg = Milligram Per Kilogram

bw - day = Body Weight - Day

HQ = Hazard Quotient

TRV = Toxicity Reference Value

EPC = Exposure Point Concentration

American Robin Specific Data from Table F.2-7

BW=	0.0635	kg
IR_{food} =	0.020	kg dw/day
BAF_{food}=	Chem Specific	unitless
IR_{soil} =	0.00100	kg dw/day
AF =	1	unitless

[a] = The following equation was used to calculate soil screening levels:

$$\boxed{C_{TRV} = \frac{ADD \cdot BW}{(IR_{food}(BAF_{food} \cdot DF) + IR_s)AF}}$$

See Appendix F.1 for an example C_{TRV} calculation.

NOAEL HQ = Maximum Detected Concentration/Calculated NOAEL-Based Concentration

LOAEL HQ = Maximum Detected Concentration/Calculated LOAEL-Based Concentration

EPC NOAEL HQ = NOAEL HQ * (EPC/Maximum Detected Concentration)

Table F.2-19
Refined Wildlife Risk Characterization - American Robin
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	NOAEL (mg/kg bw-day)	LOAEL (mg/kg bw-day)	Refined Assessment								
				Soil								
				EPC (mg/kg)	Plant BAF (unitless)	Plant Concentration (mg/kg)	Invertebrate BAF (unitless)	Invertebrate Concentration (mg/kg)	Calculated NOAEL-Based Screening Level[a] (mg/kg)	Calculated LOAEL-Based Screening Level[a] (mg/kg)	NOAEL HQ (unitless)	LOAEL HQ (unitless)
Inorganics												
Arsenic	7440-38-2	5.14E+00	1.28E+01	32.45	3.8E-02	1.2E+00	8.7E-02	2.8E+00	2.8E+02	7.0E+02	1.2E-01	4.7E-02
Chromium	7440-47-3	1.00E+00	5.00E+00	17.9	4.1E-02	7.3E-01	3.1E-01	5.5E+00	3.0E+01	1.5E+02	6.0E-01	1.2E-01
Lead	7439-92-1	1.13E+00	1.13E+01	664.4	1.5E-02	1.0E+01	2.3E-01	1.5E+02	4.4E+01	4.4E+02	**1.5E+01**	**1.5E+00**

Notes:
CAS = Chemical Abstract Services
C_{TRV}= NOAEL-based screening level (mg chemical/kg soil)
ADD = NOAEL or LOAEL (mg chemical/kg body weight-day) from Table F.2-8
BW = Average Body Weigth of Receptor (kg)
IR_{food} = Average Ingestion Rate for Food
BAF_{food} = Bioaccumulation factor, specific to prey type and chemical
DF = Dietary fraction
IRs = Incidental Ingestion Rate of soil (kg soil ingested per day, dry weight)
AF = Area Use Factor
NOAEL = No observable adverse effects level
LOAEL = Lowest observable adverse effects level
mg/kg = Milligram Per Kilogram
bw - day = Body Weight - Day
HQ = Hazard Quotient
TRV = Toxicity Reference Value
BDL = Below Detection Limit
EPC = Exposure Point Concentration

American Robin Specific Data from Table F.2-7

BW=	0.0773	kg
IR_{food} =	0.016	kg dw/day
BAF_{food}=	Chem Specific	unitless
DF_{plants} =	0.62	unitless
DF_{inv} =	0.38	unitless
IR_{soil} =	0.0008	kg dw/day
AF =	0.840	unitless

[a] = The following equation was used to calculate screening levels:

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food} \sum (BAF_{food} \cdot DF) + (IR_s)) \cdot AF}$$

See Appendix F.1 for an example C_{TRV} calculation.

NOAEL HQ = EPC/Calculated NOAEL-Based Screening Level
LOAEL HQ = EPC/Calculated LOAEL-Based Screening Level

Table F.2-20
Preliminary Wildlife Risk Characterization - Red-tailed Hawk
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	CAS #	NOAEL (mg/kg bw-day)	LOAEL (mg/kg bw-day)	Preliminary Assessment										
				Soil										
				Maximum Detected Concentration (mg/kg)	Mammal BAF (unitless)	Mammal Concentration (mg/kg)	Calculated NOAEL-Based Screening Level^a (mg/kg)	Calculated LOAEL-Based Screening Level^a (mg/kg)	NOAEL HQ (unitless)	LOAEL HQ (unitless)	NOAEL HQ >1 (Y/N)	EPC (mg/kg)	EPC NOAEL HQ (unitless)
Inorganics														
Arsenic	7440-38-2	5.14E+00	1.28E+01	49	1.5E-02	7.3E-01	5.2E+03	2.1E+03	9.4E-03	3.7E-03	N	--	--
Chromium	7440-47-3	1.00E+00	5.00E+00	17.9	3.3E-01	6.0E+00	4.6E+01	9.1E+00	3.9E-01	7.8E-02	N	--	--
Lead	7439-92-1	1.13E+00	1.13E+01	1630	2.9E-01	4.7E+02	6.0E+01	6.0E+00	**2.7E+01**	**2.7E+00**	**Y**	664.4	**1.1E+01**

Notes:

CAS = Chemical Abstract Services

C_{TRV}= NOAEL-based screening level (mg chemical/kg soil)

ADD = NOAEL or LOAEL (mg chemical/kg body weight-day) from Table F.2-8

BW_i = Minimum Body Weigth of Receptor (kg)

IR_{food} = Maximum Ingestion Rate for Food

BAF_{food} = Bioaccumulation factor (dietary component with highest concentration BSAF was used)

DF = Dietary fraction (Dietary component with highest concentration assumed to be 100% of diet)

IRs = Incidental Ingestion Rate of soil (kg soil ingested per day, dry weight)

AF = 100% Area Use Factor

NOAEL = No observable adverse effects level

LOAEL = Lowest observable adverse effects level

mg/kg = Milligram Per Kilogram

bw - day = Body Weight - Day

HQ = Hazard Quotient

TRV = Toxicity Reference Value

EPC = Exposure Point Concentration

Red-tailed Hawk Specific Data from Table F.2-7

BW=	0.957	kg
IR_{food} =	0.063	kg dw/day
BAF_{food}=	Chem Specific	unitless
DF_{mam} =	1.00	unitless
IR_{soil} =	0.00	kg dw/day
AF =	1	unitless

[a] = The following equation was used to calculate screenning levels:

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food}(BAF_{food} \cdot DF) + IR_s) AF}$$

See Appendix F.1 for an example C_{TRV} calculation.

NOAEL HQ = Maximum Detected Concentration/Calculated NOAEL-Based Concentration

LOAEL HQ = Maximum Detected Concentration/Calculated LOAEL-Based Concentration

EPC NOAEL HQ = NOAEL HQ * (EPC/Maximum Detected Concentration)

Table F.2-21
Refined Wildlife Risk Characterization - Red-tailed Hawk
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

Chemical	**CAS #**	**NOAEL (mg/kg bw-day)**	**LOAEL (mg/kg bw-day)**	**Refined Assessment**						
				Soil						
				EPC (mg/kg)	**Mammal BAF (unitless)**	**Mammal Concentration (mg/kg)**	**Calculated NOAEL-Based Soil Screening Level^a (mg/kg)**	**Calculated LOAEL-Based Soil Screening Level^a (mg/kg)**	**NOAEL HQ (unitless)**	**LOAEL HQ (unitless)**
Inorganics										
Lead	7439-92-1	1.13E+00	1.13E+01	664.40	2.9E-02	1.9E+01	4.7E+05	4.7E+06	1.4E-03	1.4E-04

Notes:

CAS = Chemical Abstract Services
C_{TRV}= NOAEL-based screening level (mg chemical/kg soil)
ADD = NOAEL or LOAEL (mg chemical/kg body weight-day) from Table F.2-8
BW = Average Body Weigth of Receptor (kg)
IR_{food} = Average Ingestion Rate for Food
BAF_{food} = Bioaccumulation factor, specific to prey type and chemical
DF = Dietary fraction
IRs = Incidental Ingestion Rate of soil (kg soil ingested per day, dry weight)
AF = Area Use Factor
NOAEL = No observable adverse effects level
LOAEL = Lowest observable adverse effects level
mg/kg = Milligram Per Kilogram
bw - day = Body Weight - Day
HQ = Hazard Quotient
TRV = Toxicity Reference Value
BDL = Below Detection Limit
EPC = Exposure Point Concentration

Red-tailed Hawk Specific Data from Table F.2-7

BW=	1.134	kg
IR_{food} =	0.059	kg dw/day
BAF_{food}=	Chem Specific	unitless
DF_{mam} =	1.00	unitless
IR_{soil} =	0.0	kg dw/day
AF =	0.0016	unitless

[a] = The following equation was used to calculate screening levels:

$$C_{TRV} = \frac{ADD \cdot BW}{(IR_{food} \sum (BAF_{food} \cdot DF) + (IR_s)) \cdot AF}$$

See Appendix F.1 for an example C_{TRV} calculation.

NOAEL HQ = EPC/Calculated NOAEL-Based Screening Level
LOAEL HQ = EPC/Calculated LOAEL-Based Screening Level

Table F.2-22
Wildlife Summary
Screening Level Ecological Risk Assessment
MMRP SSP Report
Radford Army Ammunition Plant, Radford, Virginia

		Meadow Vole					**Short-tailed Shrew**					**Red Fox**					**American Robin**					**Red-tailed Hawk**				
Chemical	**CAS#**	Preliminary NOAEL-based HQ	Preliminary LOAEL-based HQ	Preliminary EPC NOAEL HQ	Refined NOAEL-based HQ	Refined LOAEL-based HQ	Preliminary NOAEL-based HQ	Preliminary LOAEL-based HQ	Preliminary EPC NOAEL HQ	Refined NOAEL-based HQ	Refined LOAEL-based HQ	Preliminary NOAEL-based HQ	Preliminary LOAEL-based HQ	Preliminary EPC NOAEL HQ	Refined NOAEL-based HQ	Refined LOAEL-based HQ	Preliminary NOAEL-based HQ	Preliminary LOAEL-based HQ	Preliminary EPC NOAEL HQ	Refined NOAEL-based HQ	Refined LOAEL-based HQ	Preliminary NOAEL-based HQ	Preliminary LOAEL-based HQ	Preliminary EPC NOAEL HQ	Refined NOAEL-based HQ	Refined LOAEL-based HQ
Inorganics																										
Arsenic	7440-38-2	**2.7E+02**	**2.7E+01**	**1.8E+02**	**3.6E+00**	3.6E-01	**9.7E+01**	**9.7E+00**	**6.4E+01**	**6.1E+00**	6.1E-01	**1.8E+02**	**1.8E+01**	**1.2E+02**	8.2E-03	8.2E-04	**3.5E+00**	**1.4E+00**	**2.3E+00**	1.2E-01	4.7E-02	9.4E-03	3.7E-03	NC	NC	NC
Chromium	7440-47-3	2.0E-01	2.0E-02	NC	NC	NC	**2.0E+00**	2.0E-01	**2.0E+00**	1.3E-01	1.3E-02	**3.8E+00**	3.8E-01	**3.8E+00**	3.0E-04	3.0E-05	**1.8E+01**	**3.6E+00**	**1.8E+01**	6.0E-01	1.2E-01	3.9E-01	7.8E-02	NC	NC	NC
Lead	7439-92-1	**3.4E+01**	**3.4E+00**	**1.4E+01**	4.0E-01	4.0E-02	**3.7E+01**	**3.7E+00**	**1.5E+01**	**1.7E+00**	1.7E-01	**6.9E+01**	**6.9E+00**	**2.8E+01**	2.2E-03	2.2E-04	**7.1E+02**	**7.1E+01**	**2.9E+02**	**1.5E+01**	**1.5E+00**	**2.7E+01**	**2.7E+00**	**1.1E+01**	1.4E-03	1.4E-04

Notes:
CAS = Chemical Abstract Services
NC = Not Calculated
NOAEL = No observable adverse effects level
LOAEL = Lowest observable adverse effects level
HQ = Hazard Quotient
EPC = Exposure Point Concentration

APPENDIX G

DATA VALIDATION REPORTS AND LABORATORY ANALYTICAL DATA

(Provided on enclosed CD)

TABLE OF CONTENTS

CLIENT: **URS GROUP, INC.**

PROJECT: **RADFORD AAP**

SDG: **08J095**

** - Not Requested

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889
Fax:(310) 618-0818

Date: 10-30-2008
EMAX Batch No.: 08J095

Attn: Andrea Sansom

URS Group, Inc.
849 International Drive, #320
Linthicum MD 21090

Subject: Laboratory Report
Project: Radford AAP

Enclosed is the Laboratory report for samples received on 10/09/08.
The data reported include :

Sample ID	Control #	Col Date	Matrix	Analysis
ARSARSS1	J095-01	10/07/08	SOIL	METALS BY ICP
ARSARSS2	J095-02	10/07/08	SOIL	METALS BY ICP
ARSARSS3	J095-03	10/07/08	SOIL	METALS BY ICP
ARSARSS4	J095-04	10/07/08	SOIL	METALS BY ICP
ARSARSS5	J095-05	10/07/08	SOIL	METALS BY ICP
ARSARSS6	J095-06	10/07/08	SOIL	METALS BY ICP
DUP-1	J095-07	10/07/08	SOIL	METALS BY ICP
ARSARSS14	J095-08	10/07/08	SOIL	METALS BY ICP
ARSARSS15	J095-09	10/07/08	SOIL	METALS BY ICP
DUP-2	J095-10	10/07/08	SOIL	METALS BY ICP
ARSARSS7	J095-11	10/08/08	SOIL	METALS BY ICP
ARSARSS8	J095-12	10/08/08	SOIL	METALS BY ICP
ARSARSS9	J095-13	10/08/08	SOIL	METALS BY ICP
ARSARSS10	J095-14	10/08/08	SOIL	METALS BY ICP
ARSARSS11	J095-15	10/08/08	SOIL	METALS BY ICP
ARSARSS12	J095-16	10/08/08	SOIL	METALS BY ICP
ARSARSS13	J095-17	10/08/08	SOIL	METALS BY ICP
ARSARSS2MS	J095-02M	10/07/08	SOIL	METALS BY ICP
ARSARSS2MSD	J095-02S	10/07/08	SOIL	METALS BY ICP

Sample ID	Control #	Col Date	Matrix	Analysis
ARSARSS15MS	J095-09M	10/07/08	SOIL	METALS BY ICP
ARSARSS15MSD	J095-09S	10/07/08	SOIL	METALS BY ICP

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely yours,

Caspar J. Pang
Acting Laboratory Director

EMAX certifies that the results included in this report meet all NELAC requirements unless noted in the Case Narrative.

URS - 0815

CHAIN OF CUSTODY

EMAX LABORATORIES, INC.
1835 W. 205th Street, Torrance, CA 90501
Tel #: 310-618-8889 Fax #: 310-618-0818
Email: info@emaxlabs.com

PO NUMBER: 15299885

SAMPLE STORAGE

EMAX CONTROL NO. * 08J095

PROJECT CODE:

CLIENT URS / RFAAP
PROJECT RFAAP MMRP
COORDINATOR
TEL (410) 487-8995 FAX (410) 859-5202 EMAIL
SEND REPORT TO Andrea Sansom
COMPANY URS Corp. Lithicum Office
ADDRESS ~~5540 Falmouth St. Suite 210~~
EMAX PM

MATRIX CODE	PRESERVATIVE CODE
DW=Drinking Water	IC = Ice
GW=Ground Water	HC = HCl
WW=Waste Water	HN=HNO3
SD=Solid Waste SL=Sludge	SH=NaOH
SS=Soil/ Sediment	ST=Na2S2O3
WP=Wipes PP=Pure Products	ZA=Zinc Acetate
AR=Air	HS=H_2SO_4
O=	

TAT
- ☐ Rush ____hrs.
- ☐ Rush ____days
- ☐ 7 days
- ☐ 14 days
- ☐ 21 days
- ☒ 30 days
- ☐ ____days
- ☐

SAMPLE ID		SAMPLING			CONTAINER			MATRIX CODE	QC	ANALYSIS REQUIRED / PRESERVATIVE CODE								COMMENTS
LAB	CLIENT	LOCATION	DATE	TIME	NO.	SIZE	TYPE			As, Sb, Pb 6010B Trace								
1	ARSARSS 1	MMRP	10/7/08	1450	1	4oz.	Glass	SS		X								
2	ARSARSS 2 MS / MSD			1500	3					X								
3	ARSARSS 3			1508	1					X								
4	ARSARSS 4			1513	1					X								
5	ARSARSS 5			1517	1					X								
6	ARSARSS 6			1519	1					X								
7	DUP-1			—	1					X								
8	ARSARSS 14			1610	1					X								
9	ARSARSS 15 MS / MSD			1615	3					X								
10	DUP-2	↓	↓	—	1	↓	↓	↓		X								

Instructions

Cooler #	Temp. (°C)	Sample #s
1	2.8	C

SAMPLER

COURIER/AIRBILL

RELINQUISHED BY	Date	Time	RECEIVED BY
	10/8/08	1400	
	10-9-08	9:30	

NOTICE: Turn-around-time (TAT) for samples shall not begin untill all discrepancies have been resolved. For samples received and discrepacies resolved after 1500 hrs, TAT shall start at 0800 hrs the next business day. The client is responsible for all cost associated with sample disposal. Samples shall be disposed of as soon as practical (but not prior to fifteen (15) calendar days) after issuance of analytical report unless a different sample disposal schedule is pre-arranged with EMAX. Disposal fee for samples defined by CA Title 22 as non-hazardous shall be $5.00 per sample. EMAX will return hazardous samples to the client at the client's expense unless directed in writing otherwise.

CHAIN OF CUSTODY

EMAX LABORATORIES, INC.

1835 W. 205th Street, Torrance, CA 90501
Tel #: 310-618-8889 Fax #: 310-618-0818
Email: info@emaxlabs.com

PO NUMBER: 15299885

SAMPLE STORAGE

EMAX CONTROL NO. * 08J095

PROJECT CODE:

CLIENT URS / RFAAP

PROJECT RFAAP MMRP

COORDINATOR

TEL (410) 487-8995 FAX (410) 859-5202 EMAIL

SEND REPORT TO Andrea Sansom

COMPANY URS Corp.

ADDRESS Lithicum Office

EMAX PM

MATRIX CODE	PRESERVATIVE CODE
DW=Drinking Water	IC = Ice
GW=Ground Water	HC = HCl
WW=Waste Water	HN=HNO3
SD=Solid Waste SL=Sludge	SH=NaOH
SS=Soil/ Sediment	ST=Na2S2O3
WP=Wipes PP=Pure Products	ZA=Zinc Acetate
AR=Air	HS=H_2SO_4
O=	

ANALYSIS REQUIRED: As, Sb, Pb 6010B Trace

TAT
- ☐ Rush ____hrs.
- ☐ Rush ____days
- ☐ 7 days
- ☐ 14 days
- ☐ 21 days
- ☒ 30 days
- ☐ ____days
- ☐

SAMPLE ID		SAMPLING			CONTAINER			MATRIX CODE	QC	As, Sb, Pb 6010B Trace	PRESERVATIVE CODE						COMMENTS
LAB	CLIENT	LOCATION	DATE	TIME	NO.	SIZE	TYPE										
1	ARSARSS 7	MMRP	10/8/08	0945	1	4oz	Glass	SS		X							
2	ARSARSS 8	↓	↓	0950	1	↓	↓	↓		X							
3	ARSARSS 9	↓	↓	0955	1	↓	↓	↓		X							
4	ARSARSS 10	↓	↓	1000	1	↓	↓	↓		X							
5	ARSARSS 11	↓	↓	1005	1	↓	↓	↓		X							
6	ARSARSS 12	↓	↓	1010	1	↓	↓	↓		X							
7	ARSARSS 13	↓	↓	1015	1	↓	↓	↓		X							
8																	
9																	
0																	

Instructions

Cooler #	Temp. (°C)	Sample #s
1	2.8°c	

SAMPLER

COURIER/AIRBILL

RELINQUISHED BY	Date	Time	RECEIVED BY
M Tit	10/8/08	1400	
	10-9-08	9:30	

NOTICE: Turn-around-time (TAT) for samples shall not begin untill all discrepancies have been resolved. For samples received and discrepacies resolved after 1500 hrs, TAT shall start at 0800 hrs the next business day. The client is responsible for all cost associted with sample disposal. Samples shall be disposed of as soon as practical (but not prior to fifteen (15) calendar days) after issuance of analytical report unless a different sample disposal schedule is pre-arranged with EMAX. Disposal fee for samples defined by CA Title 22 as non-hazardous shall be $5.00 per sample. EMAX will return hazardous samples to the client at the client's expense unless directed in writing otherwise.

Molly Nguyen

From: Andrea_Sansom@URSCorp.com
Sent: Thursday, October 09, 2008 11:21 AM
To: Molly Nguyen
Cc: Sarah_Gettier@URSCorp.com; Brett_Fisher@URSCorp.com
Subject: Re: RFAAP MMRP Soil Sample COCs
Attachments: 20081009141821.pdf

Molly,

The Radford SI sample should arrive today. Please note that the sample ARSARSS14, ARSARSS15, MS/MSD on ARSARSS15, and DUP2 need arsenic, chromium, and lead as opposed to the rest of the samples which require arsenic, antimony, and lead. Here are corrected CoCs:

(See attached file: 20081009141821.pdf)

Andrea Sansom
Project Chemist
849 International Drive, Suite 320
Linthicum, Maryland 21090
410-859-5049 x 155
direct: 410-487-8955
fax: 859-5202

Brett Fisher/Richmond/URSCorp

Brett Fisher/Richmond/URSCorp
10/09/2008 02:01 PM

ToAndrea Sansom/Linthicum/URSCorp@URSCORP
ccSarah Gettier/Gaithersburg/URSCorp@URSCORP
SubjectRFAAP MMRP Soil Sample COCs

Attached are the COCs for the soil samples collected at the small arms firing range on October 7 and 8.

[attachment "Soil Sample COCs.pdf" deleted by Andrea Sansom/Linthicum/URSCorp]

Brett Fisher, P.G.
Geologist
URS Corporation
5540 Falmouth St., Suite 201
Richmond, VA 23230
Phone: (804) 474-5430
Mobile: (804) 677-0296
brett_fisher@urscorp.com

EMAX LABORATORIES, INC.

SAMPLE RECEIPT FORM 1

Type of Delivery	Delivered By/Airbill	
☐ EMAX Courier		ECN 08J095
☐ Client Delivery		Recepient I PATEL
☑ Third Party FedEx	849702867967	Date 10-9-08
		Time 9:30A

COC Inspection

☑ Client Name ☑ Client PM/FC ☐ Sampler Name ☑ Sampling Date/Time/Location ☑ Sample ID ☑ Matrix

☑ Address ☑ Tel # / Fax # ☐ Courier Signature ☑ Analysis Required ☐ Preservative (if any) ☑ TAT

Safety Issues

☑ None ☐ High concentrations expected ☐ Superfund Site samples ☐ Rad screening required

Comments:

Packaging Inspection

Container	☑ Cooler	☐ Box	☐ Other		
Condition	☐ Custody Seal	☑ Intact	☐ Damaged		
Packaging	☐ Bubble Pack	☐ Styrofoam	☐ Popcorn	☑ Sufficient	☐
Temperatures	☑ Cooler 1 2.8 °C	☐ Cooler 2 ___ °C	☐ Cooler 3 ___ °C	☐ Cooler 4 ___ °C	☐ Cooler 5 ___ °C
	☐ Cooler 6 ___ °C	☐ Cooler 7 ___ °C	☐ Cooler 8 ___ °C	☐ Cooler 9 ___ °C	☐ Cooler 10 ___ °C

Comments: ☐ **PM was informed on non-compliant coolers imediately.**

DISCREPANCIES

LSID	LSCID	Sample Label ID/COC ID	Discrepancy Code	Corrective Action Code

REVIEWS

Sample Labeling
Date 10-9-08

SRF
Date 10/9/08

PM
Date 10/10/08

LEGEND:

Code	Description- Sample Management
A1	Analysis is not indicated in COC
A2	Analysis is not indicated in label
A3	Analysis is inconsistent in COC vis-à-vis label
B1	Sample ID is not indicated in COC
B2	Sample ID is not indicated in label
B3	Sample ID is inconsistent in COC vis-à-vis label
C1	Wrong container
C2	Broken container
C3	Leaking container
D1	Date and/or time is not indicated in COC
D2	Date and/or time is not indicated in label
D3	Date and/or time is inconsistent in COC vis-à-vis label

Code	Description-Sample Management
E1	Preservative needed; sample has no preservative
E2	Preservative not needed but sample is preserved
F1	Not enough quantity of samples
F2	Bubble is> 6mm
G1	Temperature is out of range (4 +_ 2°C)
G2	Out of Holding Time
G3	>20 % solid particle
H1	________
H2	________

Code	Description-Project Management
R1	Hold sample(s); wait for further instructions
R2	Proceed as indicated in COC
R3	Refer to attached instruction
R4	Cancel the analysis
R5	________
R6	________

FedEx Express *US Airbill*

FedEx Tracking Number 849702867967

Form ID No. 0200

1 From

Date [illegible] [redacted]

Sender's Name [illegible] Phone [illegible]

Company [illegible]

08 J095
~~10-9-08~~
9:30

Address [illegible]

Dept./Floor/Suite/Room

City [illegible] State ZIP

2 Your Internal Billing Reference [illegible]

3 To

Recipient's Name [illegible] Phone [illegible]

Company [illegible]

Recipient's Address [illegible]

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Dept./Floor/Suite/Room

Address

To request a package be held at a specific FedEx location, print FedEx address here.

City [illegible] State CA ZIP [illegible]

8497 0286 7967

4a Express Package Service — ***Packages up to 150 lbs.*** *To most locations

☒ FedEx Priority Overnight — Next business morning*
☐ FedEx Standard Overnight — Next business afternoon*
☐ FedEx First Overnight — Earliest next business morning delivery to select locations*
☐ FedEx 2Day — Second business day*
☐ FedEx Express Saver — Third business day*

FedEx Envelope rate not available. Minimum charge: One-pound rate

4b Express Freight Service — ***Packages over 150 lbs.*** ** To most locations

☐ FedEx 1Day Freight* — Next business day**
☐ FedEx 2Day Freight — Second business day**
☐ FedEx 3Day Freight — Third business day**

*Call for Confirmation:

5 Packaging — * Declared value limit $500

☐ FedEx Envelope*
☐ FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak
☐ FedEx Box
☐ FedEx Tube
☒ Other

6 Special Handling — Include FedEx address in Section 3.

☐ **SATURDAY Delivery** — Available ONLY for FedEx Priority Overnight, FedEx 2Day, FedEx 1Day Freight, and FedEx 2Day Freight to select ZIP codes
☐ **HOLD Weekday** at FedEx Location — Not available for FedEx First Overnight
☐ **HOLD Saturday** at FedEx Location — Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked.

☒ No
☐ Yes — As per attached Shipper's Declaration
☐ Yes — Shipper's Declaration not required
☐ Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg
☐ Cargo Aircraft Only

Dangerous goods (including Dry Ice) cannot be shipped in FedEx packaging.

7 Payment ***Bill to:*** Enter FedEx Acct. No. or Credit Card No. below.

☒ Sender — Acct. No. in Section 1 will be billed.
☐ Recipient
☐ Third Party
☐ Credit Card
☐ Cash/Check
☐ Obtain Recip. Acct. No.

[redacted] [redacted]

Total Packages	Total Weight	Total Declared Value†	Total Charges
1	[illegible]	$ [illegible] .00	Credit Card Auth.

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Sign to Authorize Delivery Without a Signature

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

Questions? Visit our Web site at fedex.com
or call 1.800.GoFedEx 1.800.463.3339.
Rev. Date 11/03•Part #158281•©1994–2003 FedEx•PRINTED IN U.S.A. MWIA 04

467

REPORTING CONVENTIONS

DATA QUALIFIERS:

Lab Qualifier	AFCEE Qualifier	Description
J	F	Indicates that the analyte is positively identified and the result is less than RL but greater than MDL.
N		Indicates presumptive evidence of a compound.
B	B	Indicates that the analyte is found in the associated method blank as well as in the sample at above QC level.
E	J	Indicates that the result is above the maximum calibration range.
*	*	Out of QC limit.

Note: The above qualifiers are used to flag the results unless the project requires a different set of qualification criteria.

ACRONYMS AND ABBREVIATIONS:

CRDL	Contract Required Detection Limit
RL	Reporting Limit
MRL	Method Reporting Limit
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
DO	Diluted out

DATES

The date and time information for leaching and preparation reflect the beginning date and time of the procedure unless the method, protocol, or project specifically requires otherwise.

LABORATORY REPORT FOR

URS GROUP, INC.

RADFORD AAP

METHOD 3050B/6010B
METALS BY ICP

SDG#: 08J095

CASE NARRATIVE

CLIENT: URS GROUP, INC.

PROJECT: RADFORD AAP

SDG: 08J095

METHOD 3050B/6010B
METALS BY ICP

Seventeen (17) soil samples were received on 10/09/08 for Metals analysis by Method 3050B/6010B in accordance with MMRP'S QAPP and DoD QSM, V 3, January 2006.

1. Holding Time

Analysis met holding time criteria.

2. Continuing Calibrations (CCV's) and ICSA/ICSAB

CCV's and ICSA/ICSAB were analyzed at a frequency specified by the project. All project requirements were met.

3. Method Blank

Method blank was free of contamination at half of the reporting limit.

4. Lab Control Sample/Lab Control Sample Duplicate

Lab control results were within QC limit.

5. Serial Dilution/Post-Analytical Spike

Sample J095-02 was analyzed for serial dilution and post-analytical spike. All QC requirements were met.

6. Matrix Spike/Matrix Spike Duplicate

Samples J095-02 and -09 were spiked. All recoveries were within QC limit except two elements in J095-02M/S were out of the limits.

7. Sample Analysis

Samples were analyzed according to the prescribed QC procedures. All criteria were met with the aforementioned exception.

LAB CHRONICLE
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP

SDG NO. : 08J095
Instrument ID : T-ID8

SOIL

Client Sample ID	Laboratory Sample ID	Dilution Factor	% Moist	Analysis DateTime	Extraction DateTime	Sample Data FN	Calibration Data FN	Prep. Batch	Notes
MBLK1S	IPJ021SB	1	NA	10/15/0823:48	10/10/0814:00	ID8J017102	ID8J017100	IPJ021S	Method Blank
LCS1S	IPJ021SL	1	NA	10/15/0823:53	10/10/0814:00	ID8J017103	ID8J017100	IPJ021S	Lab Control Sample (LCS)
LCD1S	IPJ021SC	1	NA	10/15/0823:58	10/10/0814:00	ID8J017104	ID8J017100	IPJ021S	LCS Duplicate
ARSARSS2MS	J095-02M	1	15.1	10/16/0800:03	10/10/0814:00	ID8J017105	ID8J017100	IPJ021S	Matrix Spike Sample (MS)
ARSARSS2MSD	J095-02S	1	15.1	10/16/0800:07	10/10/0814:00	ID8J017106	ID8J017100	IPJ021S	MS Duplicate (MSD)
ARSARSS2AS	J095-02A	1	15.1	10/16/0800:12	10/10/0814:00	ID8J017107	ID8J017100	IPJ021S	Analytical Spike Sample
ARSARSS2	J095-02	1	15.1	10/16/0800:17	10/10/0814:00	ID8J017108	ID8J017100	IPJ021S	Field Sample
ARSARSS2DL	J095-02J	5	15.1	10/16/0800:22	10/10/0814:00	ID8J017109	ID8J017100	IPJ021S	Diluted Sample
ARSARSS1	J095-01	1	9.7	10/16/0800:27	10/10/0814:00	ID8J017110	ID8J017100	IPJ021S	Field Sample
ARSARSS3	J095-03	1	13.4	10/16/0800:44	10/10/0814:00	ID8J017113	ID8J017111	IPJ021S	Field Sample
ARSARSS4	J095-04	1	10.5	10/16/0800:49	10/10/0814:00	ID8J017114	ID8J017111	IPJ021S	Field Sample
ARSARSS5	J095-05	1	11.8	10/16/0800:54	10/10/0814:00	ID8J017115	ID8J017111	IPJ021S	Field Sample
ARSARSS6	J095-06	1	12.3	10/16/0800:59	10/10/0814:00	ID8J017116	ID8J017111	IPJ021S	Field Sample
DUP-1	J095-07	1	9.4	10/16/0801:04	10/10/0814:00	ID8J017117	ID8J017111	IPJ021S	Field Sample
ARSARSS7	J095-11	1	18.1	10/16/0801:47	10/10/0814:00	ID8J017125	ID8J017123	IPJ021S	Field Sample
ARSARSS8	J095-12	1	24.9	10/16/0801:52	10/10/0814:00	ID8J017126	ID8J017123	IPJ021S	Field Sample
ARSARSS9	J095-13	1	24.5	10/16/0801:56	10/10/0814:00	ID8J017127	ID8J017123	IPJ021S	Field Sample
ARSARSS10	J095-14	1	29.1	10/16/0802:02	10/10/0814:00	ID8J017128	ID8J017123	IPJ021S	Field Sample
ARSARSS11	J095-15	1	31.0	10/16/0802:07	10/10/0814:00	ID8J017129	ID8J017123	IPJ021S	Field Sample
ARSARSS12	J095-16	1	23.0	10/16/0802:12	10/10/0814:00	ID8J017130	ID8J017123	IPJ021S	Field Sample
ARSARSS13	J095-17	1	23.2	10/16/0802:17	10/10/0814:00	ID8J017131	ID8J017123	IPJ021S	Field Sample

FN - Filename
% Moist - Percent Moisture

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS1
Lab Samp ID: J095-01
Lab File ID: ID8J017110
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017100

Date Collected: 10/07/08 14:50
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 00:27
Dilution Factor: 1
Matrix : SOIL
% Moisture : 9.7
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	7.00J	11.1	1.11
Arsenic	4.22	1.11	0.443
Lead	319	1.11	0.221

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS2
Lab Samp ID: J095-02
Lab File ID: ID8J017108
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017100

Date Collected: 10/07/08 15:00
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 00:17
Dilution Factor: 1
Matrix : SOIL
% Moisture : 15.1
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	19.4	11.8	1.18
Arsenic	5.45	1.18	0.471
Lead	1600	1.18	0.236

```
                                   METHOD 3050B/6010B
                                     METALS BY ICP

=============================================================================
Client      : URS GROUP, INC.                       Date  Collected: 10/07/08 15:08
Project     : RADFORD AAP                           Date   Received: 10/09/08
SDG NO.     : 08J095                                Date  Extracted: 10/10/08 14:00
Sample   ID: ARSARSS3                               Date   Analyzed: 10/16/08 00:44
Lab Samp ID: J095-03                                Dilution Factor: 1
Lab File ID: ID8J017113                             Matrix         : SOIL
Ext Btch ID: IPJ021S                                % Moisture     : 13.4
Calib. Ref.: ID8J017111                             Instrument ID  : EMAXTID8
=============================================================================

                                            RESULTS         RL            MDL
PARAMETERS                                  (mg/kg)      (mg/kg)        (mg/kg)
----------                                  -------      -------        -------
Antimony                                     24.4          11.5           1.15
Arsenic                                      6.01          1.15           0.462
Lead                                         1630          1.15           0.231
```

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS4
Lab Samp ID: J095-04
Lab File ID: ID8J017114
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017111

Date Collected: 10/07/08 15:13
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 00:49
Dilution Factor: 1
Matrix : SOIL
% Moisture : 10.5
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	4.47J	11.2	1.12
Arsenic	4.56	1.12	0.447
Lead	400	1.12	0.223

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS5
Lab Samp ID: J095-05
Lab File ID: ID8J017115
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017111

Date Collected: 10/07/08 15:17
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 00:54
Dilution Factor: 1
Matrix : SOIL
% Moisture : 11.8
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	ND	11.3	1.13
Arsenic	4.56	1.13	0.454
Lead	27.1	1.13	0.227

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS6
Lab Samp ID: J095-06
Lab File ID: ID8J017116
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017111

Date Collected: 10/07/08 15:19
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 00:59
Dilution Factor: 1
Matrix : SOIL
% Moisture : 12.3
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	3.10J	11.4	1.14
Arsenic	4.03	1.14	0.456
Lead	328	1.14	0.228

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: DUP-1
Lab Samp ID: J095-07
Lab File ID: ID8J017117
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017111

Date Collected: 10/07/08 00:00
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 01:04
Dilution Factor: 1
Matrix : SOIL
% Moisture : 9.4
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	8.98J	11.0	1.10
Arsenic	3.90	1.10	0.442
Lead	407	1.10	0.221

```
                        METHOD 3050B/6010B
                          METALS BY ICP

===============================================================================
Client      : URS GROUP, INC.                    Date  Collected: 10/08/08 09:45
Project     : RADFORD AAP                        Date   Received: 10/09/08
SDG NO.     : 08J095                             Date  Extracted: 10/10/08 14:00
Sample   ID: ARSARSS7                            Date   Analyzed: 10/16/08 01:47
Lab Samp ID: J095-11                             Dilution Factor: 1
Lab File ID: ID8J017125                          Matrix         : SOIL
Ext Btch ID: IPJ021S                             % Moisture     : 18.1
Calib. Ref.: ID8J017123                          Instrument ID  : EMAXTID8
===============================================================================

                                              RESULTS         RL              MDL
PARAMETERS                                    (mg/kg)     (mg/kg)         (mg/kg)
----------                                    -------     -------         -------
Antimony                                       1.32J        12.2            1.22
Arsenic                                        9.59         1.22           0.488
Lead                                            225         1.22           0.244
```

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS8
Lab Samp ID: J095-12
Lab File ID: ID8J017126
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017123

Date Collected: 10/08/08 09:50
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 01:52
Dilution Factor: 1
Matrix : SOIL
% Moisture : 24.9
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	ND	13.3	1.33
Arsenic	8.44	1.33	0.533
Lead	88.6	1.33	0.266

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS9
Lab Samp ID: J095-13
Lab File ID: ID8J017127
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017123

Date Collected: 10/08/08 09:55
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 01:56
Dilution Factor: 1
Matrix : SOIL
% Moisture : 24.5
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	ND	13.2	1.32
Arsenic	30.4	1.32	0.530
Lead	96.1	1.32	0.265

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS10
Lab Samp ID: J095-14
Lab File ID: ID8J017128
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017123

Date Collected: 10/08/08 10:00
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 02:02
Dilution Factor: 1
Matrix : SOIL
% Moisture : 29.1
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	ND	14.1	1.41
Arsenic	25.1	1.41	0.564
Lead	174	1.41	0.282

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS11
Lab Samp ID: J095-15
Lab File ID: ID8J017129
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017123

Date Collected: 10/08/08 10:05
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 02:07
Dilution Factor: 1
Matrix : SOIL
% Moisture : 31.0
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	ND	14.5	1.45
Arsenic	32.6	1.45	0.580
Lead	104	1.45	0.290

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS12
Lab Samp ID: J095-16
Lab File ID: ID8J017130
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017123

Date Collected: 10/08/08 10:10
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 02:12
Dilution Factor: 1
Matrix : SOIL
% Moisture : 23.0
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	1.32J	13.0	1.30
Arsenic	49.2	1.30	0.519
Lead	138	1.30	0.260

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS13
Lab Samp ID: J095-17
Lab File ID: ID8J017131
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017123

Date Collected: 10/08/08 10:15
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 02:17
Dilution Factor: 1
Matrix : SOIL
% Moisture : 23.2
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	ND	13.0	1.30
Arsenic	37.0	1.30	0.521
Lead	51.5	1.30	0.260

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: MBLK1S
Lab Samp ID: IPJ021SB
Lab File ID: ID8J017102
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017100

Date Collected: NA
Date Received: 10/10/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/15/08 23:48
Dilution Factor: 1
Matrix : SOIL
% Moisture : NA
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Antimony	ND	10.0	1.00
Arsenic	ND	1.00	0.400
Lead	ND	1.00	0.200

EMAX QUALITY CONTROL DATA
LCS/LCD ANALYSIS

CLIENT: URS GROUP, INC.
PROJECT: RADFORD AAP
SDG NO.: 08J095
METHOD: METHOD 3050B/6010B

MATRIX:	SOIL			% MOISTURE:	NA
DILTN FACTR:	1	1	1		
SAMPLE ID:	MBLK1S				
CONTROL NO.:	IPJ021SB	IPJ021SL	IPJ021SC		
LAB FILE ID:	ID8J017102	ID8J017103	ID8J017104		
DATIME EXTRCTD:	10/10/0814:00	10/10/0814:00	10/10/0814:00	DATE COLLECTED:	NA
DATIME ANALYZD:	10/15/0823:48	10/15/0823:53	10/15/0823:58	DATE RECEIVED:	10/10/08
PREP. BATCH:	IPJ021S	IPJ021S	IPJ021S		
CALIB. REF:	ID8J017100	ID8J017100	ID8J017100		

ACCESSION:

PARAMETER	BLNK RSLT mg/kg	SPIKE AMT mg/kg	BS RSLT mg/kg	BS % REC	SPIKE AMT mg/kg	BSD RSLT mg/kg	BSD % REC	RPD %	QC LIMIT %	MAX RPD %
Antimony	ND	500	503	101	500	484	97	4	80-120	20
Arsenic	ND	100	105	105	100	101	101	4	80-120	20
Lead	ND	100	104	104	100	102	102	2	80-120	20

EMAX QUALITY CONTROL DATA
MS/MSD ANALYSIS

CLIENT: URS GROUP, INC.
PROJECT: RADFORD AAP
SDG NO.: 08J095
METHOD: METHOD 3050B/6010B

MATRIX:	SOIL			% MOISTURE:	15.1
DILTN FACTR:	1	1	1		
SAMPLE ID:	ARSARSS2				
CONTROL NO.:	J095-02	J095-02M	J095-02S		
LAB FILE ID:	ID8J017108	ID8J017105	ID8J017106		
DATIME EXTRCTD:	10/10/0814:00	10/10/0814:00	10/10/0814:00	DATE COLLECTED:	10/07/08 15:00
DATIME ANALYZD:	10/16/0800:17	10/16/0800:03	10/16/0800:07	DATE RECEIVED:	10/09/08
PREP. BATCH:	IPJ021S	IPJ021S	IPJ021S		
CALIB. REF:	ID8J017100	ID8J017100	ID8J017100		

ACCESSION:

PARAMETER	SMPL RSLT mg/kg	SPIKE AMT mg/kg	MS RSLT mg/kg	MS % REC	SPIKE AMT mg/kg	MSD RSLT mg/kg	MSD % REC	RPD %	QC LIMIT %	MAX RPD %
Antimony	19.4	589	348	56*	589	350	56*	1	80-120	20
Arsenic	5.45	118	112	90	118	113	91	1	80-120	20
Lead	1600	118	1680	69*	118	1670	64*	0	80-120	20

EMAX QUALITY CONTROL DATA
SERIAL DILUTION ANALYSIS

CLIENT: URS GROUP, INC.
PROJECT: RADFORD AAP
BATCH NO.: 08J095
METHOD: METHOD 3050B/6010B

MATRIX:	SOIL		% MOISTURE:	15.1
DILUTION FACTOR:	1	5		
SAMPLE ID:	ARSARSS2	ARSARSS2DL		
EMAX SAMP ID:	J095-02	J095-02J		
LAB FILE ID:	ID8J017108	ID8J017109		
DATE EXTRACTED:	10/10/0814:00	10/10/0814:00	DATE COLLECTED:	10/07/08 15:00
DATE ANALYZED:	10/16/0800:17	10/16/0800:22	DATE RECEIVED:	10/09/08
PREP. BATCH:	IPJ021S	IPJ021S		
CALIB. REF:	ID8J017100	ID8J017100		

ACCESSION:

PARAMETER	SMPL RSLT (mg/kg)	SERIAL DIL RSLT (mg/kg)	DIF RSLT %	QC LIMIT (%)
Antimony	19.4	22.3J	NA	10
Arsenic	5.45	5.37J	NA	10
Lead	1600	1690	6	10

EMAX QUALITY CONTROL DATA
ANALYTICAL SPIKE ANALYSIS

CLIENT: URS GROUP, INC.
PROJECT: RADFORD AAP
SDG NO.: 08J095
METHOD: METHOD 3050B/6010B

MATRIX: SOIL % MOISTURE: 15.1
DILTN FACTR: 1 1
SAMPLE ID: ARSARSS2
CONTROL NO.: J095-02 J095-02A
LAB FILE ID: ID8J017108 ID8J017107
DATIME EXTRCTD: 10/10/0814:00 10/10/0814:00 DATE COLLECTED: 10/07/08 15:00
DATIME ANALYZD: 10/16/0800:17 10/16/0800:12 DATE RECEIVED: 10/09/08
PREP. BATCH: IPJ021S IPJ021S
CALIB. REF: ID8J017100 ID8J017100

ACCESSION:

PARAMETER	SMPL RSLT (mg/kg)	SPIKE AMT (mg/kg)	AS RSLT (mg/kg)	AS % REC	QC LIMIT (%)
Antimony	19.4	589	580	95	80-120
Arsenic	5.45	118	124	101	80-120
Lead	1600	118	1600	7*	80-120

LAB CHRONICLE
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP

SDG NO. : 08J095
Instrument ID : T-ID8

SOIL

Client Sample ID	Laboratory Sample ID	Dilution Factor	% Moist	Analysis DateTime	Extraction DateTime	Sample Data FN	Calibration Data FN	Prep. Batch	Notes
MBLK1S	IPJ021SB	1	NA	10/15/0823:48	10/10/0814:00	ID8J017102	ID8J017100	IPJ021S	Method Blank
LCS1S	IPJ021SL	1	NA	10/15/0823:53	10/10/0814:00	ID8J017103	ID8J017100	IPJ021S	Lab Control Sample (LCS)
LCD1S	IPJ021SC	1	NA	10/15/0823:58	10/10/0814:00	ID8J017104	ID8J017100	IPJ021S	LCS Duplicate
ARSARSS2AS	J095-02A	1	15.1	10/16/0800:12	10/10/0814:00	ID8J017107	ID8J017100	IPJ021S	Analytical Spike Sample
ARSARSS2	J095-02	1	15.1	10/16/0800:17	10/10/0814:00	ID8J017108	ID8J017100	IPJ021S	Field Sample
ARSARSS2DL	J095-02J	5	15.1	10/16/0800:22	10/10/0814:00	ID8J017109	ID8J017100	IPJ021S	Diluted Sample
ARSARSS14	J095-08	1	20.7	10/16/0801:09	10/10/0814:00	ID8J017118	ID8J017111	IPJ021S	Field Sample
ARSARSS15MS	J095-09M	1	11.7	10/16/0801:15	10/10/0814:00	ID8J017119	ID8J017111	IPJ021S	Matrix Spike Sample (MS)
ARSARSS15MSD	J095-09S	1	11.7	10/16/0801:20	10/10/0814:00	ID8J017120	ID8J017111	IPJ021S	MS Duplicate (MSD)
ARSARSS15	J095-09	1	11.7	10/16/0801:24	10/10/0814:00	ID8J017121	ID8J017111	IPJ021S	Field Sample
DUP-2	J095-10	1	20.6	10/16/0801:29	10/10/0814:00	ID8J017122	ID8J017111	IPJ021S	Field Sample

FN - Filename
% Moist - Percent Moisture

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS14
Lab Samp ID: J095-08
Lab File ID: ID8J017118
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017111

Date Collected: 10/07/08 16:10
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 01:09
Dilution Factor: 1
Matrix : SOIL
% Moisture : 20.7
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Arsenic	7.04	1.26	0.504
Chromium	18.0	1.26	0.252
Lead	55.6	1.26	0.252

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: ARSARSS15
Lab Samp ID: J095-09
Lab File ID: ID8J017121
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017111

Date Collected: 10/07/08 16:15
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 01:24
Dilution Factor: 1
Matrix : SOIL
% Moisture : 11.7
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Arsenic	5.95	1.13	0.453
Chromium	13.0	1.13	0.227
Lead	16.6	1.13	0.227

METHOD 3050B/6010B
METALS BY ICP

Client : URS GROUP, INC.
Project : RADFORD AAP
SDG NO. : 08J095
Sample ID: DUP-2
Lab Samp ID: J095-10
Lab File ID: ID8J017122
Ext Btch ID: IPJ021S
Calib. Ref.: ID8J017111

Date Collected: 10/07/08 00:00
Date Received: 10/09/08
Date Extracted: 10/10/08 14:00
Date Analyzed: 10/16/08 01:29
Dilution Factor: 1
Matrix : SOIL
% Moisture : 20.6
Instrument ID : EMAXTID8

PARAMETERS	RESULTS (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Arsenic	4.65	1.26	0.504
Chromium	17.7	1.26	0.252
Lead	51.6	1.26	0.252

```
                          METHOD 3050B/6010B
                            METALS BY ICP

==============================================================================
Client      : URS GROUP, INC.                     Date  Collected: NA
Project     : RADFORD AAP                         Date   Received: 10/10/08
SDG NO.     : 08J095                              Date  Extracted: 10/10/08 14:00
Sample   ID: MBLK1S                               Date   Analyzed: 10/15/08 23:48
Lab Samp ID: IPJ021SB                             Dilution Factor: 1
Lab File ID: ID8J017102                           Matrix         : SOIL
Ext Btch ID: IPJ021S                              % Moisture     : NA
Calib. Ref.: ID8J017100                           Instrument ID  : EMAXTID8
==============================================================================

                                              RESULTS         RL            MDL
PARAMETERS                                    (mg/kg)     (mg/kg)       (mg/kg)
----------                                    -------     -------       -------
Arsenic                                          ND          1.00         0.400
Chromium                                         ND          1.00         0.200
Lead                                             ND          1.00         0.200
```

EMAX QUALITY CONTROL DATA
LCS/LCD ANALYSIS

CLIENT: URS GROUP, INC.
PROJECT: RADFORD AAP
SDG NO.: 08J095
METHOD: METHOD 3050B/6010B

MATRIX:	SOIL			% MOISTURE:	NA
DILTN FACTR:	1	1	1		
SAMPLE ID:	MBLK1S				
CONTROL NO.:	IPJ021SB	IPJ021SL	IPJ021SC		
LAB FILE ID:	ID8J017102	ID8J017103	ID8J017104		
DATIME EXTRCTD:	10/10/0814:00	10/10/0814:00	10/10/0814:00	DATE COLLECTED:	NA
DATIME ANALYZD:	10/15/0823:48	10/15/0823:53	10/15/0823:58	DATE RECEIVED:	10/10/08
PREP. BATCH:	IPJ021S	IPJ021S	IPJ021S		
CALIB. REF:	ID8J017100	ID8J017100	ID8J017100		

ACCESSION:

PARAMETER	BLNK RSLT mg/kg	SPIKE AMT mg/kg	BS RSLT mg/kg	BS % REC	SPIKE AMT mg/kg	BSD RSLT mg/kg	BSD % REC	RPD %	QC LIMIT %	MAX RPD %
Arsenic	ND	100	105	105	100	101	101	4	80-120	20
Chromium	ND	100	103	103	100	97.5	97	6	80-120	20
Lead	ND	100	104	104	100	102	102	2	80-120	20

EMAX QUALITY CONTROL DATA
MS/MSD ANALYSIS

CLIENT: URS GROUP, INC.
PROJECT: RADFORD AAP
SDG NO.: 08J095
METHOD: METHOD 3050B/6010B

MATRIX:	SOIL			% MOISTURE:	11.7
DILTN FACTR:	1	1	1		
SAMPLE ID:	ARSARSS15				
CONTROL NO.:	J095-09	J095-09M	J095-09S		
LAB FILE ID:	ID8J017121	ID8J017119	ID8J017120		
DATIME EXTRCTD:	10/10/0814:00	10/10/0814:00	10/10/0814:00	DATE COLLECTED:	10/07/08 16:15
DATIME ANALYZD:	10/16/0801:24	10/16/0801:15	10/16/0801:20	DATE RECEIVED:	10/09/08
PREP. BATCH:	IPJ021S	IPJ021S	IPJ021S		
CALIB. REF:	ID8J017111	ID8J017111	ID8J017111		

ACCESSION:

PARAMETER	SMPL RSLT mg/kg	SPIKE AMT mg/kg	MS RSLT mg/kg	MS % REC	SPIKE AMT mg/kg	MSD RSLT mg/kg	MSD % REC	RPD %	QC LIMIT %	MAX RPD %
Arsenic	5.95	113	104	86	113	107	89	3	80-120	20
Chromium	13	113	106	82	113	109	85	3	80-120	20
Lead	16.6	113	111	83	113	115	87	3	80-120	20

EMAX QUALITY CONTROL DATA
SERIAL DILUTION ANALYSIS

CLIENT: URS GROUP, INC.
PROJECT: RADFORD AAP
BATCH NO.: 08J095
METHOD: METHOD 3050B/6010B

MATRIX:	SOIL		% MOISTURE:	15.1
DILUTION FACTOR:	1	5		
SAMPLE ID:	ARSARSS2	ARSARSS2DL		
EMAX SAMP ID:	J095-02	J095-02J		
LAB FILE ID:	ID8J017108	ID8J017109		
DATE EXTRACTED:	10/10/0814:00	10/10/0814:00	DATE COLLECTED:	10/07/08 15:00
DATE ANALYZED:	10/16/0800:17	10/16/0800:22	DATE RECEIVED:	10/09/08
PREP. BATCH:	IPJ021S	IPJ021S		
CALIB. REF:	ID8J017100	ID8J017100		

ACCESSION:

PARAMETER	SMPL RSLT (mg/kg)	SERIAL DIL RSLT (mg/kg)	DIF RSLT %	QC LIMIT (%)
Arsenic	5.45	5.37J	NA	10
Chromium	17.3	17.9	4	10
Lead	1600	1690	6	10

EMAX QUALITY CONTROL DATA
ANALYTICAL SPIKE ANALYSIS

CLIENT: URS GROUP, INC.
PROJECT: RADFORD AAP
SDG NO.: 08J095
METHOD: METHOD 3050B/6010B

===

MATRIX:	SOIL		% MOISTURE:	15.1
DILTN FACTR:	1	1		
SAMPLE ID:	ARSARSS2			
CONTROL NO.:	J095-02	J095-02A		
LAB FILE ID:	ID8J017108	ID8J017107		
DATIME EXTRCTD:	10/10/0814:00	10/10/0814:00	DATE COLLECTED:	10/07/08 15:00
DATIME ANALYZD:	10/16/0800:17	10/16/0800:12	DATE RECEIVED:	10/09/08
PREP. BATCH:	IPJ021S	IPJ021S		
CALIB. REF:	ID8J017100	ID8J017100		

ACCESSION:

PARAMETER	SMPL RSLT (mg/kg)	SPIKE AMT (mg/kg)	AS RSLT (mg/kg)	AS % REC	QC LIMIT (%)
Arsenic	5.45	118	124	101	80-120
Chromium	17.3	118	126	92	80-120
Lead	1600	118	1600	7*	80-120

TRACE-LOW ICP QC CHECK TABLE

QC	ICV HIGH	ICV	CCV	ICSAB	ICSA
Limit%	95-105	90-110	90-110	80-120	80-120
Comp	mg/L	mg/L	mg/L	mg/L	mg/L
Al	10	5	5	500	500
Sb	1	0.5	0.5	1	0
As	1	0.5	0.5	1	0
Ba	1	0.5	0.5	0.5	0
Be	1	0.5	0.5	0.5	0
B	1	0.5	0.5	0.5	0
Cd	1	0.5	0.5	1	0
Ca	100	50	50	500	500
Cr	1	0.5	0.5	0.5	0
Co	1	0.5	0.5	0.5	0
Cu	1	0.5	0.5	0.5	0
Fe	10	5	5	200	200
Pb	1	0.5	0.5	1	0
Li	1	0.5	0.5	0.5	0
Mg	100	50	50	500	500
Mn	1	0.5	0.5	0.5	0
Mo	1	0.5	0.5	1	0
Ni	1	0.5	0.5	1	0
K	100	50	50	75	0
Se	1	0.5	0.5	1	0
Si	1	0.5	0.5	1	0
Ag	1	0.5	0.5	1	0
Na	100	50	50	75	0
Sr	1	0.5	0.5	0.5	0
Tl	1	0.5	0.5	1	0
Sn	1	0.5	0.5	1	0
Ti	1	0.5	0.5	1	0
U	10	5	5	1	0
V	1	0.5	0.5	0.5	0
Zn	1	0.5	0.5	1	0

ANALYSIS RUN LOG
for
ICP

Note: For samples and relevant QCs/Standards analyzed, refer to attached analytical sequence.

Start Date: 10/15/08 15:11
End Date: 10/16/08 4:45

Book #: AD8-007
Instrument No.: D8
Analytical Batch: ID8J017
Analytical Sequence: S08J60106(V10)
Method File: 08J60106(V10)

SOP #	Rev. #
☑ EMAX-6010	5
☐ EMAX-200.7	0
☐ EMAX-	

Comments:
CCV7 Mg↓ Mo↑
CCV8 Mg↓ Mo↑
CCV9 Mg↓ Mo↑
CCV10 B↑ Mo↑ Na↑
CCV11 Mo↑ K↑ Na↑ Zn↑
CCV12 Mo↑ K↑ Na↑
CCV13 Mo↑ K↑ Na↑
CCV14 Mo↑ K↑ Na↑ Fe↓
CCV15 Mo↑ K↑ Na↑ Fe↓ Al↑

STANDARDS ID	
S0	SMIB11.42.03
S1	NA
S2	SMIB11.42.04
S3	NA
S4	NA
S5	SMIB11.42.05
S6	NA
S7	NA
S8	SMIB11.42.06
S9	NA
S11	SMIB11.42.07
S17	↓ 42.08
ICV	44.01
CCV	43.01
ICSA	43.02
ICSAB	43.03
ICV-2	NA
ICV-5	↓
ICV-8	
ICV-2	
ICV-5	
ICV-8	
CRI/MRL MRL1 CAMS	SMIB11.45.01
MRL2 Bomplow	SMIB1144.02

Analyzed By: TH

Date: 10/16/08

```
                  SEQUENCE FILE : ID8J017
4-18          19-33          34-43     44-53     54-63
LFID          LSID           TIME      DATE      DF
ID8J017001    Blank          15:11     10/15/08  1.000
ID8J017002    S2             15:17     10/15/08  1.000
ID8J017003    S5             15:21     10/15/08  1.000
ID8J017004    S8             15:26     10/15/08  1.000
ID8J017005    S11            15:31     10/15/08  1.000
ID8J017006    S17            15:37     10/15/08  1.000
ID8J017007    ICV            15:42     10/15/08  1.000
ID8J017008    ICB            15:46     10/15/08  1.000
ID8J017009    MRL1           15:52     10/15/08  1.000
ID8J017010    MRL2           15:57     10/15/08  1.000
ID8J017011    ICSA1          16:02     10/15/08  1.000
ID8J017012    ICSAB1         16:07     10/15/08  1.000
ID8J017013    CCV1           16:12     10/15/08  1.000
ID8J017014    CCB1           16:17     10/15/08  1.000
ID8J017015    IPJ023SB       16:22     10/15/08  1.000
ID8J017016    IPJ023SL       16:27     10/15/08  1.000
ID8J017017    IPJ023SC       16:32     10/15/08  1.000
ID8J017018    J052-10M       16:37     10/15/08  1.000
ID8J017019    J052-10S       16:42     10/15/08  1.000
ID8J017020    J052-10A       16:46     10/15/08  1.000
ID8J017021    J052-10        16:51     10/15/08  1.000
ID8J017022    J052-10J       16:56     10/15/08  5.000
ID8J017023    J052-01        17:01     10/15/08  1.000
ID8J017024    J052-02        17:06     10/15/08  1.000
ID8J017025    CCV2           17:13     10/15/08  1.000
ID8J017026    CCB2           17:18     10/15/08  1.000
ID8J017027    J052-03        17:23     10/15/08  1.000
ID8J017028    J052-04        17:28     10/15/08  1.000
ID8J017029    J052-05        17:33     10/15/08  1.000
ID8J017030    J052-06        17:38     10/15/08  1.000
ID8J017031    J052-07        17:43     10/15/08  1.000
ID8J017032    J052-08        17:48     10/15/08  1.000
ID8J017033    J052-09        17:53     10/15/08  1.000
ID8J017034    J052-11        17:57     10/15/08  1.000
ID8J017035    J052-12        18:02     10/15/08  1.000
ID8J017036    J052-13        18:08     10/15/08  1.000
ID8J017037    CCV3           18:14     10/15/08  1.000
ID8J017038    CCB3           18:19     10/15/08  1.000
ID8J017039    J052-14        18:24     10/15/08  1.000
ID8J017040    J052-15        18:29     10/15/08  1.000
ID8J017041    J052-16        18:34     10/15/08  1.000
ID8J017042    J052-17M       18:39     10/15/08  1.000
ID8J017043    J052-17S       18:44     10/15/08  1.000
ID8J017044    J052-17        18:49     10/15/08  1.000
ID8J017045    J052-18        18:54     10/15/08  1.000
ID8J017046    J052-19        18:59     10/15/08  1.000
ID8J017047    J052-20        19:04     10/15/08  1.000
ID8J017048    CCV4           19:11     10/15/08  1.000
ID8J017049    CCB4           19:16     10/15/08  1.000
ID8J017050    IPJ024SB       19:21     10/15/08  1.000
ID8J017051    IPJ024SL       19:26     10/15/08  1.000
ID8J017052    IPJ024SC       19:31     10/15/08  1.000
ID8J017053    J052-21M       19:35     10/15/08  1.000
```

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ID8J017054    J052-21S     19:40   10/15/08  1.000
ID8J017055    J052-21A     19:45   10/15/08  1.000
ID8J017056    J052-21      19:50   10/15/08  1.000
ID8J017057    J052-21J     19:55   10/15/08  5.000
ID8J017058    J052-22      20:00   10/15/08  1.000
ID8J017059    J052-23      20:05   10/15/08  1.000
ID8J017060    CCV5         20:12   10/15/08  1.000
ID8J017061    CCB5         20:17   10/15/08  1.000
ID8J017062    J052-24      20:22   10/15/08  1.000
ID8J017063    J052-25      20:27   10/15/08  1.000
ID8J017064    J052-26      20:32   10/15/08  1.000
ID8J017065    J052-27      20:37   10/15/08  1.000
ID8J017066    J052-28      20:42   10/15/08  1.000
ID8J017067    J052-29      20:47   10/15/08  1.000
ID8J017068    J052-30      20:52   10/15/08  1.000
ID8J017069    J052-31      20:57   10/15/08  1.000
ID8J017070    J052-32      21:02   10/15/08  1.000
ID8J017071    J052-33      21:07   10/15/08  1.000
ID8J017072    CCV6         21:13   10/15/08  1.000
ID8J017073    CCB6         21:18   10/15/08  1.000
ID8J017074    J052-34M     21:23   10/15/08  1.000
ID8J017075    J052-34S     21:28   10/15/08  1.000
ID8J017076    J052-34      21:33   10/15/08  1.000
ID8J017077    J052-35      21:38   10/15/08  1.000
ID8J017078    J052-36      21:43   10/15/08  1.000
ID8J017079    J052-37      21:48   10/15/08  1.000
ID8J017080    J052-38      21:53   10/15/08  1.000
ID8J017081    J052-39      21:58   10/15/08  1.000
ID8J017082    J052-40      22:03   10/15/08  1.000
ID8J017083    CCV7         22:09   10/15/08  1.000
ID8J017084    CCB7         22:14   10/15/08  1.000
ID8J017085    IPJ022SB     22:19   10/15/08  1.000
ID8J017086    IPJ022SL     22:24   10/15/08  1.000
ID8J017087    IPJ022SC     22:29   10/15/08  1.000
ID8J017088    J101-01A     22:34   10/15/08  1.000
ID8J017089    J101-01      22:39   10/15/08  1.000
ID8J017090    J101-01J     22:44   10/15/08  5.000
ID8J017091    CCV8         22:51   10/15/08  1.000
ID8J017092    CCB8         22:56   10/15/08  1.000
ID8J017093    J101-02      23:01   10/15/08  1.000
ID8J017094    J101-03      23:06   10/15/08  1.000
ID8J017095    J101-04      23:11   10/15/08  1.000
ID8J017096    J101-05      23:16   10/15/08  1.000
ID8J017097    J101-06      23:21   10/15/08  1.000
ID8J017098    J101-07      23:26   10/15/08  1.000
ID8J017099    J101-08      23:31   10/15/08  1.000
ID8J017100    CCV9         23:38   10/15/08  1.000
ID8J017101    CCB9         23:43   10/15/08  1.000
ID8J017102    IPJ021SB     23:48   10/15/08  1.000
ID8J017103    IPJ021SL     23:53   10/15/08  1.000
ID8J017104    IPJ021SC     23:58   10/15/08  1.000
ID8J017105    J095-02M     00:03   10/16/08  1.000
ID8J017106    J095-02S     00:07   10/16/08  1.000
ID8J017107    J095-02A     00:12   10/16/08  1.000
ID8J017108    J095-02      00:17   10/16/08  1.000
ID8J017109    J095-02J     00:22   10/16/08  5.000
```

ID8J017110	J095-01	00:27	10/16/08	1.000
ID8J017111	CCV10	00:34	10/16/08	1.000
ID8J017112	CCB10	00:39	10/16/08	1.000
ID8J017113	J095-03	00:44	10/16/08	1.000
ID8J017114	J095-04	00:49	10/16/08	1.000
ID8J017115	J095-05	00:54	10/16/08	1.000
ID8J017116	J095-06	00:59	10/16/08	1.000
ID8J017117	J095-07	01:04	10/16/08	1.000
ID8J017118	J095-08	01:09	10/16/08	1.000
ID8J017119	J095-09M	01:15	10/16/08	1.000
ID8J017120	J095-09S	01:20	10/16/08	1.000
ID8J017121	J095-09	01:24	10/16/08	1.000
ID8J017122	J095-10	01:29	10/16/08	1.000
ID8J017123	CCV11	01:37	10/16/08	1.000
ID8J017124	CCB11	01:41	10/16/08	1.000
ID8J017125	J095-11	01:47	10/16/08	1.000
ID8J017126	J095-12	01:52	10/16/08	1.000
ID8J017127	J095-13	01:56	10/16/08	1.000
ID8J017128	J095-14	02:02	10/16/08	1.000
ID8J017129	J095-15	02:07	10/16/08	1.000
ID8J017130	J095-16	02:12	10/16/08	1.000
ID8J017131	J095-17	02:17	10/16/08	1.000
ID8J017132	CCV12	02:24	10/16/08	1.000
ID8J017133	CCB12	02:29	10/16/08	1.000
ID8J017134	IPJ019WB	02:34	10/16/08	1.000
ID8J017135	IPJ019WL	02:39	10/16/08	1.000
ID8J017136	IPJ019WC	02:44	10/16/08	1.000
ID8J017137	J082-18A	02:49	10/16/08	1.000
ID8J017138	J082-18	02:54	10/16/08	1.000
ID8J017139	J082-18J	02:59	10/16/08	5.000
ID8J017140	CCV13	03:06	10/16/08	1.000
ID8J017141	CCB13	03:11	10/16/08	1.000
ID8J017142	J056-02	03:16	10/16/08	1.000
ID8J017143	J056-03	03:21	10/16/08	1.000
ID8J017144	J056-04	03:26	10/16/08	1.000
ID8J017145	J056-05	03:31	10/16/08	1.000
ID8J017146	CCV14	03:38	10/16/08	1.000
ID8J017147	CCB14	03:43	10/16/08	1.000
ID8J017148	IPJ027WB	03:48	10/16/08	1.000
ID8J017149	IPJ027WL	03:53	10/16/08	1.000
ID8J017150	IPJ027WC	03:58	10/16/08	1.000
ID8J017151	WTJ003SB	04:03	10/16/08	1.000
ID8J017152	H179-01M	04:08	10/16/08	1.000
ID8J017153	H179-01S	04:13	10/16/08	1.000
ID8J017154	H179-01A	04:18	10/16/08	1.000
ID8J017155	H179-01	04:23	10/16/08	1.000
ID8J017156	H179-01J	04:29	10/16/08	5.000
ID8J017157	CCV15	04:40	10/16/08	1.000
ID8J017158	CCB15	04:45	10/16/08	1.000

SDG : 08J095 UNIT : % SUMMARY of ICV and CCV : ID8J017 DATE : 10/15/08 I

ANALYTE	Al	Sb	As	Ba	Be	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	K	Se	Ag	Na	Tl	V	Zn
BLANK	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
ICV	104	105	106	97	101	107	101	101	99	98	100	97	97	101	97	102	99	99	106	102	100	95	104	103
ICB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MRL1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MRL2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
ICSA1	99	----	----	----	----	----	----	94	----	----	----	90	----	101	----	----	----	----	----	----	----	----	----	----
ICSAB1	98	108	109	104	99	112	101	93	96	97	106	89	93	100	93	107	97	107	108	112	105	90	101	100
CCV1	103	105	104	96	101	107	101	101	99	98	99	96	96	100	96	101	98	98	105	101	98	94	103	102
CCB1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ023SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ023SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ023SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV2	102	105	105	96	100	108	101	101	99	98	99	96	97	100	97	101	98	98	105	101	98	94	103	103
CCB2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-07	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-08	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-09	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-12	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-13	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV3	103	103	105	97	99	107	103	100	98	100	100	95	97	98	96	104	100	97	106	101	98	95	102	103
CCB3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-14	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-16	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-17M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-17S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-18	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-19	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-20	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV4	107	104	106	98	99	108	104	98	98	101	102	95	99	96	94	105	101	96	107	102	97	97	103	103
CCB4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ024SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ024SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ024SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

J052-21S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-22	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-23	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV5	107	104	106	99	98	108	104	97	97	102	103	94	99	93	92	106	102	96	107	102	98	97	102	103
CCB5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-24	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-25	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-26	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-27	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-28	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-29	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-30	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-31	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-32	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-33	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV6	107	104	106	101	96	109	105	96	98	103	102	94	100	91	91	108	103	99	108	102	101	97	102	105
CCB6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-34M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-34S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-34	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-35	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-36	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-37	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-38	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-39	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-40	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV7	110	103	107	103	95	110	108	95	98	105	102	94	103	89*	90	111*	105	100	108	103	103	97	102	107
CCB7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ022SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ022SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ022SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-01A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-01J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV8	109	104	107	104	95	109	108	94	98	105	103	93	102	89*	90	111*	105	102	108	103	104	98	102	106
CCB8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-07	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-08	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV9	108	104	107	106	94	110	107	94	98	105	103	93	103	89*	92	111*	105	105	108	103	107	98	102	107
CCB9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ021SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ021SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ021SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

J095-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV10	107	103	106	108	95	111*	109	96	98	106	102	92	104	91	96	113*	107	110	108	103	111*	98	101	108
CCB10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-07	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-08	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-09M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-09S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-09	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV11	107	101	105	107	95	110	110	97	97	107	101	90	105	94	99	115*	107	111*	107	102	113*	97	99	112*
CCB11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-12	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-13	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-14	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-16	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV12	109	101	105	106	99	109	108	97	96	106	103	90	103	96	101	113*	105	111*	107	102	112*	98	100	106
CCB12	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ019WB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ019WL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ019WC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J082-18A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J082-18	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J082-18J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV13	110	103	105	106	99	109	109	96	96	107	103	90	104	94	100	114*	107	111*	107	102	111*	98	100	106
CCB13	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J056-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J056-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J056-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J056-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV14	108	101	105	105	98	110	110	98	96	107	102	89*	105	95	101	116*	107	112*	106	103	112*	97	99	108
CCB14	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ027WB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ027WL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ027WC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
WTJ003SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV15	111*	102	105	103	97	109	110	96	96	108	103	89*	105	91	95	116*	108	111*	108	102	111*	98	100	108
CCB15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

QC limit of each parameter are listed in a table attached next to all the ICP check forms
* : Out of QC Limit

SDG : 083095 UNIT : UG/L SUMMARY of CALIBRATION BLANKS : ID8J017 (WATER) DATE : 10/15/08 I

ANALYTE	Al	Sb	As	Ba	Be	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	K	Se	Ag	Na	Tl	V	Zn
BLANK	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
ICV	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
ICB	2.25	1.28	-.310	.200	.180	.280	.170	7.52	.270	-.020	.460	-3.25	.140	8.85	.290	.350	.170	-22.2	-.550	.100	19.6	-.260	.100	.430
MRL1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MRL2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
ICSA1	----	12.0	1.89	-1.13	.080	10.9	.620	----	-.340	-.880	2.85	----	-1.54	----	.010	-2.32	3.77	7.09	3.18	.670	85.9	1.000	.500	-.470
ICSAB1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB1	10.3	1.51	-.800	.220	.180	.320	.210	161	.100	.030	.230	2.87	.220	21.1	.340	.410	.160	-45.5	-1.20	.200	5.90	-.100	.000	4.92
IPJ023SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ023SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ023SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB2	-2.38	1.73	-.030	.010	.100	.330	.050	47.4	.120	.010	.250	-2.75	-.280	5.34	.310	.160	-.060	8.38	-.850	-.120	-5.70	-.740	-.230	2.13
J052-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-07	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-08	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-09	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-12	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-13	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB3	-6.09	.550	.340	.130	.140	.170	.090	43.0	.150	-.090	.380	-3.07	-.340	12.4	.410	.120	.050	6.69	-.370	-.160	-4.63	-.150	-.010	2.22
J052-14	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-16	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-17M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-17S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-18	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-19	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-20	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB4	-5.01	1.30	.950	.130	.190	.330	.070	38.3	.100	-.130	.170	-1.56	.060	15.0	.450	.160	-.160	41.2	-1.01	-.040	1.45	-.470	.090	1.69
IPJ024SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ024SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ024SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

J052-21S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-22	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-23	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB5	-7.15	2.02	-.040	.060	.090	.500	.010	30.7	-.060	-.150	.390	-2.68	-.530	-4.22	.320	.240	-.150	23.9	-.110	-.130	-8.81	-.260	.120	1.49
J052-24	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-25	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-26	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-27	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-28	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-29	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-30	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-31	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-32	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-33	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB6	-6.09	.090	1.06	.130	.140	.050	.070	56.4	.010	.040	.360	-4.50	.100	9.60	.520	.190	-.080	10.7	-.390	-.010	-.870	-.450	.030	2.72
J052-34M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-34S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-34	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-35	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-36	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-37	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-38	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-39	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-40	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB7	-11.0	.710	.570	.010	.050	.300	.070	28.0	.050	-.140	.280	-3.53	-.440	-10.9	.260	.190	-.110	23.7	-.620	.110	-1.04	-.240	-.050	1.64
IPJ022SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ022SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ022SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-01A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-01J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB8	-9.79	3.91	.430	-.030	.150	.470	.030	45.6	.060	-.150	.530	-5.87	-.050	8.22	.510	.210	-.170	30.6	-1.03	-.110	3.26	-.680	.030	1.70
J101-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-07	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-08	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB9	-9.35	1.24	-.440	.040	.090	.080	.050	35.9	.090	-.020	.500	-2.47	-.200	5.85	.480	.190	-.050	18.2	-.670	-.100	1.13	-1.21	.050	1.77
IPJ021SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ021SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ021SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

J095-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB10	-8.99	3.31	-.250	.110	.080	.430	.000	23.0	.070	.000	.520	-1.82	-.350	2.23	.300	.130	.150	1.79	-.350	.060	-2.34	-1.08	.040	1.25
J095-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-07	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-08	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-09M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-09S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-09	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB11	-9.86	2.33	.920	.110	.080	.240	.040	99.4	.020	-.060	.580	-1.72	.020	5.94	.570	.230	.030	7.36	-.850	-.210	.460	-.710	.110	3.47
J095-11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-12	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-13	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-14	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-16	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV12	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB12	-9.18	.480	-.690	.090	.120	.290	.040	53.1	-.020	-.050	.580	-1.15	-.380	4.29	.480	.250	-.130	27.2	-1.15	-.080	9.98	-1.11	.110	1.90
IPJ019WB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ019WL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ019WC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J082-18A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J082-18	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J082-18J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV13	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB13	74.0	3.42	.830	.250	.300	2.49	.070	60.2	.110	-.040	.690	-4.06	-.250	27.5	.410	.260	-.040	76.9	-.210	.030	42.5	-.370	.210	2.46
J056-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J056-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J056-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J056-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV14	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB14	-9.57	1.34	-.480	.110	.230	.160	.060	63.7	.060	-.100	.550	-3.84	-.240	16.6	.510	.230	-.100	83.6	-.310	-.020	53.3	-.590	.290	1.76
IPJ027WB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ027WL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ027WC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
WTJ003SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB15	-1.11	1.52	.740	.190	.190	.390	.030	54.7	.020	-.180	.610	-1.06	-.340	6.94	.570	.270	-.080	124	-1.49	-.150	339	-.860	.110	1.76

QC limit of each parameter are listed in a table attached next to all the ICP check forms
* : Out of QC Limit

SDG : ______ UNIT : UG/L SUMMARY of CALIBRATION BLANKS : ID8J017 (SOIL) DATE : 10/15/08 I

ANALYTE	Al	Sb	As	Ba	Be	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	K	Se	Ag	Na	Tl	V	Zn
BLANK	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
S17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
ICV	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
ICB	2.25	1.28	-.310	.200	.180	.280	.170	7.52	.270	-.020	.460	-3.25	.140	8.85	.290	.350	.170	-22.2	-.550	.100	19.6	-.260	.100	.430
MRL1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MRL2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
ICSA1	----	12.0	1.89	-1.13	.080	10.9	.620	----	-.340	-.880	2.85	----	-1.54	----	.010	-2.32	3.77	7.09	3.18	.670	85.9	1.000	.500	-.470
ICSAB1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB1	10.3	1.51	-.800	.220	.180	.320	.210	161	.100	.030	.230	2.87	.220	21.1	.340	.410	.160	-45.5	-1.20	.200	5.90	-.100	.000	4.92
IPJ023SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ023SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ023SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-10J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB2	-2.38	1.73	-.030	.010	.100	.330	.050	47.4	.120	.010	.250	-2.75	-.280	5.34	.310	.160	-.060	8.38	-.850	-.120	-5.70	-.740	-.230	2.13
J052-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-07	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-08	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-09	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-12	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-13	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB3	-6.09	.550	.340	.130	.140	.170	.090	43.0	.150	-.090	.380	-3.07	-.340	12.4	.410	.120	.050	6.69	-.370	-.160	-4.63	-.150	-.010	2.22
J052-14	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-16	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-17M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-17S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-18	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-19	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-20	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB4	-5.01	1.30	.950	.130	.190	.330	.070	38.3	.100	-.130	.170	-1.56	.060	15.0	.450	.160	-.160	41.2	-1.01	-.040	1.45	-.470	.090	1.69
IPJ024SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ024SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ024SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

J052-21S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-21J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-22	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-23	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB5	-7.15	2.02	-.040	.060	.090	.500	.010	30.7	-.060	-.150	.390	-2.68	-.530	-4.22	.320	.240	-.150	23.9	-.110	-.130	-8.81	-.260	.120	1.49
J052-24	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-25	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-26	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-27	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-28	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-29	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-30	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-31	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-32	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-33	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB6	-6.09	.090	1.06	.130	.140	.050	.070	56.4	.010	.040	.360	-4.50	.100	9.60	.520	.190	-.080	10.7	-.390	-.010	-.870	-.450	.030	2.72
J052-34M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-34S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-34	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-35	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-36	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-37	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-38	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-39	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J052-40	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB7	-11.0	.710	.570	.010	.050	.300	.070	28.0	.050	-.140	.280	-3.53	-.440	-10.9	.260	.190	-.110	23.7	-.620	.110	-1.04	-.240	-.050	1.64
IPJ022SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ022SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ022SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-01A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-01J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB8	-9.79	3.91	.430	-.030	.150	.470	.030	45.6	.060	-.150	.530	-5.87	-.050	8.22	.510	.210	-.170	30.6	-1.03	-.110	3.26	-.680	.030	1.70
J101-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-07	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J101-08	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB9	-9.35	1.24	-.440	.040	.090	.080	.050	35.9	.090	-.020	.500	-2.47	-.200	5.85	.480	.190	-.050	18.2	-.670	-.100	1.13	-1.21	.050	1.77
IPJ021SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ021SL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ021SC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-02J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

J095-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB10	-8.99	3.31	-.250	.110	.080	.430	.000	23.0	.070	.000	.520	-1.82	-.350	2.23	.300	.130	.150	1.79	-.350	.060	-2.34	-1.08	.040	1.25
J095-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-07	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-08	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-09M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-09S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-09	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB11	-9.86	2.33	.920	.110	.080	.240	.040	99.4	.020	-.060	.580	-1.72	.020	5.94	.570	.230	.030	7.36	-.850	-.210	.460	-.710	.110	3.47
J095-11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-12	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-13	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-14	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-16	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J095-17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV12	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB12	-9.18	.480	-.690	.090	.120	.290	.040	53.1	-.020	-.050	.580	-1.15	-.380	4.29	.480	.250	-.130	27.2	-1.15	-.080	9.98	-1.11	.110	1.90
IPJ019WB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ019WL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ019WC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J082-18A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J082-18	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J082-18J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV13	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB13	74.0	3.42	.830	.250	.300	2.49	.070	60.2	.110	-.040	.690	-4.06	-.250	27.5	.410	.260	-.040	76.9	-.210	.030	42.5	-.370	.210	2.46
J056-02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J056-03	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J056-04	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
J056-05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV14	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB14	-9.57	1.34	-.480	.110	.230	.160	.060	63.7	.060	-.100	.550	-3.84	-.240	16.6	.510	.230	-.100	83.6	-.310	-.020	53.3	-.590	.290	1.76
IPJ027WB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ027WL	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
IPJ027WC	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
WTJ003SB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01M	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01A	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
H179-01J	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCV15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
CCB15	-1.11	1.52	.740	.190	.190	.390	.030	54.7	.020	-.180	.610	-1.06	-.340	6.94	.570	.270	-.080	124	-1.49	-.150	339	-.860	.110	1.76

QC limit of each parameter are listed in a table attached next to all the ICP check forms
* : Out of QC Limit

	Pos ID	Rack	Row	Col	Type	Samplename	Comment	Data File	Type	Diln Factor	CorrFact	Check	Check Table	Fail Action
1	0	0	0	0	Unk	S0		ID8J017001			1	☐		---
2	0	0	0	0	Unk	S2		ID8J017002			1	☐		---
3	0	0	0	0	Unk	S5		ID8J017003			1	☐		---
4	0	0	0	0	Unk	S8		ID8J017004			1	☐		---
5	0	0	0	0	Unk	S11		ID8J017005			1	☐		---
6	0	0	0	0	Unk	S17		ID8J017006			1	☐		---
7	1	1	1	1	QC	ICV		ID8J017007			1	☒	ICV	None
8	2	1	2	1	QC	ICB		ID8J017008			1	☒	3XIDL	None
9	3	1	3	1	Unk	MRL1	CAM3	ID8J017009			1	☐		---
10	4	1	4	1	Unk	MRL2	BGMP LOW	ID8J017010			1	☐		---
11	5	1	5	1	QC	ICSA1		ID8J017011			1	☒	ICSA	None
12	6	1	6	1	QC	ICSAB1		ID8J017012			1	☒	ICSAB	None
13	7	1	7	1	QC	CCV1		ID8J017013			1	☒	CCV	None
14	8	1	8	1	QC	CCB1		ID8J017014			1	☒	3XIDL	None
15	9	1	9	1	QC	IPJ023SB		ID8J017015			1	☒	CCB1	None
16	10	1	10	1	QC	IPJ023SL		ID8J017016			1	☒	LCS	None
17	11	1	11	1	QC	IPJ023SC		ID8J017017			1	☒	LCS	None
18	12	1	12	1	Unk	J052-10M		ID8J017018			1	☐		---
19	13	1	1	2	Unk	J052-10S		ID8J017019			1	☐		---
20	14	1	2	2	Unk	J052-10A		ID8J017020			1	☐		---
21	15	1	3	2	Unk	J052-10		ID8J017021			1	☐		---
22	16	1	4	2	Unk	J052-10J		ID8J017022			1	☐		---
23	17	1	5	2	Unk	J052-01		ID8J017023			1	☐		---
24	18	1	6	2	Unk	J052-02		ID8J017024			1	☐		---
25	19	1	7	2	QC	CCV2		ID8J017025			1	☒	CCV	None
26	20	1	8	2	QC	CCB2		ID8J017026			1	☒	3XIDL	None
27	21	1	9	2	Unk	J052-03		ID8J017027			1	☐		---
28	22	1	10	2	Unk	J052-04		ID8J017028			1	☐		---
29	23	1	11	2	Unk	J052-05		ID8J017029			1	☐		---
30	24	1	12	2	Unk	J052-06		ID8J017030			1	☐		---
31	25	1	1	3	Unk	J052-07		ID8J017031			1	☐		---
32	26	1	2	3	Unk	J052-08		ID8J017032			1	☐		---
33	27	1	3	3	Unk	J052-09		ID8J017033			1	☐		---
34	28	1	4	3	Unk	J052-11		ID8J017034			1	☐		---
35	29	1	5	3	Unk	J052-12		ID8J017035			1	☐		---
36	30	1	6	3	Unk	J052-13		ID8J017036			1	☐		---
37	31	1	7	3	QC	CCV3		ID8J017037			1	☒	CCV	None
38	32	1	8	3	QC	CCB3		ID8J017038			1	☒	3XIDL	None
39	33	1	9	3	Unk	J052-14		ID8J017039			1	☐		---
40	34	1	10	3	Unk	J052-15		ID8J017040			1	☐		---
41	35	1	11	3	Unk	J052-16		ID8J017041			1	☐		---
42	36	1	12	3	Unk	J052-17M		ID8J017042			1	☐		---
43	37	1	1	4	Unk	J052-17S		ID8J017043			1	☐		---
44	38	1	2	4	Unk	J052-17		ID8J017044			1	☐		---
45	39	1	3	4	Unk	J052-18		ID8J017045			1	☐		---
46	40	1	4	4	Unk	J052-19		ID8J017046			1	☐		---

	Pos ID	Rack	Row	Col	Type	Samplename	Comment	Data File	Type	Diln Factor	CorrFact	Check	Check Table	Fail Action
47	41	1	5	4	Unk	J052-20		ID8J017047			1	☐		---
48	42	1	6	4	QC	CCV4		ID8J017048			1	☒	CCV	None
49	43	1	7	4	QC	CCB4		ID8J017049			1	☒	3XIDL	None
50	44	1	8	4	QC	IPJ024SB		ID8J017050			1	☒	CCB1	None
51	45	1	9	4	QC	IPJ024SL		ID8J017051			1	☒	LCS	None
52	46	1	10	4	QC	IPJ024SC		ID8J017052			1	☒	LCS	None
53	47	1	11	4	Unk	J052-21M		ID8J017053			1	☐		---
54	48	1	12	4	Unk	J052-21S		ID8J017054			1	☐		---
55	49	1	1	5	Unk	J052-21A		ID8J017055			1	☐		---
56	50	1	2	5	Unk	J052-21		ID8J017056			1	☐		---
57	51	1	3	5	Unk	J052-21J		ID8J017057			1	☐		---
58	52	1	4	5	Unk	J052-22		ID8J017058			1	☐		---
59	53	1	5	5	Unk	J052-23		ID8J017059			1	☐		---
60	54	1	6	5	QC	CCV5		ID8J017060			1	☒	CCV	None
61	55	1	7	5	QC	CCB5		ID8J017061			1	☒	3XIDL	None
62	56	1	8	5	Unk	J052-24		ID8J017062			1	☐		---
63	57	1	9	5	Unk	J052-25		ID8J017063			1	☐		---
64	58	1	10	5	Unk	J052-26		ID8J017064			1	☐		---
65	59	1	11	5	Unk	J052-27		ID8J017065			1	☐		---
66	60	1	12	5	Unk	J052-28		ID8J017066			1	☐		---
67	61	2	1	1	Unk	J052-29		ID8J017067			1	☐		---
68	62	2	2	1	Unk	J052-30		ID8J017068			1	☐		---
69	63	2	3	1	Unk	J052-31		ID8J017069			1	☐		---
70	64	2	4	1	Unk	J052-32		ID8J017070			1	☐		---
71	65	2	5	1	Unk	J052-33		ID8J017071			1	☐		---
72	66	2	6	1	QC	CCV6		ID8J017072			1	☒	CCV	None
73	67	2	7	1	QC	CCB6.		ID8J017073			1	☒	3XIDL	None
74	68	2	8	1	Unk	J052-34M		ID8J017074			1	☐		---
75	69	2	9	1	Unk	J052-34S		ID8J017075			1	☐		---
76	70	2	10	1	Unk	J052-34		ID8J017076			1	☐		---
77	71	2	11	1	Unk	J052-35		ID8J017077			1	☐		---
78	72	2	12	1	Unk	J052-36		ID8J017078			1	☐		---
79	73	2	1	2	Unk	J052-37		ID8J017079			1	☐		---
80	74	2	2	2	Unk	J052-38		ID8J017080			1	☐		---
81	75	2	3	2	Unk	J052-39		ID8J017081			1	☐		---
82	76	2	4	2	Unk	J052-40		ID8J017082			1	☐		---
83	77	2	5	2	QC	CCV7		ID8J017083			1	☒	CCV	None
84	78	2	6	2	QC	CCB7		ID8J017084			1	☒	3XIDL	None
85	79	2	7	2	QC	IPJ022SB		ID8J017085			1	☒	CCB1	None
86	80	2	8	2	QC	IPJ022SL		ID8J017086			1	☒	LCS	None
87	81	2	9	2	QC	IPJ022SC		ID8J017087			1	☒	LCS	None
88	82	2	10	2	Unk	J101-01A		ID8J017088			1	☐		---
89	83	2	11	2	Unk	J101-01		ID8J017089			1	☐		---
90	84	2	12	2	Unk	J101-01J		ID8J017090			1	☐		---
91	85	2	1	3	QC	CCV8		ID8J017091			1	☒	CCV	None
92	86	2	2	3	QC	CCB8		ID8J017092			1	☒	3XIDL	None

	Pos ID	Rack	Row	Col	Type	Samplename	Comment	Data File	Type	Diln Factor	CorrFact	Check	Check Table	Fail Action
93	87	2	3	3	Unk	J101-02		ID8J017093			1	☐		---
94	88	2	4	3	Unk	J101-03		ID8J017094			1	☐		---
95	89	2	5	3	Unk	J101-04		ID8J017095			1	☐		---
96	90	2	6	3	Unk	J101-05		ID8J017096			1	☐		---
97	91	2	7	3	Unk	J101-06		ID8J017097			1	☐		---
98	92	2	8	3	Unk	J101-07		ID8J017098			1	☐		---
99	93	2	9	3	Unk	J101-08		ID8J017099			1	☐		---
100	94	2	10	3	QC	CCV9		ID8J017100			1	☒	CCV	None
101	95	2	11	3	QC	CCB9		ID8J017101			1	☒	3XIDL	None
102	96	2	12	3	QC	IPJ021SB		ID8J017102			1	☒	CCB1	None
103	97	2	1	4	QC	IPJ021SL		ID8J017103			1	☒	LCS	None
104	98	2	2	4	QC	IPJ021SC		ID8J017104			1	☒	LCS	None
105	99	2	3	4	Unk	J095-02M		ID8J017105			1	☐		---
106	100	2	4	4	Unk	J095-02S		ID8J017106			1	☐		---
107	101	2	5	4	Unk	J095-02A		ID8J017107			1	☐		---
108	102	2	6	4	Unk	J095-02		ID8J017108			1	☐		---
109	103	2	7	4	Unk	J095-02J		ID8J017109			1	☐		---
110	104	2	8	4	Unk	J095-01		ID8J017110			1	☐		---
111	105	2	9	4	QC	CCV10		ID8J017111			1	☒	CCV	None
112	106	2	10	4	QC	CCB10		ID8J017112			1	☒	3XIDL	None
113	107	2	11	4	Unk	J095-03		ID8J017113			1	☐		---
114	108	2	12	4	Unk	J095-04		ID8J017114			1	☐		---
115	109	2	1	5	Unk	J095-05		ID8J017115			1	☐		---
116	110	2	2	5	Unk	J095-06		ID8J017116			1	☐		---
117	111	2	3	5	Unk	J095-07		ID8J017117			1	☐		---
118	112	2	4	5	Unk	J095-08		ID8J017118			1	☐		---
119	113	2	5	5	Unk	J095-09M		ID8J017119			1	☐		---
120	114	2	6	5	Unk	J095-09S		ID8J017120			1	☐		---
121	115	2	7	5	Unk	J095-09		ID8J017121			1	☐		---
122	116	2	8	5	Unk	J095-10		ID8J017122			1	☐		---
123	117	2	9	5	QC	CCV11		ID8J017123			1	☒	CCV	None
124	118	2	10	5	QC	CCB11		ID8J017124			1	☒	3XIDL	None
125	119	2	11	5	Unk	J095-11		ID8J017125			1	☐		---
126	120	2	12	5	Unk	J095-12		ID8J017126			1	☐		---
127	121	3	1	1	Unk	J095-13		ID8J017127			1	☐		---
128	122	3	2	1	Unk	J095-14		ID8J017128			1	☐		---
129	123	3	3	1	Unk	J095-15		ID8J017129			1	☐		---
130	124	3	4	1	Unk	J095-16		ID8J017130			1	☐		---
131	125	3	5	1	Unk	J095-17		ID8J017131			1	☐		---
132	126	3	6	1	QC	CCV12		ID8J017132			1	☒	CCV	None
133	127	3	7	1	QC	CCB12		ID8J017133			1	☒	3XIDL	None
134	128	3	8	1	QC	IPJ019WB		ID8J017134			1	☒	CCB1	None
135	129	3	9	1	QC	IPJ019WL		ID8J017135			1	☒	LCS*	None
136	130	3	10	1	QC	IPJ019WC		ID8J017136			1	☒	LCS*	None
137	131	3	11	1	Unk	J082-18A		ID8J017137			1	☐		---
138	132	3	12	1	Unk	J082-18		ID8J017138			1	☐		---

	Pos ID	Rack	Row	Col	Type	Samplename	Comment	Data File	Type	Diln Factor	CorrFact	Check	Check Table	Fail Action
139	133	3	1	2	Unk	J082-18J		ID8J017139			1	☐		---
140	134	3	2	2	QC	CCV13	↑ Na	ID8J017140			1	☒	CCV	None
141	135	3	3	2	QC	CCB13		ID8J017141			1	☒	3XIDL	None
142	136	3	4	2	Unk	J056-02		ID8J017142			1	☐		---
143	137	3	5	2	Unk	J056-03	} Na fun	ID8J017143			1	☐		---
144	138	3	6	2	Unk	J056-04		ID8J017144			1	☐		---
145	139	3	7	2	Unk	J056-05		ID8J017145			1	☐		---
146	140	3	8	2	QC	CCV14	↑ Na, K, ↓ Fe	ID8J017146			1	☒	CCV	None
147	141	3	9	2	QC	CCB14		ID8J017147			1	☒	3XIDL	None
148	142	3	10	2	QC	IPJ027WB		ID8J017148			1	☒	CCB1	None
149	143	3	11	2	QC	IPJ027WL		ID8J017149			1	☒	LCS*	None
150	144	3	12	2	QC	IPJ027WC		ID8J017150			1	☒	LCS*	None
151	145	3	1	3	Unk	WTJ003SB	STLC	ID8J017151			1	☐		---
152	146	3	2	3	Unk	H179-01M	STLC	ID8J017152			1	☐		---
153	147	3	3	3	Unk	H179-01S	STLC	ID8J017153			1	☐		---
154	148	3	4	3	Unk	H179-01A	STLC	ID8J017154			1	☐		---
155	149	3	5	3	Unk	H179-01	STLC	ID8J017155			1	☐		---
156	150	3	6	3	Unk	H179-01J	STLC	ID8J017156			1	☐		---
157	151	3	7	3	QC	CCV15		ID8J017157			1	☒	CCV	None
158	152	3	8	3	QC	CCB15		ID8J017158			1	☒	3XIDL	None

ID8J017 Section 1 of 3

INDX	LSID	Al	Sb	As	Ba	Be	B	Cd	Ca	Cr	Co	LSID
1	Blank	.00170	.00001	-.00001	.00023	.00004	.00008	-.00096	.00085	.00003	-.00116	Blank
2	S2				.47488	.73375	.08880	4.4386		.15111	1.3013	S2
3	S5		.00651	.00343								S5
4	S8								2.0896			S8
5	S11											S11
6	S17	.17965										S17
7	ICV	5.2078	.52509	.52769	.48742	.50532	.53701	.50450	50.499	.49732	.49227	ICV
8	ICB	.00225	.00128	-.00031	.00020	.00018	.00028	.00017	.00752	.00027	-.00002	ICB
9	MRL1	.03767	.01169	.00992	.01037	.01009	.00988	.00978	-.01334	.01018	.00961	MRL1
10	MRL2	.20328	.10495	.01038	.00517	.00407	.11020	.00472	.49057	.00980	.01452	MRL2
11	ICSA1	495.45	.01204	.00189	-.00113	.00008	.01095	.00062	468.50	-.00034	-.00088	ICSA1
12	ICSAB1	487.91	1.0764	1.0860	.52010	.49372	.55851	1.0118	465.48	.48043	.48317	ICSAB1
13	CCV1	5.1592	.52317	.52189	.48064	.50317	.53504	.50280	50.420	.49514	.48908	CCV1
14	CCB1	.01030	.00151	-.00080	.00022	.00018	.00032	.00021*	.16076	.00010	.00003	CCB1
15	IPJ023SB	.08534	-.00018	.00202	.00013	.00016	.00003	.00020	.07982	-.00003	.00013	IPJ023SB
16	IPJ023SL	10.220	5.1791	1.0349	.95824	1.0124	1.0028	.98464	49.725	.99939	.97352	IPJ023SL
17	IPJ023SC	10.180	5.1818	1.0349	.95971	1.0087	1.0000	.98183	49.727	1.0034	.97054	IPJ023SC
18	J052-10M	101.35	2.8485	.97139	1.4895	.91630	.97018	.91063	66.314	.98398	.94525	J052-10M
19	J052-10S	100.30	2.8370	.97036	1.4913	.91728	.96726	.90758	66.206	.98215	.94322	J052-10S
20	J052-10A	97.353	5.1389	1.0649	1.5942	1.0036	1.0488	.98529	71.784	1.0716	1.0206	J052-10A
21	J052-10	89.419	.03624	.01303	.64345	-.00794	.03897	.00362	21.580	.07841	.05117	J052-10
22	J052-10J	18.046	.01020	.00269	.13149	-.00170	.01027	.00067	4.4703	.01572	.01036	J052-10J
23	J052-01	53.044	.00446	.00863	.26932	-.00556	.01262	-.00043	6.6555	.04693	.02944	J052-01
24	J052-02	61.254	.00260	.00914	.32499	-.00560	.01293	-.00014	6.9589	.04401	.03600	J052-02
25	CCV2	5.1213	.52372	.52351	.47934	.50015	.53906	.50540	50.472	.49636	.49020	CCV2
26	CCB2	-.00238	.00173	-.00003	.00001	.00010	.00033	.00005	.04741	.00012	.00001	CCB2
27	J052-03	54.238	.00101	.00691	.32548	-.00545	.01485	.00008	7.7260	.04540	.03246	J052-03
28	J052-04	57.033	.00027	.00904	.25769	-.00580	.01227	-.00012	6.3230	.05198	.03608	J052-04
29	J052-05	84.738	.09493	.02422	1.9436	-.00593	.10966	.01909	41.813	.12889	.04578	J052-05
30	J052-06	52.102	.01149	.00953	.34419	-.00469	.02061	.00221	9.3461	.04540	.02846	J052-06
31	J052-07	77.512	.07808	.02193	.76475	-.00713	.08788	.00874	17.378	.13512	.04664	J052-07
32	J052-08	81.641	-.00032	.01121	.42415	-.00868	.01397	-.00009	10.050	.04723	.04207	J052-08
33	J052-09	26.552	.00970	.00708	.29939	-.00277	.00791	.00124	3.9049	.02749	.02091	J052-09
34	J052-11	144.30	.00757	.01798	.96253	-.01507	.05439	.00426	22.165	.12002	.08758	J052-11
35	J052-12	97.280	-.00034	.01141	.42610	-.00935	.02027	.00050	8.8706	.04377	.04386	J052-12
36	J052-13	75.950	.00971	.01260	.47618	-.00865	.01665	.00469	8.2548	.05111	.04500	J052-13
37	CCV3	5.1541	.51749	.52309	.48335	.49722	.53611	.51335	49.849	.49215	.49861	CCV3
38	CCB3	-.00609	.00055	.00034	.00013	.00014	.00017	.00009	.04296	.00015	-.00009	CCB3
39	J052-14	119.71	-.00009	.01876	.59030	-.01198	.02010	.00102	13.289	.06441	.05874	J052-14
40	J052-15	91.857	-.00313	.01373	.28050	-.01149	.00821	.00111	9.1683	.03319	.05091	J052-15
41	J052-16	49.233	.00870	.00827	.26614	-.00492	.01262	.00289	4.6866	.04289	.02900	J052-16
42	J052-17M	90.330	2.4882	.96063	1.1543	.89567	.92650	.94911	50.473	.94033	.97177	J052-17M
43	J052-17S	93.366	2.5926	.98338	1.1857	.91822	.94334	.95312	51.168	.95484	.97986	J052-17S
44	J052-17	60.216	.01540	.00743	.21048	-.00568	.01170	.00124	4.9515	.03190	.03040	J052-17
45	J052-18	76.579	.00538	.01011	.39131	-.00774	.01874	.00183	9.4594	.05668	.04191	J052-18
46	J052-19	85.224	.00337	.01217	.41630	-.00926	.02693	.00127	9.1396	.04488	.04574	J052-19
47	J052-20	93.237	.00095	.01325	.46602	-.01043	.02812	.00108	10.359	.04275	.05141	J052-20
48	CCV4	5.3588	.52183	.52878	.48944	.49534	.54039	.51905	48.964	.48880	.50656	CCV4
49	CCB4	-.00501	.00130	.00095	.00013	.00019	.00033	.00007	.03826	.00010	-.00013	CCB4
50	IPJ024SB	-.00105	-.00133	-.00003	-.00017	.00001	.00031	.00014	-.02403	.00006	-.00001	IPJ024SB
51	IPJ024SL	10.365	5.0732	1.0314	.97761	.98023	.99400	1.0271	48.368	.99604	1.0200	IPJ024SL
52	IPJ024SC	10.399	5.0832	1.0295	.97323	.97987	.99662	1.0244	47.908	.98048	1.0165	IPJ024SC
53	J052-21M	97.296	2.1876	.93668	1.2510	.86431	.90878	.93338	50.493	.90841	.96264	J052-21M

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 54  J052-21S  96.606    2.1948    .93640    1.2546    .85925    .92165    .94086    51.149    .91936    .96815   J052-21S
 55  J052-21A  96.057    4.9777    1.0579    1.3905    .94895    1.0472    1.0263    56.992    1.0151    1.0640   J052-21A
 56  J052-21   87.638    .03335    .01246    .41393    -.00846   .02561    .00211    9.4388    .04377    .04856   J052-21
 57  J052-21J  17.397    .00686    .00263    .08232    -.00169   .00583    .00038    1.8963    .00861    .00958   J052-21J
 58  J052-22   163.98    .02642    .02574    1.0585    -.01615   .11519    .01211    25.868    .12390    .08988   J052-22
 59  J052-23   71.875    .00072    .00976    .35822    -.00848   .01543    .00161    6.7756    .03512    .04090   J052-23
 60  CCV5      5.3524    .52001    .52884    .49632    .48814    .54037    .52011    48.297    .48729    .50912   CCV5
 61  CCB5      -.00715   .00202    -.00004   .00006    .00009    .00050    .00001    .03066    -.00006   -.00015  CCB5
 62  J052-24   96.068    .02644    .01463    .67702    -.01100   .04515    .00950    15.614    .07091    .05506   J052-24
 63  J052-25   93.674    .00767    .01236    .66526    -.00993   .04130    .00385    13.638    .08059    .05659   J052-25
 64  J052-26   52.849    .00306    .00735    .29227    -.00568   .01644    .00168    6.4400    .04191    .03893   J052-26
 65  J052-27   47.941    .00111    .00582    .42424    -.00491   .01280    .00127    8.2230    .04183    .03169   J052-27
 66  J052-28   55.978    .03429    .01403    .47809    -.00555   .05556    .00595    13.192    .06030    .03538   J052-28
 67  J052-29   43.438    .00029    .00711    .23795    -.00494   .00908    .00121    4.9785    .03456    .03388   J052-29
 68  J052-30   71.949    .00002    .00950    .39802    -.00690   .03367    .00129    8.2981    .04479    .03991   J052-30
 69  J052-31   64.563    -.00118   .01001    .26946    -.00908   .00963    .00155    7.0296    .02873    .04095   J052-31
 70  J052-32   22.778    -.00040   .00351    .09294    -.00361   .00022    .00068    2.9579    .00853    .02054   J052-32
 71  J052-33   71.714    .02199    .01265    .67374    -.00918   .03368    .00682    14.573    .08038    .05174   J052-33
 72  CCV6      5.3639    .51963    .53004    .50452    .48032    .54441    .52664    48.244    .49137    .51439   CCV6
 73  CCB6      -.00609   .00009    .00106    .00013    .00014    .00005    .00007    .05645    .00001    .00004   CCB6
 74  J052-34M  66.251    3.1476    .95877    1.2473    .86705    .93364    .96783    48.809    .93589    .99124   J052-34M
 75  J052-34S  67.041    3.2065    .97454    1.2796    .88111    .95997    .99475    50.522    .96408    1.0156   J052-34S
 76  J052-34   48.571    .01092    .00855    .34550    -.00683   .01547    .00143    6.4483    .04356    .03798   J052-34
 77  J052-35   49.475    .00453    .00772    .39402    -.00569   .01234    .00186    6.6946    .04578    .03294   J052-35
 78  J052-36   47.876    .00186    .00917    .43135    -.00659   .01509    .00134    8.7677    .04878    .03952   J052-36
 79  J052-37   35.214    .00181    .00365    .40985    -.00481   .00808    .00130    7.0903    .03626    .02761   J052-37
 80  J052-38   48.917    -.00111   .00696    .41935    -.00665   .01775    .00164    8.6905    .04891    .03954   J052-38
 81  J052-39   45.913    .00934    .00643    .33356    -.00613   .01917    .00305    6.8283    .04016    .04160   J052-39
 82  J052-40   59.157    .06746    .01501    .99223    -.00584   .05935    .01154    23.157    .08072    .04299   J052-40
 83  CCV7      5.4930    .51742    .53293    .51344    .47672    .54838    .54041    47.502    .49016    .52443   CCV7
 84  CCB7      -.01101   .00071    .00057    .00001    .00005    .00030    .00007    .02803    .00005    -.00014  CCB7
 85  IPJ022SB  -.00287   -.00090   .00210    .00009    .00006    -.00015   .00016    -.01079   -.00008   .00003   IPJ022SB
 86  IPJ022SL  10.412    4.9605    1.0228    1.0080    .93203    .98161    1.0362    45.924    1.0162    1.0294   IPJ022SL
 87  IPJ022SC  10.464    4.9726    1.0297    1.0148    .93782    .98663    1.0507    46.083    .98631    1.0398   IPJ022SC
 88  J101-01A  109.60    4.9562    1.0744    1.7691    .91761    1.0574    1.0713    62.842    1.0005    1.1217   J101-01A
 89  J101-01   98.704    .04214    .01240    .74600    -.01672   .03316    .00487    17.412    .02551    .07198   J101-01
 90  J101-01J  20.181    .00976    .00197    .15183    -.00338   .00490    .00081    3.5491    .00492    .01421   J101-01J
 91  CCV8      5.4359    .52227    .53413    .52224    .47317    .54739    .53761    47.034    .48819    .52525   CCV8
 92  CCB8      -.00979   .00391    .00043    -.00003   .00015    .00047    .00003    .04559    .00006    -.00015  CCB8
 93  J101-02   107.39    .00085    .03831    .65153    -.00742   .05058    .00546    32.613    .06747    .07082   J101-02
 94  J101-03   82.320    .00263    .02191    .66284    -.00961   .03034    .00418    14.656    .05591    .06142   J101-03
 95  J101-04   86.914    .00041    .01963    .76486    -.01068   .01873    .00326    14.075    .03909    .07039   J101-04
 96  J101-05   92.317    -.00254   .01263    .74329    -.01641   .01808    .00439    21.314    .05113    .12243   J101-05
 97  J101-06   67.473    .00006    .01500    .83302    -.00650   .01958    .00249    11.090    .04987    .04329   J101-06
 98  J101-07   105.94    .15933    .06399    3.1463    -.00593   .13421    .05427    104.45    .22608    .07313   J101-07
 99  J101-08   89.470    .00273    .01316    .88925    -.01347   .02475    .01094    7.1742    .02260    .05754   J101-08
100  CCV9      5.4191    .51851    .53263    .53032    .47234    .54788    .53742    47.146    .48904    .52469   CCV9
101  CCB9      -.00935   .00124    -.00044   .00004    .00009    .00008    .00005    .03591    .00009    -.00002  CCB9
102  IPJ021SB  -.00097   -.00086   .00109    .00002    .00008    -.00007   .00016    -.02019   .00001    .00000   IPJ021SB
103  IPJ021SL  10.788    5.0322    1.0463    1.0670    .93568    1.0118    1.0818    46.204    1.0317    1.0689   IPJ021SL
104  IPJ021SC  10.130    4.8424    1.0075    1.0197    .90875    .97802    1.0510    45.287    .97461    1.0347   IPJ021SC
105  J095-02M  123.53    2.9503    .94724    1.5477    .83865    .85137    .95548    50.028    1.0761    1.0380   J095-02M
106  J095-02S  125.82    2.9715    .95613    1.5514    .84829    .85324    .95717    49.836    1.0757    1.0416   J095-02S
107  J095-02A  96.374    4.9245    1.0563    1.7515    .91458    1.0006    1.0402    52.773    1.0656    1.1558   J095-02A
108  J095-02   88.351    .16497    .04626    .74030    .00203    .02510    .00327    8.6840    .14652    .12968   J095-02
109  J095-02J  18.858    .03792    .00911    .15538    .00040    .00587    .00065    1.8310    .03040    .02638   J095-02J
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110  J095-01   87.647   .06319   .03811   .68536   .00162   .02511   .00344   11.332   .25748   .05033   J095-01
111  CCV10     5.3731   .51686   .53153   .53966   .47374   .55335*  .54590   47.886   .49205   .53165   CCV10
112  CCB10     -.00899  .00331   -.00025  .00011   .00008   .00043   .00000   .02298   .00007   .00000   CCB10
113  J095-03   114.00   .21171   .05201   .47080   .00353   .02230   .00619   12.783   .29813   .09555   J095-03
114  J095-04   105.86   .04003   .04080   .45506   .00165   .01937   .00384   4.9805   .29392   .06713   J095-04
115  J095-05   143.79   .00889   .04022   .66219   .00174   .02425   .00474   8.6479   .18767   .04924   J095-05
116  J095-06   122.50   .02720   .03536   .57878   .00189   .02672   .00434   8.4645   .17842   .04678   J095-06
117  J095-07   99.105   .08133   .03534   .69454   .00125   .02451   .00308   10.405   .15242   .04566   J095-07
118  J095-08   105.80   .00699   .05583   1.3983   .00354   .07131   .01724   296.17   .14256   .08279   J095-08
119  J095-09M  103.19   2.1164   .91712   1.8077   .81596   .76157   .92422   48.720   .93654   1.0087   J095-09M
120  J095-09S  106.88   2.1838   .94339   1.8693   .84191   .78699   .95795   50.213   .96398   1.0460   J095-09S
121  J095-09   82.298   .01285   .05257   1.0841   .00493   .02649   .00602   13.238   .11478   .10586   J095-09
122  J095-10   101.05   .01460   .03691   1.0837   .00463   .05533   .01485   259.22   .14018   .08556   J095-10
123  CCV11     5.3364   .50639   .52605   .53660   .47706   .54838   .54966   48.583   .48718   .53458   CCV11
124  CCB11     -.00986  .00233   .00092   .00011   .00008   .00024   .00004   .09937   .00002   -.00006  CCB11
125  J095-11   109.13   .01079   .07858   .44061   .00749   .05557   .00745   4.0203   .13411   .11070   J095-11
126  J095-12   50.869   .00441   .06337   .29029   .00337   .02826   .00356   13.697   .06070   .05578   J095-12
127  J095-13   134.44   .00992   .22925   .91074   .00836   .08664   .01369   231.69   .15182   .08517   J095-13
128  J095-14   95.655   .00688   .17762   .72586   .00549   .10040   .01034   676.13   .07694   .04675   J095-14
129  J095-15   166.70   .00959   .22464   .95371   .01045   .06804   .01287   113.33   .15329   .09091   J095-15
130  J095-16   171.63   .01017   .37855   .95259   .01016   .08251   .01453   200.73   .15987   .11831   J095-16
131  J095-17   99.975   .00511   .28386   .55866   .00564   .03838   .00910   488.44   .11654   .07913   J095-17
132  CCV12     5.4422   .50681   .52252   .52935   .49469   .54308   .54000   48.623   .47826   .52842   CCV12
133  CCB12     -.00918  .00048   -.00069  .00009   .00012   .00029   .00004   .05309   -.00002  -.00005  CCB12
134  IPJ019WB  .02844   -.00168  .00083   .00007   .00008   .00027   .00015   .01185   -.00011  -.00010  IPJ019WB
135  IPJ019WL  6.1303*  2.7489   .58032   .56713   .52739   .61297*  .57432   49.648   .51263   .56289   IPJ019WL
136  IPJ019WC  5.1493   2.3271   .48456   .47545   .43958   .51739   .47969   41.652   .42688   .47087   IPJ019WC
137  J082-18A  5.8259   2.6075   .55168   .53846   .50079   .58707   .55091   49.896   .49451   .54050   J082-18A
138  J082-18   -.00798  .02864   .00097   .00021   .00026   .00299   .00024   .05350   .00000   .00011   J082-18
139  J082-18J  -.01279  .00878   .00117   -.00009  .00002   .00065   .00003   .00561   -.00002  -.00011  J082-18J
140  CCV13     5.4970   .51331   .52487   .52776   .49312   .54633   .54476   48.239   .47766   .53470   CCV13
141  CCB13     .07400*  .00342   .00083   .00025   .00030   .00249*  .00007   .06023   .00011   -.00004  CCB13
142  J056-02   .01196   -.00009  .02120   .94336   .00015   .07123   -.00003  84.638   .00035   -.00039  J056-02
143  J056-03   .03218   .00044   .00577   .26637   .00004   .13099   .00000   87.499   .00397   -.00020  J056-03
144  J056-04   .00465   -.00058  .01107   .57740   .00007   .06474   .00006   98.294   .00144   -.00048  J056-04
145  J056-05   .00409   -.00142  .00959   .57034   .00004   .06345   .00000   97.826   .00139   -.00045  J056-05
146  CCV14     5.4185   .50466   .52300   .52631   .49110   .54906   .54892   48.931   .48123   .53745   CCV14
147  CCB14     -.00957  .00134   -.00048  .00011   .00023   .00016   .00006   .06372   .00006   -.00010  CCB14
148  IPJ027WB  -.00850  -.00153  .00101   .00008   .00007   -.00004  .00014   -.00196  -.00001  .00006   IPJ027WB
149  IPJ027WL  5.9253   2.6939   .55392   .53262   .50331   .60922*  .53781   47.850   .48294   .52610   IPJ027WL
150  IPJ027WC  5.8931   2.7909   .55839   .53488   .50591   .62765*  .54207   47.984   .48708   .52962   IPJ027WC
151  WTJ003SB  .11718   .01379   .00422   .02565   .00007   .00595   .00006   .04052   .00531   -.00018  WTJ003SB
152  H179-01M  733.15   2.7761   .77408   1.7175   .50346   .77733   .56571   105.36   .49314   .56818   H179-01M
153  H179-01S  756.93   2.8366   .79784   1.7459   .51254   .79841   .58200   107.29   .50510   .58423   H179-01S
154  H179-01A  680.65   2.6558   .75104   1.5920   .49855   .74399   .54412   104.78   .48249   .54077   H179-01A
155  H179-01   683.93   .02125   .14419   1.0779   .00675   .18388   -.00128  61.171   .03044   .01173   H179-01
156  H179-01J  153.88   .00571   .02551   .20892   .00136   .03580   -.00036  12.438   .00613   .00223   H179-01J
157  CCV15     5.5285*  .50794   .52681   .51466   .48706   .54657   .55166*  48.029   .47841   .53959   CCV15
158  CCB15     -.00111  .00152   .00074   .00019   .00019   .00039   .00003   .05472   .00002   -.00018  CCB15
INDX LSID      Al       Sb       As       Ba       Be       B        Cd       Ca       Cr       Co       LSID
                                        ID8J017 Section 1 of 3
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ID8J017 Section 2 of 3

INDX	LSID	Cu	Fe	Pb	Mg	Mn	Mo	Ni	K	Se	Ag	LSID
1	Blank	.00085	.00005	.00008	.00002	-.00002	.00006	-.00081	-.00053	.00001	.00019	Blank
2	S2	.27566		.32653		.10976		1.2045			.19245	S2
3	S5						1.0715			.00369		S5
4	S8				.22863				.71783			S8
5	S11		.06475									S11
6	S17											S17
7	ICV	.50147	4.8434	.48299	50.291	.48421	.50893	.49395	49.634	.52778	.50876	ICV
8	ICB	.00046	-.00325	.00014	.00885	.00029	.00035	.00017	-.02222	-.00055	.00010	ICB
9	MRL1	.01087	-.00171	.00953	.10147	.01042	.00965	.00983	-.02908	.00994	.01023	MRL1
10	MRL2	.01039	.09261	.00286	.20645	.00517	.01491	.02045	1.0022	.01057	.01009	MRL2
11	ICSA1	.00285	179.42	-.00154	506.20	.00001	-.00232	.00377	.00709	.00318	.00067	ICSA1
12	ICSAB1	.52964	178.26	.93468	500.86	.46253	1.0721	.96918	79.978	1.0805	1.1212	ICSAB1
13	CCV1	.49557	4.8086	.48022	50.242	.48087	.50468	.49011	49.127	.52493	.50603	CCV1
14	CCB1	.00023	.00287	.00022	.02111	.00034	.00041*	.00016	-.04551	-.00120	.00020	CCB1
15	IPJ023SB	.00031	.02559	.00019	.09522	.00019	.00011	.00027	.00895	-.00137	.00033	IPJ023SB
16	IPJ023SL	.98786	9.7833	.95760	49.576	.96794	1.0078	.98377	47.438	1.0197	.96980	IPJ023SL
17	IPJ023SC	.98771	9.8160	.95276	49.572	.97130	1.0057	.98225	47.422	1.0110	.96772	IPJ023SC
18	J052-10M	1.3395	124.62	1.4360	77.424	3.5665	.90387	.94387	71.582	.94484	.92333	J052-10M
19	J052-10S	1.3408	124.71	1.4342	77.571	3.5666	.89913	.94057	71.294	.94035	.92230	J052-10S
20	J052-10A	1.4158	129.97	1.4550	84.033	3.6570	.97921	1.0179	77.799	1.0381	1.0037	J052-10A
21	J052-10	.40747	126.07	.53243	34.248	2.8291	.00373	.04484	29.899	.00287	.00449	J052-10
22	J052-10J	.08156	25.612	.10815	6.9981	.58400	.00078	.00898	6.0370	-.00022	.00071	J052-10J
23	J052-01	.02093	94.771	.01513	20.487	1.0564	.00202	.02034	21.046	.00213	-.00170	J052-01
24	J052-02	.03333	96.732	.03449	20.760	1.7050	.00264	.02213	21.215	.00186	-.00142	J052-02
25	CCV2	.49473	4.7967	.48344	49.955	.48272	.50595	.49231	48.847	.52738	.50694	CCV2
26	CCB2	.00025	-.00275	-.00028	.00534	.00031	.00016	-.00006	.00838	-.00085	-.00012	CCB2
27	J052-03	.04654	91.103	.04713	20.117	1.4627	.00294	.02241	20.419	.00129	-.00131	J052-03
28	J052-04	.03071	102.01	.02939	20.986	1.1542	.00183	.02278	21.520	.00274	-.00149	J052-04
29	J052-05	1.8648	154.08	2.5750	26.092	5.1098	.01671	.10035	24.579	.00453	.03019	J052-05
30	J052-06	.46598	77.925	.28708	17.193	1.6044	.00210	.02787	17.102	.00164	.00184	J052-06
31	J052-07	1.3369	123.12	3.8292	26.859	5.0374	.00513	.08163	25.832	.00329	.01485	J052-07
32	J052-08	.02826	128.43	.02327	32.355	1.5809	.00131	.02462	32.398	.00335	-.00197	J052-08
33	J052-09	.21924	56.362	.26633	8.9439	1.1941	.00270	.01468	9.8502	.00197	.00261	J052-09
34	J052-11	.41745	201.99	.36813	59.976	3.5566	.00332	.07040	49.474	.00791	.00326	J052-11
35	J052-12	.02764	127.27	.02320	31.869	2.0971	.00286	.02458	37.144	.00312	-.00191	J052-12
36	J052-13	.85262	127.77	.49763	30.587	4.6502	.00319	.03549	33.992	.00251	.00453	J052-13
37	CCV3	.49769	4.7469	.48668	48.950	.47880	.51842	.49812	48.454	.52933	.50669	CCV3
38	CCB3	.00038	-.00307	-.00034	.01240	.00041	.00012	.00005	.00669	-.00037	-.00016	CCB3
39	J052-14	.04795	176.08	.03809	41.635	2.6149	.00417	.03723	46.882	.00522	-.00272	J052-14
40	J052-15	.01054	135.41	.02813	43.683	2.0051	.00192	.02488	31.558	.00201	-.00238	J052-15
41	J052-16	.29827	81.181	.32142	15.821	2.0955	.00321	.02667	16.471	.00055	.00196	J052-16
42	J052-17M	.96449	103.11	.96598	66.017	2.3041	.94483	.95571	67.567	.92858	.91437	J052-17M
43	J052-17S	1.0013	106.13	.97218	67.251	2.3460	.94627	.96855	68.277	.96292	.93265	J052-17S
44	J052-17	.06074	86.725	.04967	19.667	1.2784	.00277	.01756	21.225	.00296	-.00051	J052-17
45	J052-18	.11326	112.12	.11133	27.712	1.9594	.00172	.03190	24.391	.00436	-.00064	J052-18
46	J052-19	.02708	119.63	.03080	30.157	2.0954	.00333	.02845	35.325	.00393	-.00171	J052-19
47	J052-20	.02477	137.38	.02119	34.110	2.0391	.00239	.02512	39.031	.00237	-.00239	J052-20
48	CCV4	.51090	4.7491	.49305	47.766	.47090	.52707	.50638	47.897	.53646	.50863	CCV4
49	CCB4	.00017	-.00156	.00006	.01502	.00045	.00016	-.00016	.04116	-.00101	-.00004	CCB4
50	IPJ024SB	.00046	-.00054	-.00013	-.00464	.00010	-.00005	.00019	-.02002	-.00119	.00008	IPJ024SB
51	IPJ024SL	1.0000	9.5097	.99557	46.620	.94904	1.0731	1.0342	47.020	1.0181	.97192	IPJ024SL
52	IPJ024SC	1.0031	9.4690	.98819	46.385	.93808	1.0739	1.0223	46.623	1.0162	.96587	IPJ024SC
53	J052-21M	.98667	111.23	.95214	66.465	2.6324	.92837	.94250	69.878	.92087	.89119	J052-21M

54	J052-21S	.97775	110.99	.96597	66.772	2.6611	.94037	.94941	70.697	.91645	.89781	J052-21S
55	J052-21A	1.1043	122.42	1.0524	73.833	3.0466	1.0581	1.0441	78.495	1.0285	.98940	J052-21A
56	J052-21	.08757	118.09	.06747	28.428	2.1910	.00371	.02677	31.692	.00284	-.00059	J052-21
57	J052-21J	.01748	23.492	.01339	5.6478	.44228	.00068	.00515	6.3377	.00047	-.00027	J052-21J
58	J052-22	.88675	209.00	.89609	53.330	3.7271	.00624	.09027	57.320	.00717	.01001	J052-22
59	J052-23	.03051	102.16	.02896	26.441	1.6038	.00191	.02145	29.060	.00116	-.00160	J052-23
60	CCV5	.51259	4.7125	.49518	46.538	.45986	.53192	.50982	48.195	.53729	.50945	CCV5
61	CCB5	.00039	-.00268	-.00053	-.00422	.00032	.00024	-.00015	.02391	-.00011	-.00013	CCB5
62	J052-24	.67992	142.06	.65372	34.896	3.6926	.00498	.05308	42.228	.00341	.00556	J052-24
63	J052-25	.41900	133.48	.34174	33.053	2.1204	.00245	.04516	33.218	.00288	.00163	J052-25
64	J052-26	.07960	82.106	.07154	17.797	1.5726	.00229	.02497	20.018	.00115	-.00073	J052-26
65	J052-27	.08608	69.108	.06694	16.092	1.3280	.00199	.01954	15.850	.00197	-.00096	J052-27
66	J052-28	1.1096	86.318	.51040	17.857	2.2640	.00482	.05301	20.051	.00064	.00578	J052-28
67	J052-29	.01866	67.948	.01814	15.114	1.3689	.00238	.01931	17.462	.00115	-.00130	J052-29
68	J052-30	.02457	94.674	.01972	21.696	1.7083	.00309	.02627	25.992	.00299	-.00169	J052-30
69	J052-31	.01151	101.12	.02816	27.845	1.5155	.00245	.02024	28.191	.00318	-.00183	J052-31
70	J052-32	.00363	36.873	.01194	11.801	.68923	.00080	.00746	9.2050	.00116	-.00085	J052-32
71	J052-33	.56559	115.39	.68070	29.753	2.8730	.00389	.05869	34.588	.00262	.00801	J052-33
72	CCV6	.51184	4.7079	.50237	45.749	.45683	.53978	.51654	49.445	.53844	.51225	CCV6
73	CCB6	.00036	-.00450	.00010	.00960	.00052	.00019	-.00008	.01074	-.00039	-.00001	CCB6
74	J052-34M	.96019	88.233	.94467	60.322	1.9825	.99466	.97855	66.288	.93813	.90544	J052-34M
75	J052-34S	.97172	90.180	.97444	61.972	2.0450	1.0242	1.0028	68.618	.95135	.92770	J052-34S
76	J052-34	.02590	84.419	.02279	21.074	1.2792	.00219	.02440	24.550	.00244	-.00144	J052-34
77	J052-35	.02736	89.874	.01684	21.131	1.7176	.00242	.02585	22.219	.00261	-.00092	J052-35
78	J052-36	.03099	90.018	.01786	20.791	1.5165	.00193	.02389	22.210	.00263	-.00178	J052-36
79	J052-37	.06935	57.612	.06051	14.684	1.0938	.00193	.01728	14.954	.00312	-.00072	J052-37
80	J052-38	.03031	89.480	.01726	20.898	1.4444	.00175	.02346	22.588	.00266	-.00176	J052-38
81	J052-39	.10550	83.842	.13670	18.028	1.6348	.00341	.02614	21.610	.00209	-.00012	J052-39
82	J052-40	1.1380	92.637	1.2586	20.161	3.5953	.00699	.06756	23.004	.00341	.01727	J052-40
83	CCV7	.51121	4.7102	.51346	44.731*	.45089	.55718*	.52516	50.199	.54045	.51306	CCV7
84	CCB7	.00028	-.00353	-.00044	-.01092	.00026	.00019	-.00011	.02372	-.00062	.00011	CCB7
85	IPJ022SB	.00056	.00074	-.00011	-.00584	.00030	-.00002	.00028	-.02367	-.00095	.00028	IPJ022SB
86	IPJ022SL	.99440	9.4519	1.0013	43.207	.88768	1.0948	1.0553	47.794	1.0079	.96125	IPJ022SL
87	IPJ022SC	.99662	9.2942	1.0117	43.267	.89169	1.1103	1.0575	48.184	1.0172	.96232	IPJ022SC
88	J101-01A	1.0625	199.40	1.0374	99.926	3.6992	1.1158	1.0716	93.487	1.0531	1.0130	J101-01A
89	J101-01	.01591	196.43	.01994	57.942	2.9373	.00316	.02286	45.540	.00519	-.00264	J101-01
90	J101-01J	.00404	40.168	.00421	11.724	.60328	.00064	.00445	9.1463	-.00040	-.00053	J101-01J
91	CCV8	.51546	4.6532	.51163	44.345*	.44885*	.55535*	.52477	50.924	.54036	.51308	CCV8
92	CCB8	.00053	-.00587	-.00005	.00822	.00051	.00021	-.00017	.03064	-.00103	-.00011	CCB8
93	J101-02	.11653	210.33	.03255	44.128	1.3275	.00228	.02344	16.451	.00556	-.00579	J101-02
94	J101-03	.08510	155.57	.11604	31.553	1.5334	.00312	.02797	26.349	.00280	-.00188	J101-03
95	J101-04	.07556	155.19	.02393	39.198	2.2969	.00319	.02216	29.342	.00308	-.00282	J101-04
96	J101-05	.18430	182.22	.01159	60.858	2.2737	.00978	.02487	39.933	.00547	-.00438	J101-05
97	J101-06	.03467	106.51	.02716	29.934	1.5511	.00668	.02152	17.430	.00195	-.00206	J101-06
98	J101-07	11.000	148.77	6.2178	33.423	16.815	.02367	.37409	28.935	.00971	.08508	J101-07
99	J101-08	.09700	143.17	.02978	43.986	3.4954	.00135	.02543	49.512	.00361	-.00177	J101-08
100	CCV9	.51405	4.6416	.51254	44.745*	.45945	.55523*	.52518	52.529	.54168	.51353	CCV9
101	CCB9	.00050	-.00247	-.00020	.00585	.00048	.00019	-.00005	.01824	-.00067	-.00010	CCB9
102	IPJ021SB	.00079	.00542	.00013	-.00336	.00059	.00007	.00031	-.01734	-.00134	-.00007	IPJ021SB
103	IPJ021SL	1.0155	9.4317	1.0438	43.404	.92860	1.1515	1.0951	51.381	1.0366	.98288	IPJ021SL
104	IPJ021SC	.96333	8.9743	1.0187	42.585	.89888	1.1206	1.0515	49.901	.99088	.94962	IPJ021SC
105	J095-02M	2.4209	135.13	14.239	44.599	9.1542	.97874	1.0035	51.111	.89275	.88473	J095-02M
106	J095-02S	2.4631	136.10	14.194	44.746	9.1684	.98020	1.0061	50.962	.90202	.88944	J095-02S
107	J095-02A	2.2959	124.33	13.624	46.902	14.700	1.0930	1.0763	54.529	1.0087	.95446	J095-02A
108	J095-02	1.3460	122.83	13.554	4.4134	14.854	.00583	.04635	4.5990	.00270	-.00042	J095-02
109	J095-02J	.27797	25.837	2.8658	.91464	3.1678	.00110	.00940	.92197	.00073	-.00012	J095-02J

110	J095-01	.32925	121.20	2.8831	5.0571	4.9561	.00510	.04109	6.1609	.00674	-.00166	J095-01
111	CCV10	.51005	4.5865	.52223	45.698	.47990	.56744*	.53252	54.779	.53966	.51730	CCV10
112	CCB10	.00052	-.00182	-.00035	.00223	.00030	.00013	.00015	.00179	-.00035	.00006	CCB10
113	J095-03	1.3132	146.37	14.135	5.4257	6.1764	.00857	.05057	5.3224	.00775	.00113	J095-03
114	J095-04	.27386	128.23	3.5783	4.2861	3.7459	.00629	.04285	4.5334	.00647	-.00123	J095-04
115	J095-05	.07451	163.92	.23859	6.1969	3.7203	.00584	.05582	6.3448	.00725	-.00221	J095-05
116	J095-06	.40774	150.47	2.8728	6.3648	2.9302	.00435	.05665	5.6514	.00728	-.00213	J095-06
117	J095-07	.30794	113.07	3.6919	5.5905	4.2220	.00471	.04769	6.7626	.00546	-.00161	J095-07
118	J095-08	4.3233	163.27	.44128	96.908	4.5430	.00516	.12292	11.309	.00539	-.00111	J095-08
119	J095-09M	.98324	163.65	.97969	49.192	5.6969	.95691	1.0378	52.108	.85772	.85249	J095-09M
120	J095-09S	1.0080	167.50	1.0143	50.864	5.9097	.99225	1.0749	53.905	.88311	.87796	J095-09S
121	J095-09	.11394	170.16	.14630	12.117	6.3639	.00437	.11436	8.7203	.00594	.00012	J095-09
122	J095-10	3.1645	151.90	.40999	92.687	3.0068	.00295	.15612	9.8658	.00589	.00065	J095-10
123	CCV11	.50347	4.5136	.52565	46.770	.49641	.57474*	.53484	55.742*	.53308	.51231	CCV11
124	CCB11	.00058	-.00172	.00002	.00594	.00057	.00023	.00003	.00736	-.00085	-.00021	CCB11
125	J095-11	.18906	227.50	1.8412	15.242	1.1650	.00558	.22673	13.356	.01114	-.00009	J095-11
126	J095-12	.12828	99.412	.66515	10.025	1.1029	.00326	.10168	6.8044	.00404	-.00011	J095-12
127	J095-13	.25768	245.23	.72575	138.32	7.8722	.02634	.19188	17.727	.01111	-.00002	J095-13
128	J095-14	2.5547	120.61	1.2346	421.23	8.8821	.02196	.12005	12.186	.00732	.00039	J095-14
129	J095-15	.23495	240.73	.71503	70.171	5.9550	.01572	.17839	20.128	.00779	-.00063	J095-15
130	J095-16	.27344	255.68	1.0643	121.03	8.5972	.03046	.19982	18.883	.01025	-.00020	J095-16
131	J095-17	.23080	179.80	.39557	306.54	4.6176	.02049	.10144	10.160	.00539	-.00049	J095-17
132	CCV12	.51274	4.5188	.51476	47.863	.50393	.56448*	.52741	55.565*	.53319	.50874	CCV12
133	CCB12	.00058	-.00115	-.00038	.00429	.00048	.00025	-.00013	.02718	-.00115	-.00008	CCB12
134	IPJ019WB	.00062	.00647	.00002	.00118	.00069	-.00004	.00018	-.02860	-.00197	.00000	IPJ019WB
135	IPJ019WL	.55172	4.8771	.56413	48.628	.54287	.59036	.56811	56.929	.59993	.55943	IPJ019WL
136	IPJ019WC	.46314	4.0640	.47176	40.602	.45343	.49678	.47479	48.279	.50104	.46817	IPJ019WC
137	J082-18A	.52262	4.6504	.54450	48.613	.52133	.57149	.54360	57.006	.56736	.53328	J082-18A
138	J082-18	.00080	-.00216	.00020	.01621	.00041	.00047	.00023	.05861	-.00060	.00027	J082-18
139	J082-18J	.00041	-.00433	-.00027	-.01031	.00020	.00021	.00000	.02686	-.00035	-.00020	J082-18J
140	CCV13	.51719	4.4871*	.51921	47.219	.49989	.57194*	.53404	55.400*	.53452	.51066	CCV13
141	CCB13	.00069	-.00406	-.00025	.02749	.00041	.00026	-.00004	.07686	-.00021	.00003	CCB13
142	J056-02	.00169	1.5912	.00090	31.460	.19396	.00141	.00455	10.406	-.00129	-.00015	J056-02
143	J056-03	.00311	.14506	.00091	46.679	.03007	.00342	.00412	12.637	-.00014	-.00022	J056-03
144	J056-04	.00143	1.9500	.00064	30.581	.21122	.00160	.00445	9.0692	-.00124	-.00022	J056-04
145	J056-05	.00231	1.9712	.00097	30.406	.21058	.00152	.00432	8.9779	-.00158	-.00028	J056-05
146	CCV14	.51055	4.4653*	.52620	47.398	.50274	.57783*	.53747	55.981*	.53180	.51256	CCV14
147	CCB14	.00055	-.00384	-.00024	.01665	.00051	.00023	-.00010	.08358	-.00031	-.00002	CCB14
148	IPJ027WB	.00073	-.00292	-.00033	.00065	.00037	.00004	.00014	.02307	-.00163	-.00003	IPJ027WB
149	IPJ027WL	.52652	4.6334	.52962	46.713	.50689	.56016	.53126	55.091	.58854	.52800	IPJ027WL
150	IPJ027WC	.53030	4.6555	.53232	46.522	.50797	.57717	.53457	55.543	.59444	.53195	IPJ027WC
151	WTJ003SB	.00207	.01053	-.00004	.01075	.00082	.00010	.00047	.94221	.02843	.00019	WTJ003SB
152	H179-01M	1.5225	26.794	.56350	54.358	7.2916	.62853	.59140	67.630	.74899	.61964	H179-01M
153	H179-01S	1.5600	27.370	.58173	54.896	7.3474	.64864	.60684	67.804	.76518	.63571	H179-01S
154	H179-01A	1.4027	25.364	.53957	54.738	6.7422	.59753	.56026	65.680	.72215	.58697	H179-01A
155	H179-01	.85571	22.363	.05020	12.789	6.4148	.00528	.04411	5.3077	.03357	-.00241	H179-01
156	H179-01J	.16386	4.7910	.01275	2.6622	1.2983	.00112	.00891	1.1893	.00616	-.00051	H179-01J
157	CCV15	.51559	4.4654*	.52647	45.349	.47367	.58203*	.53917	55.462*	.53804	.51130	CCV15
158	CCB15	.00061	-.00106	-.00034	.00694	.00057	.00027	-.00008	.12418	-.00149	-.00015	CCB15
INDX	LSID	Cu	Fe	Pb	Mg	Mn	Mo	Ni	K	Se	Ag	LSID

ID8J017 Section 2 of 3

INDX	LSID	Na	Tl	V	Zn	LSID
1	Blank	.00059	-.00047	-.00022	.00159	Blank
2	S2		.15845	.14680		S2
3	S5				1.2061	S5
4	S8	2.3227				S8
5	S11					S11
6	S17					S17
7	ICV	50.034	.47325	.51903	.51397	ICV
8	ICB	.01957	-.00026	.00010	.00043	ICB
9	MRL1	.09574	.00980	.01038	.00990	MRL1
10	MRL2	.03410	.00961	.01060	.02004	MRL2
11	ICSA1	.08589	.00100	.00050	-.00047	ICSA1
12	ICSAB1	78.383	.90229	.50641	.99916	ICSAB1
13	CCV1	49.175	.47202	.51273	.51102	CCV1
14	CCB1	.00590	-.00010	.00000	.00492	CCB1
15	IPJ023SB	.02501	.00131	.00006	.00016	IPJ023SB
16	IPJ023SL	47.749	.94072	1.0485	1.0267	IPJ023SL
17	IPJ023SC	47.885	.94198	1.0493	1.0239	IPJ023SC
18	J052-10M	45.792	.87018	1.2454	3.0676	J052-10M
19	J052-10S	45.675	.86704	1.2449	3.0574	J052-10S
20	J052-10A	51.090	.94768	1.3508	3.0791	J052-10A
21	J052-10	2.0751	.01751	.31227	2.1452	J052-10
22	J052-10J	.40702	.00317	.06238	.42389	J052-10J
23	J052-01	.69318	.00963	.27060	.13792	J052-01
24	J052-02	.71877	.00975	.25782	.19759	J052-02
25	CCV2	49.087	.46978	.51267	.51399	CCV2
26	CCB2	-.00570	-.00074	-.00023	.00213	CCB2
27	J052-03	.67994	.00867	.24718	.24779	J052-03
28	J052-04	.76605	.00912	.29634	.21080	J052-04
29	J052-05	3.2248	.01586	.28729	17.910	J052-05
30	J052-06	1.0623	.00664	.19759	1.5975	J052-06
31	J052-07	2.5503	.01408	.28607	10.601	J052-07
32	J052-08	1.4481	.01329	.30911	.26819	J052-08
33	J052-09	.78215	.00283	.12752	.91863	J052-09
34	J052-11	3.8579	.02554	.52513	1.8833	J052-11
35	J052-12	.73828	.01416	.30176	.24176	J052-12
36	J052-13	.89045	.01709	.30018	2.1209	J052-13
37	CCV3	48.977	.47585	.50966	.51565	CCV3
38	CCB3	-.00463	-.00015	-.00001	.00222	CCB3
39	J052-14	.85638	.02073	.42620	.34982	J052-14
40	J052-15	.81242	.01832	.27998	.32947	J052-15
41	J052-16	.70785	.00767	.19778	1.3151	J052-16
42	J052-17M	44.303	.87963	1.1651	1.2626	J052-17M
43	J052-17S	44.989	.89490	1.2019	1.2694	J052-17S
44	J052-17	.65674	.01095	.21295	.26261	J052-17
45	J052-18	1.3088	.01247	.27814	.53705	J052-18
46	J052-19	.76161	.01313	.27295	.25394	J052-19
47	J052-20	.82410	.01547	.34957	.24692	J052-20
48	CCV4	48.697	.48306	.51360	.51661	CCV4
49	CCB4	.00145	-.00047	.00009	.00169	CCB4
50	IPJ024SB	-.02930	.00112	.00010	-.00004	IPJ024SB
51	IPJ024SL	47.769	.96082	1.0330	1.0531	IPJ024SL
52	IPJ024SC	47.310	.96483	1.0337	1.0429	IPJ024SC
53	J052-21M	43.381	.86528	1.1750	1.3243	J052-21M

54	J052-21S	43.975	.86325	1.1726	1.3399	J052-21S
55	J052-21A	49.211	.95205	1.3056	1.4520	J052-21A
56	J052-21	1.1270	.01518	.30093	.41278	J052-21
57	J052-21J	.19923	.00241	.05908	.07905	J052-21J
58	J052-22	3.1860	.02631	.50154	3.6985	J052-22
59	J052-23	.79950	.01305	.25225	.23306	J052-23
60	CCV5	49.246	.48503	.51206	.51694	CCV5
61	CCB5	-.00881	-.00026	.00012	.00149	CCB5
62	J052-24	1.8174	.01767	.32412	3.2490	J052-24
63	J052-25	2.1821	.01469	.36059	1.5576	J052-25
64	J052-26	.76546	.00893	.22612	.42351	J052-26
65	J052-27	.78618	.00600	.21290	.32679	J052-27
66	J052-28	1.5434	.00776	.20070	2.9415	J052-28
67	J052-29	.83244	.00598	.18583	.12375	J052-29
68	J052-30	.97725	.00905	.23879	.16124	J052-30
69	J052-31	.61102	.01243	.23578	.22495	J052-31
70	J052-32	.54771	.00248	.08075	.08830	J052-32
71	J052-33	1.1678	.01417	.23975	2.4584	J052-33
72	CCV6	50.477	.48499	.51180	.52499	CCV6
73	CCB6	-.00087	-.00045	.00003	.00272	CCB6
74	J052-34M	45.210	.88112	1.1511	1.1444	J052-34M
75	J052-34S	46.889	.89889	1.1751	1.1777	J052-34S
76	J052-34	.83695	.00925	.22775	.21502	J052-34
77	J052-35	1.0972	.00907	.24132	.14886	J052-35
78	J052-36	1.2340	.00819	.25784	.14714	J052-36
79	J052-37	.80359	.00557	.18117	.27473	J052-37
80	J052-38	1.2408	.00728	.25340	.14599	J052-38
81	J052-39	.84692	.00731	.20940	.95903	J052-39
82	J052-40	1.8379	.01547	.21750	5.3519	J052-40
83	CCV7	51.303	.48712	.50866	.53613	CCV7
84	CCB7	-.00104	-.00024	-.00005	.00164	CCB7
85	IPJ022SB	-.02121	.00185	.00009	.00202	IPJ022SB
86	IPJ022SL	48.968	.95715	1.0137	1.0551	IPJ022SL
87	IPJ022SC	49.258	.96361	1.0163	1.0667	IPJ022SC
88	J101-01A	52.056	.97178	1.3942	1.5335	J101-01A
89	J101-01	1.5925	.02346	.38170	.46664	J101-01
90	J101-01J	.30192	.00479	.07639	.09024	J101-01J
91	CCV8	52.120	.49174	.50967	.53103	CCV8
92	CCB8	.00326	-.00068	.00003	.00170	CCB8
93	J101-02	6.8290	.00677	1.0273	.25219	J101-02
94	J101-03	1.6348	.01258	.52219	.43894	J101-03
95	J101-04	1.8701	.01377	.43153	.28612	J101-04
96	J101-05	2.4109	.01869	.77269	.35116	J101-05
97	J101-06	4.1163	.00661	.34985	.30318	J101-06
98	J101-07	7.2867	.02096	.31570	34.954	J101-07
99	J101-08	.81584	.02081	.28516	10.489	J101-08
100	CCV9	53.719	.48839	.50960	.53262	CCV9
101	CCB9	.00113	-.00121	.00005	.00177	CCB9
102	IPJ021SB	-.02339	.00114	.00015	.00053	IPJ021SB
103	IPJ021SL	52.530	.98134	1.0229	1.0958	IPJ021SL
104	IPJ021SC	50.915	.94312	.98445	1.0677	IPJ021SC
105	J095-02M	47.402	.85513	1.2031	1.4771	J095-02M
106	J095-02S	47.513	.86472	1.2129	1.4766	J095-02S
107	J095-02A	51.557	.94267	1.2514	1.4518	J095-02A
108	J095-02	.20590	.00760	.29197	.43194	J095-02
109	J095-02J	.02028	.00094	.06011	.08679	J095-02J

110	J095-01	.14656	-.00017	.29769	.25793	J095-01
111	CCV10	55.464*	.48959	.50452	.54188	CCV10
112	CCB10	-.00234	-.00108	.00004	.00125	CCB10
113	J095-03	.31261	.00371	.37070	.36179	J095-03
114	J095-04	.17941	-.00065	.32233	.20977	J095-04
115	J095-05	.18550	-.00081	.39448	.19362	J095-05
116	J095-06	.19092	-.00106	.35770	.28205	J095-06
117	J095-07	.17534	-.00029	.28068	.22270	J095-07
118	J095-08	.60646	.00055	.23634	6.9459	J095-08
119	J095-09M	46.382	.82189	1.0101	1.5262	J095-09M
120	J095-09S	47.961	.84856	1.0370	1.5790	J095-09S
121	J095-09	.30400	.00383	.17222	.75155	J095-09
122	J095-10	.53326	.00131	.19233	4.7314	J095-10
123	CCV11	56.296*	.48641	.49725	.56213*	CCV11
124	CCB11	.00046	-.00071	.00011	.00347	CCB11
125	J095-11	.44381	.00191	.19530	.63161	J095-11
126	J095-12	.18730	.00047	.08332	.33796	J095-12
127	J095-13	.45810	.00646	.30638	.78124	J095-13
128	J095-14	.89490	.00510	.19340	1.2307	J095-14
129	J095-15	.37714	.00336	.33750	.77771	J095-15
130	J095-16	.38686	.00678	.35466	1.2007	J095-16
131	J095-17	.82972	.00294	.22800	.41094	J095-17
132	CCV12	55.895*	.48966	.49949	.52876	CCV12
133	CCB12	.00998	-.00111	.00011	.00190	CCB12
134	IPJ019WB	-.00324	.00158	.00013	.00838	IPJ019WB
135	IPJ019WL	57.312	.53675	.53595	.57506	IPJ019WL
136	IPJ019WC	48.474	.45158	.44767	.47856	IPJ019WC
137	J082-18A	57.147	.51340	.50975	.55422	J082-18A
138	J082-18	.07845	.00082	.00018	.00384	J082-18
139	J082-18J	.00508	.00000	.00019	.00271	J082-18J
140	CCV13	55.728*	.49100	.49944	.53178	CCV13
141	CCB13	.04249	-.00037	.00021	.00246	CCB13
142	J056-02	37.578	.00088	-.00020	.00821	J056-02
143	J056-03	67.439	.00042	.00102	.01481	J056-03
144	J056-04	34.919	-.00014	-.00037	.00598	J056-04
145	J056-05	34.528	.00083	-.00026	.00971	J056-05
146	CCV14	56.104*	.48750	.49528	.53883	CCV14
147	CCB14	.05328*	-.00059	.00029	.00176	CCB14
148	IPJ027WB	.01689	.00202	.00019	.00073	IPJ027WB
149	IPJ027WL	55.076	.51033	.50523	.53872	IPJ027WL
150	IPJ027WC	55.340	.51390	.50945	.53810	IPJ027WC
151	WTJ003SB	1862.4	-.02000	.00019	.01114	WTJ003SB
152	H179-01M	1806.8	.45453	.94445	.75936	H179-01M
153	H179-01S	1833.1	.46714	.96385	.78390	H179-01S
154	H179-01A	1779.0	.42889	.89157	.73295	H179-01A
155	H179-01	1759.8	-.01298	.43410	.17504	H179-01
156	H179-01J	483.23	-.00404	.09004	.03449	H179-01J
157	CCV15	55.289*	.49171	.49766	.53825	CCV15
158	CCB15	.33932*	-.00086	.00011	.00176	CCB15
INDX	LSID	Na	Tl	V	Zn	LSID

ID8J017 Section 3 of 3

Sample Name: Blank Acquired: 10/15/2008 15:11:59 Type: Cal
Method: 08J6010b(v10) Mode: IR Corr. Factor: 1.000000
User: admin Data File: Type: Diln Factor:
Comment:

Elem	Al	Sb	As	Ba	Be	B	Cd
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**.00170**	**.00001**	**-.00001**	**.00023**	**.00004**	**.00008**	**-.00096**
Stddev	.00003	.00000	.00000	.00004	.00002	.00000	.00007
%RSD	1.8314	33.477	29.137	17.794	53.739	.80520	6.9107
#1	.00173	.00001	-.00001	.00028	.00004	.00008	-.00097
#2	.00169	.00001	-.00002	.00021	.00002	.00009	-.00101
#3	.00167	.00002	-.00001	.00020	.00006	.00008	-.00088

Elem	Ca	Cr	Co	Cu	Fe	Pb	Mg
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**.00085**	**.00003**	**-.00116**	**.00085**	**.00005**	**.00008**	**.00002**
Stddev	.00012	.00003	.00007	.00006	.00000	.00013	.00002
%RSD	14.695	86.712	5.8229	6.8286	7.1210	164.24	85.288
#1	.00098	.00002	-.00113	.00092	.00004	.00022	.00004
#2	.00084	.00001	-.00123	.00081	.00005	-.00005	.00002
#3	.00073	.00006	-.00111	.00082	.00005	.00007	.00000

Elem	Mn	Mo	Ni	K	Se	Ag	Na
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**-.00002**	**.00006**	**-.00081**	**-.00053**	**.00001**	**.00019**	**.00059**
Stddev	.00001	.00009	.00018	.00005	.00001	.00001	.00007
%RSD	44.901	140.54	22.528	9.9062	60.392	7.3939	11.391
#1	-.00002	.00005	-.00077	-.00047	.00001	.00018	.00067
#2	-.00002	.00016	-.00065	-.00055	.00002	.00019	.00058
#3	-.00001	-.00002	-.00101	-.00056	.00001	.00021	.00054

Elem	Tl	V	Zn
Units	Cts/S	Cts/S	Cts/S
Avg	**-.00047**	**-.00022**	**.00159**
Stddev	.00006	.00001	.00004
%RSD	12.879	6.2381	2.7049
#1	-.00046	-.00021	.00155
#2	-.00041	-.00021	.00158
#3	-.00053	-.00024	.00163

```
Sample Name: Blank      Acquired: 10/15/2008 15:11:59      Type: Cal
Method: 08J6010b(v10)      Mode: IR      Corr. Factor: 1.000000
User: admin      Data File:      Type:      Diln Factor:
Comment:

Int. Std.      Sc2273_A  Sc3613_R  Sc3645_A
Units              Cts/S     Cts/S     Cts/S
Avg               6485.8   112500.   158680.
Stddev              22.5      311.      350.
%RSD              .34699    .27637    .22055

#1                6459.9   112220.   158280.
#2                6501.0   112450.   158930.
#3                6496.4   112830.   158820.
```

Sample Name: S2 Acquired: 10/15/2008 15:17:05 Type: Cal
Method: 08J6010b(v10) Mode: IR Corr. Factor: 1.000000
User: admin Data File: Type: Diln Factor:
Comment:

Elem	Ba	Be	B	Cd	Cr	Co	Cu	Pb
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**.47488**	**.73375**	**.08880**	**4.4386**	**.15111**	**1.3013**	**.27566**	**.32653**
Stddev	.00109	.00023	.00013	.0078	.00033	.0005	.00035	.00039
%RSD	.22916	.03124	.14842	.17643	.22046	.04116	.12557	.12015
#1	.47595	.73400	.08865	4.4465	.15074	1.3016	.27541	.32689
#2	.47492	.73371	.08890	4.4383	.15122	1.3006	.27551	.32659
#3	.47377	.73355	.08886	4.4309	.15137	1.3016	.27605	.32611

Elem	Mn	Ni	Ag	Tl	V
Units	Cts/S	Cts/S	Cts/S	Cts/S	Cts/S
Avg	**.10976**	**1.2045**	**.19245**	**.15845**	**.14680**
Stddev	.00009	.0017	.00047	.00014	.00018
%RSD	.08355	.14433	.24174	.08978	.12396
#1	.10970	1.2065	.19203	.15830	.14659
#2	.10987	1.2036	.19238	.15858	.14686
#3	.10973	1.2034	.19295	.15848	.14694

Int. Std.	Sc2273_A	Sc3613_R	Sc3645_A
Units	Cts/S	Cts/S	Cts/S
Avg	**6626.6**	**113930.**	**163140.**
Stddev	20.8	1012.	160.
%RSD	.31350	.88851	.09787
#1	6606.9	112800.	163200.
#2	6624.7	114240.	162960.
#3	6648.3	114750.	163260.

```
Sample Name: S5      Acquired: 10/15/2008 15:21:54      Type: Cal
Method: 08J6010b(v10)       Mode: IR      Corr. Factor: 1.000000
User: admin       Data File:           Type:           Diln Factor:
Comment:

Elem                 Sb         As         Mo         Se         Zn
Units             Cts/S      Cts/S      Cts/S      Cts/S      Cts/S
Avg              .00651     .00343     1.0715     .00369     1.2061
Stddev           .00004     .00001      .0046     .00000      .0076
%RSD             .66406     .32576     .43368     .09708     .62651

#1               .00648     .00344     1.0766     .00369     1.2124
#2               .00648     .00342     1.0705     .00369     1.2083
#3               .00656     .00344     1.0674     .00369     1.1977

Int. Std.     Sc2273_A  Sc3645_A
Units            Cts/S      Cts/S
Avg             6814.2    165400.
Stddev            41.6       269.
%RSD            .61094     .16293

#1              6779.1    165090.
#2              6803.2    165580.
#3              6860.2    165530.
```

```
Sample Name: S8      Acquired: 10/15/2008 15:26:55      Type: Cal
Method: 08J6010b(v10)      Mode: IR      Corr. Factor: 1.000000
User: admin      Data File:      Type:      Diln Factor:
Comment:

Elem              Ca         Mg          K         Na
Units          Cts/S      Cts/S      Cts/S      Cts/S
Avg           2.0896     .22863     .71783     2.3227
Stddev         .0042     .00019     .00488      .0152
%RSD          .20184     .08181     .67946     .65235

#1            2.0943     .22867     .72346     2.3401
#2            2.0862     .22843     .71514     2.3162
#3            2.0882     .22880     .71489     2.3119

Int. Std.  Sc3613_R
Units         Cts/S
Avg         109840.
Stddev        1515.
%RSD         1.3795

#1          108100.
#2          110590.
#3          110830.
```

```
Sample Name: S11      Acquired: 10/15/2008 15:31:59      Type: Cal
Method: 08J6010b(v10)      Mode: IR      Corr. Factor: 1.000000
User: admin      Data File:        Type:          Diln Factor:
Comment:

Elem                  Fe
Units              Cts/S
Avg               .06475
Stddev            .00011
%RSD              .17719

#1                .06480
#2                .06462
#3                .06482

Int. Std.      Sc3645_A
Units              Cts/S
Avg              162360.
Stddev              204.
%RSD              .12592

#1               162120.
#2               162440.
#3               162510.
```

```
Sample Name: S17      Acquired: 10/15/2008 15:37:05      Type: Cal
Method: 08J6010b(v10)      Mode: IR      Corr. Factor: 1.000000
User: admin       Data File:       Type:        Diln Factor:
Comment:

Elem                Al
Units            Cts/S
Avg             .17965
Stddev          .00043
%RSD            .23935

#1              .17954
#2              .18013
#3              .17929

Int. Std.    Sc3645_A
Units            Cts/S
Avg            164510.
Stddev            397.
%RSD            .24142

#1             164090.
#2             164550.
#3             164880.
```

```
Sample Name: ICV      Acquired: 10/15/2008 15:42:10      Type: QC
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Data File: ID8J017007   Type:         Diln Factor:
Comment:

Elem             Al        Sb        As        Ba        Be         B        Cd        Ca
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          5.2078    .52509    .52769    .48742    .50532    .53701    .50450    50.499
Stddev        .0180    .00229    .00298    .00177    .00061    .00227    .00160      .045
%RSD         .34649    .43554    .56393    .36284    .11988    .42298    .31704    .08833

#1           5.2284    .52495    .53013    .48946    .50522    .53793    .50346    50.504
#2           5.1948    .52288    .52438    .48650    .50597    .53442    .50371    50.452
#3           5.2003    .52745    .52856    .48630    .50477    .53868    .50635    50.540

Check ?    Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem             Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          .49732    .49227    .50147    4.8434    .48299    50.291    .48421    .50893
Stddev       .00133    .00197    .00104     .0093    .00163      .079    .00093    .00235
%RSD         .26829    .39942    .20799    .19128    .33722    .15803    .19168    .46141

#1           .49856    .49172    .50257    4.8453    .48191    50.249    .48528    .50704
#2           .49591    .49064    .50049    4.8515    .48218    50.242    .48372    .50819
#3           .49747    .49445    .50135    4.8333    .48486    50.383    .48362    .51156

Check ?    Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem             Ni         K        Se        Ag        Na        Tl         V        Zn
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          .49395    49.634    .52778    .50876    50.034    .47325    .51903    .51397
Stddev       .00170      .191    .00245    .00146      .183    .00275    .00116    .00140
%RSD         .34510    .38475    .46514    .28660    .36542    .58122    .22298    .27255

#1           .49270    49.846    .52832    .50991    50.245    .47071    .51917    .51253
#2           .49326    49.579    .52510    .50712    49.944    .47286    .52012    .51403
#3           .49589    49.476    .52992    .50926    49.914    .47617    .51781    .51533

Check ?    Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range
```

```
Sample Name: ICV      Acquired: 10/15/2008 15:42:10      Type: QC
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017007   Type:          Diln Factor:
Comment:

Int. Std.     Sc2273_A Sc3613_R Sc3645_A
Units             Cts/S     Cts/S     Cts/S
Avg              5848.7   109050.   146090.
Stddev             14.5      763.      405.
%RSD             .24793    .69968    .27714

#1               5862.6   108190.   145620.
#2               5849.7   109650.   146280.
#3               5833.7   109310.   146360.
```

Sample Name: ICB Acquired: 10/15/2008 15:46:59 Type: QC
Method: 08J6010b(v10) Mode: CONC Corr. Factor: 1.000000
User: admin Data File: ID8J017008 Type: Diln Factor:
Comment:

Elem	Al	Sb	As	Ba	Be	B	Cd	Ca
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**.00225**	**.00128**	**-.00031**	**.00020**	**.00018**	**.00028**	**.00017**	**.00752**
Stddev	.00203	.00090	.00111	.00008	.00004	.00012	.00003	.00111
%RSD	90.165	70.491	363.02	40.768	22.623	44.091	16.682	14.759
#1	.00431	.00179	-.00149	.00017	.00020	.00034	.00017	.00702
#2	.00221	.00182	-.00015	.00015	.00021	.00037	.00014	.00676
#3	.00024	.00024	.00072	.00030	.00013	.00014	.00020	.00880
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit								
Low Limit								

Elem	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**.00027**	**-.00002**	**.00046**	**-.00325**	**.00014**	**.00885**	**.00029**	**.00035**
Stddev	.00012	.00016	.00007	.00071	.00030	.00199	.00005	.00013
%RSD	45.130	795.16	14.244	21.804	225.10	22.439	17.293	37.260
#1	.00021	-.00020	.00049	-.00402	.00014	.01082	.00030	.00049
#2	.00020	.00009	.00050	-.00262	.00044	.00685	.00024	.00023
#3	.00041	.00005	.00038	-.00312	-.00017	.00888	.00034	.00034
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit								
Low Limit								

Elem	Ni	K	Se	Ag	Na	Tl	V	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**.00017**	**-.02222**	**-.00055**	**.00010**	**.01957**	**-.00026**	**.00010**	**.00043**
Stddev	.00010	.00261	.00183	.00027	.00301	.00064	.00021	.00006
%RSD	57.989	11.770	333.07	259.95	15.388	243.96	211.21	14.095
#1	.00012	-.02447	.00123	.00013	.02094	-.00070	.00033	.00048
#2	.00028	-.01935	-.00045	.00036	.02166	-.00056	.00006	.00044
#3	.00010	-.02283	-.00243	-.00018	.01612	.00048	-.00009	.00036
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit								
Low Limit								

Sample Name: ICB Acquired: 10/15/2008 15:46:59 Type: QC
Method: 08J6010b(v10) Mode: CONC Corr. Factor: 1.000000
User: admin Data File: ID8J017008 Type: Diln Factor:
Comment:

Int. Std.	Sc2273_A	Sc3613_R	Sc3645_A
Units	Cts/S	Cts/S	Cts/S
Avg	6635.1	110650.	155370.
Stddev	23.3	945.	642.
%RSD	.35074	.85358	.41317
#1	6621.5	109700.	154630.
#2	6621.9	110670.	155720.
#3	6662.0	111580.	155760.

```
Sample Name: MRL1       Acquired: 10/15/2008 15:52:02      Type: Unk
Method: 08J6010b(v10)       Mode: CONC      Corr. Factor: 1.000000
User: admin       Data File: ID8J017009   Type:          Diln Factor:
Comment: CAM3

Elem            Al        Sb        As        Ba        Be         B        Cd        Ca
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         .03767    .01169    .00992    .01037    .01009    .00988    .00978   -.01334
Stddev      .00210    .00059    .00080    .00009    .00005    .00016    .00002    .00024
%RSD        5.5871    5.0473    8.1045    .87630    .47106    1.6242    .20575    1.7953

#1          .03794    .01106    .00900    .01031    .01003    .00975    .00976   -.01329
#2          .03963    .01222    .01050    .01048    .01012    .00982    .00978   -.01359
#3          .03544    .01178    .01026    .01033    .01011    .01006    .00981   -.01312

Elem            Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         .01018    .00961    .01087   -.00171    .00953    .10147    .01042    .00965
Stddev      .00008    .00010    .00004    .00098    .00040    .00684    .00014    .00007
%RSD        .74379    .99905    .39532    57.338    4.2118    6.7386    1.3700    .76594

#1          .01009    .00963    .01091   -.00146    .00980    .10217    .01028    .00973
#2          .01021    .00950    .01083   -.00088    .00973    .10793    .01057    .00963
#3          .01023    .00969    .01088   -.00279    .00907    .09431    .01040    .00959

Elem            Ni         K        Se        Ag        Na        Tl         V        Zn
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         .00983   -.02908    .00994    .01023    .09574    .00980    .01038    .00990
Stddev      .00015    .01186    .00104    .00026    .00823    .00102    .00014    .00003
%RSD        1.5491    40.768    10.460    2.5810    8.5963    10.404    1.3124    .33367

#1          .00995   -.03186    .01105    .01042    .10142    .00954    .01053    .00994
#2          .00966   -.01608    .00900    .01034    .09949    .00894    .01028    .00988
#3          .00989   -.03930    .00976    .00993    .08630    .01093    .01032    .00989

Int. Std.  Sc2273_A  Sc3613_R  Sc3645_A
Units         Cts/S     Cts/S     Cts/S
Avg          6646.1   113340.   156280.
Stddev         24.3      754.      213.
%RSD         .36575    .66501    .13638

#1           6618.1   112680.   156120.
#2           6661.6   113190.   156520.
#3           6658.6   114160.   156200.
```

```
Sample Name: MRL2      Acquired: 10/15/2008 15:57:05      Type: Unk
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Data File: ID8J017010   Type:          Diln Factor:
Comment: BGMP LOW

Elem            Al        Sb        As        Ba        Be         B        Cd        Ca
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         .20328    .10495    .01038    .00517    .00407    .11020    .00472    .49057
Stddev      .00132    .00106    .00089    .00007    .00003    .00064    .00002    .00096
%RSD        .64768    1.0133    8.5365    1.4239    .82109    .57639    .49449    .19597

#1          .20364    .10413    .00942    .00526    .00411    .10949    .00470    .49120
#2          .20183    .10457    .01056    .00512    .00407    .11036    .00474    .49106
#3          .20439    .10615    .01116    .00514    .00404    .11073    .00473    .48947

Elem            Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         .00980    .01452    .01039    .09261    .00286    .20645    .00517    .01491
Stddev      .00002    .00013    .00008    .00101    .00043    .00694    .00017    .00016
%RSD        .16756    .87465    .81122    1.0915    15.091    3.3622    3.2741    1.0768

#1          .00978    .01437    .01048    .09378    .00247    .19880    .00512    .01476
#2          .00982    .01459    .01033    .09203    .00333    .21234    .00503    .01490
#3          .00979    .01459    .01035    .09203    .00278    .20822    .00535    .01508

Elem            Ni         K        Se        Ag        Na        Tl         V        Zn
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         .02045    1.0022    .01057    .01009    .03410    .00961    .01060    .02004
Stddev      .00019     .0156    .00033    .00007    .00392    .00097    .00005    .00007
%RSD        .93155    1.5519    3.1554    .71470    11.497    10.141    .48083    .32814

#1          .02040    .98894    .01044    .01009    .03733    .00945    .01061    .02002
#2          .02030    .99841    .01095    .01016    .03523    .00873    .01054    .01998
#3          .02066    1.0193    .01033    .01002    .02974    .01066    .01064    .02011

Int. Std.   Sc2273_A Sc3613_R Sc3645_A
Units          Cts/S     Cts/S     Cts/S
Avg           6706.8   114750.   159720.
Stddev          30.3      265.      153.
%RSD          .45222    .23098    .09608

#1            6729.7   114630.   159550.
#2            6718.4   114570.   159780.
#3            6672.4   115050.   159840.
```

```
Sample Name: ICSA1      Acquired: 10/15/2008 16:02:10      Type: QC
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017011   Type:          Diln Factor:
Comment:

Elem              Al        Sb        As        Ba        Be         B        Cd        Ca
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           495.45    .01204    .00189   -.00113    .00008    .01095    .00062    468.50
Stddev          3.31    .00081    .00017    .00007    .00005    .00054    .00023      2.71
%RSD          .66791    6.7248    9.0543    6.2966    60.507    4.9217    37.358    .57749

#1            493.30    .01122    .00176   -.00108    .00009    .01035    .00088    465.37
#2            499.26    .01284    .00182   -.00122    .00003    .01138    .00058    470.02
#3            493.79    .01206    .00209   -.00110    .00012    .01112    .00042    470.10

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem              Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          -.00034   -.00088    .00285    179.42   -.00154    506.20    .00001   -.00232
Stddev        .00029    .00032    .00011       .58    .00122       .60    .00008    .00008
%RSD          85.124    36.694    4.0077    .32212    78.989    .11858    1271.4    3.5871

#1           -.00001   -.00117    .00280    179.39   -.00146    505.94   -.00005   -.00241
#2           -.00049   -.00053    .00298    178.86   -.00037    505.76   -.00003   -.00230
#3           -.00053   -.00095    .00276    180.02   -.00279    506.88    .00009   -.00224

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem              Ni         K        Se        Ag        Na        Tl         V        Zn
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .00377    .00709    .00318    .00067    .08589    .00100    .00050   -.00047
Stddev        .00025    .01944    .00169    .00017    .00207    .00062    .00007    .00025
%RSD          6.6603    274.05    52.926    25.569    2.4128    62.110    14.277    54.187

#1            .00370   -.01437    .00388    .00055    .08360    .00170    .00054   -.00032
#2            .00357    .01214    .00441    .00087    .08643    .00082    .00054   -.00076
#3            .00405    .02351    .00126    .00060    .08765    .00049    .00042   -.00033

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range
```

```
Sample Name: ICSA1      Acquired: 10/15/2008 16:02:10      Type: QC
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin       Data File: ID8J017011   Type:          Diln Factor:
Comment:

Int. Std.      Sc2273_A  Sc3613_R  Sc3645_A
Units             Cts/S     Cts/S     Cts/S
Avg              4791.5   104160.   130710.
Stddev             22.4      559.      232.
%RSD             .46738    .53634    .17743

#1               4769.1   103570.   130610.
#2               4791.7   104230.   130970.
#3               4813.9   104680.   130540.
```

```
Sample Name: ICSAB1      Acquired: 10/15/2008 16:07:24      Type: QC
Method: 08J6010b(v10)    Mode: CONC      Corr. Factor: 1.000000
User: admin      Data File: ID8J017012  Type:          Diln Factor:
Comment:

Elem              Al        Sb        As        Ba        Be         B        Cd        Ca
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           487.91    1.0764    1.0860    .52010    .49372    .55851    1.0118    465.48
Stddev           .59     .0036     .0054    .00136    .00081    .00077     .0024      1.36
%RSD          .12190    .33449    .50054    .26153    .16316    .13758    .23267    .29210

#1            487.55    1.0746    1.0845    .51873    .49377    .55820    1.0101    464.59
#2            487.58    1.0741    1.0815    .52014    .49451    .55939    1.0145    467.04
#3            488.59    1.0805    1.0920    .52145    .49290    .55795    1.0107    464.79

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem              Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .48043    .48317    .52964    178.26    .93468    500.86    .46253    1.0721
Stddev        .00112    .00103    .00077       .30    .00286       .52    .00039     .0035
%RSD          .23212    .21410    .14473    .17028    .30587    .10341    .08343    .32261

#1            .48163    .48215    .52972    178.18    .93381    500.76    .46278    1.0689
#2            .47942    .48422    .52884    178.00    .93788    501.42    .46209    1.0758
#3            .48023    .48314    .53037    178.59    .93236    500.40    .46273    1.0717

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem              Ni         K        Se        Ag        Na        Tl         V        Zn
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .96918    79.978    1.0805    1.1212    78.383    .90229    .50641    .99916
Stddev        .00067      .301     .0070     .0018      .143    .00266    .00121    .00435
%RSD          .06921    .37668    .64380    .16218    .18294    .29486    .23866    .43512

#1            .96866    80.326    1.0818    1.1225    78.548    .89973    .50613    1.0006
#2            .96993    79.799    1.0730    1.1191    78.286    .90210    .50537    1.0026
#3            .96894    79.810    1.0867    1.1220    78.315    .90504    .50774    .99428

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range
```

Sample Name: ICSAB1 Acquired: 10/15/2008 16:07:24 Type: QC
Method: 08J6010b(v10) Mode: CONC Corr. Factor: 1.000000
User: admin Data File: ID8J017012 Type: Diln Factor:
Comment:

Int. Std.	Sc2273_A	Sc3613_R	Sc3645_A
Units	Cts/S	Cts/S	Cts/S
Avg	**4817.1**	**104390.**	**130120.**
Stddev	14.2	1229.	386.
%RSD	.29496	1.1769	.29675
#1	4819.1	103120.	129690.
#2	4802.1	104490.	130440.
#3	4830.3	105570.	130240.

```
Sample Name: CCV1      Acquired: 10/15/2008 16:12:30      Type: QC
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Data File: ID8J017013   Type:        Diln Factor:
Comment:

Elem            Al        Sb        As        Ba        Be         B        Cd        Ca
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         5.1592    .52317    .52189    .48064    .50317    .53504    .50280    50.420
Stddev       .0164    .00406    .00165    .00114    .00032    .00076    .00105      .032
%RSD        .31805    .77614    .31582    .23807    .06406    .14170    .20869    .06337

#1          5.1628    .52402    .51999    .48195    .50313    .53477    .50273    50.383
#2          5.1413    .51876    .52295    .48013    .50351    .53446    .50388    50.441
#3          5.1735    .52675    .52273    .47983    .50287    .53590    .50178    50.435

Check ?   Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem            Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         .49514    .48908    .49557    4.8086    .48022    50.242    .48087    .50468
Stddev      .00013    .00088    .00104     .0102    .00096      .015    .00173    .00044
%RSD        .02591    .17917    .21066    .21202    .20034    .02945    .35874    .08644

#1          .49519    .48896    .49676    4.8116    .47947    50.234    .48260    .50429
#2          .49523    .49001    .49484    4.7973    .48131    50.233    .47915    .50461
#3          .49499    .48828    .49510    4.8170    .47989    50.259    .48085    .50515

Check ?   Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem            Ni         K        Se        Ag        Na        Tl         V        Zn
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         .49011    49.127    .52493    .50603    49.175    .47202    .51273    .51102
Stddev      .00065      .170    .00451    .00062      .178    .00057    .00109    .00245
%RSD        .13225    .34576    .85834    .12333    .36259    .12033    .21268    .47921

#1          .48975    49.323    .52097    .50595    49.365    .47253    .51283    .51125
#2          .49086    49.035    .52400    .50668    49.149    .47141    .51159    .51335
#3          .48973    49.024    .52983    .50544    49.011    .47213    .51377    .50847

Check ?   Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range
```

```
Sample Name: CCV1      Acquired: 10/15/2008 16:12:30      Type: QC
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin       Data File: ID8J017013  Type:          Diln Factor:
Comment:

Int. Std.     Sc2273_A Sc3613_R Sc3645_A
Units             Cts/S    Cts/S    Cts/S
Avg              5938.4  111070.  148340.
Stddev             20.2     620.     246.
%RSD             .33978   .55819   .16573

#1               5935.2  110430.  148060.
#2               5920.0  111090.  148530.
#3               5959.9  111670.  148420.
```

```
Sample Name: CCB1       Acquired: 10/15/2008 16:17:20      Type: QC
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017014   Type:          Diln Factor:
Comment:

Elem                 Al        Sb        As        Ba        Be         B         Cd
Units              mg/L      mg/L      mg/L      mg/L      mg/L      mg/L       mg/L
Avg              .01030    .00151   -.00080    .00022    .00018    .00032  F .00021
Stddev           .00096    .00068    .00125    .00012    .00004    .00007     .00003
%RSD             9.3653    45.078    156.27    56.183    23.109    23.078     11.893

#1               .01121    .00165   -.00171    .00031    .00020    .00030     .00018
#2               .01039    .00212    .00063    .00026    .00020    .00041     .00023
#3               .00929    .00077   -.00132    .00008    .00013    .00027     .00023

Check ?        Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass   Chk Fail
High Limit                                                                  .00020
Low Limit                                                                  -.00020

Elem                 Ca        Cr        Co        Cu        Fe        Pb         Mg
Units              mg/L      mg/L      mg/L      mg/L      mg/L      mg/L       mg/L
Avg              .16076    .00010    .00003    .00023    .00287    .00022     .02111
Stddev           .00527    .00014    .00002    .00000    .00122    .00050     .01383
%RSD             3.2797    134.18    73.376    1.0303    42.606    232.77     65.501

#1               .16683    .00010    .00001    .00023    .00153    .00002     .03184
#2               .15740    .00024    .00004    .00023    .00317    .00078     .02598
#3               .15804   -.00003    .00005    .00023    .00392   -.00016     .00551

Check ?        Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass   Chk Pass
High Limit
Low Limit

Elem                 Mn        Mo        Ni         K        Se        Ag         Na
Units              mg/L      mg/L      mg/L      mg/L      mg/L      mg/L       mg/L
Avg              .00034  F .00041    .00016   -.04551   -.00120    .00020     .00590
Stddev           .00022    .00009    .00015    .01583    .00008    .00020     .00445
%RSD             65.093    22.462    94.583    34.793    7.0187    100.33     75.305

#1               .00056    .00033   -.00001   -.03658   -.00128    .00043     .00969
#2               .00034    .00040    .00029   -.06379   -.00120    .00010     .00701
#3               .00012    .00051    .00020   -.03616   -.00111    .00007     .00101

Check ?        Chk Pass  Chk Fail  Chk Pass  Chk Pass  Chk Pass  Chk Pass   Chk Pass
High Limit                .00040
Low Limit                -.00040
```

```
Sample Name: CCB1       Acquired: 10/15/2008 16:17:20       Type: QC
Method: 08J6010b(v10)     Mode: CONC       Corr. Factor: 1.000000
User: admin         Data File: ID8J017014   Type:           Diln Factor:
Comment:

Elem                  Tl           V          Zn
Units               mg/L        mg/L        mg/L
Avg              -.00010      .00000      .00492
Stddev            .00079      .00005      .00009
%RSD              759.70      6108.6      1.7276

#1                .00058      .00001      .00489
#2                .00007      .00004      .00486
#3               -.00097     -.00005      .00502

Check ?         Chk Pass    Chk Pass    Chk Pass
High Limit
Low Limit

Int. Std.      Sc2273_A   Sc3613_R    Sc3645_A
Units             Cts/S       Cts/S       Cts/S
Avg              6720.2     113200.     158030.
Stddev             15.1       1214.        328.
%RSD             .22520      1.0720      .20780

#1               6723.5     111800.     157660.
#2               6733.4     113840.     158170.
#3               6703.7     113960.     158270.
```

Sample Name: CCV9 Acquired: 10/15/2008 23:38:23 Type: QC
Method: 08J6010b(v10) Mode: CONC Corr. Factor: 1.000000
User: admin Data File: ID8J017100 Type: Diln Factor:
Comment:

Elem	Al	Sb	As	Ba	Be	B	Cd
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**5.4191**	**.51851**	**.53263**	**.53032**	**.47234**	**.54788**	**.53742**
Stddev	.0106	.00273	.00228	.00134	.00126	.00149	.00114
%RSD	.19568	.52627	.42899	.25250	.26606	.27184	.21175
#1	5.4072	.51635	.53222	.53185	.47190	.54841	.53821
#2	5.4227	.51760	.53058	.52973	.47375	.54620	.53612
#3	5.4275	.52157	.53509	.52938	.47136	.54904	.53795
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value							
Range							

Elem	Ca	Cr	Co	Cu	Fe	Pb	Mg
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**47.146**	**.48904**	**.52469**	**.51405**	**4.6416**	**.51254**	F **44.745**
Stddev	.048	.00105	.00164	.00051	.0018	.00100	.227
%RSD	.10253	.21380	.31191	.09837	.03790	.19444	.50816
#1	47.123	.48884	.52541	.51448	4.6400	.51333	44.507
#2	47.202	.48811	.52282	.51417	4.6435	.51142	44.961
#3	47.114	.49017	.52585	.51350	4.6415	.51286	44.768
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Fail
Value							50.000
Range							-10.000%

Elem	Mn	Mo	Ni	K	Se	Ag	Na
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**.45945**	F **.55523**	**.52518**	**52.529**	**.54168**	**.51353**	**53.719**
Stddev	.00163	.00252	.00216	.318	.00073	.00076	.328
%RSD	.35448	.45315	.41076	.60567	.13474	.14872	.60981
#1	.46133	.55530	.52688	52.884	.54247	.51365	54.093
#2	.45845	.55268	.52275	52.436	.54104	.51271	53.579
#3	.45858	.55771	.52590	52.268	.54152	.51422	53.485
Check ?	Chk Pass	Chk Fail	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value		.50000					
Range		10.000%					

```
Sample Name: CCV9       Acquired: 10/15/2008 23:38:23      Type: QC
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017100  Type:          Diln Factor:
Comment:

Elem                 Tl          V          Zn
Units              mg/L       mg/L        mg/L
Avg              .48839     .50960      .53262
Stddev           .00256     .00073      .00193
%RSD             .52366     .14295      .36314

#1               .48612     .50890      .53485
#2               .48789     .50955      .53154
#3               .49116     .51035      .53146

Check ?        Chk Pass   Chk Pass    Chk Pass
Value
Range

Int. Std.     Sc2273_A  Sc3613_R  Sc3645_A
Units            Cts/S     Cts/S      Cts/S
Avg             5426.3   116910.    149370.
Stddev            20.2     1339.       288.
%RSD            .37187    1.1455     .19289

#1              5416.8   115450.    149080.
#2              5449.5   117220.    149660.
#3              5412.7   118070.    149360.
```

Sample Name: CCB9 Acquired: 10/15/2008 23:43:12 Type: QC
Method: 08J6010b(v10) Mode: CONC Corr. Factor: 1.000000
User: admin Data File: ID8J017101 Type: Diln Factor:
Comment:

Elem	Al	Sb	As	Ba	Be	B	Cd	Ca
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**-.00935**	**.00124**	**-.00044**	**.00004**	**.00009**	**.00008**	**.00005**	**.03591**
Stddev	.00168	.00070	.00035	.00013	.00005	.00015	.00003	.00455
%RSD	18.007	56.739	79.912	328.92	56.715	198.11	63.902	12.666
#1	-.00793	.00188	-.00053	.00017	.00012	.00021	.00006	.04054
#2	-.01121	.00136	-.00075	.00003	.00003	.00011	.00008	.03575
#3	-.00892	.00049	-.00005	-.00008	.00013	-.00009	.00001	.03144
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit								
Low Limit								

Elem	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**.00009**	**-.00002**	**.00050**	**-.00247**	**-.00020**	**.00585**	**.00048**	**.00019**
Stddev	.00010	.00004	.00003	.00056	.00054	.00849	.00016	.00007
%RSD	112.15	172.47	6.9145	22.806	266.51	145.04	33.988	38.700
#1	.00007	-.00007	.00050	-.00289	-.00070	.01515	.00047	.00016
#2	.00000	-.00002	.00053	-.00270	.00037	-.00148	.00065	.00027
#3	.00020	.00001	.00046	-.00183	-.00027	.00388	.00032	.00013
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit								
Low Limit								

Elem	Ni	K	Se	Ag	Na	Tl	V	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**-.00005**	**.01824**	**-.00067**	**-.00010**	**.00113**	**-.00121**	**.00005**	**.00177**
Stddev	.00006	.00682	.00128	.00022	.00599	.00068	.00007	.00005
%RSD	128.78	37.360	192.04	216.61	532.55	56.200	131.09	2.5793
#1	-.00006	.01986	-.00206	-.00020	.00630	-.00087	.00011	.00179
#2	-.00011	.02411	-.00042	.00015	.00251	-.00200	-.00003	.00180
#3	.00002	.01077	.00047	-.00025	-.00544	-.00077	.00008	.00171
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit								
Low Limit								

```
Sample Name: CCB9      Acquired: 10/15/2008 23:43:12      Type: QC
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Data File: ID8J017101   Type:          Diln Factor:
Comment:

Int. Std.    Sc2273_A  Sc3613_R  Sc3645_A
Units           Cts/S     Cts/S     Cts/S
Avg            6150.9   119920.   162180.
Stddev           19.0      970.      392.
%RSD           .30931    .80927    .24185

#1             6134.2   118800.   161760.
#2             6171.6   120490.   162540.
#3             6147.0   120460.   162240.
```

```
Sample Name: IPJ021SB      Acquired: 10/15/2008 23:48:18      Type: QC
Method: 08J6010b(v10)      Mode: CONC       Corr. Factor: 1.000000
User: admin        Data File: ID8J017102   Type:          Diln Factor:
Comment:

Elem                 Al         Sb         As         Ba         Be          B         Cd         Ca
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg              -.00097    -.00086     .00109     .00002     .00008    -.00007     .00016    -.02019
Stddev            .00346     .00036     .00044     .00014     .00011     .00003     .00003     .00390
%RSD              358.49     41.213     40.104     840.41     132.84     48.626     16.549     19.334

#1                .00301    -.00054     .00132     .00013    -.00003    -.00010     .00016    -.02441
#2               -.00334    -.00125     .00137    -.00014     .00009    -.00003     .00019    -.01946
#3               -.00257    -.00080     .00059     .00006     .00018    -.00006     .00013    -.01670

Check ?         Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem                 Cr         Co         Cu         Fe         Pb         Mg         Mn         Mo
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg               .00001     .00000     .00079     .00542     .00013    -.00336     .00059     .00007
Stddev            .00011      .0001     .00014     .00356     .00041     .00478     .00031     .00007
%RSD              1316.6     12390.     17.195     65.743     311.33     142.02     53.106     91.449

#1               -.00004     .00006     .00063     .00913    -.00034    -.00739     .00029     .00000
#2               -.00007     .00009     .00089     .00510     .00037    -.00462     .00057     .00012
#3                .00014    -.00016     .00085     .00203     .00037     .00192     .00091     .00010

Check ?         Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem                 Ni          K         Se         Ag         Na         Tl          V         Zn
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg               .00031    -.01734    -.00134    -.00007    -.02339     .00114     .00015     .00053
Stddev            .00004     .01805     .00105     .00019     .00380     .00041     .00016     .00015
%RSD              14.041     104.11     78.561     271.33     16.263     36.207     109.05     27.688

#1                .00026    -.02638    -.00049     .00010    -.02526     .00158     .00029     .00070
#2                .00033    -.02908    -.00100    -.00004    -.02589     .00076     .00018     .00044
#3                .00034     .00345    -.00251    -.00027    -.01901     .00109    -.00003     .00045

Check ?         Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit
```

```
Sample Name: IPJ021SB     Acquired: 10/15/2008 23:48:18     Type: QC
Method: 08J6010b(v10)     Mode: CONC     Corr. Factor: 1.000000
User: admin       Data File: ID8J017102   Type:          Diln Factor:
Comment:

Int. Std.     Sc2273_A  Sc3613_R  Sc3645_A
Units            Cts/S     Cts/S     Cts/S
Avg             6813.5   125150.   166230.
Stddev            30.2      490.      378.
%RSD            .44326    .39188    .22713

#1              6786.5   124660.   166640.
#2              6846.1   125640.   165890.
#3              6807.9   125150.   166160.
```

Sample Name: IPJ021SL Acquired: 10/15/2008 23:53:24 Type: QC
Method: 08J6010b(v10) Mode: CONC Corr. Factor: 1.000000
User: admin Data File: ID8J017103 Type: Diln Factor:
Comment:

Elem	Al	Sb	As	Ba	Be	B	Cd	Ca
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**10.788**	**5.0322**	**1.0463**	**1.0670**	**.93568**	**1.0118**	**1.0818**	**46.204**
Stddev	.040	.0248	.0026	.0036	.00191	.0017	.0018	.088
%RSD	.36912	.49240	.24460	.34075	.20370	.17159	.16853	.19033
#1	10.785	5.0292	1.0469	1.0708	.93366	1.0107	1.0805	46.115
#2	10.750	5.0090	1.0485	1.0636	.93745	1.0109	1.0811	46.291
#3	10.830	5.0583	1.0435	1.0666	.93592	1.0138	1.0839	46.206
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value								
Range								

Elem	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**1.0317**	**1.0689**	**1.0155**	**9.4317**	**1.0438**	**43.404**	**.92860**	**1.1515**
Stddev	.0027	.0021	.0003	.0174	.0016	.192	.00199	.0042
%RSD	.25777	.19372	.02521	.18476	.15479	.44306	.21391	.36401
#1	1.0308	1.0685	1.0155	9.4192	1.0434	43.202	.93086	1.1497
#2	1.0297	1.0671	1.0153	9.4243	1.0425	43.585	.92715	1.1485
#3	1.0347	1.0711	1.0158	9.4516	1.0456	43.424	.92778	1.1563
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value								
Range								

Elem	Ni	K	Se	Ag	Na	Tl	V	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**1.0951**	**51.381**	**1.0366**	**.98288**	**52.530**	**.98134**	**1.0229**	**1.0958**
Stddev	.0014	.213	.0059	.00148	.247	.00053	.0019	.0021
%RSD	.12605	.41525	.56680	.15049	.47107	.05373	.18893	.19121
#1	1.0949	51.609	1.0425	.98172	52.815	.98075	1.0228	1.0948
#2	1.0938	51.350	1.0307	.98237	52.406	.98178	1.0210	1.0982
#3	1.0966	51.185	1.0366	.98454	52.370	.98148	1.0249	1.0944
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
Value								
Range								

```
Sample Name: IPJ021SL      Acquired: 10/15/2008 23:53:24      Type: QC
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017103   Type:          Diln Factor:
Comment:

Int. Std.    Sc2273_A Sc3613_R Sc3645_A
Units           Cts/S    Cts/S    Cts/S
Avg            5132.1  114390.  147910.
Stddev            9.7    1312.     526.
%RSD           .18917   1.1473   .35533

#1             5126.0  113070.  147310.
#2             5143.3  114400.  148140.
#3             5127.0  115690.  148280.
```

```
Sample Name: IPJ021SC      Acquired: 10/15/2008 23:58:11      Type: QC
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017104   Type:           Diln Factor:
Comment:

Elem              Al        Sb        As        Ba        Be         B        Cd        Ca
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           10.130    4.8424    1.0075    1.0197    .90875    .97802    1.0510    45.287
Stddev          .017     .0150     .0031     .0015    .00187    .00171     .0032      .060
%RSD          .16354    .30947    .30294    .15089    .20532    .17512    .30210    .13257

#1            10.149    4.8571    1.0110    1.0205    .91012    .97615    1.0513    45.238
#2            10.121    4.8272    1.0054    1.0207    .90950    .97839    1.0477    45.270
#3            10.120    4.8428    1.0060    1.0179    .90663    .97952    1.0540    45.354

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem              Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .97461    1.0347    .96333    8.9743    1.0187    42.585    .89888    1.1206
Stddev        .00224     .0047    .00164     .0212     .0015      .087    .00165     .0069
%RSD          .22972    .45204    .17049    .23617    .14501    .20476    .18341    .61427

#1            .97226    1.0323    .96459    8.9734    1.0186    42.488    .89706    1.1196
#2            .97485    1.0317    .96147    8.9535    1.0173    42.607    .89931    1.1143
#3            .97672    1.0401    .96393    8.9959    1.0203    42.658    .90027    1.1280

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem              Ni         K        Se        Ag        Na        Tl         V        Zn
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           1.0515    49.901    .99088    .94962    50.915    .94312    .98445    1.0677
Stddev         .0041      .091    .00520    .00158      .024    .00235    .00128     .0015
%RSD          .39135    .18299    .52498    .16593    .04782    .24883    .12973    .14371

#1            1.0510    49.813    .99339    .94831    50.926    .94331    .98549    1.0691
#2            1.0476    49.995    .98490    .94918    50.932    .94068    .98302    1.0661
#3            1.0558    49.895    .99435    .95137    50.887    .94536    .98483    1.0680

Check ?     Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range
```

```
Sample Name: IPJ021SC      Acquired: 10/15/2008 23:58:11      Type: QC
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Data File: ID8J017104   Type:          Diln Factor:
Comment:

Int. Std.    Sc2273_A Sc3613_R Sc3645_A
Units           Cts/S    Cts/S    Cts/S
Avg            5462.5  117470.  156860.
Stddev           19.7     787.     730.
%RSD           .36053   .66980   .46527

#1             5459.8  116560.  156050.
#2             5483.4  117880.  157060.
#3             5444.3  117970.  157460.
```

```
Sample Name: J095-02M      Acquired: 10/16/2008 0:03:00      Type: Unk
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017105   Type:           Diln Factor:
Comment:

Elem             Al        Sb        As        Ba        Be         B        Cd        Ca
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          123.53    2.9503    .94724    1.5477    .83865    .85137    .95548    50.028
Stddev          .21     .0083    .00105     .0073    .00063    .00244    .00155      .114
%RSD         .16801    .28203    .11117    .47323    .07519    .28683    .16172    .22803

#1           123.55    2.9426    .94602    1.5509    .83921    .84855    .95450    49.920
#2           123.31    2.9493    .94778    1.5529    .83797    .85289    .95467    50.147
#3           123.73    2.9591    .94791    1.5394    .83877    .85267    .95726    50.018

Elem             Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          1.0761    1.0380    2.4209    135.13    14.239    44.599    9.1542    .97874
Stddev        .0019     .0021     .0071       .47      .007      .193     .0442    .00331
%RSD         .18093    .20612    .29455    .34785    .05020    .43315    .48302    .33778

#1           1.0740    1.0360    2.4171    134.76    14.239    44.449    9.1482    .97732
#2           1.0778    1.0377    2.4292    135.66    14.232    44.531    9.2011    .97639
#3           1.0766    1.0403    2.4165    134.98    14.246    44.817    9.1133    .98252

Elem             Ni         K        Se        Ag        Na        Tl         V        Zn
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          1.0035    51.111    .89275    .88473    47.402    .85513    1.2031    1.4771
Stddev        .0017      .310    .00153    .00154      .296    .00397     .0030     .0015
%RSD         .16596    .60715    .17145    .17456    .62495    .46376    .24852    .09870

#1           1.0026    51.190    .89100    .88328    47.556    .85106    1.2007    1.4766
#2           1.0025    51.374    .89342    .88636    47.588    .85535    1.2064    1.4787
#3           1.0055    50.769    .89384    .88456    47.060    .85898    1.2020    1.4759

Int. Std.   Sc2273_A Sc3613_R Sc3645_A
Units          Cts/S     Cts/S     Cts/S
Avg           5240.9   116190.   152440.
Stddev           6.8      969.      377.
%RSD          .12913    .83394    .24739

#1            5245.5   115470.   152100.
#2            5244.1   115810.   152370.
#3            5233.1   117290.   152850.
```

```
Sample Name: J095-02S     Acquired: 10/16/2008 0:07:56     Type: Unk
Method: 08J6010b(v10)     Mode: CONC     Corr. Factor: 1.000000
User: admin       Data File: ID8J017106   Type:         Diln Factor:
Comment:

Elem              Al       Sb       As       Ba       Be        B       Cd       Ca
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           125.82   2.9715   .95613   1.5514   .84829   .85324   .95717   49.836
Stddev          1.56    .0054   .00099    .0105   .00254   .00260   .00129     .058
%RSD          1.2415   .18032   .10393   .67938   .29959   .30427   .13482   .11699

#1            126.50   2.9760   .95614   1.5636   .84604   .85495   .95584   49.781
#2            124.04   2.9656   .95514   1.5454   .85105   .85025   .95724   49.830
#3            126.93   2.9731   .95712   1.5453   .84780   .85451   .95842   49.897

Elem              Cr       Co       Cu       Fe       Pb       Mg       Mn       Mo
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           1.0757   1.0416   2.4631   136.10   14.194   44.746   9.1684   .98020
Stddev         .0027    .0026    .0033      .17     .006     .219    .0353   .00379
%RSD          .24644   .25033   .13248   .12356   .04429   .48932   .38458   .38649

#1            1.0751   1.0402   2.4669   135.95   14.189   44.494   9.2051   .97689
#2            1.0735   1.0400   2.4612   136.06   14.191   44.888   9.1348   .97937
#3            1.0787   1.0446   2.4613   136.28   14.201   44.856   9.1654   .98433

Elem              Ni        K       Se       Ag       Na       Tl        V       Zn
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           1.0061   50.962   .90202   .88944   47.513   .86472   1.2129   1.4766
Stddev         .0028     .194   .00346   .00200     .269   .00438    .0009    .0028
%RSD          .27813   .38047   .38357   .22462   .56631   .50634   .07787   .18749

#1            1.0039   51.182   .90522   .89004   47.824   .86119   1.2127   1.4761
#2            1.0051   50.886   .89835   .88721   47.358   .86336   1.2121   1.4795
#3            1.0093   50.818   .90250   .89107   47.358   .86962   1.2139   1.4740

Int. Std.   Sc2273_A Sc3613_R Sc3645_A
Units          Cts/S    Cts/S    Cts/S
Avg           5199.9  117310.  151250.
Stddev          19.3     658.     519.
%RSD          .37041   .56071   .34332

#1            5201.4  116580.  150700.
#2            5218.4  117520.  151320.
#3            5179.9  117850.  151730.
```

```
Sample Name: J095-02A      Acquired: 10/16/2008 0:12:52      Type: Unk
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017107   Type:          Diln Factor:
Comment:

Elem            Al        Sb        As        Ba        Be         B        Cd        Ca
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         96.374    4.9245    1.0563    1.7515    .91458    1.0006    1.0402    52.773
Stddev        .794     .0174     .0048     .0022    .00202     .0015     .0014      .224
%RSD        .82406    .35222    .45682    .12620    .22100    .14581    .13910    .42404

#1          95.599    4.9317    1.0618    1.7517    .91249    .99906    1.0388    52.599
#2          97.186    4.9047    1.0532    1.7537    .91473    1.0020    1.0417    52.694
#3          96.338    4.9371    1.0538    1.7493    .91653    1.0007    1.0400    53.025

Elem            Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         1.0656    1.1558    2.2959    124.33    13.624    46.902    14.700    1.0930
Stddev       .0012     .0024     .0033       .34      .026      .282      .048     .0043
%RSD        .11396    .21139    .14492    .27021    .19016    .60164    .32528    .39391

#1          1.0662    1.1531    2.2979    124.72    13.595    46.645    14.646    1.0883
#2          1.0642    1.1566    2.2978    124.09    13.647    46.859    14.721    1.0942
#3          1.0664    1.1578    2.2921    124.20    13.629    47.204    14.734    1.0967

Elem            Ni         K        Se        Ag        Na        Tl         V        Zn
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         1.0763    54.529    1.0087    .95446    51.557    .94267    1.2514    1.4518
Stddev       .0016      .024     .0054    .00143      .047    .00178     .0031     .0046
%RSD        .15176    .04349    .53142    .14949    .09092    .18836    .24711    .31800

#1          1.0744    54.528    1.0121    .95348    51.610    .94301    1.2550    1.4520
#2          1.0773    54.553    1.0025    .95610    51.521    .94425    1.2495    1.4563
#3          1.0772    54.506    1.0115    .95380    51.539    .94075    1.2498    1.4471

Int. Std.  Sc2273_A Sc3613_R Sc3645_A
Units         Cts/S     Cts/S     Cts/S
Avg          5298.8   121380.   155410.
Stddev         10.3      544.      813.
%RSD         .19477    .44793    .52303

#1           5310.7   120750.   154490.
#2           5293.2   121710.   155740.
#3           5292.5   121680.   156010.
```

```
Sample Name: J095-02      Acquired: 10/16/2008 0:17:48      Type: Unk
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin      Data File: ID8J017108   Type:          Diln Factor:
Comment:

Elem             Al        Sb        As        Ba        Be         B        Cd        Ca
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          88.351    .16497    .04626    .74030    .00203    .02510    .00327    8.6840
Stddev         .904    .00286    .00093    .00268    .00011    .00058    .00005     .0164
%RSD         1.0237    1.7318    2.0101    .36138    5.2995    2.2931    1.5165    .18889

#1           88.941    .16825    .04662    .74157    .00215    .02497    .00328    8.7029
#2           88.802    .16364    .04520    .74210    .00200    .02573    .00321    8.6739
#3           87.310    .16303    .04695    .73722    .00194    .02461    .00331    8.6752

Elem             Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          .14652    .12968    1.3460    122.83    13.554    4.4134    14.854    .00583
Stddev       .00077    .00021     .0036       .45      .010     .0338      .071    .00015
%RSD         .52471    .16234    .26889    .36529    .07552    .76679    .47850    2.5419

#1           .14564    .12960    1.3422    122.47    13.564    4.4320    14.906    .00590
#2           .14705    .12951    1.3465    122.68    13.543    4.3743    14.885    .00593
#3           .14686    .12992    1.3494    123.33    13.555    4.4338    14.773    .00566

Elem             Ni         K        Se        Ag        Na        Tl         V        Zn
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          .04635    4.5990    .00270   -.00042    .20590    .00760    .29197    .43194
Stddev       .00011     .0351    .00063    .00009    .00641    .00066    .00108    .00095
%RSD         .22800    .76231    23.382    21.891    3.1119    8.7168    .36989    .21961

#1           .04624    4.6289    .00284   -.00048    .21121    .00746    .29089    .43255
#2           .04634    4.6076    .00201   -.00032    .20770    .00701    .29195    .43242
#3           .04646    4.5604    .00325   -.00048    .19878    .00832    .29305    .43084

Int. Std.  Sc2273_A Sc3613_R Sc3645_A
Units         Cts/S     Cts/S     Cts/S
Avg          5552.1   120790.   161220.
Stddev         10.1     1934.      358.
%RSD         .18140    1.6008    .22197

#1           5549.3   118720.   161020.
#2           5563.3   121120.   161000.
#3           5543.8   122540.   161630.
```

```
Sample Name: J095-02J     Acquired: 10/16/2008 0:22:50     Type: Unk
Method: 08J6010b(v10)     Mode: CONC     Corr. Factor: 1.000000
User: admin     Data File: ID8J017109  Type:          Diln Factor:
Comment:

Elem              Al        Sb        As        Ba        Be         B        Cd        Ca
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           18.858    .03792    .00911    .15538    .00040    .00587    .00065    1.8310
Stddev          .071    .00085    .00106    .00011    .00002    .00007    .00001     .0010
%RSD          .37580    2.2299    11.617    .07115    4.8380    1.1343    1.7369    .05496

#1            18.776    .03760    .01003    .15549    .00041    .00587    .00066    1.8304
#2            18.902    .03889    .00796    .15538    .00041    .00580    .00064    1.8305
#3            18.896    .03729    .00935    .15527    .00038    .00594    .00066    1.8322

Elem              Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .03040    .02638    .27797    25.837    2.8658    .91464    3.1678    .00110
Stddev        .00025    .00011    .00058      .078     .0021    .01550     .0126    .00010
%RSD          .83014    .40587    .20987    .30139    .07344    1.6948    .39638    8.7193

#1            .03015    .02627    .27732    25.757    2.8637    .93008    3.1583    .00111
#2            .03039    .02648    .27846    25.913    2.8659    .91478    3.1821    .00099
#3            .03066    .02638    .27811    25.840    2.8679    .89908    3.1630    .00118

Elem              Ni         K        Se        Ag        Na        Tl         V        Zn
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .00940    .92197    .00073   -.00012    .02028    .00094    .06011    .08679
Stddev        .00013    .00433    .00026    .00007    .00242    .00083    .00033    .00019
%RSD          1.3973    .46913    36.049    58.672    11.916    88.619    .55426    .22259

#1            .00950    .91802    .00046   -.00018    .01793    .00079    .05974    .08698
#2            .00946    .92659    .00099   -.00012    .02016    .00183    .06037    .08680
#3            .00925    .92130    .00073   -.00004    .02275    .00019    .06023    .08660

Int. Std.   Sc2273_A  Sc3613_R  Sc3645_A
Units          Cts/S     Cts/S     Cts/S
Avg           5828.4   119190.   163400.
Stddev          10.2      625.      138.
%RSD          .17499    .52444    .08459

#1            5834.2   119070.   163560.
#2            5834.4   118630.   163310.
#3            5816.6   119860.   163330.
```

```
Sample Name: J095-01      Acquired: 10/16/2008 0:27:48      Type: Unk
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Data File: ID8J017110   Type:           Diln Factor:
Comment:

Elem             Al        Sb        As        Ba        Be         B        Cd        Ca
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          87.647    .06319    .03811    .68536    .00162    .02511    .00344    11.332
Stddev         .255    .00070    .00092    .00206    .00004    .00103    .00007      .023
%RSD         .29052    1.1006    2.4158    .30046    2.2833    4.1148    2.0400    .19928

#1           87.899    .06303    .03705    .68716    .00166    .02578    .00338    11.310
#2           87.654    .06394    .03859    .68311    .00160    .02563    .00342    11.332
#3           87.390    .06258    .03870    .68581    .00160    .02392    .00352    11.355

Elem             Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          .25748    .05033    .32925    121.20    2.8831    5.0571    4.9561    .00510
Stddev       .00023    .00030    .00062       .29     .0052     .0199     .0100    .00010
%RSD         .09006    .60212    .18848    .23585    .18134    .39445    .20177    1.9140

#1           .25758    .05063    .32935    120.98    2.8834    5.0341    4.9596    .00517
#2           .25764    .05035    .32982    121.09    2.8881    5.0705    4.9448    .00513
#3           .25722    .05002    .32859    121.52    2.8776    5.0665    4.9639    .00499

Elem             Ni         K        Se        Ag        Na        Tl         V        Zn
Units          mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg          .04109    6.1609    .00674   -.00166    .14656   -.00017    .29769    .25793
Stddev       .00020     .0209    .00041    .00015    .00254    .00144    .00044    .00133
%RSD         .48612    .33892    6.0333    8.8021    1.7306    854.22    .14791    .51472

#1           .04126    6.1832    .00646   -.00183    .14761    .00001    .29733    .25857
#2           .04115    6.1418    .00656   -.00160    .14366    .00117    .29756    .25882
#3           .04087    6.1577    .00721   -.00155    .14839   -.00168    .29818    .25641

Int. Std.  Sc2273_A Sc3613_R Sc3645_A
Units         Cts/S     Cts/S     Cts/S
Avg          5288.4   112770.   153980.
Stddev         16.3      680.      563.
%RSD         .30882    .60265    .36550

#1           5272.5   112040.   153340.
#2           5287.4   112910.   154210.
#3           5305.1   113370.   154400.
```

```
Sample Name: CCV10      Acquired: 10/16/2008 0:34:41      Type: QC
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017111   Type:          Diln Factor:
Comment:

Elem                 Al         Sb         As         Ba         Be          B         Cd
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg              5.3731     .51686     .53153     .53966     .47374   F .55335     .54590
Stddev            .0121     .00119     .00054     .00216     .00110     .00050     .00173
%RSD             .22454     .22934     .10204     .40029     .23157     .08984     .31615

#1               5.3592     .51774     .53205     .54147     .47486     .55392     .54424
#2               5.3794     .51732     .53156     .54024     .47369     .55304     .54578
#3               5.3808     .51551     .53097     .53727     .47267     .55308     .54768

Check ?        Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Fail   Chk Pass
Value                                                                  .50000
Range                                                                 10.000%

Elem                 Ca         Cr         Co         Cu         Fe         Pb         Mg
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg              47.886     .49205     .53165     .51005     4.5865     .52223     45.698
Stddev             .111     .00090     .00209     .00031      .0159     .00180       .090
%RSD             .23143     .18241     .39327     .06101     .34739     .34553     .19651

#1               47.977     .49174     .52968     .51021     4.5691     .52039     45.624
#2               47.917     .49305     .53142     .51025     4.6003     .52230     45.798
#3               47.762     .49134     .53384     .50969     4.5903     .52400     45.673

Check ?        Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
Value
Range

Elem                 Mn         Mo         Ni          K         Se         Ag         Na
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg              .47990   F .56744     .53252     54.779     .53966     .51730   F 55.464
Stddev           .00114     .00348     .00184       .297     .00047     .00052       .295
%RSD             .23822     .61308     .34505     .54275     .08620     .10130     .53247

#1               .48006     .56417     .53082     55.093     .53913     .51790     55.764
#2               .48095     .56706     .53227     54.744     .53986     .51707     55.455
#3               .47868     .57109     .53447     54.501     .54000     .51693     55.174

Check ?        Chk Pass   Chk Fail   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Fail
Value                       .50000                                               50.000
Range                      10.000%                                              10.000%
```

```
Sample Name: CCV10      Acquired: 10/16/2008 0:34:41      Type: QC
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin       Data File: ID8J017111   Type:          Diln Factor:
Comment:

Elem                 Tl           V          Zn
Units              mg/L        mg/L        mg/L
Avg              .48959      .50452      .54188
Stddev           .00087      .00121      .00220
%RSD             .17765      .24024      .40668

#1               .48859      .50319      .53933
#2               .49005      .50556      .54311
#3               .49013      .50480      .54319

Check ?        Chk Pass    Chk Pass    Chk Pass
Value
Range

Int. Std.     Sc2273_A   Sc3613_R   Sc3645_A
Units            Cts/S       Cts/S       Cts/S
Avg             5344.0     112320.     149690.
Stddev            26.4       1234.        364.
%RSD            .49440      1.0983      .24306

#1              5368.2     110990.     149300.
#2              5347.9     112530.     149740.
#3              5315.8     113430.     150020.
```

```
Sample Name: CCB10      Acquired: 10/16/2008 0:39:31      Type: QC
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017112  Type:          Diln Factor:
Comment:

Elem                Al         Sb         As         Ba         Be          B         Cd         Ca
Units             mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg            -.00899     .00331    -.00025     .00011     .00008     .00043     .00000     .02298
Stddev          .00072     .00152     .00051     .00009     .00003     .00022      .0000     .00237
%RSD            7.9774     45.870     206.30     82.115     39.150     50.714     908.26     10.310

#1             -.00982     .00491    -.00030     .00016     .00010     .00066    -.00004     .02549
#2             -.00859     .00315     .00029     .00016     .00008     .00022     .00000     .02078
#3             -.00856     .00188    -.00073     .00001     .00005     .00041     .00004     .02266

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem                Cr         Co         Cu         Fe         Pb         Mg         Mn         Mo
Units             mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg             .00007     .00000     .00052    -.00182    -.00035     .00223     .00030     .00013
Stddev          .00002      .0002     .00009     .00077     .00006     .00836     .00023     .00007
%RSD            29.333     19116.     17.595     42.189     15.900     375.59     75.358     53.966

#1              .00005    -.00013     .00062    -.00121    -.00029     .00935     .00047     .00021
#2              .00007    -.00005     .00047    -.00268    -.00039    -.00697     .00039     .00008
#3              .00009     .00018     .00046    -.00156    -.00037     .00430     .00004     .00010

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem                Ni          K         Se         Ag         Na         Tl          V         Zn
Units             mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg             .00015     .00179    -.00035     .00006    -.00234    -.00108     .00004     .00125
Stddev          .00005     .00892     .00061     .00022     .00231     .00059     .00013     .00008
%RSD            31.489     498.59     171.83     377.27     98.576     54.761     367.53     6.2648

#1              .00010     .01183    -.00083     .00020    -.00410    -.00051     .00018     .00133
#2              .00015    -.00123     .00033     .00017    -.00320    -.00103    -.00006     .00125
#3              .00020    -.00523    -.00056    -.00019     .00027    -.00170    -.00002     .00118

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit
```

```
Sample Name: CCB10      Acquired: 10/16/2008 0:39:31      Type: QC
Method: 08J6010b(v10)     Mode: CONC     Corr. Factor: 1.000000
User: admin      Data File: ID8J017112  Type:          Diln Factor:
Comment:

Int. Std.     Sc2273_A Sc3613_R Sc3645_A
Units             Cts/S    Cts/S    Cts/S
Avg              6165.3  117710.  162000.
Stddev              8.1     864.     281.
%RSD             .13182   .73372   .17375

#1               6160.4  116740.  161710.
#2               6174.7  118380.  162020.
#3               6160.8  118010.  162270.
```

```
Sample Name: J095-03      Acquired: 10/16/2008 0:44:37      Type: Unk
Method: 08J6010b(v10)     Mode: CONC     Corr. Factor: 1.000000
User: admin      Data File: ID8J017113  Type:          Diln Factor:
Comment:

Elem              Al       Sb       As       Ba       Be        B       Cd       Ca
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           114.00   .21171   .05201   .47080   .00353   .02230   .00619   12.783
Stddev           .68   .00053   .00187   .00313   .00006   .00145   .00013     .026
%RSD          .60065   .25008   3.6042   .66459   1.5665   6.5018   2.0977   .20317

#1            113.95   .21206   .05417   .47425   .00351   .02260   .00604   12.754
#2            114.71   .21110   .05078   .47000   .00359   .02358   .00624   12.793
#3            113.34   .21198   .05109   .46815   .00348   .02072   .00628   12.802

Elem              Cr       Co       Cu       Fe       Pb       Mg       Mn       Mo
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           .29813   .09555   1.3132   146.37   14.135   5.4257   6.1764   .00857
Stddev        .00045   .00039    .0019      .29     .055    .0312    .0183   .00013
%RSD          .15051   .41219   .14494   .19528   .39059   .57405   .29679   1.4668

#1            .29803   .09515   1.3137   146.44   14.074   5.3930   6.1970   .00853
#2            .29862   .09557   1.3148   146.06   14.149   5.4291   6.1617   .00871
#3            .29774   .09594   1.3111   146.62   14.182   5.4550   6.1706   .00847

Elem              Ni        K       Se       Ag       Na       Tl        V       Zn
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           .05057   5.3224   .00775   .00113   .31261   .00371   .37070   .36179
Stddev        .00028    .0392   .00054   .00010   .00228   .00063   .00054   .00101
%RSD          .55431   .73611   6.9108   8.5751   .72954   17.070   .14686   .28019

#1            .05077   5.3667   .00725   .00103   .31155   .00400   .37084   .36070
#2            .05025   5.2924   .00770   .00123   .31523   .00298   .37009   .36271
#3            .05069   5.3081   .00832   .00112   .31106   .00415   .37115   .36195

Int. Std.   Sc2273_A Sc3613_R Sc3645_A
Units          Cts/S    Cts/S    Cts/S
Avg           5452.1  119510.  158050.
Stddev          29.1     501.     627.
%RSD          .53394   .41916   .39684

#1            5478.7  118960.  157400.
#2            5456.6  119650.  158110.
#3            5421.0  119930.  158650.
```

```
Sample Name: J095-04      Acquired: 10/16/2008 0:49:41      Type: Unk
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017114   Type:           Diln Factor:
Comment:

Elem                 Al         Sb         As         Ba         Be          B         Cd         Ca
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg              105.86     .04003     .04080     .45506     .00165     .01937     .00384     4.9805
Stddev              .43     .00146     .00082     .00323     .00005     .00052     .00018      .0169
%RSD             .40840     3.6599     1.9976     .70903     2.9883     2.7105     4.6034     .34020

#1               105.57     .03975     .04022     .45299     .00162     .01941     .00370     4.9619
#2               105.65     .04161     .04045     .45341     .00170     .01882     .00378     4.9844
#3               106.35     .03872     .04173     .45878     .00161     .01987     .00404     4.9951

Elem                 Cr         Co         Cu         Fe         Pb         Mg         Mn         Mo
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg              .29392     .06713     .27386     128.23     3.5783     4.2861     3.7459     .00629
Stddev           .00106     .00029     .00046        .48      .0151      .0140      .0247     .00027
%RSD             .35896     .43367     .16617     .37247     .42300     .32717     .65837     4.3448

#1               .29270     .06685     .27345     127.68     3.5644     4.2883     3.7279     .00633
#2               .29461     .06743     .27378     128.42     3.5759     4.2712     3.7359     .00599
#3               .29444     .06710     .27435     128.57     3.5944     4.2990     3.7740     .00654

Elem                 Ni          K         Se         Ag         Na         Tl          V         Zn
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg              .04285     4.5334     .00647    -.00123     .17941    -.00065     .32233     .20977
Stddev           .00029      .0135     .00131     .00010     .00455     .00165     .00114     .00036
%RSD             .67812     .29838     20.198     8.0110     2.5354     254.48     .35245     .17350

#1               .04274     4.5328     .00560    -.00134     .17593     .00111     .32102     .20983
#2               .04263     4.5202     .00797    -.00116     .17774    -.00218     .32299     .20939
#3               .04318     4.5473     .00583    -.00119     .18455    -.00087     .32298     .21011

Int. Std.     Sc2273_A  Sc3613_R  Sc3645_A
Units            Cts/S      Cts/S      Cts/S
Avg             5451.4    119490.    160000.
Stddev            32.8       615.       106.
%RSD            .60208     .51457     .06596

#1              5471.3    118800.    159950.
#2              5469.3    119650.    160130.
#3              5413.5    120000.    159940.
```

```
Sample Name: J095-05     Acquired: 10/16/2008 0:54:45     Type: Unk
Method: 08J6010b(v10)    Mode: CONC     Corr. Factor: 1.000000
User: admin      Data File: ID8J017115   Type:        Diln Factor:
Comment:

Elem              Al        Sb        As        Ba        Be         B        Cd        Ca
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           143.79    .00889    .04022    .66219    .00174    .02425    .00474    8.6479
Stddev           .95    .00079    .00180    .00210    .00004    .00057    .00005     .0038
%RSD          .66203    8.8692    4.4666    .31739    2.1776    2.3647    1.0846    .04344

#1            144.89    .00869    .03824    .65987    .00178    .02481    .00468    8.6436
#2            143.30    .00976    .04066    .66271    .00171    .02367    .00478    8.6503
#3            143.18    .00822    .04175    .66397    .00172    .02426    .00475    8.6498

Elem              Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .18767    .04924    .07451    163.92    .23859    6.1969    3.7203    .00584
Stddev        .00053    .00053    .00018       .10    .00213     .0307     .0126    .00020
%RSD          .28008    1.0823    .23834    .06224    .89068    .49600    .33887    3.3778

#1            .18827    .04904    .07471    163.95    .23812    6.2248    3.7072    .00585
#2            .18731    .04884    .07438    164.01    .24091    6.1640    3.7324    .00603
#3            .18743    .04984    .07444    163.81    .23673    6.2019    3.7213    .00564

Elem              Ni         K        Se        Ag        Na        Tl         V        Zn
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .05582    6.3448    .00725   -.00221    .18550   -.00081    .39448    .19362
Stddev        .00030     .0354    .00048    .00017    .00382    .00149    .00034    .00076
%RSD          .54294    .55832    6.6272    7.7646    2.0600    183.69    .08563    .39371

#1            .05551    6.3209    .00687   -.00232    .18115   -.00253    .39484    .19337
#2            .05612    6.3855    .00779   -.00229    .18703    .00001    .39446    .19448
#3            .05582    6.3281    .00710   -.00201    .18833    .00009    .39416    .19302

Int. Std.   Sc2273_A  Sc3613_R  Sc3645_A
Units          Cts/S     Cts/S     Cts/S
Avg           5256.7   116470.   155460.
Stddev          11.0     1146.      762.
%RSD          .21015    .98367    .49037

#1            5268.4   115310.   154600.
#2            5255.3   116500.   155710.
#3            5246.5   117600.   156060.
```

```
Sample Name: J095-06      Acquired: 10/16/2008 0:59:48      Type: Unk
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017116   Type:          Diln Factor:
Comment:

Elem               Al         Sb         As         Ba         Be          B         Cd         Ca
Units            mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg            122.50     .02720     .03536     .57878     .00189     .02672     .00434     8.4645
Stddev           1.30     .00135     .00121     .00246     .00001     .00048     .00023      .0093
%RSD           1.0642     4.9767     3.4192     .42527     .75360     1.7975     5.3333     .10973

#1             121.72     .02779     .03406     .58162     .00188     .02717     .00421     8.4697
#2             121.77     .02816     .03559     .57732     .00188     .02677     .00420     8.4538
#3             124.00     .02565     .03644     .57740     .00191     .02621     .00461     8.4701

Elem               Cr         Co         Cu         Fe         Pb         Mg         Mn         Mo
Units            mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg            .17842     .04678     .40774     150.47     2.8728     6.3648     2.9302     .00435
Stddev         .00042     .00050     .00036        .69      .0152      .0188      .0064     .00022
%RSD           .23607     1.0589     .08783     .46007     .53024     .29583     .21879     4.9898

#1             .17803     .04623     .40733     149.68     2.8599     6.3844     2.9369     .00423
#2             .17887     .04691     .40791     150.80     2.8688     6.3469     2.9241     .00423
#3             .17835     .04720     .40798     150.94     2.8896     6.3629     2.9296     .00460

Elem               Ni          K         Se         Ag         Na         Tl          V         Zn
Units            mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg            .05665     5.6514     .00728    -.00213     .19092    -.00106     .35770     .28205
Stddev         .00047      .0294     .00197     .00016     .00087     .00073     .00119     .00112
%RSD           .83263     .52075     27.067     7.6741     .45512     69.206     .33348     .39666

#1             .05626     5.6847     .00536    -.00206     .19129    -.00184     .35650     .28125
#2             .05650     5.6287     .00930    -.00201     .19155    -.00039     .35771     .28157
#3             .05717     5.6410     .00718    -.00231     .18993    -.00094     .35889     .28333

Int. Std.   Sc2273_A  Sc3613_R  Sc3645_A
Units           Cts/S      Cts/S      Cts/S
Avg            5515.4    118900.    161420.
Stddev           31.9      1177.       442.
%RSD           .57890     .98953     .27359

#1             5532.4    117540.    161220.
#2             5535.2    119540.    161120.
#3             5478.5    119620.    161930.
```

```
Sample Name: J095-07      Acquired: 10/16/2008 1:04:51      Type: Unk
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin      Data File: ID8J017117   Type:          Diln Factor:
Comment:

Elem              Al        Sb        As        Ba        Be         B        Cd        Ca
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           99.105    .08133    .03534    .69454    .00125    .02451    .00308    10.405
Stddev         1.178    .00074    .00204    .00216    .00006    .00101    .00010      .011
%RSD          1.1886    .91038    5.7789    .31154    4.7212    4.1348    3.1008    .10546

#1            100.34    .08063    .03425    .69701    .00123    .02446    .00304    10.393
#2            97.997    .08211    .03406    .69359    .00132    .02554    .00301    10.408
#3            98.975    .08124    .03769    .69301    .00121    .02352    .00319    10.415

Elem              Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .15242    .04566    .30794    113.07    3.6919    5.5905    4.2220    .00471
Stddev        .00060    .00010    .00089       .26     .0178     .0239     .0085    .00007
%RSD          .39332    .22435    .29000    .22743    .48174    .42732    .20035    1.5561

#1            .15177    .04558    .30782    112.85    3.7028    5.5700    4.2311    .00463
#2            .15295    .04562    .30889    113.02    3.6714    5.5848    4.2144    .00476
#3            .15255    .04578    .30712    113.35    3.7016    5.6168    4.2205    .00474

Elem              Ni         K        Se        Ag        Na        Tl         V        Zn
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .04769    6.7626    .00546   -.00161    .17534   -.00029    .28068    .22270
Stddev        .00024     .0188    .00041    .00011    .00203    .00064    .00015    .00047
%RSD          .50629    .27784    7.4254    7.0397    1.1574    219.83    .05227    .20960

#1            .04795    6.7728    .00592   -.00173    .17455   -.00102    .28068    .22317
#2            .04764    6.7741    .00515   -.00151    .17765    .00014    .28054    .22223
#3            .04748    6.7409    .00530   -.00158    .17382    .00002    .28084    .22269

Int. Std.  Sc2273_A  Sc3613_R  Sc3645_A
Units          Cts/S     Cts/S     Cts/S
Avg           5585.2   116580.   162300.
Stddev          34.0     1077.      492.
%RSD          .60959    .92380    .30308

#1            5569.8   115430.   161900.
#2            5624.2   116760.   162160.
#3            5561.5   117560.   162850.
```

```
Sample Name: J095-08      Acquired: 10/16/2008 1:09:54      Type: Unk
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin       Data File: ID8J017118  Type:          Diln Factor:
Comment:

Elem              Al        Sb        As        Ba        Be         B        Cd        Ca
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           105.80    .00699    .05583    1.3983    .00354    .07131    .01724    296.17
Stddev           .67    .00101    .00360     .0059    .00009    .00073    .00020      2.54
%RSD          .63221    14.467    6.4487    .42367    2.6410    1.0210    1.1410    .85773

#1            106.35    .00677    .05416    1.3955    .00360    .07127    .01746    293.24
#2            105.05    .00610    .05337    1.4051    .00359    .07206    .01707    297.59
#3            105.99    .00809    .05996    1.3943    .00343    .07061    .01719    297.69

Elem              Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .14256    .08279    4.3233    163.27    .44128    96.908    4.5430    .00516
Stddev        .00015    .00019     .0078       .34    .00058      .573     .0240    .00005
%RSD          .10350    .22978    .17977    .20648    .13085    .59103    .52839    .89112

#1            .14239    .08263    4.3265    163.42    .44189    96.395    4.5211    .00519
#2            .14263    .08275    4.3144    162.88    .44120    96.802    4.5687    .00511
#3            .14266    .08300    4.3289    163.50    .44074    97.526    4.5391    .00519

Elem              Ni         K        Se        Ag        Na        Tl         V        Zn
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .12292    11.309    .00539   -.00111    .60646    .00055    .23634    6.9459
Stddev        .00025      .075    .00081    .00014    .00215    .00034    .00044     .0162
%RSD          .20501    .66653    15.097    12.691    .35488    61.861    .18589    .23360

#1            .12296    11.247    .00506   -.00121    .60820    .00082    .23676    6.9555
#2            .12265    11.393    .00631   -.00117    .60712    .00067    .23588    6.9550
#3            .12315    11.286    .00479   -.00095    .60405    .00017    .23638    6.9271

Int. Std.  Sc2273_A  Sc3613_R  Sc3645_A
Units         Cts/S     Cts/S     Cts/S
Avg          4999.4   118410.   151030.
Stddev         10.6      378.      766.
%RSD         .21174    .31955    .50722

#1           4988.0   118090.   150150.
#2           5001.1   118310.   151380.
#3           5009.0   118830.   151560.
```

```
Sample Name: J095-09M     Acquired: 10/16/2008 1:15:05     Type: Unk
Method: 08J6010b(v10)     Mode: CONC     Corr. Factor: 1.000000
User: admin       Data File: ID8J017119   Type:        Diln Factor:
Comment:

Elem             Al       Sb       As       Ba       Be        B       Cd       Ca
Units          mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg          103.19   2.1164   .91712   1.8077   .81596   .76157   .92422   48.720
Stddev          .93    .0051   .00213    .0011   .00032   .00214   .00188     .044
%RSD         .90010   .23911   .23205   .06165   .03864   .28150   .20303   .08955

#1           102.14   2.1111   .91958   1.8074   .81631   .76236   .92624   48.675
#2           103.56   2.1169   .91587   1.8067   .81569   .75914   .92252   48.722
#3           103.88   2.1211   .91591   1.8089   .81589   .76320   .92390   48.762

Elem             Cr       Co       Cu       Fe       Pb       Mg       Mn       Mo
Units          mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg          .93654   1.0087   .98324   163.65   .97969   49.192   5.6969   .95691
Stddev       .00198    .0020   .00190      .46   .00176     .024    .0125   .00178
%RSD         .21147   .19976   .19366   .28222   .17944   .04974   .21917   .18550

#1           .93462   1.0099   .98544   163.20   .98163   49.220   5.6866   .95678
#2           .93642   1.0064   .98227   163.63   .97822   49.185   5.6934   .95520
#3           .93857   1.0099   .98203   164.13   .97921   49.172   5.7108   .95874

Elem             Ni        K       Se       Ag       Na       Tl        V       Zn
Units          mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg          1.0378   52.108   .85772   .85249   46.382   .82189   1.0101   1.5262
Stddev        .0020     .100   .00171   .00092     .029   .00182    .0021    .0060
%RSD         .19581   .19183   .19984   .10791   .06233   .22161   .20498   .39200

#1           1.0382   52.012   .85935   .85319   46.371   .82075   1.0091   1.5320
#2           1.0357   52.100   .85788   .85284   46.361   .82092   1.0087   1.5267
#3           1.0397   52.212   .85593   .85145   46.415   .82399   1.0125   1.5200

Int. Std.   Sc2273_A Sc3613_R Sc3645_A
Units         Cts/S    Cts/S    Cts/S
Avg          5355.2  120980.  158510.
Stddev         20.2     849.     514.
%RSD         .37657   .70179   .32457

#1           5343.9  120000.  157940.
#2           5378.5  121400.  158650.
#3           5343.2  121520.  158940.
```

```
Sample Name: J095-09S     Acquired: 10/16/2008 1:20:03     Type: Unk
Method: 08J6010b(v10)     Mode: CONC     Corr. Factor: 1.000000
User: admin       Data File: ID8J017120   Type:          Diln Factor:
Comment:

Elem           Al        Sb        As        Ba        Be         B        Cd        Ca
Units        mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg        106.88    2.1838    .94339    1.8693    .84191    .78699    .95795    50.213
Stddev        .53     .0029    .00180     .0062    .00138    .00163    .00441      .046
%RSD       .49491    .13056    .19108    .32983    .16426    .20657    .46037    .09079

#1         106.30    2.1847    .94547    1.8650    .84113    .78879    .95304    50.160
#2         107.33    2.1806    .94226    1.8764    .84109    .78564    .96158    50.236
#3         107.02    2.1861    .94244    1.8666    .84350    .78653    .95923    50.242

Elem           Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units        mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg        .96398    1.0460    1.0080    167.50    1.0143    50.864    5.9097    .99225
Stddev     .00044     .0041     .0022       .19     .0067      .100     .0222    .00645
%RSD       .04544    .39031    .21898    .11205    .65709    .19735    .37538    .65027

#1         .96358    1.0413    1.0105    167.68    1.0069    50.749    5.8861    .98483
#2         .96391    1.0491    1.0069    167.53    1.0197    50.907    5.9302    .99536
#3         .96445    1.0474    1.0066    167.31    1.0163    50.935    5.9129    .99656

Elem           Ni         K        Se        Ag        Na        Tl         V        Zn
Units        mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg        1.0749    53.905    .88311    .87796    47.961    .84856    1.0370    1.5790
Stddev      .0037      .134    .00222    .00155      .137    .00218     .0017     .0086
%RSD       .34858    .24900    .25095    .17665    .28591    .25744    .16094    .54376

#1         1.0705    53.760    .88494    .87740    47.858    .84671    1.0389    1.5711
#2         1.0772    54.026    .88064    .87676    48.117    .85097    1.0365    1.5881
#3         1.0769    53.930    .88375    .87971    47.908    .84800    1.0356    1.5777

Int. Std.  Sc2273_A Sc3613_R Sc3645_A
Units        Cts/S     Cts/S     Cts/S
Avg        5149.3    117510.   154190.
Stddev       22.3      987.      515.
%RSD       .43279    .83995    .33378

#1         5174.8    116490.   153630.
#2         5139.1    117580.   154290.
#3         5133.9    118460.   154640.
```

```
Sample Name: J095-09      Acquired: 10/16/2008 1:24:59      Type: Unk
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin       Data File: ID8J017121   Type:          Diln Factor:
Comment:

Elem            Al        Sb        As        Ba        Be         B        Cd        Ca
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         82.298    .01285    .05257    1.0841    .00493    .02649    .00602    13.238
Stddev        .328    .00158    .00213     .0065    .00012    .00080    .00020      .014
%RSD        .39817    12.324    4.0432    .60025    2.5179    3.0161    3.3276    .10487

#1          81.957    .01399    .05110    1.0838    .00499    .02741    .00592    13.243
#2          82.610    .01351    .05501    1.0777    .00501    .02613    .00589    13.249
#3          82.327    .01104    .05160    1.0907    .00478    .02593    .00625    13.222

Elem            Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         .11478    .10586    .11394    170.16    .14630    12.117    6.3639    .00437
Stddev      .00027    .00021    .00051       .49    .00096      .024     .0307    .00008
%RSD        .23899    .19677    .45104    .28616    .65329    .19721    .48213    1.8278

#1          .11470    .10569    .11363    169.60    .14543    12.117    6.3674    .00438
#2          .11508    .10580    .11453    170.35    .14614    12.141    6.3316    .00429
#3          .11454    .10610    .11366    170.52    .14732    12.093    6.3927    .00445

Elem            Ni         K        Se        Ag        Na        Tl         V        Zn
Units         mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg         .11436    8.7203    .00594    .00012    .30400    .00383    .17222    .75155
Stddev      .00024     .0365    .00153    .00010    .00209    .00189    .00030    .00151
%RSD        .21027    .41897    25.778    85.316    .68802    49.409    .17337    .20138

#1          .11423    8.6870    .00458    .00006    .30299    .00518    .17189    .74992
#2          .11420    8.7146    .00564    .00024    .30640    .00463    .17245    .75184
#3          .11463    8.7594    .00760    .00006    .30260    .00167    .17233    .75291

Int. Std.   Sc2273_A Sc3613_R Sc3645_A
Units         Cts/S     Cts/S     Cts/S
Avg         5321.4   116730.   158080.
Stddev        16.2     1194.      445.
%RSD        .30436    1.0228    .28119

#1          5326.3   115350.   157640.
#2          5334.5   117370.   158060.
#3          5303.3   117460.   158530.
```

```
Sample Name: J095-10     Acquired: 10/16/2008 1:29:54     Type: Unk
Method: 08J6010b(v10)    Mode: CONC     Corr. Factor: 1.000000
User: admin       Data File: ID8J017122   Type:        Diln Factor:
Comment:

Elem              Al       Sb       As       Ba       Be        B       Cd       Ca
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           101.05   .01460   .03691   1.0837   .00463   .05533   .01485   259.22
Stddev           .61   .00109   .00048    .0084   .00005   .00050   .00008     2.72
%RSD          .59875   7.4928   1.2873   .78011   1.1631   .91233   .52226   1.0511

#1            101.73   .01339   .03645   1.0924   .00459   .05562   .01493   257.81
#2            100.88   .01552   .03688   1.0756   .00469   .05562   .01478   257.49
#3            100.55   .01489   .03740   1.0832   .00461   .05475   .01482   262.36

Elem              Cr       Co       Cu       Fe       Pb       Mg       Mn       Mo
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           .14018   .08556   3.1645   151.90   .40999   92.687   3.0068   .00295
Stddev        .00054   .00015    .0039      .55   .00059     .354    .0196   .00010
%RSD          .38484   .17668   .12250   .36514   .14309   .38201   .65287   3.4132

#1            .13976   .08550   3.1674   151.44   .41020   92.313   3.0230   .00294
#2            .13998   .08544   3.1601   151.74   .41045   92.731   2.9850   .00286
#3            .14079   .08573   3.1659   152.51   .40933   93.018   3.0123   .00306

Elem              Ni        K       Se       Ag       Na       Tl        V       Zn
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           .15612   9.8658   .00589   .00065   .53326   .00131   .19233   4.7314
Stddev        .00054    .0641   .00061   .00022   .00648   .00110   .00029    .0057
%RSD          .34866   .65004   10.364   33.353   1.2143   84.219   .14903   .12107

#1            .15617   9.9130   .00560   .00040   .52924   .00184   .19208   4.7329
#2            .15555   9.7928   .00659   .00080   .52980   .00204   .19227   4.7362
#3            .15664   9.8916   .00548   .00075   .54073   .00004   .19265   4.7251

Int. Std.  Sc2273_A Sc3613_R Sc3645_A
Units          Cts/S    Cts/S    Cts/S
Avg           5084.8  120170.  155950.
Stddev           6.1     950.     529.
%RSD          .12010   .79075   .33953

#1            5078.3  119090.  155390.
#2            5085.6  120850.  156000.
#3            5090.4  120580.  156450.
```

```
Sample Name: CCV11      Acquired: 10/16/2008 1:37:05      Type: QC
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017123  Type:          Diln Factor:
Comment:

Elem               Al        Sb        As        Ba        Be         B        Cd
Units            mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg            5.3364    .50639    .52605    .53660    .47706    .54838    .54966
Stddev          .0108    .00145    .00141    .00245    .00224    .00046    .00087
%RSD           .20277    .28558    .26799    .45678    .46971    .08399    .15749

#1             5.3352    .50640    .52687    .53937    .47485    .54886    .54914
#2             5.3262    .50494    .52442    .53569    .47933    .54834    .55066
#3             5.3477    .50784    .52685    .53473    .47701    .54794    .54917

Check ?      Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem               Ca        Cr        Co        Cu        Fe        Pb        Mg
Units            mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg            48.583    .48718    .53458    .50347    4.5136    .52565    46.770
Stddev           .089    .00060    .00143    .00093     .0171    .00118      .083
%RSD           .18412    .12367    .26742    .18566    .37999    .22399    .17837

#1             48.650    .48771    .53299    .50326    4.5143    .52499    46.678
#2             48.617    .48652    .53498    .50266    4.4961    .52701    46.842
#3             48.481    .48729    .53576    .50449    4.5304    .52495    46.789

Check ?      Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass  Chk Pass
Value
Range

Elem               Mn        Mo        Ni         K        Se        Ag        Na
Units            mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg            .49641  F .57474    .53484  F 55.742    .53308    .51231  F 56.296
Stddev         .00131    .00115    .00071      .301    .00135    .00049      .282
%RSD           .26359    .19989    .13364    .53919    .25261    .09520    .50136

#1             .49789    .57346    .53403    56.085    .53275    .51266    56.613
#2             .49594    .57508    .53538    55.615    .53193    .51175    56.201
#3             .49540    .57568    .53511    55.526    .53456    .51251    56.073

Check ?      Chk Pass  Chk Fail  Chk Pass  Chk Fail  Chk Pass  Chk Pass  Chk Fail
Value                    .50000              50.000                        50.000
Range                   10.000%             10.000%                       10.000%
```

```
Sample Name: CCV11      Acquired: 10/16/2008 1:37:05      Type: QC
Method: 08J6010b(v10)       Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017123   Type:            Diln Factor:
Comment:

Elem                     Tl          V          Zn
Units                  mg/L       mg/L        mg/L
Avg                  .48641     .49725    F .56213
Stddev               .00071     .00057      .00190
%RSD                 .14596     .11453      .33750

#1                   .48686     .49720      .56063
#2                   .48559     .49671      .56426
#3                   .48677     .49785      .56150

Check ?            Chk Pass   Chk Pass    Chk Fail
Value                                       .50000
Range                                      10.000%

Int. Std.         Sc2273_A   Sc3613_R    Sc3645_A
Units                Cts/S      Cts/S       Cts/S
Avg                 5312.0    111280.     151670.
Stddev                 8.5      1383.        455.
%RSD                .16074     1.2426      .29967

#1                  5321.6    109720.     151150.
#2                  5308.9    111760.     151910.
#3                  5305.4    112350.     151950.
```

```
Sample Name: CCB11        Acquired: 10/16/2008 1:41:54        Type: QC
Method: 08J6010b(v10)        Mode: CONC        Corr. Factor: 1.000000
User: admin        Data File: ID8J017124   Type:             Diln Factor:
Comment:

Elem                Al         Sb         As         Ba         Be          B         Cd         Ca
Units             mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg            -.00986     .00233     .00092     .00011     .00008     .00024     .00004     .09937
Stddev          .00016     .00038     .00184     .00007     .00001     .00005     .00005     .00221
%RSD            1.5921     16.495     200.07     64.024     15.144     19.944     131.44     2.2268

#1             -.00991     .00274     .00301     .00003     .00010     .00021     .00003     .10176
#2             -.00968     .00227     .00016     .00016     .00009     .00021     .00009     .09898
#3             -.00998     .00198    -.00042     .00014     .00007     .00029     .00000     .09738

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem                Cr         Co         Cu         Fe         Pb         Mg         Mn         Mo
Units             mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg             .00002    -.00006     .00058    -.00172     .00002     .00594     .00057     .00023
Stddev          .00004     .00005     .00025     .00082     .00028     .01231     .00017     .00009
%RSD            189.49     71.481     43.062     47.827     1270.6     207.16     30.396     40.167

#1              .00007    -.00011     .00083    -.00147     .00007    -.00700     .00077     .00019
#2             -.00001    -.00002     .00033    -.00106    -.00028     .01751     .00051     .00033
#3              .00000    -.00006     .00057    -.00264     .00027     .00732     .00044     .00016

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit

Elem                Ni          K         Se         Ag         Na         Tl          V         Zn
Units             mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg             .00003     .00736    -.00085    -.00021     .00046    -.00071     .00011     .00347
Stddev          .00008     .01199     .00013     .00016     .00783     .00055     .00004     .00004
%RSD            230.62     162.95     15.106     74.480     1691.0     77.203     36.656     1.2792

#1              .00004     .01707    -.00082    -.00006     .00781    -.00008     .00015     .00352
#2             -.00005    -.00604    -.00099    -.00038     .00136    -.00104     .00011     .00346
#3              .00011     .01105    -.00074    -.00020    -.00778    -.00102     .00007     .00344

Check ?       Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
High Limit
Low Limit
```

Sample Name: CCB11 Acquired: 10/16/2008 1:41:54 Type: QC
Method: 08J6010b(v10) Mode: CONC Corr. Factor: 1.000000
User: admin Data File: ID8J017124 Type: Diln Factor:
Comment:

Int. Std.	Sc2273_A	Sc3613_R	Sc3645_A
Units	Cts/S	Cts/S	Cts/S
Avg	**6055.3**	**113510.**	**160170.**
Stddev	12.5	717.	472.
%RSD	.20577	.63167	.29454
#1	6064.1	112680.	159660.
#2	6060.7	114010.	160590.
#3	6041.0	113820.	160270.

Sample Name: J095-11 Acquired: 10/16/2008 1:47:00 Type: Unk
Method: 08J6010b(v10) Mode: CONC Corr. Factor: 1.000000
User: admin Data File: ID8J017125 Type: Diln Factor:
Comment:

Elem	Al	Sb	As	Ba	Be	B	Cd	Ca
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**109.13**	**.01079**	**.07858**	**.44061**	**.00749**	**.05557**	**.00745**	**4.0203**
Stddev	1.77	.00062	.00136	.00103	.00004	.00166	.00031	.0085
%RSD	1.6221	5.7880	1.7319	.23271	.57654	2.9903	4.2145	.21035
#1	107.82	.01094	.07788	.44073	.00753	.05406	.00722	4.0298
#2	111.14	.01132	.07771	.44158	.00749	.05531	.00732	4.0138
#3	108.42	.01010	.08015	.43954	.00744	.05735	.00781	4.0173

Elem	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**.13411**	**.11070**	**.18906**	**227.50**	**1.8412**	**15.242**	**1.1650**	**.00558**
Stddev	.00040	.00013	.00087	.76	.0027	.030	.0046	.00013
%RSD	.29872	.11833	.46153	.33585	.14955	.19551	.39802	2.3096
#1	.13366	.11085	.18955	227.24	1.8399	15.220	1.1693	.00568
#2	.13427	.11064	.18957	228.36	1.8393	15.276	1.1656	.00544
#3	.13441	.11061	.18805	226.89	1.8444	15.230	1.1601	.00564

Elem	Ni	K	Se	Ag	Na	Tl	V	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**.22673**	**13.356**	**.01114**	**-.00009**	**.44381**	**.00191**	**.19530**	**.63161**
Stddev	.00094	.060	.00040	.00024	.00299	.00045	.00074	.00088
%RSD	.41538	.45206	3.5736	279.53	.67464	23.411	.38046	.13907
#1	.22569	13.423	.01105	-.00007	.44165	.00235	.19504	.63256
#2	.22696	13.338	.01157	.00015	.44723	.00190	.19614	.63083
#3	.22753	13.306	.01079	-.00033	.44255	.00146	.19473	.63145

Int. Std.	Sc2273_A	Sc3613_R	Sc3645_A
Units	Cts/S	Cts/S	Cts/S
Avg	**5467.6**	**120010.**	**161210.**
Stddev	12.0	1431.	698.
%RSD	.21894	1.1922	.43312
#1	5472.0	118480.	160660.
#2	5476.7	120230.	160980.
#3	5454.0	121320.	162000.

Sample Name: J095-12 Acquired: 10/16/2008 1:52:03 Type: Unk
Method: 08J6010b(v10) Mode: CONC Corr. Factor: 1.000000
User: admin Data File: ID8J017126 Type: Diln Factor:
Comment:

Elem	Al	Sb	As	Ba	Be	B	Cd	Ca
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**50.869**	**.00441**	**.06337**	**.29029**	**.00337**	**.02826**	**.00356**	**13.697**
Stddev	.314	.00064	.00101	.00055	.00008	.00043	.00015	.045
%RSD	.61811	14.582	1.5869	.18898	2.4924	1.5147	4.1805	.33042
#1	50.718	.00377	.06398	.29030	.00344	.02846	.00355	13.743
#2	50.659	.00439	.06392	.28974	.00328	.02777	.00341	13.694
#3	51.231	.00506	.06221	.29084	.00339	.02855	.00371	13.653

Elem	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**.06070**	**.05578**	**.12828**	**99.412**	**.66515**	**10.025**	**1.1029**	**.00326**
Stddev	.00006	.00049	.00044	.020	.00118	.046	.0033	.00013
%RSD	.09371	.87113	.34153	.01970	.17736	.45977	.29776	4.0227
#1	.06075	.05592	.12786	99.423	.66549	10.062	1.1061	.00315
#2	.06064	.05524	.12825	99.389	.66384	10.039	1.0996	.00340
#3	.06070	.05618	.12873	99.423	.66613	9.9732	1.1029	.00322

Elem	Ni	K	Se	Ag	Na	Tl	V	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**.10168**	**6.8044**	**.00404**	**-.00011**	**.18730**	**.00047**	**.08332**	**.33796**
Stddev	.00028	.0343	.00019	.00012	.00356	.00095	.00026	.00161
%RSD	.27225	.50404	4.5999	111.89	1.9010	202.61	.30748	.47641
#1	.10193	6.7997	.00423	-.00024	.18455	.00001	.08341	.33973
#2	.10138	6.8408	.00387	-.00003	.18603	-.00016	.08352	.33657
#3	.10173	6.7726	.00401	-.00005	.19132	.00156	.08303	.33759

Int. Std.	Sc2273_A	Sc3613_R	Sc3645_A
Units	Cts/S	Cts/S	Cts/S
Avg	**6579.3**	**142810.**	**191790.**
Stddev	41.0	1583.	290.
%RSD	.62278	1.1083	.15116
#1	6565.9	141260.	191480.
#2	6625.3	142760.	191820.
#3	6546.8	144420.	192060.

```
Sample Name: J095-13     Acquired: 10/16/2008 1:56:59     Type: Unk
Method: 08J6010b(v10)    Mode: CONC     Corr. Factor: 1.000000
User: admin      Data File: ID8J017127  Type:          Diln Factor:
Comment:

Elem                Al        Sb        As        Ba        Be         B        Cd        Ca
Units             mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg             134.44    .00992    .22925    .91074    .00836    .08664    .01369    231.69
Stddev            1.14    .00107    .00145    .00180    .00005    .00094    .00018      1.81
%RSD            .84553    10.792    .63416    .19771    .59249    1.0880    1.3314    .78142

#1              133.36    .01051    .22943    .90867    .00838    .08557    .01387    229.97
#2              134.34    .01057    .22772    .91165    .00839    .08699    .01350    233.58
#3              135.62    .00869    .23061    .91191    .00830    .08735    .01369    231.54

Elem                Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units             mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg             .15182    .08517    .25768    245.23    .72575    138.32    7.8722    .02634
Stddev          .00016    .00007    .00049       .72    .00463       .32     .0190    .00032
%RSD            .10236    .08717    .19153    .29237    .63844    .23249    .24146    1.2297

#1              .15168    .08524    .25802    245.17    .73110    138.06    7.8504    .02665
#2              .15180    .08509    .25712    244.54    .72327    138.68    7.8846    .02601
#3              .15199    .08517    .25791    245.97    .72289    138.23    7.8818    .02637

Elem                Ni         K        Se        Ag        Na        Tl         V        Zn
Units             mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg             .19188    17.727    .01111   -.00002    .45810    .00646    .30638    .78124
Stddev          .00084      .016    .00018    .00012    .00579    .00115    .00045    .00530
%RSD            .43538    .09279    1.6524    514.39    1.2640    17.768    .14732    .67804

#1              .19284    17.711    .01132   -.00015    .45264    .00597    .30635    .78617
#2              .19145    17.744    .01100    .00009    .46417    .00777    .30595    .78191
#3              .19134    17.727    .01102   -.00001    .45749    .00564    .30685    .77564

Int. Std.    Sc2273_A  Sc3613_R  Sc3645_A
Units            Cts/S     Cts/S     Cts/S
Avg             4700.7   115140.   147240.
Stddev            18.8      522.      237.
%RSD            .40012    .45369    .16128

#1              4680.8   114660.   146980.
#2              4718.2   115060.   147440.
#3              4703.0   115700.   147290.
```

```
Sample Name: J095-14      Acquired: 10/16/2008 2:02:12      Type: Unk
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin       Data File: ID8J017128   Type:          Diln Factor:
Comment:

Elem              Al       Sb       As       Ba       Be        B       Cd       Ca
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           95.655   .00688   .17762   .72586   .00549   .10040   .01034   676.13
Stddev          .270   .00094   .00202   .00404   .00003   .00069   .00009     3.13
%RSD          .28248   13.730   1.1377   .55623   .58256   .68776   .88263   .46317

#1            95.934   .00579   .17780   .73032   .00552   .09979   .01043   673.13
#2            95.395   .00743   .17955   .72482   .00546   .10115   .01034   679.38
#3            95.636   .00742   .17552   .72245   .00550   .10028   .01025   675.89

Elem              Cr       Co       Cu       Fe       Pb       Mg       Mn       Mo
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           .07694   .04675   2.5547   120.61   1.2346   421.23   8.8821   .02196
Stddev        .00048   .00028    .0067      .36    .0030     1.40    .0169   .00028
%RSD          .62377   .59716   .26064   .29690   .24232   .33348   .19031   1.2599

#1            .07674   .04668   2.5574   120.80   1.2379   419.95   8.9016   .02223
#2            .07660   .04706   2.5472   120.19   1.2338   420.99   8.8726   .02197
#3            .07749   .04652   2.5597   120.83   1.2321   422.73   8.8721   .02168

Elem              Ni        K       Se       Ag       Na       Tl        V       Zn
Units           mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L     mg/L
Avg           .12005   12.186   .00732   .00039   .89490   .00510   .19340   1.2307
Stddev        .00027     .043   .00208   .00005   .00397   .00115   .00084    .0078
%RSD          .22842   .35250   28.380   13.478   .44317   22.558   .43365   .63312

#1            .12026   12.235   .00698   .00034   .89887   .00629   .19405   1.2389
#2            .12015   12.171   .00954   .00038   .89490   .00500   .19245   1.2298
#3            .11974   12.153   .00543   .00044   .89094   .00400   .19370   1.2234

Int. Std.  Sc2273_A Sc3613_R Sc3645_A
Units          Cts/S    Cts/S    Cts/S
Avg           4099.3  106760.  132130.
Stddev          13.4     753.     270.
%RSD          .32691   .70565   .20408

#1            4084.2  105940.  131830.
#2            4109.7  106930.  132340.
#3            4103.9  107420.  132230.
```

```
Sample Name: J095-15     Acquired: 10/16/2008 2:07:15     Type: Unk
Method: 08J6010b(v10)    Mode: CONC     Corr. Factor: 1.000000
User: admin      Data File: ID8J017129  Type:         Diln Factor:
Comment:

Elem              Al        Sb        As        Ba        Be         B        Cd        Ca
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           166.70    .00959    .22464    .95371    .01045    .06804    .01287    113.33
Stddev           .16    .00139    .00288    .00306    .00010    .00090    .00018       .13
%RSD          .09684    14.462    1.2834    .32107    .97030    1.3220    1.3834    .11764

#1            166.77    .00828    .22536    .95537    .01055    .06721    .01277    113.23
#2            166.83    .01105    .22710    .95559    .01044    .06899    .01278    113.27
#3            166.52    .00945    .22147    .95018    .01035    .06793    .01308    113.48

Elem              Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .15329    .09091    .23495    240.73    .71503    70.171    5.9550    .01572
Stddev        .00021    .00022    .00019       .42    .00053      .205     .0082    .00014
%RSD          .13528    .24168    .08043    .17288    .07369    .29172    .13790    .89107

#1            .15305    .09074    .23480    240.29    .71562    69.957    5.9533    .01556
#2            .15340    .09082    .23489    241.12    .71487    70.191    5.9640    .01579
#3            .15343    .09116    .23516    240.76    .71461    70.365    5.9478    .01582

Elem              Ni         K        Se        Ag        Na        Tl         V        Zn
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .17839    20.128    .00779   -.00063    .37714    .00336    .33750    .77771
Stddev        .00054      .085    .00319    .00016    .00632    .00156    .00070    .00209
%RSD          .30113    .42007    40.994    24.674    1.6745    46.513    .20880    .26916

#1            .17800    20.216    .00979   -.00046    .38442    .00516    .33672    .77846
#2            .17900    20.120    .00946   -.00077    .37310    .00237    .33770    .77933
#3            .17816    20.048    .00411   -.00067    .37391    .00255    .33808    .77535

Int. Std.   Sc2273_A  Sc3613_R  Sc3645_A
Units          Cts/S     Cts/S     Cts/S
Avg           4838.9   113520.   149960.
Stddev           4.2      583.      466.
%RSD          .08715    .51336    .31103

#1            4834.9   112850.   149510.
#2            4838.5   113770.   149940.
#3            4843.3   113930.   150440.
```

```
Sample Name: J095-16      Acquired: 10/16/2008 2:12:19      Type: Unk
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017130   Type:         Diln Factor:
Comment:

Elem              Al        Sb        As        Ba        Be         B        Cd        Ca
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           171.63    .01017    .37855    .95259    .01016    .08251    .01453    200.73
Stddev          1.32    .00155    .00263    .00229    .00006    .00127    .00020       .56
%RSD          .77151    15.271    .69569    .24037    .57447    1.5376    1.3605    .27759

#1            172.21    .01192    .37659    .95135    .01022    .08152    .01431    200.44
#2            172.56    .00965    .37752    .95523    .01014    .08206    .01460    201.37
#3            170.11    .00895    .38155    .95118    .01011    .08394    .01469    200.38

Elem              Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .15987    .11831    .27344    255.68    1.0643    121.03    8.5972    .03046
Stddev        .00018    .00043    .00054       .31     .0022       .13     .0194    .00008
%RSD          .11214    .35983    .19787    .11968    .20968    .10919    .22612    .27137

#1            .15968    .11801    .27403    255.36    1.0617    120.99    8.5785    .03038
#2            .16004    .11814    .27332    255.98    1.0656    121.18    8.6173    .03046
#3            .15988    .11880    .27296    255.69    1.0656    120.92    8.5957    .03054

Elem              Ni         K        Se        Ag        Na        Tl         V        Zn
Units           mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg           .19982    18.883    .01025   -.00020    .38686    .00678    .35466    1.2007
Stddev        .00063      .046    .00116    .00024    .00569    .00300    .00028     .0044
%RSD          .31347    .24308    11.298    120.03    1.4696    44.174    .07840    .36690

#1            .19914    18.834    .01157   -.00039    .38841    .01023    .35458    1.1985
#2            .20038    18.925    .00977    .00007    .39162    .00532    .35497    1.2058
#3            .19995    18.891    .00941   -.00026    .38057    .00479    .35443    1.1978

Int. Std.   Sc2273_A  Sc3613_R  Sc3645_A
Units          Cts/S     Cts/S     Cts/S
Avg           4892.0   114020.   151590.
Stddev          13.9      661.      452.
%RSD          .28386    .57955    .29815

#1            4907.8   113390.   151120.
#2            4886.7   113960.   151630.
#3            4881.6   114710.   152020.
```

```
Sample Name: J095-17     Acquired: 10/16/2008 2:17:31     Type: Unk
Method: 08J6010b(v10)    Mode: CONC     Corr. Factor: 1.000000
User: admin       Data File: ID8J017131   Type:          Diln Factor:
Comment:

Elem               Al        Sb        As        Ba        Be         B        Cd        Ca
Units            mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg            99.975    .00511    .28386    .55866    .00564    .03838    .00910    488.44
Stddev           .452    .00091    .00082    .00097    .00004    .00048    .00015      2.58
%RSD           .45171    17.821    .28902    .17383    .72062    1.2517    1.5994    .52872

#1             100.43    .00406    .28419    .55822    .00566    .03836    .00920    486.45
#2             99.959    .00553    .28447    .55977    .00559    .03791    .00894    491.36
#3             99.532    .00573    .28293    .55798    .00567    .03887    .00918    487.50

Elem               Cr        Co        Cu        Fe        Pb        Mg        Mn        Mo
Units            mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg            .11654    .07913    .23080    179.80    .39557    306.54    4.6176    .02049
Stddev         .00014    .00065    .00035       .23    .00219       .44     .0043    .00019
%RSD           .12144    .82600    .14998    .12644    .55433    .14344    .09421    .94126

#1             .11660    .07974    .23047    180.06    .39668    306.04    4.6214    .02071
#2             .11638    .07844    .23116    179.63    .39698    306.71    4.6184    .02038
#3             .11665    .07920    .23078    179.72    .39304    306.87    4.6128    .02037

Elem               Ni         K        Se        Ag        Na        Tl         V        Zn
Units            mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L      mg/L
Avg            .10144    10.160    .00539   -.00049    .82972    .00294    .22800    .41094
Stddev         .00008      .019    .00153    .00014    .00366    .00147    .00059    .00130
%RSD           .08152    .19042    28.386    28.358    .44157    50.080    .25666    .31592

#1             .10145    10.178    .00628   -.00041    .82558    .00252    .22864    .41157
#2             .10151    10.139    .00627   -.00041    .83105    .00457    .22750    .41181
#3             .10135    10.163    .00362   -.00065    .83253    .00172    .22786    .40945

Int. Std.   Sc2273_A Sc3613_R Sc3645_A
Units           Cts/S     Cts/S     Cts/S
Avg            4590.3   112600.   142690.
Stddev            9.2     1122.      262.
%RSD           .20129    .99609    .18375

#1             4586.7   111430.   142390.
#2             4600.8   112700.   142870.
#3             4583.4   113670.   142810.
```

```
Sample Name: CCV12       Acquired: 10/16/2008 2:24:43      Type: QC
Method: 08J6010b(v10)      Mode: CONC      Corr. Factor: 1.000000
User: admin        Data File: ID8J017132   Type:          Diln Factor:
Comment:

Elem                 Al         Sb         As         Ba         Be          B         Cd
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg              5.4422     .50681     .52252     .52935     .49469     .54308     .54000
Stddev            .0242     .00158     .00011     .00139     .00051     .00092     .00179
%RSD             .44369     .31122     .02191     .26203     .10383     .17022     .33149

#1               5.4675     .50803     .52260     .53081     .49522     .54391     .53872
#2               5.4397     .50503     .52239     .52918     .49466     .54326     .53922
#3               5.4195     .50737     .52257     .52805     .49419     .54208     .54204

Check ?        Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
Value
Range

Elem                 Ca         Cr         Co         Cu         Fe         Pb         Mg
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg              48.623     .47826     .52842     .51274     4.5188     .51476     47.863
Stddev             .077     .00065     .00120     .00176      .0131     .00100       .092
%RSD             .15802     .13642     .22627     .34312     .28932     .19488     .19184

#1               48.712     .47777     .52748     .51476     4.5161     .51383     47.959
#2               48.582     .47801     .52800     .51197     4.5073     .51461     47.853
#3               48.576     .47900     .52976     .51151     4.5331     .51582     47.776

Check ?        Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass   Chk Pass
Value
Range

Elem                 Mn         Mo         Ni          K         Se         Ag         Na
Units              mg/L       mg/L       mg/L       mg/L       mg/L       mg/L       mg/L
Avg              .50393   F .56448     .52741   F 55.565     .53319     .50874   F 55.895
Stddev           .00189     .00301     .00279       .192     .00100     .00058       .215
%RSD             .37591     .53401     .52874     .34515     .18781     .11308     .38517

#1               .50612     .56280     .52549     55.779     .53434     .50933     56.135
#2               .50280     .56269     .52613     55.509     .53250     .50818     55.830
#3               .50287     .56796     .53061     55.408     .53274     .50871     55.719

Check ?        Chk Pass   Chk Fail   Chk Pass   Chk Fail   Chk Pass   Chk Pass   Chk Fail
Value                       .50000                50.000                           50.000
Range                      10.000%               10.000%                          10.000%
```

```
Sample Name: CCV12      Acquired: 10/16/2008 2:24:43      Type: QC
Method: 08J6010b(v10)     Mode: CONC      Corr. Factor: 1.000000
User: admin      Data File: ID8J017132  Type:          Diln Factor:
Comment:

Elem               Tl          V         Zn
Units            mg/L       mg/L       mg/L
Avg            .48966     .49949     .52876
Stddev         .00309     .00059     .00109
%RSD           .63131     .11820     .20586

#1             .48914     .50017     .52752
#2             .48686     .49925     .52922
#3             .49298     .49907     .52954

Check ?      Chk Pass   Chk Pass   Chk Pass
Value
Range

Int. Std.   Sc2273_A  Sc3613_R  Sc3645_A
Units          Cts/S      Cts/S      Cts/S
Avg           5282.6    113790.    150750.
Stddev          18.6      1245.       497.
%RSD          .35284     1.0940     .32969

#1            5295.6    112400.    150200.
#2            5290.9    114160.    150890.
#3            5261.2    114800.    151160.
```

Sample Name: CCB12 Acquired: 10/16/2008 2:29:33 Type: QC
Method: 08J6010b(v10) Mode: CONC Corr. Factor: 1.000000
User: admin Data File: ID8J017133 Type: Diln Factor:
Comment:

Elem	Al	Sb	As	Ba	Be	B	Cd	Ca
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**-.00918**	**.00048**	**-.00069**	**.00009**	**.00012**	**.00029**	**.00004**	**.05309**
Stddev	.00093	.00042	.00089	.00003	.00004	.00010	.00004	.00557
%RSD	10.180	88.746	130.35	31.496	34.450	32.418	115.39	10.483
#1	-.00814	.00083	-.00025	.00012	.00017	.00027	.00002	.05938
#2	-.00947	.00059	-.00171	.00010	.00011	.00040	.00000	.05113
#3	-.00994	.00001	-.00009	.00006	.00009	.00021	.00008	.04878
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit								
Low Limit								

Elem	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**-.00002**	**-.00005**	**.00058**	**-.00115**	**-.00038**	**.00429**	**.00048**	**.00025**
Stddev	.00009	.00006	.00006	.00377	.00034	.00462	.00029	.00005
%RSD	546.81	117.60	9.7716	328.62	90.922	107.81	60.216	18.883
#1	.00006	-.00009	.00061	.00154	-.00055	.00942	.00059	.00020
#2	.00001	-.00009	.00051	.00048	-.00060	.00297	.00015	.00030
#3	-.00011	.00002	.00062	-.00546	.00002	.00047	.00069	.00024
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit								
Low Limit								

Elem	Ni	K	Se	Ag	Na	Tl	V	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Avg	**-.00013**	**.02718**	**-.00115**	**-.00008**	**.00998**	**-.00111**	**.00011**	**.00190**
Stddev	.00003	.02121	.00141	.00003	.00864	.00089	.00012	.00009
%RSD	24.660	78.036	122.94	35.486	86.516	80.201	114.31	4.7163
#1	-.00017	.03040	-.00032	-.00007	.01993	-.00073	.00025	.00199
#2	-.00011	.00454	-.00034	-.00010	.00438	-.00047	.00008	.00181
#3	-.00011	.04659	-.00278	-.00005	.00564	-.00212	.00000	.00190
Check ?	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass	Chk Pass
High Limit								
Low Limit								

Sample Name: CCB12 Acquired: 10/16/2008 2:29:33 Type: QC
Method: 08J6010b(v10) Mode: CONC Corr. Factor: 1.000000
User: admin Data File: ID8J017133 Type: Diln Factor:
Comment:

Int. Std.	Sc2273_A	Sc3613_R	Sc3645_A
Units	Cts/S	Cts/S	Cts/S
Avg	**5931.4**	**114910.**	**160500.**
Stddev	13.8	1219.	71.
%RSD	.23290	1.0609	.04427
#1	5916.3	113510.	160580.
#2	5943.4	115460.	160440.
#3	5934.6	115760.	160480.

EMAX LABORATORIES, INC.

DIGESTION LOG FOR ICP METALS

SOP ☐ EMAX-3005 Rev. No.4 ☐ EMAX-3010 Rev. No. 3 ☑ EMAX-3050 Rev. No. 3 ☐ EMAX-CLP-TAL ☐

Book # EIP-07

Matrix: SOIL Start Date: 10-10-08 Time: 14:00 Temp: 90 °C Ending Date: 10-10-08 Time: 18:00 Temp.: 90 °C

BATCH: IPJ021-S

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	IPJ021-SB					—	N/A	100		
02	-SL					—		100		
03	-SC					—		100		
04	J095-01					1.003		100		
05	-02					1.001		100		
06	-02M					1.003		100		
07	-02S					1.003		100		
08	-03					1.002		100		
09	-04					1.001		100		
10	-05					1.002		100		
11	-06					1.003		100		
12	-07					1.001		100		
13	-08					1.002		100		
14	-09					1.001		100		
15	-09M					1.001		100		
16	-09S					1.003		100		
17	-10					1.002		100		
18	-11					1.000		100		
19	-12					1.001		100		
20	-13					1.003		100		
21	-14					1.002		100		
22	-15					1.000		100		
23	-16					1.003		100		
24	-17					1.002		100		
25										
26		10-10-08 mc								
27										

Standards	ID	Amount Added (ml)
LCS -1	SM/A -11-55	1.0
LCS -2	SM/A -11-56	1.0
LCS -3	SM/A -11-57	1.0
MS		
Reagent	**Lot# / ID**	**Amount Added (ml)**
HNO$_3$	SW/A 03-773	10.0
HCl	SW/A -03-789	10.0
H$_2$O$_2$	SW/A -03-769	10.0
HNO3 (1:1)	SMS/B-02-87	10.0

Digestate Location ICP

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 the project

Prepared By: mc Standard Added By: mc

Witnessed By: TH Extracts Rcvd. By: TH 10/10/08

Checked By: TH

Date Disposed: Disposed by:

APPENDIX H

TECHNICAL PROJECT PLANNING MEETING MINUTES

URS

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
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
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 I

HISTORIAL RECORDS REVIEW
(Provided on enclosed CD)

APPENDIX J

MRSPP NOTIFICATION LETTER AND PUBLIC NOTICE

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

03/26/2009 10:23 AM

To <Geiger.William@epamail.epa.gov>, <jlcutler@deq.virginia.gov>
cc <jerome.redder@atk.com>, <nancy.e.flaherty@nab02.usace.army.mil>, <Sarah_Gettier@URSCorp.com>, "Meyer, Tom NAB02"
bcc
Subject MRSPP Notifications for RFAAP and Draft SSP MMRP Report Jan 2009 (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: FOUO

Will and Jim,

I just learned of an Army requirement for notification in re the scoring process associated with the Draft Stakeholder Site Screening Process Report, Military Munitions Response Program that we submitted January 30, 2009. The text of the notification is below and refers to our draft SSP report. Note per our February 18, 2009 meeting we/Army are in the process of implementing the recommendation/s from the draft SSP report so the stakeholders agreed to take this report out of EPA and DEQ review queue so you wouldn't have had the opportunity to comment on the scoring process. If EPA and/or DEQ wants to participate in the scoring process please let us know within 30 days. My understanding is this notification doesn't affect our path forward in continuing to implement the SSP recommendation/s. Finally note another part of this scoring process notification requirement is for the Army to publish a public notice. I working this separate action through the USAEC.

NOTIFICATION:

As a lead agency and in accordance with the 32 Code of Federal Regulations 179.5 requirements, Radford Army Ammunition Plant is providing this notification that a Military Munitions Response Program (MMRP) Site Screening Process (SSP) is being executed; this report is equivalent to a Site Inspection (SI). An MMRP site established during the SSP process will be evaluated and scored by applying the Munitions Response Site Prioritization Protocol (MRSPP). The MRSPP evaluation criteria includes assessing types of munitions which may be potentially present, assessing land uses, determining ease of access to the site, and quantifying the number of people with access to the Site.

The Site will be initially scored and presented in the Stakeholder Draft SSP Report. If you, or any applicable stakeholder, are interested in participating in the initial scoring process, a meeting can be setup. Please let us know within 30 days, if you are interested in participating in the scoring process. However, you may elect to simply review and provide input on the initial scores within the Stakeholder Draft SI Report. If requests for a scoring meeting and/or comments on the initial scores in the Stakeholder Draft SI Report are not received within 30 days of submittal this email, the scores will be considered final for the SSP phase. Scores can be modified or updated as additional information becomes available.

Should you have any questions regarding the SSP and the application of MRSPP, please do not hesitate to contact me.

Thanks,

Jim McKenna
Radford AAP
Classification: UNCLASSIFIED
Caveats: FOUO

The Roanoke Times
Roanoke, Virginia
Affidavit of Publication

New River Current

US ARMY ENVIRONMENTAL COMMAND
5179 HOADLEY ROAD, BLDG E
ABERDEEN PG MD 21010

REFERENCE: 80167556
11375226 Notice of Availabili

State of Virginia
City of Roanoke

I, (the undersigned) an authorized representative of the Times-World Corporation, which corporation is publisher of the Roanoke Times, a daily newspaper published in Roanoke, in the State of Virginia, do certify that the annexed notice was published in said newspapers on the following dates:

City/County of Roanoke, Commonwealth/State of Virginia. Sworn and subscribed before me this 24th day of Apr 2009. Witness my hand and official seal.

Judith L. Bennett Notary Public
My commission expires 10-31-2011.
228622

Over →

PUBLISHED ON: 04/17 04/19

TOTAL COST: 405.75
FILED ON: 04/22/09

Authorized
Signature: Billing Services Representative

Notice of Availability

Radford Army Ammunition Plant
Munitions Response Site Prioritization Protocol
Army Reserve Small Arms Range
Radford, Virginia

Taking into consideration various factors relating to safety and environmental hazard potential, the Radford Army Ammunition Plant intends to apply the Munitions Response Site Prioritization Protocol (MRSPP) at the following potential Military Munitions Response Program site: Army Reserve Small Arms Range. The Department of Defense (DoD) has conducted live-fire training and testing of weapon systems at active and former military installations throughout the United States to ensure force readiness and defend our nation. While the DoD has made great progress in addressing the potential hazards associated with former munitions-related activities, there remains work to be done. Through direction provided by Congress, the DoD has developed the MRSPP which assigns priorities to defense sites containing unexploded ordnance, discarded military munitions or munitions constituents.

The Army and Radford Army Ammunition Plant are in the process of completing a Site Inspection for the Site listed above and shall evaluate the Site by applying the MRSPP. The MRSPP evaluation criteria includes assessing types of munitions that may be potentially present, assessing land uses, determining ease of access to the site, and quantifying the number of people with access to the site. Information collected will be used to apply the MRSPP and will be made available for public review at the Montgomery-Floyd Library located at 125 Sheltman Street, Christiansburg, VA 24073 in accordance with the 32 CFR Part 179 requirements.

If you have or would like additional information about the Munitions Response Site or other potential Munitions Response Sites associated with Radford Army Ammunition Plant, please contact: Joy Case, Radford Army Ammunition Plant, Route 114, Peppers Ferry Road, Building 220, Attn: Joy Case, Radford, VA 24143, joy.case@us.army.mil, (540) 731-5762.

AD#11375226