US Army Corps of Engineers
Buffalo District
BUILDING STRONG®

Sampling and Analysis Plan
Volume 2 – Quality Assurance Project Plan
Final

Balance of Plant Operable Unit
Investigation to Refine the Extent of Soil Contamination
Niagara Falls Storage Site
Lewiston, New York

Formerly Utilized Sites Remedial Action Program
Contract No. W912QR-12-D-0023
Delivery Order No. DN02

U.S. Army Corps of Engineers (USACE)
Buffalo District
Buffalo, New York

Prepared by:
URS Group, Inc.

October 2013

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List of Acronyms and Abbreviations

Ac	Actinium
AEC	Atomic Energy Commission
APP	Accident Prevention Plan
ASTM	American Society for Testing Materials
B	Boron
BOP	Balance of Plant
°C	Degrees Celsius
CA	Corrective Action
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
Cl	Chloride
CLP	Contract Laboratory Program
COC	Chain-of-Custody
CQC	Contractor Quality Control
CRDL	Contract Requires Detection Limit
Cs	Cesium
CV	Calibration Verification
DoD	Department of Defense
DOE	Department of Energy
DNAPL	Dense Non-Aqueous Phase Liquid
DQI	Data Quality Indicators
DQO	Data Quality Objectives
ELAP	Environmental Laboratory Accreditation Program
EU	Exposure Units
F	Fluoride
FS	Feasibility Study
FSP	Field Sampling Plan
FUSRAP	Formerly Utilized Site Remedial Action Program
FWHM	Full Width Half Mass
GC	Gas chromatograph
GC/MS	Gas Chromatography/Mass Spectroscopy
GW	Groundwater
HASL	Health and Safety Laboratory
ICAL	Initial Calibration
ICP	Inductively Coupled Plasma
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IDQTF	Intergovernmental Data Quality Task Force
IDW	Investigation Derived Waste
IWCS	Interim Waste Containment Structure
K	Potassium
keV	Kilo-electron Volts
LCL	Lower Control Limit
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicates
LFB	Laboratory Fortified Blank
Li	Lithium

LIMS	Laboratory Information Management System
LOD	Limit of Detection
LOOW	Lake Ontario Ordnance Works
LOQ	Limit of Quantitation
LWBZ	Lower Water Bearing Zone
MARLAP	Multi-Agency Radiological Laboratory Analytical Protocols Manual
MD	Method Duplicate
MDA	Minimum Detected Activity
MDL	Method Detection Limit
MED/AEC	Manhattan Engineer District/Atomic Energy Commission
mg/Kg	Milligram per Kilogram
mg/L	Milligram per Liter
MPC	Measurement Performance Criteria
MS	Mass Spectroscopy or Matrix Spike
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAD	Normalized Absolute Difference
NAPL	Non-Aqueous Phase Liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NFSS	Niagara Falls Storage Site
NO_2	Nitrite
NO_3	Nitrate
NPL	National Priorities List
NUREG	U. S. Nuclear Regulatory Commission
NYSDOH	New York State Department of Health
OU	Operable Unit
o-PO_4	ortho-Phosphate
PAH	Polynuclear Aromatic Hydrocarbons
PAL	Performance Acceptance Limits
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity
PE	Performance Evaluation
pCi/g	Picocuries per gram
pCi/L	Picocuries per Liter
PQL	Practical Quantitation Limit
PQO	Project Quality Objectives
PSO	Project Safety Officer
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
QL	Quantitation Limit
QSM	Quality Systems Manual
Ra	Radium
RCRA	Resource Conservation Recovery Act
RER	Relative Error Ratio
RF	Response Factors
RI/FS	Remedial Investigation/Feasibility Study
RLs	Reporting limits
ROD	Record of Decision
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SIM	Selected Ion Monitoring

SO_4	Sulfate
SOP	Standard Operating Procedure
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compounds
TA	TestAmerica Laboratories, Inc.
TAL	Target Analyte List
TDS	Total Dissolved Solids
Th	Thorium
TOC	Total Organic Carbon
TCLP	Toxicity Characteristic Leaching Procedure
TSA	Technical System Audits
TSS	Total Suspended Solids
U	Uranium
UCL	Upper Control Limit
UFP	Uniform Federal Policy
ug/Kg	Microgram per Kilogram
ug/L	Microgram per Liter
URS	URS Group, Inc.
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Society
UWBZ	Upper Water Bearing Zone
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

This document presents the Quality Assurance Project Plan (*QAPP*) in support of the Balance of Plant (BOP) Operable Unit (OU) Investigation to Refine the Extent of Soil Contamination at the Niagara Falls Storage Site (NFSS or Site) in Lewiston, New York. This document was prepared by URS Group, Inc. (URS) for the United States Army Corps of Engineers (USACE) under the Formerly Utilized Sites Remedial Action Program (FUSRAP), as authorized in Contract No. W912QR-12-D-0023, Delivery Order No. DN02.

1.1 Purpose

The Intergovernmental Data Quality Task Force (IDQTF), which consists of representatives of the United States Environmental Protection Agency (USEPA), the Department of Defense (DoD), and the Department of Energy (DOE), established a single national consensus guidance for preparing QAPPs for environmental data collection efforts at federal facilities under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The NCP requires lead agents to develop Sampling and Analysis Plans (SAP) and QAPPs which provide a process for obtaining data of sufficient quality and quantity to satisfy data needs.

This *QAPP* is Volume II to the SAP (URS, 2013) and was prepared in accordance with the following IDQTF document:

- *Uniform Federal Policy Quality Assurance Project Plans (UFP-QAPP): Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs*, Final, Version 1, March 2005, (including March 2012 Part 2A Optimized Worksheets, Rev. 1).

The *QAPP* addresses the data quality objectives (DQO), analytical methodologies, specific quality assurance/quality control (QA/QC) activities, laboratory requirements, and data assessment activities designed to achieve the project quality objectives (PQO). This *QAPP*, in conjunction with the SAP, is required reading for all staff participating in the work associated with this field investigation, and shall be in the possession of the field teams collecting the types of samples outlined herein. All contractors and subcontractors shall be required to comply with the procedures documented in the *QAPP* and SAP in order to maintain comparability and representativeness of the collected and generated data.

Under FUSRAP, the USACE has authority to address the following categories of materials:

1. Radioactive contamination from past Manhattan Engineer District/U.S. Atomic Energy Commission (MED/AEC) activities, or
2. Other hazardous substances, pollutants, or contamination resulting from MED/AEC activities, or
3. Hazardous substances, pollutants or contamination unrelated to MED/AEC activities, but which are co-mingled with MED/AEC waste.

The NFSS is designated for inclusion under FUSRAP. This *QAPP* outlines the QA/QC methods for sample collection, analytical chemistry, and data management in support of the BOP OU Investigation to Refine the Extent of Soil Contamination. The purpose of the field investigation at the NFSS is to delineate the vertical and horizontal extent of contamination in surface and subsurface soils; remove one manhole; and investigate a concrete-incased sanitary sewer line for condition and presence of contamination. The data collected will support the BOP OU Feasibility Study (FS) by reducing the uncertainty of the estimated volume of soil that may require excavation. The planned investigation will involve the following activities:

- Advance 378 borings.
- Collect delineation soil samples from the following depth intervals:
  - 0 to 0.5 ft
  - 0.5 ft to 2 ft
  - 2 ft to 3 ft
- Collect trench excavation soil samples from side-walls.
- Field screen the soils for radioactivity and volatile organic vapors.
- Analyze the soil samples for select radionuclides and polynuclear aromatic hydrocarbons (PAHs).
- Collect groundwater samples (if encountered) from excavation trenches and analyze for select radionuclides (filtered) and inorganic parameters.
- Manage/sample/dispose of existing Investigation-Derived Waste (IDW) and IDW that will be generated during the field investigation.

1.2 Site Description, History and Background

The NFSS is located at 1397 Pletcher Road in the Town of Lewiston (Figure 1). The NFSS represents a portion of the Lake Ontario Ordnance Works (LOOW), a former trinitrotoluene (TNT) production plant which shut down in 1943. Portions of the LOOW site were used by the USACE Manhattan Engineer District (MED) and U.S. Atomic Energy Commission (AEC) to store radioactive residues and other materials beginning in 1944. Much of the radioactive residues sent to the NFSS originated from uranium processing activities conducted for MED and AEC at the Linde Air Products facility in Tonawanda, New York, the Mallinckrodt Chemical Works refinery in St. Louis, Missouri, and the Middlesex Sampling Plant in Middlesex, New Jersey.

Radiological constituents of concern at NFSS include isotopic uranium (U), isotopic thorium (Th), and radium (Ra)-226/228. Other constituents that occur on-site in lesser amounts include daughter products of the uranium series (Uranium-238 [U-238]) and, to some extent, the actinium (Ac) series (Uranium-235 [U-235]). Some volatile organic compound (VOC) contaminants are also present at the site.

Between 1982 and 1986, the US Department of Energy (USDOE) consolidated radioactive materials from a portion of the LOOW into a 10-acre Interim Waste Containment Structure (IWCS) on the NFSS (see Figure

2). The IWCS is an engineered landfill designed to retard radon emissions, infiltration from precipitation, and migration of contamination to groundwater.

During the development of the remedial investigation (RI), the NFSS was divided into 14 soil exposure units (EU) (see Figure 2 of FSP). An EU is defined as the geographic area in which a future receptor (for purposes of the baseline risk assessment) is assumed to work or live, and where a receptor may be exposed to site-related contaminants.

QAPP Worksheet #1
Title and Approval Page

Sampling and Analysis Plan, Volume 2: Quality Assurance Project Plan
Document Title

U.S. Army Corps of Engineers – Buffalo District
Lead Organization

[redacted] URS Group, Inc.
Preparer's Name and Organizational Affiliation

77 Goodell Street, Buffalo, New York 14203, (716) 856-5636, [redacted]
Preparer's Address, Telephone Number, and E-mail Address

16 October 2013
Preparation Date (Day/Month/Year)

[redacted]

Investigative Organization's Project Manager — **17 October 2013** Date
[redacted], URS Group, Inc.

[redacted]

Investigative Organization's Project Certified Health Physicist — **17 October 2013** Date
[redacted], PhD, PE, CHP, URS Group, Inc.

[redacted]

Investigative Organization's Project QA/QC Officer — **17 October 2013** Date
[redacted] PE, URS Group, Inc.

Lead Organization's Project Manager — Date
[redacted], CELRB-PM-F, USACE

QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project Name: Niagara Falls Storage Site Balance of Plant Operable Unit Investigation to Refine the Extent of Soil Contamination

Site Location: Lewiston, New York

Contractor Name: URS Group, Inc.

Contract Title: Niagara Falls Storage Site Balance of Plant Operable Unit Investigation to Refine the Extent of Soil Contamination

Contract Number: W912QR-12-D-0023

1. **Identify guidance used to prepare QAPP:** IDQTF – Uniform Federal Policy for Quality Assurance Project Plans, Final, Version 1, March 2005 (including March 2012 Part 2A Optimized Worksheets, Rev.1).

2. **Identify regulatory program:** Formerly Utilized Sites Remedial Action Program (FUSRAP)

3. **Identify approval entity:** U.S. Army Corps of Engineers – Buffalo District

4. **Indicate whether the QAPP is a generic or a project-specific QAPP**. (underline one)

5. **List dates of scoping sessions that were held:** See Worksheet #9

6. **List dates and titles of QAPP documents written for previous site work, if applicable:**

Title	Received Date
Remedial Investigation for NFSS (SAIC, 2007)	July 2012
NFSS Sampling and Analysis Plan (SAIC, 2009)	July 2012
NFSS Bldg 401 Demolition QAPP (TMPC, 2010)	July 2012
NFSS BOP Field Investigation QAPP (URS, 2012)	NA

7. List organizational partners (stakeholders) and connection with lead organization:

_____

8. List data users: USACE – Buffalo District, URS Group, Inc.

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below:

All required elements, except where noted, are included in this QAPP. Also, some worksheets were combined (i.e., Worksheets #14/16, #19/30, #26/27, and #31/32/33), per IDQTF – UFP March 2012 Optimized Guidance.

QAPP Worksheet #2
QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to Required Documents	Required Information
2.1 Title and Approval Page	Worksheet #1	- Title and Approval Page
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	2	- Table of Contents - QAPP Identifying Information
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	3 4	- Distribution List - Project Personnel Sign-Off Sheet
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	5 6 7 8	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	9 10	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	11 12	- Site-Specific PQOs - Measurement Performance Criteria Table
2.7 Secondary Data Evaluation	13	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table

QAPP Worksheet #2
QAPP Identifying Information

2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	14 15 16	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, Preservation, and Hold Times 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	17 18 19 20 21 22	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/ SOP Requirements Table - Analytical Methods/SOP Requirements Table - Field Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	 23 24 25	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
3.3 Sample Collection Documentation, Handling, Tracking, Custody, and Disposal Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	26	- Sample Collection Documentation Handling, Tracking, Custody and Disposal SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody Form and Seal
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	27 28	- QC Samples Table - Screening/Confirmatory Analysis Decision Tree - Analytical quality control and corrective action

QAPP Worksheet #2
QAPP Identifying Information

3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	29 30 31/32/33	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	31/32/33	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table
4.2 QA Management Reports		- QA Management Reports Table
4.3 Final Project Report		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	34 35 36 37	- Data Verification Inputs - Data Verification Procedures - Data Validation Procedures - Usability Assessment
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		

QAPP Worksheet #3
Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
[redacted]	Project Manager	USACE	[redacted]	716-879-4355	[redacted]	1
[redacted]	Project Manager	URS	[redacted]	716-856-2545	[redacted]	2
[redacted]	QA/QC Officer	URS	[redacted]	716-856-2545	[redacted]	3
[redacted]	Certified Health Physicist	URS	[redacted]	845-483-9061	[redacted]	4
[redacted]	Field Investigation Coordinator	URS	[redacted]	716-856-2545	[redacted]	5
[redacted]	Chemist	URS	[redacted]	716-856-2545	[redacted]	6
[redacted]	Project Manager	TestAmerica	[redacted]	314-298-8757	[redacted]	7

QAPP Worksheet #4
Project Personnel Sign-Off Sheet

Organization: USACE – Buffalo District

Project Personnel	Title	Telephone Number	Signature	Date QAPP Reviewed
[redacted]	Project Manager	[redacted]		

Organization: URS Group, Inc.

Project Personnel	Title	Telephone Number	Signature	Date QAPP Reviewed
[redacted]	Project Manager	[redacted]	[redacted]	17 October 2013
[redacted]	QA/QC Officer	[redacted]	[redacted]	17 October 2013
[redacted]	Certified Health Physicist	[redacted]	[redacted]	17 October 2013
[redacted]	Field Investigation Coordinator	[redacted]	[redacted]	17 October 2013
[redacted]	Chemist	[redacted]	[redacted]	17 October 2013

Organization: TestAmerica Laboratories, Inc.

Project Personnel	Title	Telephone Number	Signature	Date QAPP Reviewed
[redacted]	Project Manager	[redacted]	[redacted]	17 October 2013

QAPP Worksheet #5
Project Organizational Chart

See Figure 13 in Field Sampling Plan (FSP).

QAPP Worksheet #6
Communication Pathways

This worksheet describes the communication pathways and modes of communication that will be used for this project.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Primary USACE Point-of-Contact (POC)	USACE Project Manager (PM)	[redacted]	[redacted]	Primary USACE POC for URS Group, Inc. Coordinates management with USACE contracting officer. Can delegate communication to other internal or external points of contact. Technical and scheduling scope modification items to be discussed with USACE POC for clarification, and approved by Contracting Officer as necessary.
Primary URS Group, Inc. for Contractual Issues	URS Group, Inc. Program Manager	[redacted]	[redacted]	All correspondence with the USACE Contracting Officer will be transmitted through the URS Program Manager's office. The Program Manager will coordinate with the URS Project Manager to meet all base contract and project technical and administrative requirements. Also provides a critical outlet for USACE outside the project team and is in a position to coordinate with other senior URS executives to implement corrective actions.
Primary URS Group, Inc. POC	URS Group, Inc. Project Manager	[redacted]	[redacted]5	Primary POC for USACE. Responsibilities also include the following: Maintaining communication with the Field Investigation Coordinator; Establishing and maintaining communication among the Project QA/QC Officer, Sr. Health Physicist, Project Team, and all other subcontractors.

QAPP Worksheet #6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Primary URS Group, Inc. POC for QA/QC Issues	URS Group, Inc. QA/QC Officer	[redacted]	[redacted]	The URS QA/QC/Officer will be responsible for: Providing guidance or assistance and resolving problems on QA/QC topics; Verifying that the specified data collection methods comply with all QA/QC requirements and will yield data of desired quality and integrity; Reviewing and evaluating quality-related changes to the *QAPP*; Ensuring that all non-conformances are identified and appropriate corrective actions are taken; Providing assistance to the Project Manager to implement corrective actions; Acting as the main point of contact for all project QA matters and providing guidance on appropriate procedures to the Project Manager and support personnel; and Ensuring delivery of quality project reports.
Health Physics Issues	URS Group, Inc. Certified Health Physicist	[redacted]	[redacted]	The Sr. Health Physicist will provide senior level review of project deliverables and oversee project field health physics support personnel.
Field Coordination and Activities	URS Group, Inc. Field Investigation Coordinator	[redacted]	[redacted]	The Field Investigation Coordinator will aid the Project Manager in coordinating and monitoring the activities of the project team, URS field resources, and subcontractors associated with the project. The Field Investigation Coordinator is responsible for the following: Directing all on-site activities, and ensuring that all procedures described in the SAP and *QAPP* are adhered to in the field; Ensuring the compliance of all subcontractor activities in the field with project guidelines and performance; and Ensuring that all site-safety requirements are adhered to by site personnel.
Health and Safety Issues	URS Group, Inc. Site Safety and Health Officer	[redacted]	[redacted]	Receives direction from the URS Group, Inc. PM. Provides direction to field team, Direct POC for field health and safety (H&S) issues.

QAPP Worksheet #6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Data Tracking from Collection through Analysis	URS Group, Inc. Project Chemist	[redacted]	[redacted]	The URS Project Chemist will be responsible for analytical data collection activities from sample collection through analysis for the project. Project Chemist will receive validated data from USACE for inclusion into URS database for final investigative report preparation.
Field Sample Collection and Analytical Corrective Actions	URS Group, Inc. Project Chemist	[redacted]	[redacted]	The Project Chemist will be the URS POC for the subcontracted laboratory to verify that chemistry components of the QAPP are met by the laboratory and field personnel. If data quality issues are identified by the Project Chemist, these issues will be reported to the Field Investigation Coordinator, Project Manager and the Project QA/QC Officer. The Project Chemist will coordinate analytical requests with the subcontracted laboratory, track samples received at the laboratory, communicate with the laboratory and field personnel to resolve outstanding issues during the sampling effort.
Review and Approve Release of Analytical Data and Upload to Database	USACE Project Chemist	[redacted]	[redacted]	The USACE Project Chemist will review data deliverables received from the laboratory for completeness and accuracy prior to upload to database.
Primary POC for Laboratory	TestAmerica Laboratories, Inc. Project Manager	[redacted]	[redacted]	The Laboratory PM receives direction from URS Group, Inc. Project Chemist, and is responsible for meeting the QAPP requirements. Communicates with laboratory personnel on a daily basis and reports any analytical problems/non-conformances to URS Group, Inc. Project Chemist. Copies of the analytical data reports and ERPIMS 5.0 electronic data deliverables (EDDs) will be forwarded to URS and USACE, concurrently.

QAPP Worksheet #7
Personnel Responsibilities and Qualifications

Project personnel associated with each organization participating in responsible roles are identified below.

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
[redacted]	USACE Project Manager (PM)	USACE	Manages Project for USACE. Provides direction to URS Group, Inc. on field coordination and reporting, technical implementation and scheduling matters.	Not Applicable
[redacted]	URS Group, Inc. Program Manager	URS Group, Inc.	Coordinates with the URS Project Manager to meet all base contract and project technical and administrative requirements. Also provides a critical outlet for USACE outside the project team and is in a position to coordinate with other senior URS executives to implement corrective actions.	B.A. in Biology and Chemistry, graduate studies in Environmental Engineering, 34 years of experience
[redacted]	URS Group, Inc. Project Manager	URS Group, Inc.	The Project Manager is responsible for the direction, coordination, and technical consistency of specific projects conducted at NFSS. Responsibilities also include the following: Documenting performance of all subcontractors; Ensuring completion of all site-specific requirements by URS and other project subcontractors; Assist in providing all deliverables and associated documents to USACE; and Ensuring that applicable technical protocols are implemented.	M.S. in Geology and B.S. in Geology, 31 years of experience.

QAPP Worksheet #7
Personnel Responsibilities and Qualifications

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
[redacted]	URS Group, Inc. QA/QC Officer	URS Group, Inc.	The URS QA/QC/Officer will be responsible for: Providing guidance or assistance and resolving problems on QA/QC topics; Verifying that the specified data collection methods comply with all QA/QC requirements and will yield data of desired quality and integrity; Reviewing and evaluating quality-related changes to the *QAPP*; Ensuring that all non-conformances are identified and appropriate corrective actions are taken; Providing assistance to the Project Manager to implement corrective actions; Acting as the main point of contact for all project QA matters and providing guidance on appropriate procedures to the Project Manager and support personnel; and Ensuring delivery of quality project reports.	M.S. in Civil Engineering, B.S. in Civil Engineering, Professional Engineer (multiple states), 43 years of experience.
[redacted]	URS Group, Inc. Certified Health Physicist	URS Group, Inc.	The Sr. Health Physicist will provide senior level review of project deliverables and oversee project field health physics support personnel.	Ph.D. in Nuclear Engineering, M.S. in Nuclear Engineering, B.S. in Nuclear Engineering, Professional Engineer, Certified Health Physicist, 28 years of experience.
[redacted]	URS Group, Inc. Field Investigation Coordinator	URS Group, Inc.	The Field Investigation Coordinator will aid the Project Manager in coordinating and monitoring the activities of the project team, URS field resources, and subcontractors associated with the project. The Field Investigation Coordinator is responsible for the following: Directing all on-site activities, and ensuring that all procedures described in the SAP and *QAPP* are adhered to in the field; Ensuring the compliance of all subcontractor activities in the field with project guidelines and performance; and Ensuring that all site-safety requirements are adhered to by site personnel.	B.A. in Geology, Professional Geologist, 20 years of experience.

QAPP Worksheet #7
Personnel Responsibilities and Qualifications

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
[redacted]	URS Group, Inc. Site Safety and Health Officer	URS Group, Inc.	Provides direction to field team. Can stop work on site due to worker injury or unsafe working conditions.	M.A. in Geology, 24 years of experience.
[redacted]	URS Group, Inc. Project Chemist	URS Group, Inc.	The URS Project Chemist will be responsible for analytical data collection activities from sample collection through analysis for the project. The URS Project Chemist verifies that chemistry components of the QAPP are met by the laboratory and field personnel. The Project Chemist will coordinate analytical requests with the subcontracted laboratory, track samples received at the laboratory, communicate with the laboratory and field personnel to resolve outstanding issues during the sampling effort. Project Chemist will receive validated data from USACE for inclusion into URS database for final investigative report preparation.	B.S. in Biology, B.S. in Chemistry, 31 years of experience.
[redacted]	USACE Project Chemist	USACE	The USACE Project Chemist will review data deliverables received from the laboratory for completeness and accuracy prior to upload to database.	Not Applicable
[redacted]	TestAmerica Laboratories, Inc. Project Manager	TestAmerica Laboratories, Inc.	Communicates with laboratory personnel on a daily basis and reports any analytical problems/non-conformances to URS Group, Inc. Project Chemist. Copies of the analytical data reports and ERPIMS 5.0 electronic data deliverables (EDDs) will be forwarded to URS and USACE, concurrently.	B.A. Psychology, 8 years of experience.

QAPP Worksheet #8
Special Personnel Training Requirements

Specialized personnel training requirements are referenced in the Accident Prevention Plan (APP).

QAPP Worksheet #9
Project Planning Session Summary
Session 1

Project Name: NFSS Balance of Plant Operable Unit Investigation to Refine the Extent of Soil Contamination **Projected Date(s) of Sampling:** Oct – Dec 2013 **Project Manager:** Kevin Connare	**Site Name:** NFSS **Site Location:** Lewiston, New York

Date of Session: August 2, 2013
Scoping Session Purpose: Discuss scope of work, additional work planned, schedule, planning document preparation, budget, and personnel training requirements.

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
[redacted]	Project Manager	URS Group, Inc.	[redacted]	[redacted]	Project Manager
[redacted]	Project QA/QC Officer	URS Group, Inc.	[redacted]	[redacted]	Project QA/QC Officer
[redacted]	Field Investigation Coordinator	URS Group, Inc.	[redacted]	[redacted]	Field Investigation Coordinator
[redacted]	Site Supervisor/CQC System Manager	URS Group, Inc.	[redacted]	[redacted]	Site Supervisor/CQC System Manager
[redacted]	Site Radiation Safety Officer	URS Group, Inc.	[redacted]	[redacted]	Site Radiation Safety Officer
[redacted]	Site Safety and Health Officer	URS Group, Inc.	[redacted]	[redacted]	Site Safety and Health Officer
[redacted]	Site Supervisor/Contractor QC System Manager Alternate	URS Group, Inc.	[redacted]	[redacted]	Site Supervisor/ Contractor QC System Manager Alternate
[redacted]	Independent Technical Review	URS Group, Inc.	[redacted]	[redacted]	Independent Technical Review
[redacted]	Geographical Information System Manager	URS Group, Inc.	[redacted]3	[redacted]	Geographical Information System Manager

QAPP Worksheet #10
Conceptual Site Model

Background Information: See Section 1.2 Site Description, History and Background.

Sources of known or suspected hazardous waste: The NFSS represents a portion of the former LOOW that was used by the USACE MED/AEC to store radioactive residues and other materials beginning in 1944. Nearly all the radioactive residues sent to the NFSS originated from uranium processing activities conducted for MED and AEC at the Linde Air Products facility in Tonawanda, New York, the Mallinckrodt Chemical Works refinery in St. Louis, Missouri, and the Middlesex Sampling Plant in Middlesex, New Jersey.

Known or suspected contaminants or classes of contaminants: Radiological constituents of concern at NFSS include isotopic uranium, isotopic thorium, and radium-226/228. Other constituents that occur on-site in lesser amounts include daughter products of the uranium series (U-238) and, to some extent, the actinium series (U-235). Chemical constituents of concern at NFSS include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and metals.

Primary release mechanism: Contaminants of concern released from storage or containment structures into the soil and groundwater.

Secondary containment migration: Contaminants of concern potentially migrating along underground utility pipelines.

Fate and transport considerations: Based on information collected through the Remedial Investigation (RI), the areas of dissolved total uranium groundwater contamination in the upper water-bearing zones (UWBZ) in exposure units (EUs) 1 and 2, EU 4, and EU 10 are fairly well bounded. Uranium contamination in the groundwater in EU 11 requires further investigation. Proposed activities include removing manhole MH06 and exposing the sanitary sewer from South 31 Ditch to the area just south of the decontamination pad. Soil and groundwater samples will be collected for radionuclide analyses during these activities. The intent of the investigation is to determine if the sanitary sewer line is a pathway for contaminated groundwater migration.

Surface and near surface soil samples will be collected from locations across the Site to delineate soil contamination the may require excavation.

Potential receptors and exposure pathways: During development of the RI, the NFSS was divided into 14 soil EUs. An EU is defined as the geographic area in which a future receptor (for purposes of the baseline risk assessment) is assumed to work or live, and where a receptor may be exposed to site-related contaminants. The goal sanitary sewer investigation is to eliminate potential preferential pathways for off-site migration of groundwater contaminants. The goal of the soil sampling investigation is to delineate areas that may require excavation.

QAPP Worksheet #10
Conceptual Site Model

Land use considerations: The NFSS is a radioactive waste storage site with restricted use under the FUSRAP.

Key physical aspects of the site: See Section 1.2 Site Description, History and Background.

Current interpretation of nature and extent of contamination to the extent it will influence project-specific decision making: See fate and transport considerations noted above.

QAPP Worksheet #11
Project/Data Quality Objectives

Problem: See Worksheet #10.

Goals of the Field Investigation: The purpose of this field investigation is to collect additional soil data to delineate the extent of contaminated soil requiring excavation. The data collected will support the BOP OU FS and will involve the following activities:

- Complete 378 soil borings to depth of 3 feet each,
- Collect soil samples from the 0.0 to 0.5 ft interval, 0.05 to 2.0 ft interval, and 2.0 to 3.0 ft interval,
- Collect trench excavation soil samples from side-walls,
- Collect groundwater samples (if encountered) from excavation trenches, and
- Manage/sample/dispose of IDW.

Information Inputs: Definitive data will be collected (i.e., soil) to delineate the extent of contaminated soil in support of the BOP OU FS, as noted above.

Boundaries of the Field Investigation:

The field investigation will be performed at locations throughout the NFSS (excluding the ICWS).

Analytical Approach: The parameters of interest for the delineation soil sampling and trench excavation [soil (sidewall) and groundwater (if encountered)] programs include: isotopic uranium, isotopic thorium, and radium-226. In addition, some delineation soil samples will be analyzed for PAHs, while the trench excavation samples will also be analyzed for total uranium and inorganic parameters [groundwater only: anions, alkalinity and total dissolved solids (TDS)].

The parameters of interest for IDW include: full toxicity characteristic leaching procedure (TCLP); isotopic uranium; isotopic thorium; gamma spectroscopy; metals; VOCs; SVOCs; pesticides; herbicides; PCBs; metals; pH; oil and grease; total organic carbon (TOC); total suspended solids (TSS); and paint filter test.

Performance and Acceptance Criteria: The definitive soil data collected will be used to further delineate contaminated soil. The performance and acceptance criteria will be those that support the sampling rationale specified above under Boundaries of the Field Investigation and in the FSP. The soil and water IDW analytical results will be used to identify the proper disposal fate of the IDW.

Plan for Obtaining Data: The basis for sampling design and rationale is briefly discussed above under Goals and Boundaries of the Field Investigation. A more detailed discussion on the sampling design and the basis for its selection is presented in the FSP, with analytical design requirements presented in Worksheets #19/30, 20, 24, 25, 26/27, 28, and 30.

QAPP Worksheet #12
Measurement Performance Criteria

As part of assessing data usability, measurement performance criteria (MPC) have been established to evaluate the data quality indicators (DQIs), in terms of precision, accuracy, and sensitivity. The MPC for the soil, groundwater, pipe sediment and liquid, and IDW monitoring programs are summarized below on a per matrix per method basis.

Precision. Precision measures the reproducibility of measurements. It is strictly defined as the degree of reproducibility among independent measurements as the result of repeated application of the same process under prescribed similar conditions. The precision measurement is established using the relative percent difference (RPD) or relative error ratio (RER) between the duplicate sample results, and is expressed as follows:

$$RPD = \frac{[X_1 - X_2]}{[(X_1 + X_2)/2]} \times 100 \qquad RER = \frac{[X_1 - X_2]}{[(u_c^{\,2}(X_1) + u_c^{\,2}(X_2)]^{0.5}}$$

where:

X_1 and X_2 represent the individual values/activities found for the target analyte in the two replicate analyses.
$u_c(X_1)$ and $u_c(X_2)$ represent respective combined standard uncertainties.

RER is functionally equivalent to the normalized absolute difference (NAD) based on MARLAP Z-statistics ($Z_{LCSD/MSD/Dup}$) statistic. The calculated RER/NAD are compared to an acceptable performance range of -1.96 to +1.96. Calculated RER/NAD results within the performance range are considered acceptable. Calculated RER/NAD results outside the performance range are investigated for possible discrepancies in analytical precision.

When RPDs and RERs (radiochemistry only) exceed established control limits, corrective action is warranted. Corrective action can include recalibration, reanalysis of the laboratory duplicate samples or matrix spike/matrix spike duplicate (MS/MSD) samples, or environmental sample reanalysis. Corrective actions must be taken, but if the laboratory cannot improve results, data will be flagged.

Field duplicate samples and laboratory duplicate samples (or MS/MSD samples) will be analyzed to assess field and analytical precision. Field duplicates are defined as two samples collected independently at a single sampling location during a single sample collection. Field duplicates will be collected at a frequency of 10 percent. Field duplicates will be collected for all matrices and analyzed for the same parameters. Frequency of analysis of laboratory duplicates or MS/MSD are 5 percent, as summarized by method on Worksheet #20.

Accuracy/Bias. Accuracy is the statistical measurement of correctness and includes components of random error (variability due to imprecision) and systematic error. A measurement is accurate when the reported value does not differ from the true value or known concentration of the spike or standard. Analytical accuracy is measured by comparing the percent recovery (organic and inorganic) or warning/control limits (radiochemistry) of analytes spiked into laboratory control samples (LCSs) and MS and/or MSD samples to the laboratory-established or method-established control limits. Control limits will be based on previously established laboratory capabilities for similar samples using control chart techniques. Recoveries outside the control limits indicate a cause other than normal measurement error. Corrective action may include instrument recalibration, reanalysis of the QC sample, or reanalysis of the samples in the batch. For organic and radiochemistry analyses, surrogate compound recoveries and tracer yields, respectively, are also used to assess accuracy and method performance for each sample analyzed. The calculation used for percent recovery/yield is expressed as:

QAPP Worksheet #12
Measurement Performance Criteria

$$\text{Percent Recovery (organics and inorganics)} = \frac{[X - D]}{[D]} \times 100$$

Percent Recovery LCS/MS (radiochemistry)

$$Z_{LCS} = \frac{[X - D]}{[(u_c{}^2(X) + u_c{}^2(D)]^{0.5}}$$

$$Z_{MS} = \frac{[X - X_0 - D]}{[(u_c{}^2(X) + u_c{}^2(X_0) + u_c{}^2(D)]^{0.5}}$$

where:
Z_{LCS} represents performance indicator for laboratory control samples.
Z_{MS} represents performance indicator for matrix spikes.
X represents the value/activity of the spike sample.
D represents the spike concentration added.
X_0 represents the value of the unspiked sample.
$u_c(X)$, $u_c(X_0)$, and $u_c(D)$ represent respective combined standard uncertainties.

The calculated Z_{LCS} and Z_{MS} statistic(s) should be between -1.96 and +1.96. Calculated Z_{MS} outside the performance range require further evaluation.

Accuracy of analytical results reported in environmental samples is also measured against any contamination present in laboratory method blanks and instrument blanks, as well as field blanks, such as trip and equipment rinsate blank samples. Frequency of sampling and analysis of laboratory and field blanks is specified on Worksheet #20. For radiochemistry, blank/sample accuracy is expressed as follows, and will only be evaluated when the blank/sample result is above the minimum detected activity (MDA):

$$Z_{Blank} = \frac{X}{[(u_c(X)]} \qquad Z_{Sample} = \frac{X}{[(u_c(X)]}$$

where:

$Z_{Blank/Sample}$ represents performance indicator for blanks/samples.

X represents the measures blank/sample activity. $u_c(X)$ represent the combined standard uncertainty.

QAPP Worksheet #12
Measurement Performance Criteria

Radiochemistry blank analysis results are assessed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks applies to any blank associated with the samples. If problems with any blank exist, all data associated with the case shall be carefully evaluated to determine whether or not there is an inherent variability in the data for the case, or if the problem is an isolated occurrence not affecting other data.

If the blank QC results fall outside the appropriate tolerance limits or if the net blank results are not less than the associated uncertainty, the following equation should be used in determining the effect of possible blank contamination on the sample results. NAD evaluation: > 2.58 no qualification, 1.96>x<2.58 -J flag, x<1.96 -J or R*.

*Minimally the result should be qualified as estimated, J; however, if other quality indicators are deficient the validator may determine the result should be qualified as unusable, R.

The temperature receipt of the cooler is measured either through the use of a temperature blank (the liquid water contents measured with a mercury thermometer) or from a representative sample in the cooler (the temperature of the outside of a container measured with an infrared gun). If the cooler receipt temperature is measured between 4 ± 2 degrees Celsius (°C), then the samples are considered to be preserved at the correct temperature. Samples contained in coolers with receipt temperatures measured outside of the acceptance limits are considered to be improperly preserved. Corrective action for coolers received at temperatures outside the acceptance limits may be qualification of results or resampling of affected samples. Note, samples submitted for radionuclide analysis are not required to be cooled to 4 ± 2 °C.

Sensitivity. Sensitivity is the ability of the method or instrument to detect the contaminant of concern and other target compounds at the level of interest. Sensitivity is achieved for a majority of the methods by the use of a low-level calibration standard. For those methods that require a multi-level initial calibration, the low-level calibration standard is spiked at or below the quantitation level specified on Worksheet #15. The criterion used to measure the performance of this QC sample is the initial calibration acceptance criteria specified by the method and summarized on Worksheet #24. The corrective action performed if the acceptance criterion is not achieved is that specified by the method and summarized on Worksheet #24.

Sensitivity for the chemicals/radionuclides of concern is also achieved by preparing and analyzing laboratory fortified blank (LFB) samples, although not required by most methods, except metals. An LFB sample is a blank sample matrix spiked at the quantitation limit (QL) or at 2 times the QL for metals. Sensitivity is measured by calculating the percent recovery of the analyte at the QL. The criterion used to measure the performance of this QC sample is typically 60-140 percent recovery for organics and 80–120 percent recovery for metals. The corrective action performed if the acceptance criterion is not achieved is the reanalysis and/or repreparation and reanalysis. If the recovery remains outside the acceptance criterion upon reanalysis, then the instrument will be recalibrated and another LFB will be reprepared and reanalyzed. If failure continues, then the analytical process will be evaluated and a method detection limit study will be performed. LFB analyses for organics will not be performed under this QAPP.

Table 12-1
Measurement Performance Criteria

Matrix	Soil
Analytical Group or Method	Total Uranium / ASTM D5174-02
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 30%; RER ≤ 1 (2σ)
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-2
Measurement Performance Criteria

Matrix	Soil
Analytical Group or Method	Isotopic Uranium / HASL-300
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RER ≤ 1 (2σ)
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ minimum detected activity (MDA)
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-3
Measurement Performance Criteria

Matrix	Soil
Analytical Group or Method	Isotopic Thorium / HASL-300
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RER ≤ 1 (2σ)
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ MDA
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-4
Measurement Performance Criteria

Matrix	Soil
Analytical Group or Method	Gamma Spectroscopy / 901.1 (Ra-226)
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RER ≤ 1 (2σ)
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ MDA
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-5
Measurement Performance Criteria

Matrix	Soil
Analytical Group or Method	PAHs / 8270D-SIM
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20% or ≤ 2x Contract Required Detection Limit (CRDL)
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	80-120%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-6
Measurement Performance Criteria

Matrix	Soil/Solid IDW
Analytical Group or Method	VOCs / 8260C
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 30%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-7
Measurement Performance Criteria

Matrix	Solid IDW
Analytical Group or Method	SVOCs / 8270D
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 30%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-8
Measurement Performance Criteria

Matrix	Solid IDW
Analytical Group or Method	Pesticides / 8081B
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 30%
Analytical Precision (laboratory)	See Worksheet #15	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-9
Measurement Performance Criteria

Matrix	Groundwater
Analytical Group or Method	Total Uranium / ASTM D5174-02
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 30%; RER ≤ 1 (2σ)
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-10
Measurement Performance Criteria

Matrix	Groundwater/IDW Liquid
Analytical Group or Method	Isotopic Uranium / HASL-300
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RER ≤ 1 (2σ)
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-11
Measurement Performance Criteria

Matrix	Groundwater/IDW Liquid
Analytical Group or Method	Isotopic Thorium / HASL-300
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RER ≤ 1 (2σ)
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-12
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	Gamma Spectroscopy / 901.1
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RER ≤ 1 (2σ)
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-13
Measurement Performance Criteria

Matrix	Groundwater
Analytical Group or Method	Ra-226 / 903.1
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RER ≤ 1 (2σ)
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-14
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	TAL Metals (plus B, Li, Mo, P) / 6010C/7470A
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20% or ≤ 2x CRDL
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	80-120%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-15
Measurement Performance Criteria

Matrix	Groundwater
Analytical Group or Method	Anions / 300.0
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field/Lab Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	80-120%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-16
Measurement Performance Criteria

Matrix	Groundwater
Analytical Group or Method	Alkalinity / 310.1
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field/Lab Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	80-120%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-17
Measurement Performance Criteria

Matrix	Groundwater
Analytical Group or Method	TDS / 160.1
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field/Lab Duplicates	RPD ≤ 20% or ≤ 2x CRDL
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	NA	NA
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	Not Applicable
Completeness	See Worksheet #37	See Worksheet #37

Table 12-18
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	VOCs / 8260C
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-19
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	SVOCs / 8270D
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-20
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	Pesticides / 8081B
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-21
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	Herbicides / 8151A
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-22
Measurement Performance Criteria

Matrix	Solid/Liquid IDW
Analytical Group or Method	TCLP Metals / 1311/6010C/7470A
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20% or ≤ 2x CRDL
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	80-120%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-23
Measurement Performance Criteria

Matrix	Solid IDW
Analytical Group or Method	Herbicides / 8151A
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-24
Measurement Performance Criteria

Matrix	Solid IDW
Analytical Group or Method	Paint Filter Liquid Test / 9056
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field/Lab Duplicates	RPD ≤ 30%
Analytical Precision (laboratory)	LCS Duplicates	Not Applicable
Analytical Accuracy (laboratory)	LCS	Not Applicable
Analytical Accuracy (matrix interference)	MS/MSD	Not Applicable
Overall Accuracy (blank contamination)	Method/Field Blanks	Not Applicable
Sensitivity	QL verification sample	Not Applicable
Completeness	See Worksheet #37	See Worksheet #37

Table 12-25
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	TCLP VOCs / 1311/8260C
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-27
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	TCLP SVOCs / 1311/8270D
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-27
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	TCLP Pesticides / 1311/8081B
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-28
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	TCLP Herbicides / 1311/8151A
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	75-125%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-29
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	pH / 9040B
Concentration Level	Not Applicable

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field/Lab Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	NA	NA
Overall Accuracy (blank contamination)	Method/Field Blanks	Not Applicable
Sensitivity	QL verification sample	Not Applicable
Completeness	See Worksheet #37	See Worksheet #37

Table 12-30
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	Oil and Grease /1664A
Concentration Level	Not Applicable

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	80-120%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-31
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	Total Organic Carbon (TOC) / 415.1
Concentration Level	Low

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	MS/MSD	See Worksheet #15
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	80-120%
Completeness	See Worksheet #37	See Worksheet #37

Table 12-32
Measurement Performance Criteria

Matrix	Liquid IDW
Analytical Group or Method	Total Suspended Solids / 160.2
Concentration Level	Not Applicable

Data Quality Indicators (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field/Lab Duplicates	RPD ≤ 20%
Analytical Precision (laboratory)	LCS Duplicates	See Worksheet #15
Analytical Accuracy (laboratory)	LCS	See Worksheet #15
Analytical Accuracy (matrix interference)	NA	NA
Overall Accuracy (blank contamination)	Method/Field Blanks	No target analyte concentrations ≥ ½ QL
Sensitivity	QL verification sample	Not Applicable
Completeness	See Worksheet #37	See Worksheet #37

QAPP Worksheet #13
Secondary Data Uses and Limitations

Identify all secondary data and information that will be used for the project and their originating sources. Specify how the secondary data will be used and the limitations on their use. Each project specific area must include any limitations on use of the data in the final report. Data from each project specific area is accumulated in the final site report and the limits on data use must be presented.

Data type	Source	Data uses relative to current project	Factors affecting the reliability of data and limitations on data use
Meteorological	National Weather Service	Estimations of seasonal fluctuations in storm runoff.	Published data available. No known limitations.
Topographic	United States Geological Society (USGS)	Surface water drainage pathways.	No known limitations.
Historical	RI Report, SAIC 2007	Use historical data to determine future delineation sampling locations.	No known limitations.

QAPP Worksheet #14/16
Project Tasks and Schedule

See Appendix A in Field Sampling Plan.

QAPP Worksheet #15
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Solid	8260C	VOCs	1,1,1,2-Tetrachloroethane	630-20-6			5	0.346	ug/Kg	75	125	75	125	20
Solid	8260C	VOCs	1,1,1-Trichloroethane	71-55-6		0.5	5	0.431	ug/Kg	70	135	70	135	20
Solid	8260C	VOCs	1,1,2,2-Tetrachloroethane	79-34-5		0.5	5	0.401	ug/Kg	55	130	55	130	20
Solid	8260C	VOCs	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1		0.5	5	1.682	ug/Kg	73	124	73	124	20
Solid	8260C	VOCs	1,1,2-Trichloroethane	79-00-5		0.5	5	0.573	ug/Kg	60	125	60	125	20
Solid	8260C	VOCs	1,1-Dichloroethane	75-34-3		0.5	5	0.392	ug/Kg	75	125	75	125	20
Solid	8260C	VOCs	1,1-Dichloroethene	75-35-4		0.5	5	1.61	ug/Kg	65	135	65	135	20
Solid	8260C	VOCs	1,1-Dichloropropene	563-58-6		0.5	5	0.3	ug/Kg	70	135	70	135	20
Solid	8260C	VOCs	1,2,3-Trichlorobenzene	87-61-6		0.5	5	0.444	ug/Kg	60	135	60	135	20
Solid	8260C	VOCs	1,2,4-Trichlorobenzene	120-82-1		0.5	5	0.425	ug/Kg	65	130	65	130	20
Solid	8260C	VOCs	1,2-Dibromo-3-Chloropropane	96-12-8		0.5	10	1.45	ug/Kg	40	135	40	135	20
Solid	8260C	VOCs	1,2-Dibromoethane	106-93-4		0.5	5	0.699	ug/Kg	70	125	70	125	20
Solid	8260C	VOCs	1,2-Dichlorobenzene	95-50-1		0.5	5	0.282	ug/Kg	75	120	75	120	20
Solid	8260C	VOCs	1,2-Dichloroethane	107-06-2		0.5	5	0.867	ug/Kg	70	135	70	135	20
Solid	8260C	VOCs	1,2-Dichloropropane	78-87-5		0.5	5	0.383	ug/Kg	70	120	70	120	20
Solid	8260C	VOCs	1,3-Dichlorobenzene	541-73-1		0.5	5	0.28	ug/Kg	70	125	70	125	20
Solid	8260C	VOCs	1,3-Dichloropropane	142-28-9		0.5	5	0.322	ug/Kg	75	125	75	125	20
Solid	8260C	VOCs	1,4-Dichlorobenzene	106-46-7		0.5	5	0.6	ug/Kg	70	125	70	125	20
Solid	8260C	VOCs	1,4-Dioxane	123-91-1		50	400	35.8	ug/Kg	72	136	72	136	20
Solid	8260C	VOCs	2-Butanone (MEK)	78-93-3		0.5	20	1.92	ug/Kg	30	160	30	160	20
Solid	8260C	VOCs	2-Chloro-1,3-butadiene	126-99-8			5	0.388	ug/Kg	81	121	81	121	20
Solid	8260C	VOCs	2-Chlorotoluene	95-49-8			5	0.336	ug/Kg	70	130	70	130	20
Solid	8260C	VOCs	2-Hexanone	591-78-6		0.5	20	1.77	ug/Kg	45	145	45	145	20
Solid	8260C	VOCs	2-Nitropropane	79-46-9			10	1.8	ug/Kg	66	137	66	137	20
Solid	8260C	VOCs	4-Chlorotoluene	106-43-4			5	0.375	ug/Kg	75	125	75	125	20
Solid	8260C	VOCs	4-Methyl-2-pentanone (MIBK)	108-10-1		0.5	20	0.732	ug/Kg	45	145	45	145	20
Solid	8260C	VOCs	Acetone	67-64-1		0.5	20	6.47	ug/Kg	20	160	20	160	20
Solid	8260C	VOCs	Benzene	71-43-2		0.5	5	0.253	ug/Kg	75	125	75	125	20

QAPP Worksheet #15
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Solid	8260C	VOCs	Bromobenzene	108-86-1		0.5	5	0.368	ug/Kg	65	125	65	125	20
Solid	8260C	VOCs	Bromochloromethane	74-97-5		0.5	5	0.823	ug/Kg	70	130	70	130	20
Solid	8260C	VOCs	Bromodichloromethane	75-27-4		0.5	5	0.254	ug/Kg	70	120	70	120	20
Solid	8260C	VOCs	Bromoform	75-25-2		0.5	5	0.366	ug/Kg	55	130	55	130	20
Solid	8260C	VOCs	Bromomethane	74-83-9		0.5	10	1.1	ug/Kg	30	145	30	145	20
Solid	8260C	VOCs	Carbon disulfide	75-15-0		0.5	5	0.685	ug/Kg	45	160	45	160	20
Solid	8260C	VOCs	Carbon tetrachloride	56-23-5		0.5	5	0.513	ug/Kg	65	140	65	140	20
Solid	8260C	VOCs	Chlorobenzene	108-90-7		0.5	5	0.382	ug/Kg	75	120	75	120	20
Solid	8260C	VOCs	Chloroethane	75-00-3		0.5	10	0.516	ug/Kg	40	155	40	155	20
Solid	8260C	VOCs	Chloroform	67-66-3		0.5	5	0.376	ug/Kg	70	125	70	125	20
Solid	8260C	VOCs	Chloromethane	74-87-3		0.5	10	0.65	ug/Kg	50	130	50	130	20
Solid	8260C	VOCs	cis-1,2-Dichloroethene	156-59-2		0.5	5	0.597	ug/Kg	65	125	65	125	20
Solid	8260C	VOCs	cis-1,3-Dichloropropene	10061-01-5		0.5	5	0.595	ug/Kg	70	125	70	125	20
Solid	8260C	VOCs	Cyclohexane	110-82-7		0.5	10	0.363	ug/Kg	85	115	85	115	20
Solid	8260C	VOCs	Cyclohexanone	108-94-1			100	17.8	ug/Kg	47	140	47	140	20
Solid	8260C	VOCs	Dibromochloromethane	124-48-1		0.5	5	0.406	ug/Kg	65	130	65	130	20
Solid	8260C	VOCs	Dibromomethane	74-95-3		0.5	5	0.966	ug/Kg	75	130	75	130	20
Solid	8260C	VOCs	Dichlorodifluoromethane	75-71-8		0.5	10	1.31	ug/Kg	35	130	35	130	20
Solid	8260C	VOCs	Ethyl methacrylate	97-63-2			5	0.994	ug/Kg	67	130	67	130	20
Solid	8260C	VOCs	Ethylbenzene	100-41-4		0.5	5	0.299	ug/Kg	75	125	75	125	20
Solid	8260C	VOCs	Hexachlorobutadiene	87-68-3			5	0.682	ug/Kg	55	140	55	140	20
Solid	8260C	VOCs	Isopropylbenzene	98-82-8		0.5	5	0.258	ug/Kg	75	130	75	130	20
Solid	8260C	VOCs	m-Xylene & p-Xylene	179601-23-1		0.5	5	0.569	ug/Kg	80	125	80	125	20
Solid	8260C	VOCs	Methyl acetate	79-20-9		0.5	10	1.38	ug/Kg	66	130	66	130	20
Solid	8260C	VOCs	Methyl methacrylate	80-62-6			5	1.8	ug/Kg	67	127	67	127	20
Solid	8260C	VOCs	Methyl tert-butyl ether	1634-04-4		0.5	5	0.476	ug/Kg	80	120	80	120	20
Solid	8260C	VOCs	Methylcyclohexane	108-87-2		0.5	10	0.26	ug/Kg	85	115	85	115	20
Solid	8260C	VOCs	Methylene Chloride	75-09-2		0.5	10	1.58	ug/Kg	55	140	55	140	20
Solid	8260C	VOCs	n-Butylbenzene	104-51-8			5	0.6	ug/Kg	65	140	65	140	20
Solid	8260C	VOCs	n-Hexane	110-54-3			10	0.455	ug/Kg	71	136	71	136	20
Solid	8260C	VOCs	N-Propylbenzene	103-65-1			5	0.32	ug/Kg	65	135	65	135	20

QAPP Worksheet #15
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Solid	8260C	VOCs	Naphthalene	91-20-3			5	0.492	ug/Kg	40	125	40	125	20
Solid	8260C	VOCs	o-Xylene	95-47-6		0.5	5	0.336	ug/Kg	75	125	75	125	20
Solid	8260C	VOCs	p-Isopropyltoluene	99-87-6			5	0.319	ug/Kg	75	135	75	135	20
Solid	8260C	VOCs	sec-Butylbenzene	135-98-8			5	0.31	ug/Kg	65	130	65	130	20
Solid	8260C	VOCs	Styrene	100-42-5		0.5	5	0.347	ug/Kg	75	125	75	125	20
Solid	8260C	VOCs	tert-Butylbenzene	98-06-6			5	0.311	ug/Kg	65	130	65	130	20
Solid	8260C	VOCs	Tetrachloroethene	127-18-4		0.5	5	0.322	ug/Kg	65	140	65	140	20
Solid	8260C	VOCs	Tetrahydrofuran	109-99-9			25	6.54	ug/Kg	78	127	78	127	20
Solid	8260C	VOCs	Toluene	108-88-3		0.5	5	0.7	ug/Kg	70	125	70	125	20
Solid	8260C	VOCs	trans-1,2-Dichloroethene	156-60-5		0.5	5	0.943	ug/Kg	65	135	65	135	20
Solid	8260C	VOCs	trans-1,3-Dichloropropene	10061-02-6		0.5	5	0.349	ug/Kg	65	125	65	125	20
Solid	8260C	VOCs	trans-1,4-Dichloro-2-butene	110-57-6			10	1.78	ug/Kg	57	140	57	140	20
Solid	8260C	VOCs	Trichloroethene	79-01-6		0.5	5	0.385	ug/Kg	75	125	75	125	20
Solid	8260C	VOCs	Trichlorofluoromethane	75-69-4		0.5	5	0.5	ug/Kg	25	185	25	185	20
Solid	8260C	VOCs	Vinyl acetate	108-05-4			5	0.784	ug/Kg	65	140	65	140	20
Solid	8260C	VOCs	Vinyl chloride	75-01-4		0.5	10	0.428	ug/Kg	60	125	60	125	20
Solid	8260C	VOCs	1,2-Dichloroethene (total)	540-59-0			10	0.958	ug/Kg	85	115	85	115	20
Solid	8260C	VOCs	Xylenes, Total	1330-20-7			10	0.854	ug/Kg	70	130	70	130	20
Water	8260C	VOCs	1,1,1,2-Tetrachloroethane	630-20-6			5	0.254	ug/L	80	130	80	130	20
Water	8260C	VOCs	1,1,1-Trichloroethane	71-55-6	0.435	0.5	5	0.291	ug/L	65	130	65	130	20
Water	8260C	VOCs	1,1,2,2-Tetrachloroethane	79-34-5		0.5	5	0.425	ug/L	65	130	65	130	20
Water	8260C	VOCs	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1		0.5	5	0.246	ug/L	72	123	72	123	20
Water	8260C	VOCs	1,1,2-Trichloroethane	79-00-5		0.5	5	0.573	ug/L	75	125	75	125	20
Water	8260C	VOCs	1,1-Dichloroethane	75-34-3		0.5	5	0.392	ug/L	70	135	70	135	20
Water	8260C	VOCs	1,1-Dichloroethene	75-35-4		0.5	5	0.365	ug/L	70	130	70	130	20
Water	8260C	VOCs	1,1-Dichloropropene	563-58-6		0.5	5	0.30	ug/L	75	130	75	130	20
Water	8260C	VOCs	1,2,3-Trichlorobenzene	87-61-6		0.5	5	0.65	ug/L	55	140	55	140	20
Water	8260C	VOCs	1,2,4-Trichlorobenzene	120-82-1		0.5	5	0.55	ug/L	65	135	65	135	20
Water	8260C	VOCs	1,2-Dibromo-3-Chloropropane	96-12-8		0.5	10	1.15	ug/L	50	130	50	130	20
Water	8260C	VOCs	1,2-Dibromoethane	106-93-4		0.5	5	0.437	ug/L	80	120	80	120	20
Water	8260C	VOCs	1,2-Dichlorobenzene	95-50-1		0.5	5	0.28	ug/L	70	120	70	120	20

QAPP Worksheet #15
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Water	8260C	VOCs	1,2-Dichloroethane	107-06-2		0.5	5	0.372	ug/L	70	130	70	130	20
Water	8260C	VOCs	1,2-Dichloropropane	78-87-5		0.5	5	0.317	ug/L	75	125	75	125	20
Water	8260C	VOCs	1,3-Dichlorobenzene	541-73-1		0.5	5	0.234	ug/L	75	125	75	125	20
Water	8260C	VOCs	1,3-Dichloropropane	142-28-9		0.5	5	0.238	ug/L	75	125	75	125	20
Water	8260C	VOCs	1,4-Dichlorobenzene	106-46-7		0.5	5	0.35	ug/L	75	125	75	125	20
Water	8260C	VOCs	1,4-Dioxane	123-91-1		50	400	22.86	ug/L	77	128	77	128	20
Water	8260C	VOCs	2-Butanone (MEK)	78-93-3	4.49	0.5	20	0.389	ug/L	30	150	30	150	20
Water	8260C	VOCs	2-Chloro-1,3-butadiene	126-99-8			5	0.388	ug/L	79	120	79	120	20
Water	8260C	VOCs	2-Chlorotoluene	95-49-8			5	0.336	ug/L	75	125	75	125	20
Water	8260C	VOCs	2-Hexanone	591-78-6		0.5	20	0.593	ug/L	55	130	55	130	20
Water	8260C	VOCs	2-Nitropropane	79-46-9			10	0.636	ug/L	77	115	77	115	20
Water	8260C	VOCs	4-Chlorotoluene	106-43-4			5	0.305	ug/L	75	130	75	130	20
Water	8260C	VOCs	4-Methyl-2-pentanone (MIBK)	108-10-1		0.5	20	0.326	ug/L	60	135	60	135	20
Water	8260C	VOCs	Acetone	67-64-1	30.5	0.5	20	6.67	ug/L	40	140	40	140	20
Water	8260C	VOCs	Benzene	71-43-2	0.366	0.5	5	0.253	ug/L	80	120	80	120	20
Water	8260C	VOCs	Bromobenzene	108-86-1		0.5	5	0.334	ug/L	75	125	75	125	20
Water	8260C	VOCs	Bromochloromethane	74-97-5		0.5	5	0.552	ug/L	65	130	65	130	20
Water	8260C	VOCs	Bromodichloromethane	75-27-4		0.5	5	0.254	ug/L	75	120	75	120	20
Water	8260C	VOCs	Bromoform	75-25-2		0.5	5	0.366	ug/L	70	130	70	130	20
Water	8260C	VOCs	Bromomethane	74-83-9		0.5	10	0.396	ug/L	30	145	30	145	20
Water	8260C	VOCs	Carbon disulfide	75-15-0		0.5	5	0.369	ug/L	35	160	35	160	20
Water	8260C	VOCs	Carbon tetrachloride	56-23-5		0.5	5	0.36	ug/L	65	140	65	140	20
Water	8260C	VOCs	Chlorobenzene	108-90-7	0.387	0.5	5	0.382	ug/L	80	120	80	120	20
Water	8260C	VOCs	Chloroethane	75-00-3		0.5	10	0.382	ug/L	60	135	60	135	20
Water	8260C	VOCs	Chloroform	67-66-3		0.5	5	0.147	ug/L	65	135	65	135	20
Water	8260C	VOCs	Chloromethane	74-87-3		0.5	10	0.553	ug/L	40	125	40	125	20
Water	8260C	VOCs	cis-1,2-Dichloroethene	156-59-2		0.5	5	0.159	ug/L	70	125	70	125	20
Water	8260C	VOCs	cis-1,3-Dichloropropene	10061-01-5		0.5	5	0.339	ug/L	70	130	70	130	20
Water	8260C	VOCs	Cyclohexane	110-82-7		0.5	10	0.363	ug/L	85	115	85	115	20
Water	8260C	VOCs	Cyclohexanone	108-94-1			100	17.97	ug/L	51	140	51	140	20
Water	8260C	VOCs	Dibromochloromethane	124-48-1		0.5	5	0.329	ug/L	60	135	60	135	20

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Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Water	8260C	VOCs	Dibromomethane	74-95-3		0.5	5	0.405	ug/L	75	125	75	125	20
Water	8260C	VOCs	Dichlorodifluoromethane	75-71-8		0.5	10	0.449	ug/L	30	155	30	155	20
Water	8260C	VOCs	Ethyl methacrylate	97-63-2			5	0.246	ug/L	69	129	69	129	20
Water	8260C	VOCs	Ethylbenzene	100-41-4	0.297	0.5	5	0.299	ug/L	75	125	75	125	20
Water	8260C	VOCs	Hexachlorobutadiene	87-68-3			5	0.254	ug/L	50	140	50	140	20
Water	8260C	VOCs	Isopropylbenzene	98-82-8		0.5	5	0.258	ug/L	75	125	75	125	20
Water	8260C	VOCs	m-Xylene & p-Xylene	179601-23-1		0.5	5	0.569	ug/L	75	130	75	130	20
Water	8260C	VOCs	Methyl acetate	79-20-9		0.5	10	2.29	ug/L	66	121	66	121	20
Water	8260C	VOCs	Methyl methacrylate	80-62-6			5	0.514	ug/L	75	123	75	123	20
Water	8260C	VOCs	Methyl tert-butyl ether	1634-04-4		0.5	5	0.401	ug/L	65	125	65	125	20
Water	8260C	VOCs	Methylcyclohexane	108-87-2		0.5	10	0.259	ug/L	85	115	85	115	20
Water	8260C	VOCs	Methylene Chloride	75-09-2		0.5	7.5	1.67	ug/L	55	140	55	140	20
Water	8260C	VOCs	n-Butylbenzene	104-51-8			5	0.232	ug/L	70	135	70	135	20
Water	8260C	VOCs	n-Hexane	110-54-3			10	0.455	ug/L	67	140	67	140	20
Water	8260C	VOCs	N-Propylbenzene	103-65-1			5	0.298	ug/L	70	130	70	130	20
Water	8260C	VOCs	Naphthalene	91-20-3			5	0.85	ug/L	55	140	55	140	20
Water	8260C	VOCs	o-Xylene	95-47-6		0.5	5	0.318	ug/L	80	120	80	120	20
Water	8260C	VOCs	p-Isopropyltoluene	99-87-6			5	0.319	ug/L	75	130	75	130	20
Water	8260C	VOCs	sec-Butylbenzene	135-98-8			5	0.31	ug/L	70	125	70	125	20
Water	8260C	VOCs	Styrene	100-42-5		0.5	5	0.347	ug/L	65	135	65	135	20
Water	8260C	VOCs	tert-Butylbenzene	98-06-6			5	0.311	ug/L	70	130	70	130	20
Water	8260C	VOCs	Tetrachloroethene	127-18-4		0.5	5	0.28	ug/L	45	150	45	150	20
Water	8260C	VOCs	Tetrahydrofuran	109-99-9			25	1.67	ug/L	77	125	77	125	20
Water	8260C	VOCs	Toluene	108-88-3	4.45	0.5	5	1	ug/L	75	120	75	120	20
Water	8260C	VOCs	trans-1,2-Dichloroethene	156-60-5		0.5	5	0.178	ug/L	60	140	60	140	20
Water	8260C	VOCs	trans-1,3-Dichloropropene	10061-02-6	0.495	0.5	5	0.349	ug/L	55	140	55	140	20
Water	8260C	VOCs	trans-1,4-Dichloro-2-butene	110-57-6			10	0.946	ug/L	47	140	47	140	20
Water	8260C	VOCs	Trichloroethene	79-01-6		0.5	5	0.29	ug/L	70	125	70	125	20
Water	8260C	VOCs	Trichlorofluoromethane	75-69-4		0.5	5	0.221	ug/L	60	145	60	145	20
Water	8260C	VOCs	Vinyl acetate	108-05-4			10	0.605	ug/L	67	140	67	140	20
Water	8260C	VOCs	Vinyl chloride	75-01-4	1.48	0.5	5	0.428	ug/L	50	145	50	145	20

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Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Water	8260C	VOCs	1,2-Dichloroethene (total)	540-59-0			10	0.237	ug/L	85	115	85	115	20
Water	8260C	VOCs	Xylenes, Total	1330-20-7	0.958		10	0.854	ug/L	70	130	70	130	20
Solid	8270D	SVOCs	1,1'-Biphenyl	92-52-4		170	330	33.3	ug/Kg					
Solid	8270D	SVOCs	1,2,4-Trichlorobenzene	120-82-1			330	33.3	ug/Kg	45	110	45	110	30
Solid	8270D	SVOCs	1,2-Dichlorobenzene	95-50-1			330	33.3	ug/Kg	45	100	45	100	30
Solid	8270D	SVOCs	1,3-Dichlorobenzene	541-73-1			330	33.3	ug/Kg	40	100	40	100	30
Solid	8270D	SVOCs	1,4-Dichlorobenzene	106-46-7			330	33.3	ug/Kg	35	105	35	105	30
Solid	8270D	SVOCs	1,4-Dioxane	123-91-1			330	33.3	ug/Kg					
Solid	8270D	SVOCs	2,2'-oxybis[1-chloropropane]	108-60-1		170	330	33.3	ug/Kg	20	115	20	115	30
Solid	8270D	SVOCs	2,4,5-Trichlorophenol	95-95-4		170	330	33.3	ug/Kg	50	110	50	110	30
Solid	8270D	SVOCs	2,4,6-Trichlorophenol	88-06-2		170	330	33.3	ug/Kg	45	110	45	110	30
Solid	8270D	SVOCs	2,4-Dichlorophenol	120-83-2		170	330	33.3	ug/Kg	45	110	45	110	30
Solid	8270D	SVOCs	2,4-Dimethylphenol	105-67-9		170	330	33.3	ug/Kg	30	105	30	105	30
Solid	8270D	SVOCs	2,4-Dinitrophenol	51-28-5		330	1600	330	ug/Kg	15	130	15	130	30
Solid	8270D	SVOCs	2,4-Dinitrotoluene	121-14-2		170	330	33.3	ug/Kg	50	115	50	115	30
Solid	8270D	SVOCs	2,6-Dinitrotoluene	606-20-2		170	330	33.3	ug/Kg	50	110	50	110	30
Solid	8270D	SVOCs	2-Chloronaphthalene	91-58-7		170	330	33.3	ug/Kg	45	105	45	105	30
Solid	8270D	SVOCs	2-Chlorophenol	95-57-8		170	330	33.3	ug/Kg	45	105	45	105	30
Solid	8270D	SVOCs	2-Methylnaphthalene	91-57-6		170	330	33.3	ug/Kg	45	105	45	105	30
Solid	8270D	SVOCs	2-Methylphenol	95-48-7		170	330	33.3	ug/Kg	40	105	40	105	30
Solid	8270D	SVOCs	2-Nitroaniline	88-74-4		330	1600	33.3	ug/Kg	45	120	45	120	30
Solid	8270D	SVOCs	2-Nitrophenol	88-75-5		170	330	33.3	ug/Kg	40	110	40	110	30
Solid	8270D	SVOCs	3 & 4 Methylphenol	15831-10-4		170	660	66.6	ug/Kg	40	105	40	105	30
Solid	8270D	SVOCs	3,3'-Dichlorobenzidine	91-94-1		170	1600	33.3	ug/Kg	24	101	24	101	30
Solid	8270D	SVOCs	3-Nitroaniline	99-09-2		330	1600	33.3	ug/Kg	25	110	25	110	30
Solid	8270D	SVOCs	4,6-Dinitro-2-methylphenol	534-52-1		330	1600	330	ug/Kg	30	135	30	135	30
Solid	8270D	SVOCs	4-Bromophenyl phenyl ether	101-55-3		170	330	33.3	ug/Kg	45	115	45	115	30
Solid	8270D	SVOCs	4-Chloro-3-methylphenol	59-50-7		170	330	33.3	ug/Kg	45	115	45	115	30
Solid	8270D	SVOCs	4-Chloroaniline	106-47-8		170	330	33.3	ug/Kg	28	80	28	80	30
Solid	8270D	SVOCs	4-Chlorophenyl phenyl ether	7005-72-3		170	330	33.3	ug/Kg	45	110	45	110	30
Solid	8270D	SVOCs	4-Nitroaniline	100-01-6		330	1600	330	ug/Kg	35	115	35	115	30

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Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Solid	8270D	SVOCs	4-Nitrophenol	100-02-7		330	1600	330	ug/Kg	15	140	15	140	30
Solid	8270D	SVOCs	Acenaphthene	83-32-9	79	170	330	33.3	ug/Kg	45	110	45	110	30
Solid	8270D	SVOCs	Acenaphthylene	208-96-8		170	330	33.3	ug/Kg	45	105	45	105	30
Solid	8270D	SVOCs	Acetophenone	98-86-2		170	330	33.3	ug/Kg					
Solid	8270D	SVOCs	Aniline	62-53-3			330	33.3	ug/Kg					
Solid	8270D	SVOCs	Anthracene	120-12-7	8	170	330	33.3	ug/Kg	55	105	55	105	30
Solid	8270D	SVOCs	Atrazine	1912-24-9		170	330	33.3	ug/Kg					
Solid	8270D	SVOCs	Benzaldehyde	100-52-7		170	330	33.3	ug/Kg					
Solid	8270D	SVOCs	Benzo[a]anthracene	56-55-3	284	170	330	33.3	ug/Kg	50	110	50	110	30
Solid	8270D	SVOCs	Benzo[a]pyrene	50-32-8	313	170	330	33.3	ug/Kg	50	110	50	110	30
Solid	8270D	SVOCs	Benzo[b]fluoranthene	205-99-2	396	170	330	33.3	ug/Kg	45	115	45	115	30
Solid	8270D	SVOCs	Benzo[g,h,i]perylene	191-24-2	16	170	330	33.3	ug/Kg	40	125	40	125	30
Solid	8270D	SVOCs	Benzo[k]fluoranthene	207-08-9	322	170	330	33.3	ug/Kg	45	125	45	125	30
Solid	8270D	SVOCs	Benzyl alcohol	100-51-6			330	33.3	ug/Kg	20	125	20	125	30
Solid	8270D	SVOCs	Bis(2-chloroethoxy)methane	111-91-1		170	330	33.3	ug/Kg	45	110	45	110	30
Solid	8270D	SVOCs	Bis(2-chloroethyl)ether	111-44-4		170	330	33.4	ug/Kg	40	105	40	105	30
Solid	8270D	SVOCs	Bis(2-ethylhexyl) phthalate	117-81-7		170	330	45.3	ug/Kg	45	125	45	125	30
Solid	8270D	SVOCs	Butyl benzyl phthalate	85-68-7		170	330	33.3	ug/Kg	50	125	50	125	30
Solid	8270D	SVOCs	Caprolactam	105-60-2		170	330	33.3	ug/Kg					
Solid	8270D	SVOCs	Carbazole	86-74-8		170	330	33.3	ug/Kg	45	115	45	115	30
Solid	8270D	SVOCs	Chrysene	218-01-9	378	170	330	33.3	ug/Kg	55	110	55	110	30
Solid	8270D	SVOCs	Di-n-butyl phthalate	84-74-2		170	330	33.3	ug/Kg	55	110	55	110	30
Solid	8270D	SVOCs	Di-n-octyl phthalate	117-84-0		170	330	33.3	ug/Kg	40	130	40	130	30
Solid	8270D	SVOCs	Dibenz(a,h)anthracene	53-70-3	2.7	170	330	33.3	ug/Kg	40	125	40	125	30
Solid	8270D	SVOCs	Dibenzofuran	132-64-9		170	330	33.3	ug/Kg	50	105	50	105	30
Solid	8270D	SVOCs	Diethyl phthalate	84-66-2		170	330	33.3	ug/Kg	50	115	50	115	30
Solid	8270D	SVOCs	Dimethyl phthalate	131-11-3		170	330	33.3	ug/Kg	50	110	50	110	30
Solid	8270D	SVOCs	Fluoranthene	206-44-0	889	170	330	33.3	ug/Kg	55	115	55	115	30
Solid	8270D	SVOCs	Fluorene	86-73-7	2.9	170	330	33.3	ug/Kg	50	110	50	110	30
Solid	8270D	SVOCs	Hexachlorobenzene	118-74-1		170	330	33.3	ug/Kg	45	120	45	120	30
Solid	8270D	SVOCs	Hexachlorobutadiene	87-68-3		170	330	33.3	ug/Kg	40	115	40	115	30

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Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Solid	8270D	SVOCs	Hexachlorocyclopentadiene	77-47-4		170	1600	330	ug/Kg	38	107	38	107	30
Solid	8270D	SVOCs	Hexachloroethane	67-72-1		170	330	33.3	ug/Kg	35	110	35	110	30
Solid	8270D	SVOCs	Indeno[1,2,3-cd]pyrene	193-39-5	8.8	170	330	33.3	ug/Kg	40	120	40	120	30
Solid	8270D	SVOCs	Isophorone	78-59-1		170	330	33.3	ug/Kg	45	110	45	110	30
Solid	8270D	SVOCs	N-Nitrosodi-n-propylamine	621-64-7		170	330	33.3	ug/Kg	40	115	40	115	30
Solid	8270D	SVOCs	Naphthalene	91-20-3		170	330	33.3	ug/Kg	40	105	40	105	30
Solid	8270D	SVOCs	Nitrobenzene	98-95-3		170	330	33.3	ug/Kg	40	115	40	115	30
Solid	8270D	SVOCs	Nitrosodiphenylamine	86-30-6		170	330	33.3	ug/Kg	50	115	50	115	30
Solid	8270D	SVOCs	Pentachlorophenol	87-86-5		330	1600	330	ug/Kg	25	120	25	120	30
Solid	8270D	SVOCs	Phenanthrene	85-01-8	538	170	330	33.3	ug/Kg	50	110	50	110	30
Solid	8270D	SVOCs	Phenol	108-95-2		170	330	33.3	ug/Kg	40	100	40	100	30
Solid	8270D	SVOCs	Pyrene	129-00-0	716	170	330	33.3	ug/Kg	45	125	45	125	30
Solid	8270D	SVOCs	Pyridine	110-86-1			660	66.6	ug/Kg					
Water	8270D	SVOCs	1,1'-Biphenyl	92-52-4		5	10	1	ug/L					
Water	8270D	SVOCs	1,2,4-Trichlorobenzene	120-82-1			10	1	ug/L	35	105	35	105	30
Water	8270D	SVOCs	1,2-Dichlorobenzene	95-50-1			10	1	ug/L	35	100	35	100	30
Water	8270D	SVOCs	1,3-Dichlorobenzene	541-73-1			10	1	ug/L	30	100	30	100	30
Water	8270D	SVOCs	1,4-Dichlorobenzene	106-46-7			10	1	ug/L	30	100	30	100	30
Water	8270D	SVOCs	1,4-Dioxane	123-91-1			20	1	ug/L					
Water	8270D	SVOCs	2,2'-oxybis[1-chloropropane]	108-60-1		5	10	1	ug/L	25	130	25	130	30
Water	8270D	SVOCs	2,4,5-Trichlorophenol	95-95-4		5	10	1	ug/L	50	110	50	110	30
Water	8270D	SVOCs	2,4,6-Trichlorophenol	88-06-2		5	10	1	ug/L	50	115	50	115	30
Water	8270D	SVOCs	2,4-Dichlorophenol	120-83-2		5	10	1.08	ug/L	50	105	50	105	30
Water	8270D	SVOCs	2,4-Dimethylphenol	105-67-9		5	10	1	ug/L	30	110	30	110	30
Water	8270D	SVOCs	2,4-Dinitrophenol	51-28-5		10	50	2	ug/L	15	140	15	140	30
Water	8270D	SVOCs	2,4-Dinitrotoluene	121-14-2		5	10	1	ug/L	50	120	50	120	30
Water	8270D	SVOCs	2,6-Dinitrotoluene	606-20-2		5	10	2.16	ug/L	50	115	50	115	30
Water	8270D	SVOCs	2-Chloronaphthalene	91-58-7		5	10	1	ug/L	50	105	50	105	30
Water	8270D	SVOCs	2-Chlorophenol	95-57-8		5	10	1	ug/L	35	105	35	105	30
Water	8270D	SVOCs	2-Methylnaphthalene	91-57-6		5	10	1	ug/L	45	105	45	105	30
Water	8270D	SVOCs	2-Methylphenol	95-48-7		5	10	1	ug/L	40	110	40	110	30

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Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Water	8270D	SVOCs	2-Nitroaniline	88-74-4		10	10	1	ug/L	50	115	50	115	30
Water	8270D	SVOCs	2-Nitrophenol	88-75-5		5	10	1	ug/L	40	115	40	115	30
Water	8270D	SVOCs	3 & 4 Methylphenol	15831-10-4		5	10	2	ug/L	30	110	30	110	30
Water	8270D	SVOCs	3,3'-Dichlorobenzidine	91-94-1		5	50	1.29	ug/L	20	110	20	110	30
Water	8270D	SVOCs	3-Nitroaniline	99-09-2		10	10	1	ug/L	20	125	20	125	30
Water	8270D	SVOCs	4,6-Dinitro-2-methylphenol	534-52-1		5	50	1	ug/L	40	130	40	130	30
Water	8270D	SVOCs	4-Bromophenyl phenyl ether	101-55-3		5	10	1	ug/L	50	115	50	115	30
Water	8270D	SVOCs	4-Chloro-3-methylphenol	59-50-7		10	10	1	ug/L	45	110	45	110	30
Water	8270D	SVOCs	4-Chloroaniline	106-47-8		5	10	2.2	ug/L	15	110	15	110	30
Water	8270D	SVOCs	4-Chlorophenyl phenyl ether	7005-72-3		5	10	1	ug/L	50	110	50	110	30
Water	8270D	SVOCs	4-Nitroaniline	100-01-6		10	10	1	ug/L	35	120	35	120	30
Water	8270D	SVOCs	4-Nitrophenol	100-02-7		10	25	2	ug/L	19	49	19	49	30
Water	8270D	SVOCs	Acenaphthene	83-32-9		5	10	1	ug/L	45	110	45	110	30
Water	8270D	SVOCs	Acenaphthylene	208-96-8		5	10	1	ug/L	50	105	50	105	30
Water	8270D	SVOCs	Acetophenone	98-86-2		5	10	1.12	ug/L					
Water	8270D	SVOCs	Anthracene	120-12-7		5	10	1	ug/L	55	110	55	110	30
Water	8270D	SVOCs	Atrazine	1912-24-9			10	1	ug/L					
Water	8270D	SVOCs	Benzaldehyde	100-52-7		5	10	1	ug/L					
Water	8270D	SVOCs	Benzo[a]anthracene	56-55-3		5	10	1	ug/L	55	110	55	110	30
Water	8270D	SVOCs	Benzo[a]pyrene	50-32-8		5	10	1	ug/L	55	110	55	110	30
Water	8270D	SVOCs	Benzo[b]fluoranthene	205-99-2		5	10	1	ug/L	45	120	45	120	30
Water	8270D	SVOCs	Benzo[g,h,i]perylene	191-24-2		5	10	1	ug/L	45	125	45	125	30
Water	8270D	SVOCs	Benzo[k]fluoranthene	207-08-9	0.0334	5	10	1	ug/L	40	125	40	125	30
Water	8270D	SVOCs	Benzyl alcohol	100-51-6			10	1	ug/L	30	110	30	110	30
Water	8270D	SVOCs	Bis(2-chloroethoxy)methane	111-91-1		5	10	1	ug/L	45	105	45	105	30
Water	8270D	SVOCs	Bis(2-chloroethyl)ether	111-44-4		5	10	1	ug/L	35	110	35	110	30
Water	8270D	SVOCs	Bis(2-ethylhexyl) phthalate	117-81-7		5	10	1	ug/L	40	125	40	125	30
Water	8270D	SVOCs	Butyl benzyl phthalate	85-68-7		5	10	1	ug/L	45	115	45	115	30
Water	8270D	SVOCs	Caprolactam	105-60-2		5	15	2	ug/L					
Water	8270D	SVOCs	Carbazole	86-74-8		5	10	1	ug/L	50	115	50	115	30
Water	8270D	SVOCs	Chrysene	218-01-9		5	10	1	ug/L	55	110	55	110	30

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Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Water	8270D	SVOCs	Di-n-butyl phthalate	84-74-2		5	10	1	ug/L	55	115	55	115	30
Water	8270D	SVOCs	Di-n-octyl phthalate	117-84-0		5	15	1	ug/L	35	135	35	135	30
Water	8270D	SVOCs	Dibenz(a,h)anthracene	53-70-3		5	10	1	ug/L	40	125	40	125	30
Water	8270D	SVOCs	Dibenzofuran	132-64-9		5	10	1	ug/L	55	105	55	105	30
Water	8270D	SVOCs	Diethyl phthalate	84-66-2		5	10	1	ug/L	40	120	40	120	30
Water	8270D	SVOCs	Dimethyl phthalate	131-11-3		5	10	1	ug/L	25	125	25	125	30
Water	8270D	SVOCs	Fluoranthene	206-44-0		5	10	1	ug/L	55	115	55	115	30
Water	8270D	SVOCs	Fluorene	86-73-7		5	10	1	ug/L	50	110	50	110	30
Water	8270D	SVOCs	Hexachlorobenzene	118-74-1		5	10	1	ug/L	50	110	50	110	30
Water	8270D	SVOCs	Hexachlorobutadiene	87-68-3		5	10	1	ug/L	25	105	25	105	30
Water	8270D	SVOCs	Hexachlorocyclopentadiene	77-47-4		5	10	1	ug/L	16	86	16	86	30
Water	8270D	SVOCs	Hexachloroethane	67-72-1		5	10	1	ug/L	30	100	30	100	30
Water	8270D	SVOCs	Indeno[1,2,3-cd]pyrene	193-39-5		5	10	1	ug/L	45	125	45	125	30
Water	8270D	SVOCs	Isophorone	78-59-1		5	10	1	ug/L	50	110	50	110	30
Water	8270D	SVOCs	N-Nitrosodi-n-propylamine	621-64-7		5	10	1	ug/L	35	130	35	130	30
Water	8270D	SVOCs	Naphthalene	91-20-3		5	10	1	ug/L	40	100	40	100	30
Water	8270D	SVOCs	Nitrobenzene	98-95-3		5	10	1.09	ug/L	45	110	45	110	30
Water	8270D	SVOCs	Nitrosodiphenylamine	86-30-6		5	10	1	ug/L	50	110	50	110	30
Water	8270D	SVOCs	Pentachlorophenol	87-86-5		10	50	1.27	ug/L	40	115	40	115	30
Water	8270D	SVOCs	Phenanthrene	85-01-8		5	10	1	ug/L	50	115	50	115	30
Water	8270D	SVOCs	Phenol	108-95-2		5	15	2	ug/L	19	47	19	47	30
Water	8270D	SVOCs	Pyrene	129-00-0		5	10	1	ug/L	50	130	50	130	30
Water	8270D	SVOCs	Pyridine	110-86-1			20	2	ug/L					
Solid	8270D	PAHs	2-Methylnaphthalene	91-57-6		10	6.6		ug/Kg					
Solid	8270D	PAHs	Acenaphthene	83-32-9	79	10	6.6	1.13	ug/Kg	43	103	43	103	20
Solid	8270D	PAHs	Acenaphthylene	208-96-8		10	6.6	0.795	ug/Kg	47	103	47	103	20
Solid	8270D	PAHs	Anthracene	120-12-7	8	1	6.6	0.502	ug/Kg	49	106	50	107	20
Solid	8270D	PAHs	Benzo[a]anthracene	56-55-3	284	5	6.6	0.614	ug/Kg	46	106	37	115	20
Solid	8270D	PAHs	Benzo[a]pyrene	50-32-8	313	5	6.6	0.868	ug/Kg	51	111	31	122	20
Solid	8270D	PAHs	Benzo[b]fluoranthene	205-99-2	396	5	6.6	1.13	ug/Kg	46	110	29	102	20
Solid	8270D	PAHs	Benzo[g,h,i]perylene	191-24-2	16	10	6.6	0.635	ug/Kg	39	127	20	136	20

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Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Solid	8270D	PAHs	Benzo[k]fluoranthene	207-08-9	322	5	6.6	0.470	ug/Kg	52	103	33	108	20
Solid	8270D	PAHs	Chrysene	218-01-9	378	5	6.6	0.636	ug/Kg	25	120	25	120	20
Solid	8270D	PAHs	Dibenz(a,h)anthracene	53-70-3	2.7	10	6.6	1.50	ug/Kg	39	113	30	124	20
Solid	8270D	PAHs	Fluoranthene	206-44-0	889	5	6.6	0.766	ug/Kg	46	115	42	119	20
Solid	8270D	PAHs	Fluorene	86-73-7	2.9	5	6.6	0.871	ug/Kg	47	107	48	106	20
Solid	8270D	PAHs	Indeno[1,2,3-cd]pyrene	193-39-5	8.8	5	6.6	0.933	ug/Kg	39	112	30	150	20
Solid	8270D	PAHs	Naphthalene	91-20-3		10	6.6	1.01	ug/Kg	43	104	36	94	20
Solid	8270D	PAHs	Phenanthrene	85-01-8	538	5	6.6	0.619	ug/Kg	44	112	44	112	20
Solid	8270D	PAHs	Pyrene	129-00-0	716	10	6.6	0.552	ug/Kg	54	118	54	118	20
Water	8270D	PAHs	2-Methylnaphthalene	91-57-6			0.2		ug/L					20
Water	8270D	PAHs	Acenaphthene	83-32-9			0.2	0.035	ug/L	30	104	50	150	20
Water	8270D	PAHs	Acenaphthylene	208-96-8			0.2	0.038	ug/L	28	107	50	150	20
Water	8270D	PAHs	Anthracene	120-12-7			0.2	0.039	ug/L	35	113	50	150	20
Water	8270D	PAHs	Benzo[a]anthracene	56-55-3			0.2	0.031	ug/L	30	122	50	150	20
Water	8270D	PAHs	Benzo[a]pyrene	50-32-8			0.2	0.055	ug/L	32	114	50	150	20
Water	8270D	PAHs	Benzo[b]fluoranthene	205-99-2			0.2	0.073	ug/L	37	138	50	150	20
Water	8270D	PAHs	Benzo[g,h,i]perylene	191-24-2			0.2	0.04	ug/L	27	115	50	150	20
Water	8270D	PAHs	Benzo[k]fluoranthene	207-08-9	0.0334		0.2	0.053	ug/L	42	131	50	150	20
Water	8270D	PAHs	Chrysene	218-01-9			0.2	0.039	ug/L	38	107	50	150	20
Water	8270D	PAHs	Dibenz(a,h)anthracene	53-70-3			0.2	0.046	ug/L	21	114	50	150	20
Water	8270D	PAHs	Fluoranthene	206-44-0			0.2	0.034	ug/L	41	128	50	150	20
Water	8270D	PAHs	Fluorene	86-73-7			0.2	0.032	ug/L	34	112	50	150	20
Water	8270D	PAHs	Indeno[1,2,3-cd]pyrene	193-39-5			0.2	0.040	ug/L	26	120	50	150	20
Water	8270D	PAHs	Naphthalene	91-20-3			0.2	0.068	ug/L	28	104	50	150	20
Water	8270D	PAHs	Phenanthrene	85-01-8			0.2	0.048	ug/L	51	116	50	150	20
Water	8270D	PAHs	Pyrene	129-00-0			0.2	0.037	ug/L	44	130	50	150	20
Solid	8081B	Pesticides	4,4'-DDD	72-54-8		0.5	1.7	0.221	ug/Kg	30	135	30	135	30
Solid	8081B	Pesticides	4,4'-DDE	72-55-9	1.4	0.5	1.7	0.39	ug/Kg	70	125	70	125	30
Solid	8081B	Pesticides	4,4'-DDT	50-29-3	0.65	0.5	1.7	0.628	ug/Kg	45	140	45	140	30
Solid	8081B	Pesticides	Aldrin	309-00-2		0.2	1.7	0.306	ug/Kg	45	140	45	140	30
Solid	8081B	Pesticides	alpha-BHC	319-84-6		0.2	1.7	0.185	ug/Kg	60	125	60	125	30

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Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Solid	8081B	Pesticides	alpha-Chlordane	5103-71-9		0.2	1.7	0.567	ug/Kg	65	120	65	120	30
Solid	8081B	Pesticides	beta-BHC	319-85-7		0.2	1.7	0.3	ug/Kg	60	125	60	125	30
Solid	8081B	Pesticides	delta-BHC	319-86-8		0.2	1.7	0.242	ug/Kg	55	130	55	130	30
Solid	8081B	Pesticides	Dieldrin	60-57-1		0.2	1.7	0.215	ug/Kg	65	125	65	125	30
Solid	8081B	Pesticides	Endosulfan I	959-98-8		0.2	1.7	0.57	ug/Kg	15	135	15	135	30
Solid	8081B	Pesticides	Endosulfan II	33213-65-9		0.2	1.7	0.235	ug/Kg	35	140	35	140	30
Solid	8081B	Pesticides	Endosulfan sulfate	1031-07-8		0.2	1.7	0.34	ug/Kg	60	135	60	135	30
Solid	8081B	Pesticides	Endrin	72-20-8		0.2	1.7	0.158	ug/Kg	60	135	60	135	30
Solid	8081B	Pesticides	Endrin aldehyde	7421-93-4		0.2	1.7	0.389	ug/Kg	35	145	35	145	30
Solid	8081B	Pesticides	Endrin ketone	53494-70-5		0.2	1.7	0.417	ug/Kg	65	135	65	135	30
Solid	8081B	Pesticides	gamma-BHC (Lindane)	58-89-9		0.2	1.7	0.168	ug/Kg	60	125	60	125	30
Solid	8081B	Pesticides	gamma-Chlordane	5103-74-2		0.2	1.7	0.158	ug/Kg	65	125	65	125	30
Solid	8081B	Pesticides	Heptachlor	76-44-8		0.2	1.7	0.204	ug/Kg	50	140	50	140	30
Solid	8081B	Pesticides	Heptachlor epoxide	1024-57-3	0.37	0.2	1.7	0.429	ug/Kg	65	130	65	130	30
Solid	8081B	Pesticides	Methoxychlor	72-43-5		0.2	3.3	0.719	ug/Kg	55	145	55	145	30
Solid	8081B	Pesticides	Chlordane (technical)	57-74-9		4	17	3.73	ug/Kg					
Solid	8081B	Pesticides	Toxaphene	8001-35-2		5	67	15.16	ug/Kg					
Water	8081B	Pesticides	4,4'-DDD	72-54-8		0.01	0.05	0.01	ug/L	25	150	25	150	30
Water	8081B	Pesticides	4,4'-DDE	72-55-9	0.0146	0.01	0.05	0.01	ug/L	35	140	35	140	30
Water	8081B	Pesticides	4,4'-DDT	50-29-3	0.0413	0.01	0.05	0.01	ug/L	45	140	45	140	30
Water	8081B	Pesticides	Aldrin	309-00-2		0.01	0.05	0.01	ug/L	25	140	25	140	30
Water	8081B	Pesticides	alpha-BHC	319-84-6		0.01	0.055	0.01	ug/L	60	130	60	130	30
Water	8081B	Pesticides	alpha-Chlordane	5103-71-9		0.01	0.05	0.01	ug/L	65	125	65	125	30
Water	8081B	Pesticides	beta-BHC	319-85-7		0.01	0.05	0.13	ug/L	65	125	65	125	30
Water	8081B	Pesticides	delta-BHC	319-86-8		0.01	0.05	0.01	ug/L	45	135	45	135	30
Water	8081B	Pesticides	Dieldrin	60-57-1		0.01	0.05	0.01	ug/L	60	130	60	130	30
Water	8081B	Pesticides	Endosulfan I	959-98-8		0.01	0.05	0.01	ug/L	50	110	50	110	30
Water	8081B	Pesticides	Endosulfan II	33213-65-9		0.01	0.05	0.01	ug/L	30	130	30	130	30
Water	8081B	Pesticides	Endosulfan sulfate	1031-07-8		0.01	0.055	0.01	ug/L	55	135	55	135	30
Water	8081B	Pesticides	Endrin	72-20-8		0.01	0.05	0.017	ug/L	55	135	55	135	30
Water	8081B	Pesticides	Endrin aldehyde	7421-93-4		0.01	0.05	0.01	ug/L	55	135	55	135	30

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Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Water	8081B	Pesticides	Endrin ketone	53494-70-5		0.01	0.05	0.01	ug/L	75	125	75	125	30
Water	8081B	Pesticides	gamma-BHC (Lindane)	58-89-9		0.01	0.05	0.01	ug/L	25	135	25	135	30
Water	8081B	Pesticides	gamma-Chlordane	5103-74-2		0.01	0.05	0.01	ug/L	60	125	60	125	30
Water	8081B	Pesticides	Heptachlor	76-44-8		0.01	0.100	0.01	ug/L	40	130	40	130	30
Water	8081B	Pesticides	Heptachlor epoxide	1024-57-3		0.01	0.05	0.017	ug/L	60	130	60	130	30
Water	8081B	Pesticides	Methoxychlor	72-43-5		0.01	0.100	0.01	ug/L	55	130	55	130	30
Water	8081B	Pesticides	Chlordane (technical)	57-74-9		0.01	0.5	0.231	ug/L					
Water	8081B	Pesticides	Toxaphene	8001-35-2		0.01	2	0.66	ug/L					
Solid	8151A	Herbicides	2,4,5-T	93-76-5			26	7.93	ug/Kg	35	110	35	110	20
Solid	8151A	Herbicides	2,4-D	94-75-7			250	22	ug/Kg	35	115	35	115	20
Solid	8151A	Herbicides	2,4-DB	94-82-6			250	43.8	ug/Kg	45	130	45	130	20
Solid	8151A	Herbicides	Dalapon	75-99-0			90	38.5	ug/Kg	40	110	40	110	20
Solid	8151A	Herbicides	Dicamba	1918-00-9			40	3.93	ug/Kg	60	110	60	110	20
Solid	8151A	Herbicides	Dichlorprop	120-36-5			250	23.4	ug/Kg	70	120	70	120	20
Solid	8151A	Herbicides	Dinoseb	88-85-7			45	13.6	ug/Kg	20	100	20	100	20
Solid	8151A	Herbicides	MCPA	94-74-6			20500	3071	ug/Kg	60	145	60	145	20
Solid	8151A	Herbicides	MCPP	93-65-2			17500	4796	ug/Kg	18	140	18	140	30
Solid	8151A	Herbicides	Silvex (2,4,5-TP)	93-72-1			30	3.28	ug/Kg	50	115	50	115	20
Water	8151A	Herbicides	2,4,5-T	93-76-5			1	0.137	ug/L	30	110	30	110	20
Water	8151A	Herbicides	2,4-D	94-75-7			5	1.8	ug/L	35	115	35	115	20
Water	8151A	Herbicides	2,4-DB	94-82-6			5	2.42	ug/L	45	130	45	130	20
Water	8151A	Herbicides	Dalapon	75-99-0			12	0.939	ug/L	40	110	40	110	20
Water	8151A	Herbicides	Dicamba	1918-00-9			2	0.29	ug/L	60	110	60	110	20
Water	8151A	Herbicides	Dichlorprop	120-36-5			9	1.18	ug/L	70	120	70	120	20
Water	8151A	Herbicides	Dinoseb	88-85-7			2	0.632	ug/L	20	95	20	95	20
Water	8151A	Herbicides	MCPA	94-74-6			400	121	ug/L	50	150	50	150	20
Water	8151A	Herbicides	MCPP	93-65-2			400	142	ug/L	50	150	50	150	20
Water	8151A	Herbicides	Silvex (2,4,5-TP)	93-72-1			1	0.148	ug/L	50	115	50	115	20
Water	1311/8260C	TCLP VOCs	1,1-Dichloroethene	75-35-4			50	3.65	ug/L	70	130	70	130	20
Water	1311/8260	TCLP VOCs	1,2-Dichloroethane	107-06-2			50	3.72	ug/L	70	130	70	130	20

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Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
	C													
Water	1311/8260 C	TCLP VOCs	2-Butanone (MEK)	78-93-3			50	3.89	ug/L	30	150	30	150	20
Water	1311/8260 C	TCLP VOCs	Benzene	71-43-2			50	2.53	ug/L	80	120	80	120	20
Water	1311/8260 C	TCLP VOCs	Carbon tetrachloride	56-23-5			50	3.6	ug/L	65	140	65	140	20
Water	1311/8260 C	TCLP VOCs	Chlorobenzene	108-90-7			50	3.82	ug/L	80	120	80	120	20
Water	1311/8260 C	TCLP VOCs	Chloroform	67-66-3			50	0.92	ug/L	65	135	65	135	20
Water	1311/8260 C	TCLP VOCs	Tetrachloroethene	127-18-4			50	2.8	ug/L	45	150	45	150	20
Water	1311/8260 C	TCLP VOCs	Trichloroethene	79-01-6			50	2.9	ug/L	70	125	70	125	20
Water	1311/8260 C	TCLP VOCs	Vinyl chloride	75-01-4			100	4.3	ug/L	50	145	50	145	20
Water	1311/8270 D	TCLP SVOCs	1,4-Dichlorobenzene	106-46-7			50	5	ug/L	30	100	30	100	30
Water	1311/8270 D	TCLP SVOCs	2,4,5-Trichlorophenol	95-95-4			50	10	ug/L	50	110	50	110	30
Water	1311/8270 D	TCLP SVOCs	2,4,6-Trichlorophenol	88-06-2			50	10	ug/L	50	115	50	115	30
Water	1311/8270 D	TCLP SVOCs	2,4-Dinitrotoluene	121-14-2			50	5	ug/L	50	120	50	120	30
Water	1311/8270 D	TCLP SVOCs	2-Methylphenol	95-48-7			50	10	ug/L	40	110	40	110	30
Water	1311/8270 D	TCLP SVOCs	3 & 4 Methylphenol	15831-10-4			100	5	ug/L	30	110	30	110	30
Water	1311/8270 D	TCLP SVOCs	Hexachlorobenzene	118-74-1			50	5	ug/L	50	110	50	110	30
Water	1311/8270 D	TCLP SVOCs	Hexachlorobutadiene	87-68-3			50	5	ug/L	25	105	25	105	30
Water	1311/8270 D	TCLP SVOCs	Hexachloroethane	67-72-1			50	5	ug/L	30	100	30	100	30
Water	1311/8270 D	TCLP SVOCs	Nitrobenzene	98-95-3			50	5	ug/L	45	110	45	110	30
Water	1311/8270 D	TCLP SVOCs	Pentachlorophenol	87-86-5			250	10	ug/L	40	115	40	115	30
Water	1311/8270 D	TCLP SVOCs	Pyridine	110-86-1			100	25	ug/L	10	72	10	72	30

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Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Water	1311/8151 A	TCLP Herbicides	2,4-D	94-75-7			40	20	ug/L	35	115	35	115	20
Water	1311/8151 A	TCLP Herbicides	Silvex (2,4,5-TP)	93-72-1			10	3.0	ug/L	50	115	50	115	20
Solid/ Water	1311/6010 C	TCLP RCRA Metals	Arsenic	7440-38-2			1000	4.925	ug/L	80	120	80	120	20
Solid/ Water	1311/6010 C	TCLP RCRA Metals	Barium	7440-39-3			125	19.8	ug/L	80	120	80	120	20
Solid/ Water	1311/6010 C	TCLP RCRA Metals	Cadmium	7440-43-9			25	2.28	ug/L	80	120	80	120	20
Solid/ Water	1311/6010 C	TCLP RCRA Metals	Chromium	7440-47-3			25	15.7	ug/L	80	120	80	120	20
Solid/ Water	1311/6010 C	TCLP RCRA Metals	Lead	7439-92-1			250	6.35	ug/L	80	120	80	120	20
Solid/ Water	1311/6010 C	TCLP RCRA Metals	Selenium	7782-49-2			1000	6.65	ug/L	80	120	80	120	20
Solid/ Water	1311/6010 C	TCLP RCRA Metals	Selenium	7782-49-2			500	13.3	ug/L	80	120	80	120	20
Solid/ Water	1311/6010 C	TCLP RCRA Metals	Silver	7440-22-4			40	14.9	ug/L	80	120	80	120	20
Solid/ Water	1311/7470 A	TCLP RCRA Metals	Mercury	7439-97-6			1.5	0.079	ug/L	80	120	80	120	20
Solid	1311/8081 B	TCLP Pesticides	Endrin	72-20-8			0.50	0.050	ug/L	55	135	55	135	30
Solid	1311/8081 B	TCLP Pesticides	gamma-BHC (Lindane)	58-89-9			0.50	0.015	ug/L	60	125	60	125	30
Solid	1311/8081 B	TCLP Pesticides	Heptachlor	76-44-8			0.50	0.015	ug/L	40	130	40	130	30
Solid	1311/8081 B	TCLP Pesticides	Heptachlor epoxide	1024-57-3			0.50	0.050	ug/L	60	130	60	130	30
Solid	1311/8081 B	TCLP Pesticides	Methoxychlor	72-43-5			1.0	0.050	ug/L	55	150	55	150	30
Solid	1311/8081 B	TCLP Pesticides	Technical Chlordane	12789-03-6			5.0	0.20	ug/L					
Solid	1311/8081 B	TCLP Pesticides	Toxaphene	8001-35-2			20	0.050	ug/L					
Water	7470A	Mercury	Mercury	7439-97-6	0.17		0.18	0.06	ug/L	80	120	80	120	20
Water	6010C	Metals	Aluminum	7429-90-5	979		1000	79.9	ug/L	80	120	80	120	20
Water	6010C	Metals	Antimony	7440-36-0	2.34		20	19.8	ug/L	80	120	80	120	20
Water	6010C	Metals	Arsenic	7440-38-2	30.6		10	9.85	ug/L	80	120	80	120	20

QAPP Worksheet #15
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Water	6010C	Metals	Barium	7440-39-3	46.8		250	9.88	ug/L	80	120	80	120	20
Water	6010C	Metals	Beryllium	7440-41-7			25	0.61	ug/L	80	120	80	120	20
Water	6010C	Metals	Boron	7440-42-8	3820		100	27	ug/L	80	120	80	120	20
Water	6010C	Metals	Cadmium	7440-43-9	2.51		5.0	0.91	ug/L	80	120	80	120	20
Water	6010C	Metals	Calcium	7440-70-2	620000		1000	265	ug/L	80	120	80	120	20
Water	6010C	Metals	Chromium	7440-47-3	3.19		10	15.7	ug/L	80	120	80	120	20
Water	6010C	Metals	Cobalt	7440-48-4	2.8		250	3.96	ug/L	80	120	80	120	20
Water	6010C	Metals	Copper	7440-50-8	207		25	11.4	ug/L	80	120	80	120	20
Water	6010C	Metals	Iron	7439-89-6	8810		250	141	ug/L	80	120	80	120	20
Water	6010C	Metals	Lead	7439-92-1	5.99		250	6.35	ug/L	80	120	80	120	20
Water	6010C	Metals	Lithium	7439-93-2	1130		125	24.05	ug/L	80	120	80	120	20
Water	6010C	Metals	Magnesium	7439-95-4	580000		2500	330	ug/L	80	120	80	120	20
Water	6010C	Metals	Manganese	7439-96-5	722		15	8.3	ug/L	80	120	80	120	20
Water	6010C	Metals	Molybdenum	7439-98-7			5	1	ug/L	80	120	80	120	20
Water	6010C	Metals	Nickel	7440-02-0	6.48		40	13.3	ug/L	80	120	80	120	20
Water	6010C	Metals	Potassium	9/7/7440	62100		12500	1650	ug/L	80	120	80	120	20
Water	6010C	Metals	Selenium	7782-49-2	4.24		15	5.0	ug/L	80	120	80	120	20
Water	6010C	Metals	Silver	7440-22-4	0.018		50	5.95	ug/L	80	120	80	120	20
Water	6010C	Metals	Sodium	7440-23-5	1200000		5000	1620	ug/L	80	120	80	120	20
Water	6010C	Metals	Thallium	7440-28-0	1.72		20	9.92	ug/L	80	120	80	120	20
Water	6010C	Metals	Uranium	7440-61-1			1275	118	ug/L	80	120	80	120	20
Water	6010C	Metals	Vanadium	7440-62-2	2.8		125	10.2	ug/L	80	120	80	120	20
Water	6010C	Metals	Zinc	7440-66-6	131		50	12.9	ug/L	80	120	80	120	20
Water	300.0	Anions	Chloride	16887-00-6			0.20	0.02	mg/L	90	110	90	110	20
Water	300.0	Anions	Fluoride	16984-48-8			0.10	0.01	mg/L	90	110	90	110	20
Water	300.0	Anions	Nitrate as N	14797-55-8			0.02	0.004	mg/L	90	110	90	110	20
Water	300.0	Anions	Nitrite as N	14797-65-0			0.02	0.003	mg/L	90	110	90	110	20
Water	300.0	Anions	ortho-Phosphate	14265-44-2			0.50	0.054	mg/L	90	110	90	110	20
Water	300.0	Anions	Sulfate	14808-79-8			0.50	0.05	mg/L	90	110	90	110	20
Water	310.1	Alkalinity	Alkalinity	STL00171			5.0	0.542	mg/L	90	110	80	120	20
Water	310.1	Alkalinity	Bicarbonate Alkalinity as CaCO3	STL00138			5.0	0.542	mg/L	90	110	80	120	20

QAPP Worksheet #15
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Water	310.1	Alkalinity	Carbonate Alkalinity as CaCO3	STL00154			5.0	0.542	mg/L	90	110	80	120	20
Water	160.1	Solids	Total Dissolved Solids (TDS)	STL00242			5.0	3.497	mg/L	90	110			20
Water	415.1	Total Organic Carbon (TOC)	Total Organic Carbon (TOC)	7440-44-0			1.0	0.265	mg/L	90	110	76	120	20
Water	1664A	Oil & Grease	Oil & Grease	STL00181			5.0	2.03	mg/L	78	114	78	114	20
Water	160.2	Solids	Total Suspended Solids	STL00161			4.0		mg/L	66	127			20
Solid	A-01-R	Isotopic Uranium	U-233/234	13966-29-5	1.66	0.5	0.5		pCi/g	84	120	70	130	40
Solid	A-01-R	Isotopic Uranium	U-235/236	15117-96-1	0.0847	0.5	0.5		pCi/g					40
Solid	A-01-R	Isotopic Uranium	U-238	7440-61-1	1.34	0.5	0.5		pCi/g	82	122	70	130	40
Solid	A-01-R	Isotopic Thorium	Th-228	14274-82-9	1.64	0.5	0.5		pCi/g	70	130	70	130	40
Solid	A-01-R	Isotopic Thorium	Th-230	14269-63-7	1.39	0.5	0.5		pCi/g	81	118	76	115	40
Solid	A-01-R	Isotopic Thorium	Th-232	7440-29-1	1.24	0.5	0.5		pCi/g	70	130	70	130	40
Water	A-01-R	Isotopic Uranium	U-233/234	13966-29-5	8.73	0.2	0.2		pCi/L	84	120	65	146	40
Water	A-01-R	Isotopic Uranium	U-235/236	15117-96-1	0.715	0.2	0.2		pCi/L					40
Water	A-01-R	Isotopic Uranium	U-238	7440-61-1	5.79	0.2	0.2		pCi/L	83	121	68	143	40
Water	A-01-R	Isotopic Thorium	Th-228	14274-82-9	0.25	0.2	0.2		pCi/L	70	130	70	130	40
Water	A-01-R	Isotopic Thorium	Th-230	14269-63-7	0.877	0.2	0.2		pCi/L	81	125	82	139	40
Water	A-01-R	Isotopic Thorium	Th-232	7440-29-1	0.229	0.2	0.2		pCi/L	70	130	70	130	40
Water	903.1	Radium-226	Ra-226	13982-63-3	1.76	0.5	0.5		pCi/L	75	125	60	140	75
Solid	901.1	Gamma Spectroscopy	Ra-226	13982-63-3	1.2	0.5	0.5		pCi/g	73	107			40
Water	901.1	Gamma Spectroscopy	Actinium-227	13982-63-3					pCi/L					
Water	901.1	Gamma Spectroscopy	Actinium-228	14331-83-0					pCi/L					
Water	901.1	Gamma Spectroscopy	Bismuth-212	14913-49-6					pCi/L					

QAPP Worksheet #15
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix	Analytical Method	Method Description	Analyte	CAS Number	Site-Specific Background Criteria[1]	Project QL Goal	QL or MDA	MDL	Units	LCS LCL	LCS UCL	MS LCL	MS UCL	RPD
Water	901.1	Gamma Spectroscopy	Bismuth-214	14733-03-0					pCi/L					
Water	901.1	Gamma Spectroscopy	Cesium-137	10045-97-3			20		pCi/L	90	111			40
Water	901.1	Gamma Spectroscopy	Lead-210	14255-04-0					pCi/L					
Water	901.1	Gamma Spectroscopy	Lead-212	18879-28-2					pCi/L					
Water	901.1	Gamma Spectroscopy	Lead-214	1506728-4					pCi/L					
Water	901.1	Gamma Spectroscopy	Potassium-40	7447-40-7					pCi/L					
Water	901.1	Gamma Spectroscopy	Protactinium-231	14331-85-2					pCi/L					
Water	901.1	Gamma Spectroscopy	Radium-226	13982-63-3			50		pCi/L					
Water	901.1	Gamma Spectroscopy	Radium-228	15262-20-1			50		pCi/L					
Water	901.1	Gamma Spectroscopy	Thallium-208	14913-50-9					pCi/L					
Water	901.1	Gamma Spectroscopy	Thorium-232	7440-29-1					pCi/L					
Water	901.1	Gamma Spectroscopy	Thorium-234	15065-10-8					pCi/L					
Water	901.1	Gamma Spectroscopy	Uranium-235	15117-96-1					pCi/L					
Water	901.1	Gamma Spectroscopy	Uranium-238	7440-61-1					pCi/L					
Water	D5174-91	Total Uranium	Total Uranium	7440-61-1	15.6		1.0		ug/L	75	125	40	160	40
Solid	D5174-91	Total Uranium	Total Uranium	7440-61-1	3580		100		ug/kg	75	125	40	160	40

Notes:

1 – SAIC, NFSS Remedial Investigation Report Addendum, Table 13-1, April 2011.

LCL – Lower Control Limit
LCS – Laboratory Control Sample
MDA – Minimum Detected Activity (radionuclides only)
MDL – Method Detection Limit (as determined by 40 CFR Part 136)
MS – Matrix Spike
PAHs – Polynuclear Aromatic Hydrocarbons

QAPP Worksheet #15
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

QL – Quantitation Limit (equivalent to lowest point of calibration curve, organics and inorganics only)
VOCs – Volatile Organic Compounds
SVOCs – Semivolatile Organic compounds
TCLP – Toxicity Characteristic Leaching Procedure
UCL – Upper Control Limit

QAPP Worksheet #17
Sampling Design and Rationale

Sampling Design and Rationale is described in the FSP.

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]:

QAPP Worksheet #18
Sampling Locations and Methods

Sampling Locations and Methods are described in the FSP.

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Rationale for Sampling Location

[1]Specify the appropriate letter or number from the Project Sampling SOP References table (Worksheet #21).

QAPP Worksheet #19 & 30
Sample Containers, Preservation, and Hold Times

Laboratory Name: TestAmerica Laboratories, Inc. (TA) , 13715 Rider Trail North, Earth City, MO 63045;
POC: Jayna Awalt (Project Manager); jayna.awalt@testamericainc.com; (314) 298-8566
Accreditations/Certifications: DoD (expires 01/10/2016 and 06/30/2014)/NYSDOH ELAP (expires 04/01/2014)
Backup Laboratory: TestAmerica Laboratories, Inc., (Richland, WA)
Sample Delivery Method: Lab Courier from site to TestAmerica Laboratories, Inc. (Amherst, NY); FedEx from TA – Amherst, NY to TA – Earth City, MO and Richland, WA labs)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)	Data Package Turnaround Time
IDW/Solid	VOCs	EPA 5035A/8260C SOP ST-MS-0002	Two 2-oz VOA vials w/ Teflon septa	4±2°C	14 days	28 Days
IDW/Solid	SVOCs	EPA 3550C/8270D SOP ST-MS-0001	One 8-oz glass jar	4±2°C	14 days/40 days	
IDW/Solid	Pesticides	EPA 3550C/8081B SOP ST-GC-0016	One 8-oz glass jar	4±2°C	14 days/40 days	
Soil	PAHs	EPA 3550C/8270D SOP ST-MS-0001	One 8-oz glass jar	4±2°C	14 days/40 days	
Soil	Total Uranium	ASTM D5174-02 SOP RL-KPA-003	One 4-oz glass jar	None	180 days	
Soil	Gamma Spec	EPA 901.1 SOP ST-RD-0102	1 16oz. Jar	None	180 days	
Soil	Isotopic Uranium	HASL-300 A-01-R SOP ST-RD-0210	One 4-oz glass jar	None	180 days	
Soil	Isotopic Thorium	HASL-300 A-01-R SOP ST-RD-0210	One 4-oz glass jar	None	180 days	
IDW/Liquid	VOCs	EPA 5030B/8260C SOP ST-MS-0002	Three 40-mL VOA vials	pH ≤ 2 w/HCl, 4±2°C	14 days	
IDW/Liquid	SVOCs	EPA 3510C/8270D SOP ST-MS-0001	Two 1-L amber bottles	4±2°C	7 days/40 days	
IDW/Liquid	Pesticides	EPA 3510C/8081B SOP ST-GC-0016	Two 1-L amber bottles	4±2°C	7 days/40 days	
IDW/Liquid	Herbicides	EPA 8151A SOP ST-GC-0015	Two 1-L amber bottles	4±2°C	7 days/40 days	

QAPP Worksheet #19 & 30
Sample Containers, Preservation, and Hold Times

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)	Data Package Turnaround Time
IDW/Liquid	ICP Metals	EPA 3010A/6010C SOP ST-MT-0001	One 250-mL poly bottle	pH ≤ 2 w/HNO_3	180 days	28 Days
IDW/Liquid	Mercury	EPA 7470A SOP ST-MT-0005	One 250-mL poly bottle	pH ≤ 2 w/HNO_3	28 days	
Water	Anions	EPA 300.0A SOP ST-WC-0028	One 250-mL poly bottle	4±2°C	48 hours/28 days	
Water	Alkalinity	EPA 310.1 SOP ST-WC-0019	One 250-mL poly bottle	4±2°C	28 days	
Water	TDS	EPA 160.1 SOP ST-WC-0036	One 250-mL poly bottle	4±2°C	7 days	
IDW/Liquid	pH	EPA 9040B SOP ST-WC-0011	One 250-mL poly bottle	4±2°C	48 hours	
IDW/Liquid	Oil and Grease	EPA 1664A SOP ST-WC-0039	Two 1L amber glass	pH ≤ 2 w/HCL	28 days	
IDW/Liquid	Total Organic Carbon	EPA 415.1 SOP ST-WC-0016	One 250-mL poly bottle	pH ≤ 2 w/H2SO4	28 days	
IDW/Liquid	TSS	EPA 160.2 SOP ST-WC-0036	One 250-mL poly bottle	4±2°C	7 days	
Water	Total Uranium	ASTM D5174-02 SOP RL-KPA-003	One 1L poly bottle	pH ≤ 2 w/HNO_3	180 days	
Water	Radium-226	EPA 903.1 SOP RL-RA-001	One 1L poly bottle	pH ≤ 2 w/HNO_3	180 days	
Water/IDW/Liquid	Isotopic Uranium	HASL-300 A-01-R SOP ST-RD-0210	One 1L poly bottle	pH ≤ 2 w/HNO_3	180 days	
Water/IDW/Liquid	Isotopic Thorium	HASL-300 A-01-R SOP ST-RD-0210	One 1L poly bottle	pH ≤ 2 w/HNO_3	180 days	
IDW/Liquid	Gamma Spec	EPA 901.1 SOP ST-RD-0102 SOP ST-GC-0017	One 1L poly bottle	pH ≤ 2 w/HNO_3	180 days	
IDW/Solid	TCLP ICP Metals	EPA 1311/3010A/6010C SOP ST-MT- 0001	One 4-oz glass jar	4±2°C	180 days (TCLP)/180 days analysis	

QAPP Worksheet #19 & 30
Sample Containers, Preservation, and Hold Times

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)	Data Package Turnaround Time
IDW/Solid	TCLP Mercury	EPA 1311/7471B SOP ST-MT-0007	One 4-oz glass jar	4±2°C	28 days (TCLP)/28 days analysis	28 Days
IDW/Solid	Herbicides	EPA 8151A SOP ST-GC-0017	One 8-oz glass jar	4±2°C	14 days/40 days	
IDW/Solid	Paint Filter Liquids Test	EPA 9095 SOP ST-WC-0031	One 4-oz glass jar	4±2°C	28 days	
IDW/Liquid	TCLP VOCs	EPA 1311/5030B/8260C SOP ST-MS-0002	Three 40-mL VOA vials	4±2°C	14 days (TCLP)/14 days analysis	
IDW/Liquid	TCLP SVOCs	EPA 1311/3510C/8270D SOP ST-MS-0001	One 1-L amber bottle	4±2°C	14 days (TCLP)7 days/40 days	
IDW/Liquid	TCLP Pesticides	EPA 1311/3510C/8081B SOP ST-GC-0016	One 1-L amber bottle	4±2°C	14 days (TCLP)7 days/40 days	
IDW/Liquid	TCLP Herbicides	EPA1311/ 8151A SOP ST-GC-0017	One 1-L amber bottle	4±2°C	14 days (TCLP)7 days/40 days	
IDW/Liquid	TCLP ICP Metals	EPA 1311/3010A/6010C SOP ST-MT- 0001	One 1-L amber bottle	4±2°C	180 days (TCLP)/180 days analysis	
IDW/Liquid	TCLP Mercury	EPA 1311/7470A SOP ST-MT-0007	One 1-L amber bottle	4±2°C	28 days (TCLP)/28 days analysis	

QAPP Worksheet #20
Field QC Summary

Analytical Parameter	Analytical Method	Reference	Matrix	Estimated No. of Field Samples	Field Duplicates*	Rinsate Blanks**	MS/MSD/MD (Pairs)*	Total No. of Samples
Task 2a								
1. Soil Delineation Sampling								
Isotopic Uranium (U-234, U-235 and U-238)	HASL-300	1	Soil	1134	111	25	57	1384
Isotopic Thorium (Th-228, Th-230 and Th-232)	HASL-300	1	Soil	1134	111	25	57	1384
Radium-226	EPA 901.1	2	Soil	1134	111	25	57	1327
Polynuclear Aromatic Hydrocarbons (PAHs)	EPA SW8270D-SIM	3	Soil	78	8	10	4	104
2. Trench Excavation Sampling								
Mass Uranium (Total-U)	ASTM D5174-02	4	Soil	24	3	2	2	33
Isotopic Uranium (U-234, U-235 and U-238)	HASL-300	1	Soil	24	3	2	2	33
Isotopic Thorium (Th-228, Th-230 and Th-232)	HASL-300	1	Soil	24	3	2	2	33
Radium-226	EPA 901.1	2	Soil	24	3	2	1	30
Filtered								
Mass Uranium (Total-U)	ASTM D5174-02	4	GW	8	1	2	1	13
Isotopic Uranium (U-234, U-235 and U-238)	HASL-300	1	GW	8	1	2	1	13
Isotopic Thorium (Th-228, Th-230 and Th-232)	HASL-300	1	GW	8	1	2	1	13
Radium-226	EPA 903.1	2	GW	8	1	2	1	13
Unfiltered								
Anions (Cl, F, NO_3, NO_2, o-PO_4, SO_4)	EPA 300.0	5	GW	8	1	2	1	13
Alkalinity (Carbonate and Bicarbonate)	EPA 310.1	6	GW	8	1	2	1	13
Total Dissolved Solids (TDS)	EPA 160.1	6	GW	8	1	2	0	11

QAPP Worksheet #20
Field QC Summary

Analytical Parameter	Analytical Method	Reference	Matrix	Estimated No. of Field Samples	Field Duplicates*	Rinsate Blanks**	MS/MSD/MD (Pairs)*	Total No. of Samples
3. Investigation Derived Waste (IDW) Sampling								
Toxicity Characteristic Leaching Procedure (TCLP) Metals	EPA SW1311/6010C/7470A	3	Solid	5	0	0	0	5
Paint Filter Liquids Test	EPA SW9056	3	Solid	5	0	0	0	5
Volatile Organic Compounds (VOCs)	EPA SW8260C	3	Solid	5	0	0	0	5
Semivolatile Organic Compounds (SVOCs)	EPA SW8270D	3	Solid	5	0	0	0	5
Pesticides	EPA SW8081B	3	Solid	5	0	0	0	5
Herbicides	EPA SW8151A	3	Solid	5	0	0	0	5
Isotopic Uranium (U-234, U-235 and U-238)	HASL-300	1	Liquid	2	0	0	0	2
Isotopic Thorium (Th-228, Th-230 and Th-232)	HASL-300	1	Liquid	2	0	0	0	2
Gamma Spectroscopy	EPA 901.1	2	Liquid	2	0	0	0	2
TCLP VOCs	EPA SW1311/8260C	3	Liquid	2	0	0	0	2
TCLP SVOCs	EPA SW1311/8270D	3	Liquid	2	0	0	0	2
TCLP Pesticides	EPA SW1311/8081B	3	Liquid	2	0	0	0	2
TCLP Herbicides	EPA SW1311/8151A	3	Liquid	2	0	0	0	2
TCLP Metals	EPA SW1311/6010C/7470A	3	Liquid	2	0	0	0	2
VOCs	EPA SW8260C	3	Liquid	2	0	0	0	2
SVOCs	EPA SW8270D	3	Liquid	2	0	0	0	2
Pesticides	EPA SW8081B	3	Liquid	2	0	0	0	2
Herbicides	EPA SW8151A	3	Liquid	2	0	0	0	2
Total Target Analyte List (TAL) Metals (plus B, Li, Mo, P)	EPA SW6010C/7470A	3	Liquid	2	0	0	0	2
pH	EPA SW9040B	3	Liquid	2	0	0	0	2
Oil & Grease (HEM)	EPA 1664A	7	Liquid	2	0	0	0	2
Total Organic Carbon (TOC)	EPA 415.1	6	Liquid	2	0	0	0	2
Total Suspended Solids (TSS)	EPA 160.2	6	Liquid	2	0	0	0	2

QAPP Worksheet #20
Field QC Summary

References:

1. U. S. Department of Energy, Environmental Measurements Laboratory, HASL-300, 28th Edition, February 1997.
2. USEPA, Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032, August 1980.
3. USEPA, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Final Update III, June 1997 (most current version).
4. American Society of Testing Materials (most recent version).
5. USEPA, The Determination of Inorganic Anions in Water by Ion Chromatography, November 1991.
6. USEPA, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Revised March 1983 (or most recent version).
7. USEPA, N-Hexane Extractable Material (HEM) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM) by Extraction and Gravimetry (Oil and Grease and Total Petroleum Hydrocarbons), May 1999.

Notes:

* Assumes a 10% frequency (one per 10 field samples) for field duplicates, and a 5% (one per 20 field samples) frequency for MS/MSDs (organics), MS/MDs (inorganics), and MD for gamma spec. (soils only). The USACE will take QA samples at the discretion of USACE oversight personnel.

** Assumes a 5% frequency (or 1 per day, whichever is less) for rinsate blanks, and will be collected only when non-disposable equipment is used.

GW – Groundwater

MS/MSD/MD – Matrix Spike/Matrix Spike Duplicate/Matrix Duplicate

QAPP Worksheet #21
Field SOPs

The Field SOPs are presented in the FSP.

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection

The field equipment calibration, maintenance, testing, and inspection information are described in the FSP.

Field Equipment	Calibration Activity	Maint. Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference[1]

[1]Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21).

QAPP Worksheet #23
Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
CA-I-S-004	EDD Development and Verification (Revision 1, 06/18/2012)	Definitive	All Matrices/ Analytical Groups	NA	TestAmerica St. Louis	N
RL-KPA-001	Environmental Sample Preparation for Uranium by Laser-Induced Phosphorescence Analysis (Revision 2, 08/31/2011)	Definitive	Soil/Water - Total Uranium/ASTM D5174	KPA	TestAmerica Richland	N
RL-KPA-003	Determination of Uranium by Phosphorescence Analysis (Revision 2, 08/12/2011)	Definitive	Soil/Water - Total Uranium/ASTM D5174	KPA	TestAmerica Richland	N
RL-RA-001	Radium-226 and Radium-228 Separation in Radiochemical Matrices (Revision 2, 09/30/2011)	Definitive	Water - Radium-226/ EPA 903.1	Gas Flow Proportional Counter	TestAmerica Richland	N
ST-GC-0016	Pesticide GC Analysis (Revision 13, Effective 05/31/2012)	Definitive	Liquid and Solid IDW - Pesticides/EPA 8081B	GC	TestAmerica St. Louis	N
ST-GC-0017	Herbicide GC Analysis (Revision 12, Effective 05/31/2012)	Definitive	Liquid and Solid IDW - Herbicides/EPA 8151A	GC	TestAmerica St. Louis	N
ST-HS-0004	Hazardous Waste Management Plan (Revision 15, 08/03/2012.	Definitive	All Matrices/ Analytical Groups	NA	TestAmerica St. Louis	N
ST-IP-0002	Acid Digestion of Soils (Revision 15, 05/11/2012)	Definitive	Solid IDW - Metals/EPA 6010C	ICP / ICP/MS	TestAmerica St. Louis	N
ST-IP-0004	Labware Preparation for Inorganic and Trace Metal Analysis (Revision 10, 06/30/2011)	Definitive	Liquid and Solid IDW - Metals/EPA 6010C/7470A/7471B	Preparation	TestAmerica St. Louis	N

QAPP Worksheet #23
Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
ST-IP-0013	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by ICP or ICP/MS (Revision 18, 11/30/2011)	Definitive	Liquid IDW - Metals/EPA 6010C	ICP / ICP/MS	TestAmerica St. Louis	N
ST-IP-0015	Filtration Procedure (Revision 8, 01/20/12)	Definitive	Water	Filtration System	TestAmerica St. Louis	N
ST-MS-0001	GC/MS Semivolatiles Analysis (Revision 13, Effective 12/30/2011)	Definitive	Soil and Liquid/Solid IDW – SVOCs and PAHs/EPA 8270D and 8270D-SIM	GC/MS	TestAmerica St. Louis	N
ST-MS-0002	Determination of Volatile Organics by GC/MS (Revision 18, Effective 03/19/2012)	Definitive	Liquid and Solid IDW - VOCs/EPA 8260C	GC/MS	TestAmerica St. Louis	N
ST-MT-0003	Analysis of Metals by Inductively Coupled Plasma (Revision 14, Effective 05/11/2012)	Definitive	Liquid and Solid IDW - TCLP Metals/EPA 6010C	ICP	TestAmerica St. Louis	N
ST-MT-0005	Preparation and Analysis of Mercury in Aqueous Samples by Cold Vapor Atomic Absorption (Revision 13, Effective 08/17/2012)	Definitive	Liquid and Solid IDW – Mercury/EPA 7470A	Cold Vapor Atomic Absorption	TestAmerica St. Louis	N
ST-OP-0001	Labware Preparation for Organic Analysis (Revision 16, 09/04/2012)	Definitive	All Matrices for Organics	Cleaning Supplies	TestAmerica St. Louis	N
ST-OP-0002	Extraction and Cleanup of Organic Compounds from Waters and Soils (Revision 19, 04/20/2012)	Definitive	All Matrices for Organics	Extraction/Cleanup	TestAmerica St. Louis	N
ST-OP-0007	Extraction of Herbicides from Waters and Soils (Revision 12, 08/24/2012)	Definitive	Liquid and Solid IDW – Herbicides/EPA 8151A	Extraction	TestAmerica St. Louis	N
ST-OP-0009	Toxicity Characteristic Leaching Procedure (TCLP) (Revision 2, 02/10/2012)	Definitive	Liquid and Solid IDW for Organics/Inorganics	Extraction	TestAmerica St. Louis	N

QAPP Worksheet #23
Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
ST-PM-0002	Sample Receipt and Chain of Custody (Revision 17, 07/01/2012)	Definitive	All Matrices/ Analytical Groups	Chain of Custody	TestAmerica St. Louis	N
ST-PM-0003	Bottle Preparation Kit (Revision 13, 07/01/2012)	Definitive	All Matrices/ Analytical Groups	Bottle Preparation	TestAmerica St. Louis	N
ST-PM-0004	Data Review, Verification and Reporting (Revision 9, 12/30/2011)	Definitive	All Matrices/ Analytical Groups	NA	TestAmerica St. Louis	N
ST-QA-0002	Standards and Reagent Preparation (Revision 14, 04/20/2012)	Definitive	All Matrices/ Analytical Groups	Preparatory	TestAmerica St. Louis	N
ST-QA-0005	Calibration and Verification Procedure for Thermometers, Refrigerators, Balances, Weights, and Pipettes (Revision 22, 02/10/2012)	Definitive	All Matrices/ Analytical Groups	Calibration	TestAmerica St. Louis	N
ST-QA-0014	Evaluation of Analytical Accuracy and Precision Through the Use of Control Charts (Revision 13, 09/30/2011)	Definitive	All Matrices/ Analytical Groups	NA	TestAmerica St. Louis	N
ST-QA-0014	MDL/IDL, LOD/LOQ Determination (Revision 14, 09/30/2011)	Definitive	All Matrices/ Analytical Groups	All Instrumentation	TestAmerica St. Louis	N
ST-QA-0021	Internal Surveillance (Revision 12, 08/31/2012)	Definitive	All Matrices/ Analytical Groups	All Instrumentation	TestAmerica St. Louis	N
ST-QA-0023	Control of Records (Revision 11, 04/20/2012)	Definitive	All Matrices/ Analytical Groups	All Instrumentation	TestAmerica St. Louis	N
ST-QA-0024	Preventive Maintenance (Revision 10, 12/14/2011)	Definitive	All Matrices/ Analytical Groups	All Instrumentation	TestAmerica St. Louis	N
ST-QA-0028	Water System Maintenance and Monitoring (Revision 10, 12/14/2011)	Definitive	All Matrices/ Analytical Groups	All Instrumentation	TestAmerica St. Louis	N

QAPP Worksheet #23
Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
ST-QA-0031	VOA Holding Blank Analysis (Revision 11, 09/04/2012)	Definitive	Liquid and Solid IDW - VOCs/EPA 8260C	GC/MS	TestAmerica St. Louis	N
ST-QA-0035	Preparation and Management of Standard Operating Procedures (Revision 12, 12/02/2011)	Definitive	All Matrices/ Analytical Groups	All Instrumentation	TestAmerica St. Louis	N
ST-QA-0036	Nonconformance Memorandum (NCM) / Validation request and Corrective Action Processes (Revision 10, 04/20/2012)	Definitive	All Matrices/ Analytical Groups	All Instrumentation	TestAmerica St. Louis	N
ST-QA-0037	Procurement of Quality Related Items (Revision 9, 04/30/2012)	Definitive	All Matrices/ Analytical Groups	All Instrumentation	TestAmerica St. Louis	N
ST-QA-0038	Procedure for Compositing and Subsampling (Revision 7, 09/30/2011)	Definitive	All Matrices/ Analytical Groups	Preparatory	TestAmerica St. Louis	N
ST-QA-0039	Sample Transfer Utility (STU) (Revision 7, 05/11/2012)	Definitive	All Matrices/ Analytical Groups	Chain of Custody	TestAmerica St. Louis	N
ST-QA-0040	Manual Integration Procedure (Revision 9, 04/30/2012)	Definitive	All Matrices/ Analytical Groups	GC /GC/MS	TestAmerica St. Louis	N
ST-QA-0043	DOD QSM Versuion 4.X Project Requirement Summary (Revision 2, 12/30/2011)	Definitive	All Matrices/ Analytical Groups	All Instrumentation	TestAmerica St. Louis	N
ST-QAM	Quality Assurance Manual (Revision 5, 10/28/2011)	Definitive	All Matrices/Analytical Groups	All Instrumentation	TestAmerica St. Louis	N
ST-RC-0002	Planchet Preparation for Radiochemistry and Radiological Screening Analysis (Revision 11, 11/09/2011)	Definitive	All Matrices/Radiochemistry	All Radiochemistry Instrumentation	TestAmerica St. Louis	N
ST-RC-0003	Drying and Grinding of Soil and Solid Samples (Revision 12, 09/16/2011)	Definitive	Soil/Radiochemistry	All Radiochemistry Instrumentation	TestAmerica St. Louis	N

QAPP Worksheet #23
Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
ST-RC-0004	Preparation of Soil, Sludge, Filter, Biota and Oil & Grease Samples for Actinide Analyses (Revision 20, 04/06/2012)	Definitive	Soil - Isotopic Uranium and Thorium/HASL 300	Alpha Spectrometry	TestAmerica St. Louis	N
ST-RC-0010	Screening Samples for the Presence of Radioactive Material (Revision 11, 11/18/2011)	Definitive	All Matrices/Radiochemistry	All Radiochemistry Instrumentation	TestAmerica St. Louis	N
ST-RC-0014	Bulk Drying and Grinding of Soil and Solid Samples (Revision 2, 04/27/2012)	Definitive	Soil/Radiochemistry	All Radiochemistry Instrumentation	TestAmerica St. Louis	N
ST-RC-0025	Preparation of Samples for Gamma Spectroscopy (Revision 14, 08/31/2012)	Definitive	Soil and Liquid IDW - Gamma Spectroscopy/EPA 901.1	Gamma Spectroscopy	TestAmerica St. Louis	N
ST-RC-0041	Radium-226 and Radium-228 by Chemical Separation Preparation (Revision 11, 07/06/2012	Definitive	Water – Radium-226/EPA 903.1	Gas Flow Proportional Counter	TestAmerica St. Louis	N
ST-RC-0238	Isotopic Uranium by Eichrom® Uteva Resin for Various Matrices (Revision 13, 11/18/2012)	Definitive	Soil/Water/Liquid IDW - Isotopic Uranium/HASL 300	Alpha Spectrometry	TestAmerica St. Louis	N
ST-RC-0242	Isotopic Uranium, Plutonium and Uranium in Various Matrices by Eichrom® Separation Resin (Revision 15, 04/27/2012)	Definitive	Soil/Water/Liquid IDW - Isotopic Uranium/HASL 300	Alpha Spectrometry	TestAmerica St. Louis	N
ST-RD-0102	Gamma Vision Analysis (Revision 9, 05/18/2012)	Definitive	Soil and Liquid IDW - Gamma Spec/EPA 901.1	Gamma Spectroscopy	TestAmerica St. Louis	N
ST-RD-0210	Alpha Spectroscopy Analysis (Revision 10, 03/19/2012)	Definitive	Soil/Water/Liquid IDW - Isotopic Uranium/HASL 300	Alpha Spectrometry	TestAmerica St. Louis	N
ST-WC-0005	Percent Solids Determination (Revision 11, 03/19/2012)	Definitive	Solids – Percent Solids	Gravimetric	TestAmerica St. Louis	N

QAPP Worksheet #23
Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
ST-WC-0011	pH Analysis in Water and Soil (Revision 14, 10/07/2011)	Definitive	Liquid IDW - pH/EPA 9040B	None	TestAmerica St. Louis	N
ST-WC-0016	Total Organic Carbon (Revision 13, 05/11/2012)	Definitive	Liquid IDW - Total Organic Carbon/EPA 415.1	TOC analyzer	TestAmerica St. Louis	N
ST-WC-0019	Alkalinity in Water and Soil (Revision 14, 03/14/2012)	Definitive	Water- Alkalinity/EPA 310.1	Gravimetric	TestAmerica St. Louis	N
ST-WC-0028	The Analysis of Anions by Ion Chromatography (Revision 19, 03/19/2012)	Definitive	Water - Anions/EPA 300.0	Ion Chromatography	TestAmerica St. Louis	N
ST-WC-0031	Paint Filter Liquids Test (Revision 9, 02/10/2012)	Definitive	Solid IDW - Paint Filter/EPA 9095	None	TestAmerica St. Louis	N
ST-WC-0036	Determination of Solids in Water and Wastes (Revision 11, 10/07/2011)	Definitive	Water - Total Dissolved Solids/EPA 160.1	Gravimetric	TestAmerica St. Louis	N
ST-WC-0036	Determination of Solids in Water and Wastes (Revision 11, 10/07/2011)	Definitive	Liquid IDW - Total Suspended Solids/EPA 160.2	Gravimetric	TestAmerica St. Louis	N
ST-WC-0039	N-Hexane Extractable Material and Silica Gel Treated HEM by Extraction and Gravimetry (Revision 8, 01/20/2012)	Definitive	Liquid IDW - Oil and Grease/EPA 1664A	Gravimetric	TestAmerica St. Louis	N

Notes:

GC - Gas chromatography

GC/MS - Gas chromatography/mass spectrometry.

HPLC - high-performance liquid chromatography.

ICP - inductively coupled plasma

IDL – Instrument Detection Limit

LOD – Limit of Detection

LOQ – Limit of Quantitation

MDL – Method Detection Limit

NA – Not Applicable

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration[1]	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	%RSD<20% all compounds, Relative Response Factor meet method criteria	Repeat calibration	TestAmerica – St. Louis Analyst	ST-MS-0002
GC/MS	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ±30% of expected	Rerun ICV one time, second failure requires recalibration	TestAmerica – St. Louis Analyst	ST-MS-0002
GC/MS	Calibration Verification (CV)	Daily, before sample analysis, and every 12 hours of analysis time	+/- 20%D criteria for all analytes	Re-inject CV; if passes rerun previous 10 samples and continue run; if 2nd CV fails, recalibrate	TestAmerica – St. Louis Analyst	ST-MS-0002
GC/MS	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	%RSD<20% all compounds, Relative Response Factor meet method criteria	Repeat calibration	TestAmerica – St. Louis Analyst	ST-MS-0001
GC/MS	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ±30% of expected	Rerun ICV one time, second failure requires recalibration	TestAmerica – St. Louis Analyst	ST-MS-0001
GC/MS	Calibration Verification (CV)	Daily, before sample analysis, and every 12 hours of analysis time	+/- 20%D criteria for all analytes	Re-inject CV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	TestAmerica – St. Louis Analyst	ST-MS-0001
GC	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	RSD for each analyte <20%	Repeat calibration	TestAmerica – St. Louis Analyst	ST-GC-0016
GC	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Rerun ICV one time, second failure requires recalibration	TestAmerica – St. Louis Analyst	ST-GC-0016
GC	Calibration Verification (Initial [ICV] and continuing [CCV])	ICV: Daily, before sample analysis; CCV: After every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	TestAmerica – St. Louis Analyst	ST-GC-0016

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration[1]	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	Mean RSD for each analyte <20%	Recalibrate	TestAmerica – St. Louis Analyst	ST-GC-0017
GC	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 30% of expected value (initial source)	Rerun ICV one time, second failure requires re-calibration	TestAmerica – St. Louis Analyst	ST-GC-0017
GC	Calibration Verification (Initial [ICV] and continuing [CCV])	ICV: Daily, before sample analysis; CCV: After every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	TestAmerica – St. Louis Analyst	ST-GC-0017
ICP-AES	Initial Calibration (ICAL) – minimum one high standard and a calibration blank	Daily initial calibration prior to sample analysis	3 standards and a blank. Correlation Coefficient of ≥ 0.998	Recalibrate	TestAmerica – St. Louis Analyst	ST-MT-0003
ICP-AES	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Recalibrate	TestAmerica – St. Louis Analyst	ST-MT-0003
ICP-AES	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	TestAmerica – St. Louis Analyst	ST-MT-0003
Cold Vapor AA	Initial Calibration (ICAL)	Daily initial calibration prior to sample analysis	Correlation coefficient R>=0.995 for linear regression	Recalibrate	TestAmerica – St. Louis Analyst	ST-MT-0005
Cold Vapor AA	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected value (second source)	Recalibrate	TestAmerica – St. Louis Analyst	ST-MT-0005
Cold Vapor AA	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence.	All analytes within + 20% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	TestAmerica – St. Louis Analyst	ST-MT-0005

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration[1]	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Balance	Initial Calibration	Daily	The analytical balance used must be calibrated daily. The balance needs to be calibrated at a minimum of 2 weights that bracket the target weight. Recovery within +/- 0.1%. Method 1664A requires check at 0.2 g with +/- 10% recovery.	Recalibrate	TestAmerica – St. Louis Analyst	ST-WC-0039, ST-WC-0036, ST-WC-0019, ST-WC-0031
Pensky-Marten Closed Cup	Initial Calibration	Annual	Thermometers are verified annually. Rotation apparatus verified annually.	Maintenance required	TestAmerica – St. Louis Analyst	ST-WC-0026
Pensky-Marten Closed Cup	Calibration Check	Prior to running samples	The flash point of a check standard (p-xylene) must be obtained within a value of 27.2 ± 1.1°C	Rerun check	TestAmerica – St. Louis Analyst	ST-WC-0026
Pensky-Marten Closed Cup	Continuing Calibration Check (second source)	Every 10 samples	Control limit is 27.2 ± 1.1°C.	Recalibrate – rerun samples bracketed by failing CCV	TestAmerica – St. Louis Analyst	ST-WC-0026
Ion Chromatography	Initial Calibration (ICAL) – five-point calibration and a calibration blank	Weekly initial calibration prior to sample analysis	The intercept of the curve at zero must be < +/- the reporting limit. Correlation Coefficient of ≥ 0.995	Recalibrate	TestAmerica – St. Louis Analyst	ST-WC-0028
Ion Chromatography	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Recalibrate	TestAmerica – St. Louis Analyst	ST-WC-0028
Ion Chromatography	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	TestAmerica – St. Louis Analyst	ST-WC-0028
TOC Analyzer	Initial Calibration (ICAL) – five-point calibration and a calibration blank	Weekly initial calibration prior to sample analysis	The intercept of the curve at zero must be < +/- the reporting limit. Correlation Coefficient of ≥ 0.995	Recalibrate	TestAmerica – St. Louis Analyst	ST-WC-0016
TOC Analyzer	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Recalibrate	TestAmerica – St. Louis Analyst	ST-WC-0016

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration[1]	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
TOC Analyzer	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	TestAmerica – St. Louis Analyst	ST-WC-0016
Alpha Spectroscopy	ICAL	Monthly	Energy: each isotope ± 40 keV of expected Energy: Slope ≤ 15 keV/channel Efficiency: Fixed Point	Repeat initial calibration	TestAmerica – St. Louis Analyst	ST-RD-0210
	ICV	1/calibration	Efficiency ≤ 5%	Repeat ICV once; repeat ICAL if second ICV fails	TestAmerica – St. Louis Analyst	ST-RD-0210
	CCV	Daily Pulser	Within "Boundary" parameters	Repeat CCV once; repeat ICAL if second CCV fails	TestAmerica – St. Louis Analyst	ST-RD-0210
HPGe Gamma Spectroscopy System	ICAL	Yearly	Energy within 0.1keV FWHM ≤ 3.0 keV at 1332 keV Efficiency ≤ 8%	Repeat initial calibration	TestAmerica – St. Louis Analyst	ST-RC-0025
	ICV	After ICAL	Efficiency ≤ 10%	Repeat ICV once; repeat ICAL if second ICV fails	TestAmerica – St. Louis Analyst	ST-RC-0025
	CCV	Daily	Control chart mean ±2 σ	Repeat CCAL once; flag detector out of service for day if second CCAL fails	TestAmerica – St. Louis Analyst	ST-RC-0025
Phosphorescence Analyzer	ICAL	Initial calibration prior to sample analysis	Correlation Coefficient of ≥ 0.995	Repeat initial calibration	TestAmerica – Richland Analyst	RL-KPA-003
	ICV	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Recalibrate	TestAmerica – Richland Analyst	RL-KPA-003
	CCV	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	TestAmerica – Richland Analyst	RL-KPA-003
Alpha Scintillation Counter	Source Calibration Check	Daily prior to sample analysis	Count within ± 2 σ	Investigate. If value > ± 3 σ repeat.	TestAmerica – Richland Analyst	RL-RA-001
	Cell Background	Daily prior to sample analysis	Background Count < 1cpm	Backfill and recount	TestAmerica – Richland Analyst	RL-RA-001

Notes:
1 – Initial calibration ranges are referenced in the laboratory SOPs

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

All analytical instrumentation will undergo maintenance, testing, and inspection in accordance with the laboratory SOPs. Laboratory SOPs must be compliant with minimum method requirements. All applicable SOPs are provided for review in Attachment A. Calibration will follow frequency, acceptance criteria, and corrective action requirements in the SOPs.

QAPP Worksheet #26 & 27
Sample Handling, Custody, and Disposal

Sampling Organization: URS Group, Inc.

Laboratory: TestAmerica Laboratories, Inc. (St. Louis, MO and Richland, WA)

Method of sample delivery (shipper/carrier): Lab courier to TestAmerica (Amherst, NY); then FedEx to TestAmerica (St. Louis, MO) and TestAmerica (Richland, WA)

Number of days from reporting until sample disposal: minimum of 30 days

Activity	Organization and Title of Position of Person Responsible for the Activity	SOP Reference
Sample Labeling	URS Group, Inc. / field technician	See Field Sampling Plan
Chain of Custody Form Completion	URS Group, Inc. / field technician	See Field Sampling Plan
Packaging	URS Group, Inc. / field technician	See Field Sampling Plan
Shipping Coordination	URS Group, Inc. / field technician	See Field Sampling Plan
Sample Receipt, Inspection, and Login	TestAmerica Laboratories, Inc. / sample custodian	ST-PM-0002
Sample Custody and Storage	TestAmerica Laboratories, Inc. / sample custodian	ST-PM-0002
Sample Disposal	TestAmerica Laboratories, Inc. / sample custodian	ST-HS-0004

QAPP Worksheet #28-1
Analytical Quality Control and Corrective Action

Matrix	**Liquid/Solid IDW**
Analytical Group	**VOCs**
Analytical Method/SOP	**EPA Method 8260C/ST-MS-002**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal standards	Every field sample and QC samples	RT within ±30 seconds from RT of initial calibration midpoint standard; area counts within -50% to +100% of initial calibration midpoint standard	Correct problem, then re-reanalyze affected samples	Lab Manager/ Analyst	Accuracy	RT within ±30 seconds and area count within -50% to +100%
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.
MS/MSD	One MS/MSD pair per preparation batch per matrix	EPA 8260: LCS limits specified in the DoD QSM. RPD less than 20% between MS and MSD	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	EPA 8260: LCS limits specified in the DoD QSM. RPD less than 20% between MS and MSD

QAPP Worksheet #28-1
Analytical Quality Control and Corrective Action

LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	EPA 8260: LCS limits specified in the DoD QSM. RPD less than 20% between LCS and LCSD	Correct problem, then re-reanalyze the LCS and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	EPA 8260: LCS limits specified in the DoD QSM. RPD less than 20% between LCS and LCSD
Surrogate standards	Every field sample and QC sample	EPA 8260: Surrogate recovery acceptance criteria specified in the DoD QSM	Correct problem, then re-reanalyze all affected samples	Lab Manager/ Analyst	Accuracy	EPA 8260: Surrogate recovery acceptance criteria specified in the DoD QSM
MDL study	Initial setup, once per 12-month period or quarterly MDL verification	Detection limits established will be below the RLs	Correct problem, then repeat the MDL study	Lab Manager/ Analyst	Sensitivity	Follow requirements from 40CFR 136 appendix B
LOD study	Initial setup and quarterly LOD verification	Signal to noise ratio at the LOD will be greater than 3 and meet method requirements	Correct problem, then repeat detection limit study and LOD verification at a higher concentration, or pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration in accordance with DoD QSM requirements.	Lab Manager/ Analyst	Sensitivity	Detection of the analyte
LOQ study	Annually and quarterly LOQ verification	LOQ will be greater than LOD and within calibration range. Laboratory procedure for establishing the LOQ will empirically demonstrate precision and bias at the LOQ	Correct problem, then repeat the LOQ study.	Lab Manager/ Analyst	Sensitivity	Recovery within established limits.

QAPP Worksheet #28-2
Analytical Quality Control and Corrective Action

Matrix	**Liquid/Solid IDW**
Analytical Group	**SVOCs**
Analytical Method/SOP	**EPA Method 8270D/ST-MS-001**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal standards	Every field sample and QC samples	RT within ±30 seconds from RT of initial calibration midpoint standard; area counts within -50% to +100% of initial calibration midpoint standard	Correct problem, then re-reanalyze affected samples	Lab Manager/ Analyst	Accuracy	RT within ±30 seconds and area count within -50% to +100%
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.
MS/MSD	One MS/MSD pair per preparation batch per matrix	EPA 8270: LCS limits specified in the DoD QSM. RPD less than 30% between MS and MSD	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	EPA 8270: LCS limits specified in the DoD QSM. RPD less than 30% between MS and MSD

QAPP Worksheet #28-2
Analytical Quality Control and Corrective Action

LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	EPA 8270: LCS limits specified in the DoD QSM. RPD less than 30% between LCS and LCSD	Correct problem, then re-reanalyze the LCS and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	EPA 8270: LCS limits specified in the DoD QSM. RPD less than 30% between LCS and LCSD
Surrogate standards	Every field sample and QC sample	EPA 8270: Surrogate recovery acceptance criteria specified in the DoD QSM	Correct problem, then re-reanalyze all affected samples	Lab Manager/ Analyst	Accuracy	EPA 8270: Surrogate recovery acceptance criteria specified in the DoD QSM
MDL study	Initial setup, once per 12-month period or quarterly MDL verification	Detection limits established will be below the RLs	Correct problem, then repeat the MDL study	Lab Manager/ Analyst	Sensitivity	Follow requirements from 40CFR 136 appendix B
LOD study	Initial setup and quarterly LOD verification	Signal to noise ratio at the LOD will be greater than 3 and meet method requirements	Correct problem, then repeat detection limit study and LOD verification at a higher concentration, or pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration in accordance with DoD QSM requirements.	Lab Manager/ Analyst	Sensitivity	Detection of the analyte
LOQ study	Annually and quarterly LOQ verification	LOQ will be greater than LOD and within calibration range. Laboratory procedure for establishing the LOQ will empirically demonstrate precision and bias at the LOQ	Correct problem, then repeat the LOQ study.	Lab Manager/ Analyst	Sensitivity	Recovery within established limits.

QAPP Worksheet #28-3
Analytical Quality Control and Corrective Action

Matrix	**Soil**
Analytical Group	**PAHs**
Analytical Method/SOP	**EPA Method 8270D-SIM/ST-MS-001**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal standards	Every field sample and QC samples	RT within ±30 seconds from RT of initial calibration midpoint standard; area counts within -50% to +100% of initial calibration midpoint standard	Correct problem, then re-reanalyze affected samples	Lab Manager/ Analyst	Accuracy	RT within ±30 seconds and area count within -50% to +100%
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.
MS/MSD	One MS/MSD pair per preparation batch per matrix	EPA 8270: LCS limits specified in the DoD QSM. RPD less than 30% between MS and MSD	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	EPA 8270: LCS limits specified in the DoD QSM. RPD less than 30% between MS and MSD

QAPP Worksheet #28-3
Analytical Quality Control and Corrective Action

LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	EPA 8270: LCS limits specified in the DoD QSM. RPD less than 30% between LCS and LCSD	Correct problem, then re-reanalyze the LCS and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	EPA 8270: LCS limits specified in the DoD QSM. RPD less than 30% between LCS and LCSD
Surrogate standards	Every field sample and QC sample	EPA 8270: Surrogate recovery acceptance criteria specified in the DoD QSM	Correct problem, then re-reanalyze all affected samples	Lab Manager/ Analyst	Accuracy	EPA 8270: Surrogate recovery acceptance criteria specified in the DoD QSM
MDL study	Initial setup, once per 12-month period or quarterly MDL verification	Detection limits established will be below the RLs	Correct problem, then repeat the MDL study	Lab Manager/ Analyst	Sensitivity	Follow requirements from 40CFR 136 appendix B
LOD study	Initial setup and quarterly LOD verification	Signal to noise ratio at the LOD will be greater than 3 and meet method requirements	Correct problem, then repeat detection limit study and LOD verification at a higher concentration, or pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration in accordance with DoD QSM requirements.	Lab Manager/ Analyst	Sensitivity	Detection of the analyte
LOQ study	Annually and quarterly LOQ verification	LOQ will be greater than LOD and within calibration range. Laboratory procedure for establishing the LOQ will empirically demonstrate precision and bias at the LOQ	Correct problem, then repeat the LOQ study.	Lab Manager/ Analyst	Sensitivity	Recovery within established limits.

QAPP Worksheet #28-4
Analytical Quality Control and Corrective Action

Matrix	**Liquid/Solid IDW**
Analytical Group	**Pesticides**
Analytical Method/SOP	**EPA Method 8081B/ST-GC-0016**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater).	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater).
MS/MSD	One MS/MSD pair per preparation batch per matrix	EPA 8081: LCS limits specified in the DoD QSM. RPD less than 30% between MS and MSD	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	EPA 8081: LCS limits specified in the DoD QSM. RPD less than 30% between MS and MSD
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	EPA 8081: LCS limits specified in the DoD QSM. RPD less than 30% between MS and MSD	Correct problem, then re-reanalyze the LCS and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	EPA 8081: LCS limits specified in the DoD QSM. RPD less than 30% between LCS and LCSD
Surrogate standards	Every field sample and QC sample	EPA 8081: Surrogate recovery acceptance criteria specified in the DoD QSM	Correct problem, then re-reanalyze all affected samples	Lab Manager/ Analyst	Accuracy	EPA 8081: Surrogate recovery acceptance criteria specified in the DoD QSM

QAPP Worksheet #28-4
Analytical Quality Control and Corrective Action

MDL study	Initial setup, once per 12-month period or quarterly MDL verification	Detection limits established will be below the RLs	Correct problem, then repeat the MDL study	Lab Manager/ Analyst	Sensitivity	Follow requirements from 40CFR 136 appendix B
LOD study	Initial setup and quarterly LOD verification	Signal to noise ratio at the LOD will be greater than 3 and meet method requirements	Correct problem, then repeat detection limit study and LOD verification at a higher concentration, or pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration in accordance with DoD QSM requirements.	Lab Manager/ Analyst	Sensitivity	Detection of the analyte
LOQ study	Annually and quarterly LOQ verification	LOQ will be greater than LOD and within calibration range. Laboratory procedure for establishing the LOQ will empirically demonstrate precision and bias at the LOQ	Correct problem, then repeat the LOQ study.	Lab Manager/ Analyst	Sensitivity	Recovery within established limits.

QAPP Worksheet #28-5
Analytical Quality Control and Corrective Action

Matrix	**Liquid/Solid IDW**
Analytical Group	**Herbicides**
Analytical Method/SOP	**EPA Method 8151A/ST-GC-0017**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater).	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater).
MS/MSD	One MS/MSD pair per preparation batch per matrix	EPA 8151: LCS limits specified in the DoD QSM. RPD less than 20% between MS and MSD	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	EPA 8151: LCS limits specified in the DoD QSM. RPD less than 20% between MS and MSD
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	EPA 8151: LCS limits specified in the DoD QSM. RPD less than 20% between LCS and LCSD	Correct problem, then re-reanalyze the LCS and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	EPA 8151: LCS limits specified in the DoD QSM. RPD less than 20% between LCS and LCSD
Surrogate standards	Every field sample and QC sample	EPA 8151: Surrogate recovery acceptance criteria specified in the DoD QSM	Correct problem, then re-reanalyze all affected samples	Lab Manager/ Analyst	Accuracy	EPA 8151: Surrogate recovery acceptance criteria specified in the DoD QSM

QAPP Worksheet #28-5
Analytical Quality Control and Corrective Action

MDL study	Initial setup, once per 12-month period or quarterly MDL verification	Detection limits established will be below the RLs	Correct problem, then repeat the MDL study	Lab Manager/ Analyst	Sensitivity	Follow requirements from 40CFR 136 appendix B
LOD study	Initial setup and quarterly LOD verification	Signal to noise ratio at the LOD will be greater than 3 and meet method requirements	Correct problem, then repeat detection limit study and LOD verification at a higher concentration, or pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration in accordance with DoD QSM requirements.	Lab Manager/ Analyst	Sensitivity	Detection of the analyte
LOQ study	Annually and quarterly LOQ verification	LOQ will be greater than LOD and within calibration range. Laboratory procedure for establishing the LOQ will empirically demonstrate precision and bias at the LOQ	Correct problem, then repeat the LOQ study.	Lab Manager/ Analyst	Sensitivity	Recovery within established limits.

QAPP Worksheet #28-6
Analytical Quality Control and Corrective Action

Matrix	**Liquid/Solid IDW**
Analytical Group	**Metals**
Analytical Method/SOP	**EPA Method 6010C/ST-MT-0003**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater).	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater).
MS/MSD	One MS/MSD pair per preparation batch per matrix	80-120% per DoD QSM; RPD less than 20%	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	80-120% per DoD QSM; RPD less than 20%
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	80-120% per DoD QSM; RPD less than 20%	Correct problem, then re-reanalyze the LCS and all associated batch samples	Lab Manager/ Analyst	Accuracy	80-120% per DoD QSM; RPD less than 20%

QAPP Worksheet #28-6
Analytical Quality Control and Corrective Action

Calibration Blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > 2 × MDL	Any sample associated with a blank that fails the criteria checks will be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results will be reported with appropriate data qualifying codes.	TestAmerica - St. Louis Analyst	Accuracy	No analytes detected > 2 × MDL
Serial dilution	Each new sample matrix	1:5 dilution must agree within ±10% of original determination.	Perform post-digestion spike if serial dilution does not meet criteria	TestAmerica - St. Louis Analyst	Accuracy	1:5 dilution must agree within ±10% of original determination.
Post-digestion spike	When serial dilution or matrix spike fails	75-125%	Re-analyze post-digestion spike.	TestAmerica - St. Louis Analyst	Accuracy	75-125%
MDL study	Initial setup, once per 12-month period or quarterly MDL verification	Detection limits established will be below the RLs	Correct problem, then repeat the MDL study	Lab Manager/ Analyst	Sensitivity	Follow requirements from 40CFR 136 appendix B
LOD study	Initial setup and quarterly LOD verification	Signal to noise ratio at the LOD will be greater than 3 and meet method requirements	Correct problem, then repeat detection limit study and LOD verification at a higher concentration, or pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration in accordance with DoD QSM requirements.	Lab Manager/ Analyst	Sensitivity	Detection of the analyte

QAPP Worksheet #28-6
Analytical Quality Control and Corrective Action

LOQ study	Annually and quarterly LOQ verification	LOQ will be greater than LOD and within calibration range. Laboratory procedure for establishing the LOQ will empirically demonstrate precision and bias at the LOQ	Correct problem, then repeat the LOQ study.	Lab Manager/ Analyst	Sensitivity	Recovery within established limits.

QAPP Worksheet #28-7
Analytical Quality Control and Corrective Action

Matrix	**Liquid/Solid IDW**
Analytical Group	**Mercury**
Analytical Method/SOP	**EPA Method 7470A/ST-MT-0005**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater).	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater).
MS/MSD	One MS/MSD pair per preparation batch per matrix	80-120% per DoD QSM; RPD less than 20%	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	80-120% per DoD QSM; RPD less than 20%
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	80-120% per DoD QSM; RPD less than 20%	Correct problem, then re-reanalyze the LCS and all associated batch samples	Lab Manager/ Analyst	Accuracy	80-120% per DoD QSM; RPD less than 20%

QAPP Worksheet #28-7
Analytical Quality Control and Corrective Action

Calibration Blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > 2 × MDL	Any sample associated with a blank that fails the criteria checks will be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results will be reported with appropriate data qualifying codes.	TestAmerica - St. Louis Analyst	Accuracy	No analytes detected > 2 × MDL
MDL study	Initial setup, once per 12-month period or quarterly MDL verification	Detection limits established will be below the RLs	Correct problem, then repeat the MDL study	Lab Manager/ Analyst	Sensitivity	Follow requirements from 40CFR 136 appendix B
LOD study	Initial setup and quarterly LOD verification	Signal to noise ratio at the LOD will be greater than 3 and meet method requirements	Correct problem, then repeat detection limit study and LOD verification at a higher concentration, or pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration in accordance with DoD QSM requirements.	Lab Manager/ Analyst	Sensitivity	Detection of the analyte
LOQ study	Annually and quarterly LOQ verification	LOQ will be greater than LOD and within calibration range. Laboratory procedure for establishing the LOQ will empirically demonstrate precision and bias at the LOQ	Correct problem, then repeat the LOQ study.	Lab Manager/ Analyst	Sensitivity	Recovery within established limits.

QAPP Worksheet #28-8
Analytical Quality Control and Corrective Action

Matrix	Liquid IDW
Analytical Group	Oil & Grease
Analytical Method/SOP	EPA Method 1664A/ST-WC-0039

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	Oil and Grease 78–114%; RPD ≤ 20%	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	Oil and Grease 78–114%; RPD ≤ 20%
MS/MSD	One MS/MSD pair per preparation batch per matrix	Oil and Grease 78–114%; RPD ≤ 20%	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Analyst	Precision/Accuracy	Oil and Grease 78–114%; RPD ≤ 20%

QAPP Worksheet #28-9
Analytical Quality Control and Corrective Action

Matrix	**Water**
Analytical Group	**TDS**
Analytical Method/SOP	**EPA Method 160.1/ST-WC-0036**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	90-110% recovery	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	90-110% recovery
Sample Duplicate	1 per preparatory batch per matrix	RPD < 20%	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 20%

QAPP Worksheet #28-10
Analytical Quality Control and Corrective Action

Matrix	Liquid IDW
Analytical Group	TSS
Analytical Method/SOP	EPA Method 160.2/ST-WC-0036

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	66-127% recovery	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	66-127% recovery
Sample Duplicate	1 per preparatory batch per matrix	RPD < 20%	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 20%

QAPP Worksheet #28-11
Analytical Quality Control and Corrective Action

Matrix	Liquid IDW
Analytical Group	pH
Analytical Method/SOP	EPA Method 9040B/ST-WC-0011

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS	1 per preparatory batch	99-101%	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	99-101%
Sample Duplicate	1 per preparatory batch per matrix	RPD < 20%	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 20%

QAPP Worksheet #28-12
Analytical Quality Control and Corrective Action

Matrix	**Water**
Analytical Group	**Anions**
Analytical Method/SOP	**EPA Method 300.0/ST-WC-0028**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	90-110% recovery - all Anions	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	90-110% recovery - all Anions
MS	One MS per preparation batch per matrix	90-110% recovery - all Anions	Identify problem; if not related to matrix interference, re-reanalyze MS and all associated batch samples	Analyst	Accuracy	90-110% recovery - all Anions
Sample Duplicate	1 per preparatory batch per matrix	RPD < 20%	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 20%

QAPP Worksheet #28-13
Analytical Quality Control and Corrective Action

Matrix	Liquid IDW
Analytical Group	TOC
Analytical Method/SOP	EPA Method 415.1/ST-WC-0016

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	90-110% recovery	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	90-110% recovery
MS	One MS per preparation batch per matrix	76-120% recovery	Identify problem; if not related to matrix interference, re-reanalyze MS and all associated batch samples	Analyst	Accuracy	76-120% recovery
Sample Duplicate	1 per preparatory batch per matrix	RPD < 20%	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 20%

QAPP Worksheet #28-14
Analytical Quality Control and Corrective Action

Matrix	**Water**
Analytical Group	**Alkalinity**
Analytical Method/SOP	**EPA Method 310.1/ST-WC-0019**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	90-110% recovery	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	90-110% recovery
MS	One MS per preparation batch per matrix	80-120% recovery	Identify problem; if not related to matrix interference, re-reanalyze MS and all associated batch samples	Analyst	Accuracy	80-120% recovery
Sample Duplicate	1 per preparatory batch per matrix	RPD < 20%	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 20%

QAPP Worksheet #28-15
Analytical Quality Control and Corrective Action

Matrix	Soil
Analytical Group	Isotopic Uranium
Analytical Method/SOP	HASL-300/ST-RD-0210

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	No contamination above the MDC	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	No contamination above the MDC
LCS	1 per preparatory batch	84-120% recovery - U-234; 82-122% recovery - U-234	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	Acceptable recovery limits
Sample Duplicate	1 per preparatory batch per matrix	RPD < 40%; RER < 1	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 40%; RER < 1

QAPP Worksheet #28-16
Analytical Quality Control and Corrective Action

Matrix	**Water/Liquid IDW**
Analytical Group	**Isotopic Uranium**
Analytical Method/SOP	**HASL-300**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	No contamination above the MDC	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	No contamination above the MDC
LCS	1 per preparatory batch	84-120% recovery - U-234; 83-121% recovery - U-234	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	Acceptable recovery limits
Sample Duplicate	1 per preparatory batch per matrix	RPD < 40%; RER < 1	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 40%; RER < 1

QAPP Worksheet #28-17
Analytical Quality Control and Corrective Action

Matrix	Soil
Analytical Group	Isotopic Thorium
Analytical Method/SOP	HASL-300/ST-RD-0210

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	No contamination above the MDC	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	No contamination above the MDC
LCS	1 per preparatory batch	70-130% recovery - Th-228; 81-118% recovery - Th-230; 70-130% recovery - Th-232	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	Acceptable recovery limits
Sample Duplicate	1 per preparatory batch per matrix	RPD < 40%; RER < 1	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 40%; RER < 1

QAPP Worksheet #28-18
Analytical Quality Control and Corrective Action

Matrix	**Water/Liquid IDW**
Analytical Group	**Isotopic Thorium**
Analytical Method/SOP	**HASL-300/ST-RD-0210**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	No contamination above the MDC	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	No contamination above the MDC
LCS	1 per preparatory batch	70-130% recovery - Th-228; 81-125% recovery - Th-230; 70-130% recovery - Th-232	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	Acceptable recovery limits
Sample Duplicate	1 per preparatory batch per matrix	RPD < 40%; RER < 1	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 40%; RER < 1

QAPP Worksheet #28-19
Analytical Quality Control and Corrective Action

Matrix	Soil
Analytical Group	Gamma Spec
Analytical Method/SOP	EPA 901.1/ST-RD-0102

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	No contamination above the MDC	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	No contamination above the MDC
LCS	1 per preparatory batch	73-107% recovery - Ra-226; 82-126% recovery - Th-232	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	Acceptable recovery limits
Sample Duplicate	1 per preparatory batch per matrix	RPD < 40%; RER < 1	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 40%; RER < 1

QAPP Worksheet #28-20
Analytical Quality Control and Corrective Action

Matrix	**Liquid IDW**
Analytical Group	**Gamma Spec**
Analytical Method/SOP	**EPA 901.1/ST-RD-0102**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	No contamination above the MDC	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	No contamination above the MDC
LCS	1 per preparatory batch	90-111% recovery - Am-241; 90-111% recovery - Cs-137; 89-110% recovery - Co-60	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	Acceptable recovery limits
Sample Duplicate	1 per preparatory batch per matrix	RPD < 40%; RER < 1	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 40%; RER < 1

QAPP Worksheet #28-21
Analytical Quality Control and Corrective Action

Matrix	Water
Analytical Group	Radium-226
Analytical Method/SOP	EPA 903.1/RL-RA-001

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	No contamination above the MDC	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	No contamination above the MDC
LCS	1 per preparatory batch	75-125% recovery	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	Acceptable recovery limits
Sample Duplicate	1 per preparatory batch per matrix	RPD < 40%; RER < 1	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 40%; RER < 1

QAPP Worksheet #28-22
Analytical Quality Control and Corrective Action

Matrix	Soil and Water
Analytical Group	Total Uranium
Analytical Method/SOP	ASTM D5174/RL-KPA-003

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	No contamination above the MDC	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Analyst	Accuracy	No contamination above the MDC
LCS	1 per preparatory batch	75-125% recovery	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	Analyst	Accuracy	Acceptable recovery limits
Sample Duplicate	1 per preparatory batch per matrix	RPD < 40%; RER < 3	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 40%; RER < 3

QAPP Worksheet #28-23
Analytical Quality Control and Corrective Action

Matrix	**Solid IDW**
Analytical Group	**Paint Filter Liquid Test**
Analytical Method/SOP	**EPA Method 9056/ST-WC-0031**

QC Sample	Frequency/ Number	QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Sample Duplicate	1 per preparatory batch per matrix	RPD < 20%	Correct problem, then re-reanalyze all samples processed with the duplicate	Analyst	Precision	RPD < 20%

QAPP Worksheet #29
Project Documents and Records

Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records
Daily Field Notes/Observations COC and Shipping Records Telephone Logs Corrective Action Forms GIS information QA review records **Generation:** URS Site Supervisor/Contractor QC System Manager **Verification:** URS Project Manager **Storage Location:** URS Project File	Field Equipment Maintenance, Testing, and Inspection Logs Corrective Action Forms Checklists Telephone Logs QA Review Records **Generation:** URS Site Supervisor/Contractor QC System Manager **Verification:** URS Project Manager **Storage Location:** URS Project File	Hard copy analytical data will consist of a full CLP equivalent deliverables. The reporting forms and raw data will allow for a full data validation by the USACE as noted in Worksheet 36. All analytical records will be reviewed during the data validation. Analytical records include the following: Case Narratives Sample Receipt, Custody, and Tracking Records Standard Traceability Logs Equipment Calibration Logs Sample Prep Logs Run Logs Corrective Action Forms Reported Field Sample Results Reported Results for Standards, QC Checks, calibrations and QC Samples Summary forms for surrogates and internal standards Confirmation results if applicable Instrument tuning and mass calibration for MS methods Instrument Printout (raw data) for Field Samples, Standards, QC Checks, and QC Samples Example calculation for obtaining numerical results for at least one sample per matrix Chromatograms and spectra Data review and package completeness checklists Sample Disposal Records Telephone Logs Extraction/Clean-up Records QA Review Records Electronic Data Reports **Generation:** TestAmerica Laboratories, Inc. (TA)	Data Validation Reports Corrective Action Forms Telephone Logs QA review records **Generation:** USACE **Verification:** USACE Project Manager **Storage Location: USACE** and URS Project File

QAPP Worksheet #29
Project Documents and Records

Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records
		Verification: TA QA/QC Officer **Storage Location:** TA and URS Project File	

QAPP Worksheet #31, 32, & 33
Assessments and Corrective Actions

Assessments:

Assessment Type	Responsible Party & Organization	Number/Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Readiness Review	USACE PM and QA/QC Officer; URS	One assessment one week prior to mobilization	10/23/13	Readiness Review Memorandum and Checklist	24 hours following assessment
Field Sampling TSA	URS QA/QC Officer	One on 1st day of drilling and excavation and IDW management sampling events	11/04/13; and 12/18/13, respectively	TSA Memorandum and Checklist	24 hours following assessment
On-site Analytical TSA*	NA	NA	NA	NA	NA
Project-specific PE Samples*	NA	NA	NA	NA	NA
Management Review	URS PM and QA/QC Officer	Interim Management Review following site mobilization. Final management review upon completion of field work.	10/30/13 (mobilization); 12/18/2013 (demobilization)	QA Management Report	48 hour following Management Review

QAPP Worksheet #31, 32, & 33
Assessments and Corrective Actions

Assessment Response and Corrective Action:

Assessment Type	Responsibility for Responding to Assessment Findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for Monitoring Corrective Action Implementation
Readiness Review	URS PM	Readiness Review Corrective Action Response	24 hours from receipt of Readiness Review Memorandum	As directed by URS PM	URS QA/QC Officer
Field Sampling TSA	URS Field Investigation Coordinator	Field Sampling Corrective Action Response	24 hours from receipt of Memorandum	URS Field Investigation Coordinator	URS QA/QC Officer
On-site Analytical TSA*	NA	NA	NA	NA	NA
Project-specific PE Samples*	NA	NA	NA	NA	NA
Management Review	URS PM and QA/QC Officer	QA Management Response	24 hours from receipt of QA Management Report	As assigned in QA Management Response	URS QA/QC Officer

Notes:
* On-site analytical TSA and project specific PE samples are not required elements for the NFSS project.
NA – Not Applicable
PE – Performance Evaluation
PM – Project Manager
QA/QC – Quality Assurance/Quality Control
TA – TestAmerica Laboratories, Inc.
TSA – Technical Assessment Audit
URS – URS Group, Inc.
USACE – United States Army Corps of Engineers

QAPP Worksheet #34
Data Verification and Validation Inputs

Item	Description	Verification	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	**X**	
2	Laboratory Contract	**X**	
3	Field SOPs	**X**	
4	Laboratory SOPs	**X**	
Field Records			
5	Field logbooks	**X**	**X**
6	Equipment calibration records	**X**	**X**
7	Chain-of-custody Forms	**X**	**X**
8	Sampling diagrams/surveys	**X**	**X**
9	Drilling logs	**X**	**X**
10	Excavation logs	**X**	**X**
11	Relevant Correspondence	**X**	**X**
12	Change orders/deviations	**X**	**X**
13	Field audit reports	**X**	**X**
14	Field corrective action reports	**X**	**X**

QAPP Worksheet #34
Data Verification and Validation Inputs

Item	Description	Verification	Validation (conformance to specifications)
Analytical Data Package			
15	Coversheet (laboratory identifying information)	**X**	**X**
16	Case narrative	**X**	**X**
17	Internal chain-of-custody	**X**	**X**
18	Sample receipt records	**X**	**X**
19	Sample chronology (i.e., dates and times of receipt, preparation, and analysis)	**X**	**X**
20	Communication records	**X**	**X**
21	Project-specific PE sample results	**NA**	**NA**
22	QL/MDL establishment and verification	**X**	**X**
23	Standards traceability	**X**	**X**
24	Instrument calibration records	**X**	**X**
25	Definition of laboratory qualifiers	**X**	**X**
26	Results reporting forms	**X**	**X**
27	QC sample results	**X**	**X**
28	Corrective action reports	**X**	**X**
29	Raw data	**X**	**X**
30	Electronic data deliverable	**X**	**X**

QAPP Worksheet #35
Data Verification Procedures

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
Field logbook	FSP	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	Daily – URS Field Investigation Coordinator At conclusion of field activities – URS QA/QC Officer
Chain-of-custody forms	FSP	Verify the completeness of chain-of-custody records. Examine entries for consistency with the field logbook. Check that appropriate methods and sample preservation have been recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for QC samples (e.g., MS/MSD). Verify that all required signatures and dates are present. Check for transcription errors.	Daily – URS Field Investigation Coordinator At conclusion of field activities – URS Project Chemist
Laboratory Deliverable	QAPP	Verify that the laboratory deliverable contains all records specified in the QAPP. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported according to plan. Compare the data package with the COCs to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. Check for evidence that any required notifications were provided to project personnel as specified in the QAPP. Verify that necessary signatures and dates are present.	Before release – TestAmerica QA/QC Officer Upon receipt – URS Project Chemist
Audit Reports, Corrective Action Reports	QAPP	Verify that all planned audits were conducted. Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	URS QA/QC Officer

QAPP Worksheet #36
Data Validation Procedures

Data Validator: USACE, Project Chemist

Analytical Group/Method	Data Deliverable Requirements	Analytical Specifications	Measurement Performance Criteria	Validation Procedure	Percent Data Reviewed/Raw Data Calculated	EPA Data Validation Level[1]
Mass Uranium /ASTM D5174-02	EPA Level 4 (CLP equivalent)	Worksheet # 28-22, SOP RL-KPA-003	Worksheet #12-1 and 12-9	See Attachment B	100%	4
Isotopic Uranium /HASL-300		Worksheet # 28-15 and 28-16, SOP ST-RD-0210	Worksheet #12-2 and 12-10		100%	4
Isotopic Thorium /HASL-300		Worksheet # 28-17 and 28-18, SOP ST-RD-0210	Worksheet #12-3 and 28-11		100%	4
Gamma Spectroscopy /EPA 901.1		Worksheet # 28-19 and 28-20, SOP ST-RD-0102	Worksheet #12-4 and 12-12		100%	4
Ra-226/EPA 903.1		Worksheet # 28-21, SOP RL-RA-001	Worksheet #12-13		100%	4
Target Analyte List (TAL) Metals (23) plus Boron, Lithium, Molybdenum, Phosphorus/ EPA 6010C/7470A		Worksheet # 28-6 and 28-7, SOP ST-MT-0005	Worksheet #12-14		10%	3
Volatile Organic Compounds (VOCs)/EPA 8260C		Worksheet # 28-1, SOP ST-MS-002	Worksheet #12-6 and 12-18		10%	3
Semivolatile Organic Compounds (SVOCs)/EPA 8270D		Worksheet # 28-2, SOP ST-MS-001	Worksheet #12-7 and 12-19		10%	3

QAPP Worksheet #36
Data Validation Procedures

Data Validator: USACE, Project Chemist

Analytical Group/Method	Data Deliverable Requirements	Analytical Specifications	Measurement Performance Criteria	Validation Procedure	Percent Data Reviewed/Raw Data Calculated	EPA Data Validation Level
Polynuclear Aromatic Hydrocarbons (PAHs)/EPA 8270D-SIM	EPA Level 4 (CLP equivalent)	Worksheet # 28-3, SOP ST-MS-001	Worksheet #12-5	See Attachment B	10%	3
Pesticides/EPA 8081B		Worksheets # 28-4, SOP ST-GC-0016	Worksheet #12-8 and 12-20			
Herbicides/EPA 8151A)		Worksheets # 28-5, SOP ST-GC-0017	Worksheet #12-21 and 28-23			
Anions/EPA 300.0		Worksheets # 28-12, SOP ST-WC-0028	Worksheet #12-15			
Alkalinity/EPA 310.1		Worksheets # 28-14, SOP ST-WC-0028	Worksheet #12-16			
Total Dissolved Solids (TDS)/EPA 160.1		Worksheets # 28-9, SOP ST-WC-0036	Worksheet #12-17			
Total Suspended Solids (TSS)/EPA 160.2		Worksheets # 28-10, SOP ST-WC-0036	Worksheet #12-32			
pH/EPA 9040B/9045C		Worksheets # 28-11, SOP ST-WC-0011	Worksheet #12-29			
Oil & Grease (HEM)/EPA 1664A		Worksheets # 28-8, SOP ST-WC-0039	Worksheet #12-30			
Total Organic Carbon (TOC)/EPA 415.1		Worksheets # 28-13, SOP ST-WC-0016	Worksheet #12-31			

QAPP Worksheet #36
Data Validation Procedures

Data Validator: USACE, Project Chemist

Analytical Group/Method	Data Deliverable Requirements	Analytical Specifications	Measurement Performance Criteria	Validation Procedure	Percent Data Reviewed/Raw Data Calculated	EPA Data Validation Level
Toxicity Characteristic Leaching Procedure (TCLP) Metals/EPA 1311/6010C/7470A	EPA Level 4 (CLP equivalent)	Worksheet # 28-6 and 28-7; SOP ST-MT-0003 and ST-MT-0005	Worksheet #12-22	See Attachment B	10%	3
TCLP VOCs/EPA 1311/8260C		Worksheet # 28-1, SOP ST-MS-002	Worksheet #12-25			
TCLP SVOCs/EPA 1311/8270D		Worksheet # 28-2, SOP ST-MS-001	Worksheet #12-26			
TCLP Pesticides/EPA 1311/8081B		Worksheets # 28-4, SOP ST-GC-0016	Worksheet #12-27			
TCLP Herbicides/EPA 1311/8151A		Worksheets # 28-5, SOP ST-GC-0017	Worksheet #12-28			
Paint Filter liquid Test /EPA 9056		Worksheets # 28-23, SOP ST-WC-0031	Worksheet #12-24			

Notes:

1 – EPA Level 4 is equivalent to full data validation, while Level 3 is equivalent to limited data validation (QC forms only, no raw data).

QAPP Worksheet #37
Data Usability Assessment

The data usability assessment is an evaluation based on the results of data verification and validation in the context of the overall project decisions or objectives. The assessment determines whether project execution and resulting data meet the project DQOs. Both the sampling and analytical activities must be considered, with the ultimate goal of assessing whether the final, qualified results support the decisions to be made with the data.

It is the responsibility of the URS Project Chemist and the laboratory to ensure that the data meet the method detection limits, reporting limits/minimum detected activities, and laboratory QC limits listed in this QAPP. During the data validation assessment, non-conformances are documented and data are qualified for use in decision making. The data are determined to be usable by the USACE/URS Project Chemist based on the requirements of this QAPP; the guidance presented in the *USACE Kansas City and St. Louis District Radionuclide Data Quality Evaluation Guidance for Alpha and Gamma Spectroscopy,* 2002; and the U. S. Nuclear Regulatory Commission (NUREG), *Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP), NUREG-1576,* July 2004. Data gaps will be present if a sample is not collected, a sample is not analyzed for the requested parameters, or the data are determined to be unusable. The need for further investigation will be determined on a case-by-case basis, depending on whether data can be extrapolated from adjacent sampling locations, and whether or not the results are unnecessary based on the results from adjacent locations. All data are usable as qualified by the data validator (USACE Project Chemist), with the exception of rejected data. Estimated and/or biased results are usable. Outliers, if present, can be addressed on a case-by-case basis.

The following sections summarize the processes to determine whether the collected data are of the right type, quality, and quantity to support the environmental decision-making for the project, and describes how data quality issues will be addressed and how limitations of the use of the data will be handled.

Personnel responsible for participating in the data usability assessment:

URS Project Manager
URS QA/QC Officer
URS Certified Health Physicist
URS Project Chemist
URS Field Investigation Coordinator
URS Site Supervisor/Contractor QC System Manager

QAPP Worksheet #37
Data Usability Assessment

Data Usability Assessment:

The data verification report will identify precision and accuracy exceedances with respect to the laboratory performance for each batch of samples, as well as comparability of field and lab duplicates.

The assessment will cover precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS) parameters, which are defined as follows.

Precision. Precision measures the reproducibility of measurements. It is strictly defined as the degree of reproducibility among independent measurements as the result of repeated application of the same process under prescribed similar conditions. The precision measurement is established using the relative percent difference (RPD) or relative error ratio (RER) between the duplicate sample results, and is expressed as follows:

$$\text{RPD} = \frac{[X_1 - X_2]}{[(X_1 + X_2)/2]} \text{ x } 100 \qquad \text{RER} = \frac{[X_1 - X_2]}{[(u_c{}^2(X_1) + u_c{}^2(X_2)]^{0.5}}$$

where:

X_1 and X_2 represent the individual values/activities found for the target analyte in the two replicate analyses.
$u_c(X_1)$ and $u_c(X_2)$ represent respective combined standard uncertainties.

RER is functionally equivalent to the normalized absolute difference (NAD) based on MARLAP Z-statistics (ZLCSD/MSD/Dup) statistic. The calculated RER/NAD are compared to an acceptable performance range of -1.96 to +1.96. Calculated RER/NAD results within the performance range are considered acceptable. Calculated RER/NAD results outside the performance range are investigated for possible discrepancies in analytical precision.

When RPDs and RERs (radiochemistry only) exceed established control limits, corrective action is warranted. Corrective action can include recalibration, reanalysis of the laboratory duplicate samples or matrix spike/matrix spike duplicate (MS/MSD) samples, or environmental sample reanalysis. Corrective actions must be taken, but if the laboratory cannot improve results, data will be flagged.

Field duplicate samples and laboratory duplicate samples (or MS/MSD samples) will be analyzed to assess field and analytical precision. Field duplicates are defined as two samples collected independently at a single sampling location during a single sample collection. Field duplicates will be collected at a frequency of 10 percent. Field duplicates will be collected for all matrices and analyzed for the same parameters. Frequency of analysis of laboratory duplicates or MS/MSD is 5 percent, as summarized by method on Worksheet #20.

Accuracy/Bias. Accuracy is the statistical measurement of correctness and includes components of random error (variability due to imprecision) and systematic error. A measurement is accurate when the reported value does not differ from the true value or known concentration of the spike or standard. Analytical accuracy is measured by comparing the percent recovery (organic and inorganic) or warning/control limits

QAPP Worksheet #37
Data Usability Assessment

(radiochemistry) of analytes spiked into Laboratory Control Samples (LCSs) and MS and/or MSD samples to the laboratory-established or method-established control limits. Control limits will be based on previously established laboratory capabilities for similar samples using control chart techniques. Recoveries outside the control limits indicate a cause other than normal measurement error. Corrective action may include instrument recalibration, reanalysis of the QC sample, or reanalysis of the samples in the batch. For organic and radiochemistry analyses, surrogate compound recoveries and tracer yields, respectively, are also used to assess accuracy and method performance for each sample analyzed. The calculation used for percent recovery/yield is expressed as:

$$\text{Percent Recovery (organics and inorganics)} = \frac{[X - D]}{[D]} \text{ x } 100$$

Percent Recovery LCS/MS (radiochemistry)

$$Z_{LCS} = \frac{[X - D]}{[(u_c{}^2(X) + u_c{}^2(D)]^{0.5}}$$

$$Z_{MS} = \frac{[X - X_0 - D]}{[(u_c{}^2(X) + u_c{}^2(X_0) + u_c{}^2(D)]^{0.5}}$$

where:

Z_{LCS} represents performance indicator for laboratory control samples.
Z_{MS} represents performance indicator for matrix spikes.
X represents the value/activity of the spike sample.
D represents the spike concentration added.
X_0 represents the value of the unspiked sample.
$u_c(X)$, $u_c(X_0)$, and $u_c(D)$ represent respective combined standard uncertainties.

The calculated Z_{LCS} and Z_{MS} statistic(s) should be between -1.96 and +1.96. Calculated Z_{MS} outside the performance range require further evaluation.

Accuracy of analytical results reported in environmental samples is also measured against any contamination present in laboratory method blanks and instrument blanks, as well as field blanks, such as trip and equipment rinsate blank samples. Frequency of sampling and analysis of laboratory and field blanks is specified on Worksheet #20. For radiochemistry, blank/sample accuracy is expressed as follows, and will only be evaluated when the blank/sample result is above the minimum detected activity (MDA):

QAPP Worksheet #37
Data Usability Assessment

$$Z_{Blank} = \frac{X}{[(u_c(X)]} \qquad Z_{Sample} = \frac{X}{[(u_c(X)]}$$

where:

$Z_{Blank/Sample}$ represents performance indicator for blanks/samples.

X represents the measures blank activity.
$u_c(X)$ represent the combined standard uncertainty.

Radiochemistry blank analysis results are assessed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks applies to any blank associated with the samples. If problems with any blank exist, all data associated with the case shall be carefully evaluated to determine whether or not there is an inherent variability in the data for the case, or if the problem is an isolated occurrence not affecting other data.

If the blank QC results fall outside the appropriate tolerance limits or if the net blank results are not less than the associated uncertainty, the following equation should be used in determining the effect of possible blank contamination on the sample results. NAD evaluation: > 2.58 no qualification, 1.96>x<2.58 -J flag, x<1.96 -J or R*.

*Minimally the result should be qualified as estimated, J; however, if other quality indicators are deficient the validator may determine the result should be qualified as unusable, R.

Representativeness. Representativeness is the degree to which sample data accurately reflect the characteristics of a population of samples. It is achieved through a well-designed sampling program and by using standardized sampling strategies and techniques and analytical procedures. Factors that can
affect representativeness include site homogeneity, sample homogeneity at a single point, and available information around which the sampling program is designed.

Completeness. Completeness is a measure of the amount of valid data obtained compared with the amount expected under correct, normal conditions. It is calculated for the aggregation of data for each analyte measured as a compound of concern for the project objectives. Valid data are data that
are usable in the context of the project goals. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with an R-flag after a usability assessment has been performed. The goal for completeness, based on

QAPP Worksheet #37
Data Usability Assessment

specific project goals, is 90 percent. Defined as follows for all measurements:

$$\text{Percent Completeness} = \frac{V}{T} \text{ x } 100$$

where:

V = number of measurements judged valid

T = total number of measurements

Comparability. Comparability is the confidence with which one data set can be compared to another. It is achieved by maintaining standard techniques and procedures for collecting and analyzing samples and reporting the analytical results in standard units.

Sensitivity. Sensitivity is the ability of the method or acceptable sensitivity instrument to detect the contaminant of concern and other target compounds at the level of interest. Quantitative measurement performance criteria need to be determined for acceptable sensitivity to ensure that the quantitation limits or minimum detected activities can be routinely achieved for each matrix, analytical parameter, and concentration level. The use of standards and instrument calibration will enable the instrument to identify and differentiate between various compounds/analytes of interest and interferences/instrument background.

2.0 REFERENCES

- "Report of the Results for the Remedial Investigation of Underground Utility Lines Formerly Used by the Department of Defense, Lake Ontario Ordnance Works (LOOW)".
- IDQTF, *Uniform Federal Policy Quality Assurance Project Plans (UFP-QAPP): Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs*, Final, Version 1, March 2005, (including March 2012 Part 2A Optimized Worksheets, Rev. 1).
- NUREG, *Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP), NUREG-1576,* July 2004.
- SAIC, *Remedial Investigation Report for the Niagara Falls Storage Site,* December 2007.
- USACE, *Kansas City and St. Louis District Radionuclide Data Quality Evaluation Guidance for Alpha and Gamma Spectroscopy,* 2002.
- URS, *Sampling and Analysis Plan, Volume 2 - Quality Assurance Project Plan*, November 2012.

ATTACHMENT A

LABORATORY SOPs
(on CD-ROM)

ATTACHMENT B

USACE DATA VALIDATION CHECKLISTS

Data Qualification Checklist

USACE -Buffalo District (LRB-TSD-EH)

Project:	
Date Submitted:	
Intended Use:	Data qualification for the purpose of assigning a final qualifier.
Submitted by:	
Laboratory:	
SDG:	
Samples	-Sediment/Soil -Water
Analysis:	

Yes	No	NA	**Supporting Defensible Data Package**
			Coversheet (laboratory Identifying information)
			Comment:
			1. Sample Receipt :Chain-of-custody forms and Sample Receipt Checklist;
			Comment:
			2. Case narrative listing sample IDs, analysis methodologies and non-compliance issues/nonconformance report.
			Comment:
			3. Laboratory Flags defined
			Comment:
			4. Cover page/Certificate of Analysis/Analytical Report contents: sample ID, client ID, matrix, collection date, receive date, project, sample results, reporting units, laboratory, laboratory qualifier and surrogate/tracer recoveries.
			Comment:
			5. Holding times meet?
			Comment:
			6. Sample Preservation - proper container and preservative
			Comment:
			7. Quality-Indicator Samples Quality-Indicator Samples (QIS) used to evaluate the usability of data- LCS and MS/MSD results with spike amount and percent recoveries and percent RPD per analyte including associated tracer/surrogate recoveries.
			Comment:
			8. Calibration: ICAL, ICV and CCV included
			Comment:
			9. Calibration/LCS standards must be traceable to a reliable source (e.g., NIST). The offsite laboratory utilizes a traceable reliable source (e.g. NIST, IAEA) for calibration, daily QC, LCS, MS, and tracer evaluations.
			Comment:
			10. The required detection limits established in the QAPP apply to definitive samples,
			Comment:
Yes	No	NA	**Electronic Data Deliverable**
			Is the EDD error free and in agreement with the results of the supporting defensible data package?
			Comment:
			Does the EDD contain those elements required to conduct the QIS evaluation?
			Underline: MB LCS MS MSD Lab-Duplicate Field Duplicate Tracer Surrogate
			Comment:
Yes	No	NA	**Data Evaluation/Qualification Work Sheet**
			Quality-Indicator Samples values checked.
			Comment:
			SEE WORKSHEET FOR QIS CALCUALTIONS AN EXPLANATION OF CHANGED OR ADDED DATA QUALIFIERS