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SRSNE Site Group

Remedial Design Project Operations Plan Attachment C

Quality Assurance Project Plan (Rev. 1)

Solvents Recovery Service of New England, Inc.
(SRSNE) Superfund Site
Southington, Connecticut

November 2010

ARCADIS

Remedial Design Project
Operations Plan Attachment C

Quality Assurance Project Plan (Rev. 1)

Solvents Recovery Service of New England, Inc. (SRSNE) Superfund Site
Southington, Connecticut

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Figures

Worksheets

Appendices

ANSI	American National Standards Institute
ASCQ	American Society for Quality Control
CD	Consent Decree
ELUR	Environmental Land Use Restriction
HCTS	Hydraulic Containment and Treatment System
MNA	Monitored Natural Attenuation
NAPL	non-aqueous phase liquid
NPL	National Priorities List
PCBs	polychlorinated biphenyls
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RCPs	Reasonable Confidence Protocols
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RD POP	Remedial Design Project Operations Plan
RD/RA	Remedial Design/Remedial Action
RDWP	Remedial Design Work Plan
ROD	Record of Decision
SOPs	Standard Operating Procedures
SOW	Statement of Work
SRSNE	Solvents Recovery Service of New England, Inc.
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds

1. Introduction

On September 30, 2005, the United States Environmental Protection Agency (USEPA) issued a Record of Decision (ROD) (USEPA 2005a) for the Solvents Recovery Service of New England, Inc. (SRSNE) Superfund Site in Southington, Connecticut (Site) (Figure C-1). A Consent Decree (CD) and Statement of Work (SOW) were subsequently prepared for the Remedial Design/Remedial Action (RD/RA) at the Site. The CD was developed between the USEPA and the SRSNE Site Group (an unincorporated association of Settling Defendants to the CD), and lodged on October 30, 2008 with the United States District Court for the District of Connecticut in connection with Civil Actions No. 3:08cv1509 (SRU) and No. 3:08cv1504 (WWE). The CD was entered by the Court on March 26, 2009. The CD and the SOW define the response activities and deliverable obligations that the SRSNE Site Group is to perform to implement RD/RA activities at the Site.

As detailed in Section D of the ROD, the selected remedy for the Site requires the in-situ thermal treatment of subsurface source material (non-aqueous phase liquid [NAPL]) in the overburden aquifer; capping surface source material (contaminated soil and wetland soil); capturing and treating groundwater that exceeds federal drinking water standards and other risk-based cleanup levels; institutional controls; and monitored natural attenuation (MNA) of NAPL in the deep subsurface (bedrock) and contaminated groundwater throughout the plume including outside the capture zone, until cleanup levels are achieved across the entire Site.

This Q*uality Assurance Project Plan* (QAPP) has been developed as a component of the *Remedial Design Project Operations Plan* (RD POP) to address the requirement of Section V.C.2.c of the SOW, and it addresses the content specified in Part B of Attachment C to the SOW. The purpose of the QAPP is to support the sampling and analytical methods and procedures that will be used during the remedial design (RD) phase of the project, including pre-design investigations and SOW-specified groundwater sampling events. The specific activities addressed by this QAPP include the various soil, groundwater, soil gas, and indoor air sampling contemplated in the *Remedial Design Work Plan* (RDWP) that was submitted to the USEPA in April 2009 and subsequently modified to address USEPA comments.

1.1 Development of the QAPP

As described on USEPA's Quality System Website (http://www.epa.gov/QUALITY/qapps.html), a QAPP is to document the planning, implementation and assessment procedures for a particular project, as well as any specific quality assurance and quality control activities. It is to integrate all the technical and quality aspects of the project to provide a "blueprint" for obtaining the type and quality of environmental data and information needed for a specific decision or use.

In March 2005, the Intergovernmental Data Quality Task Force developed a policy and guidance document to fulfill the project-specific requirements of Part B of American National Standards Institute (ANSI)/American Society for Quality Control (ASCQ) E4, to ensure that Federal departments and agencies will produce consistent QAPPs that reflect a systematic planning approach to collection and use of environmental data. That guidance document—the *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP) Manual V1, March 2005 (USEPA 2005b)—was followed in the development of this QAPP. Additionally, the provisions of this QAPP were reviewed against the Minimum Quality Assurance/Quality Control (QA/QC) Activities identified in the UFP-QAPP (USEPA 2005b).

As per the UFP-QAPP Manual V1, March 2005, the UFP approach was developed to be compliant with USEPA QA/R-5 and QA/G-5. Other existing QAPP guidance – including selected Region 1 (New England) QAPP guidance – was used as a point of reference for creation of the UFP-QAPP Manual. Therefore, use of the UFP-QAPP manual meets the substantive SOW requirements associated with the development of the QAPP for this site, as specified in Attachment C of the SOW.

As appropriate, pertinent state guidance available in the CTDEP Reasonable Confidence Protocols (RCPs) was adopted and incorporated into this QAPP. Note that the RCPs were developed, in part, due to the fact that project-specific QAPPs are often not developed in support of environmental projects undertaken in the state, resulting in inconsistent data quality among projects. To the extent practical, RCPs have been incorporated into this QAPP, including reporting limit and data quality indicator control limits. Given the USEPA lead on this project, the fact that the need for and scope of the QAPP were prescribed in the SOW, the extensive historical dataset available for this site, and other site-specific factors, deviations from RCPs potentially exist. Nevertheless, this QAPP serves the functional purpose of the RCPs; namely,

to provide a basis for ensuring data is of a known and consistent quality to support the RD/RA activities for the Site.

This version of the QAPP addresses USEPA's comments regarding the draft QAPP that was submitted to the USEPA for review in April 2009, as well as the SRSNE Site Group's responses to said comments, dated October 15, 2009; January 5, 2010; January 15, 2010; and February 4, 2010.

1.2 Project Setting

The SRSNE Site is located in the Town of Southington, Connecticut, in Hartford County, approximately 15 miles southwest of the City of Hartford. It is located on Lazy Lane, just off Route 10 (Queen Street), and adjacent to the Quinnipiac River. The SRSNE Site, generally depicted on Figure C-2, consists of the SRSNE Operations Area (4 acres), the Cianci Property (10 acres), a railroad right-of-way, and those areas where the SRSNE-related plume in groundwater has come to be located, including Southington's Curtiss Street Well Field (the Town Well Field Property). The Town Well Field Property is a 28-acre parcel of undeveloped land containing two municipal drinking water wells (Production Wells No. 4 and No. 6). The wells were closed in 1979 when they were found to contain volatile organic compounds (VOCs). The Site was listed on the National Priorities List (NPL) in September 1983.

Additional information regarding the site location and setting is provided in the RDWP.

1.3 Applicability of the QAPP

This QAPP is applicable to RD activities performed at the Site. This includes soil sampling, groundwater sampling, field investigations, pre-design investigations, and related work activities described in the RDWP. Although the QAPP was developed primarily for RD activities, it will be updated as appropriate to address unique components of future RD/RA activities.

1.4 Remedial Activities

The overall purpose of RD/RA activities is to design and implement the selected remedial approach for the Site. The selected remedy, developed by combining components of different alternatives for source control and management of migration to obtain a comprehensive approach for Site

remediation, was described in the ROD. Key elements are summarized as follows:

- Treat waste oil and solvents – where present as NAPL in the subsurface in the overburden aquifer (i.e., the Overburden NAPL Area) – using in-situ thermal treatment.

- Following in-situ thermal treatment, cap the former SRSNE Operations Area and the railroad right-of-way. The cap will be low-permeability and multi-layered and is to be designed, constructed, and maintained to meet the requirements of a Resource Conservation and Recovery Act (RCRA) Subtitle C ("RCRA C") type of cap.

- Excavate soils exceeding cleanup levels from certain discrete portions of the former Cianci Property. The estimated limits of soil removal on the former Cianci Property (five discrete excavation areas) are shown on Figure G-1 of the *Post-Excavation Confirmatory Sampling Plan* (Attachment G to the RDWP); these limits are subject to modification based on additional sampling proposed as part of remedial design. Provided that concentrations of polychlorinated biphenyls (PCBs) do not warrant off-site disposal, soils excavated from the former Cianci Property (and from other areas excavated outside the cap limits as part of other RD/RA activities) may be relocated to the former SRSNE Operations Area for placement beneath the cap.

- Capture and treat (on site) groundwater in both the overburden and bedrock aquifers that exceeds applicable federal drinking water standards and risk-based levels. This will be achieved through continued operation, maintenance, and modification (as needed) of the Hydraulic Containment and Treatment System (HCTS).

- MNA of the groundwater plume outside the capture zones (i.e., the severed plume, shown on Figure 3A of the RDWP) that exceeds cleanup levels.

- Monitor natural degradation of constituents in the groundwater plume inside the capture zones and within the Bedrock NAPL Area (shown on Figure 3B of the RDWP).

- Implement institutional controls (i.e., Environmental Land Use Restrictions [ELURs]) to minimize the potential for human exposure to Site-related

constituents in the subsurface soils and to prohibit activities that might affect the performance or integrity of the cap.

- Monitor groundwater and maintain the cap over the long term.

2. Document Overview

The UFP-QAPP guidance (USEPA 2005b) includes a series of 37 worksheets that can be used to present the critical information required in a QAPP. Since the worksheets were designed to "ensure consistent content and presentation of information in a project-specific QAPP... and streamline the review of QAPPs by regulators and others" (USEPA 2005b), this QAPP has been developed using these worksheets, which provide information associated with four key topics:

- Project Management and Objectives
- Measurement and Data Acquisition
- Assessment and Oversight
- Data Review

A summary of the required QAPP elements and corresponding QAPP sections and general scope/content of the 37 worksheets can be found in Worksheet 2 within this QAPP.

Two appendices are also included with this QAPP. The first (Appendix C-1) is a compact disk that includes the following:

- Laboratory Quality Assurance Plans and Standard Operating Procedures (SOPs)
- Laboratory certifications

Appendix C-2 contains a copy of an example chain of custody form.

When elements required by the UFP-QAPP are present in other documents (e.g., SOPs), careful cross-referencing of these other documents can be used in lieu of repeating information (USEPA 2005b). Following this guidance, this QAPP provides certain relevant information by reference to other supporting documents, including the RDWP, RD POP, and supporting plans attached thereto. All of these planning documents are companion documents to this QAPP.

3. References

The following references are cited within and/or considered in the development of this QAPP.

USEPA. 1996. Office of Environmental measurement and Evaluation, Region I, EPA-New England Data Validation Functional Guidelines for Evaluation Environmental Analysis, July 1996 (Revised December 1996).

USEPA. 1996. Office of Environmental measurement and Evaluation, Region I, EPA-New England Part II Volatile/Semivolatile Data Validation Functional Guidelines, (Draft December 1996).

USEPA. 2001. *EPA Requirements for QA Project Plans for Environmental Operations*. EPA-QA/R-5. Office of Environmental Information. March 2001.

USEPA. 2002. *Guidance for QA Project Plans*. EPA-QA/G-5. Office of Environmental Information. December 2002.

USEPA. 2004. Office of Environmental measurement and Evaluation, Region I, EPA-New England Part III Pesticides/PCBs Data Validation Functional Guidelines, (February, 2004).USEPA. 2005a. Record of Decision Summary, Solvents Recovery Service of New England, Inc. (SRSNE) Site, Southington, Connecticut. September 2005.

USEPA. 2005b. *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP) Manual V1. March 2005.

USEPA. 2006. Guidance on Systematic Planning using the Data Quality Objectives Process. EPA-QA/G-4. Office of Environmental Information. February 2006.

USEPA. 2008. Office of Environmental measurement and Evaluation, Region I, EPA-New England Part IV Inorganic Data Validation Functional Guidelines, (November, 2008).

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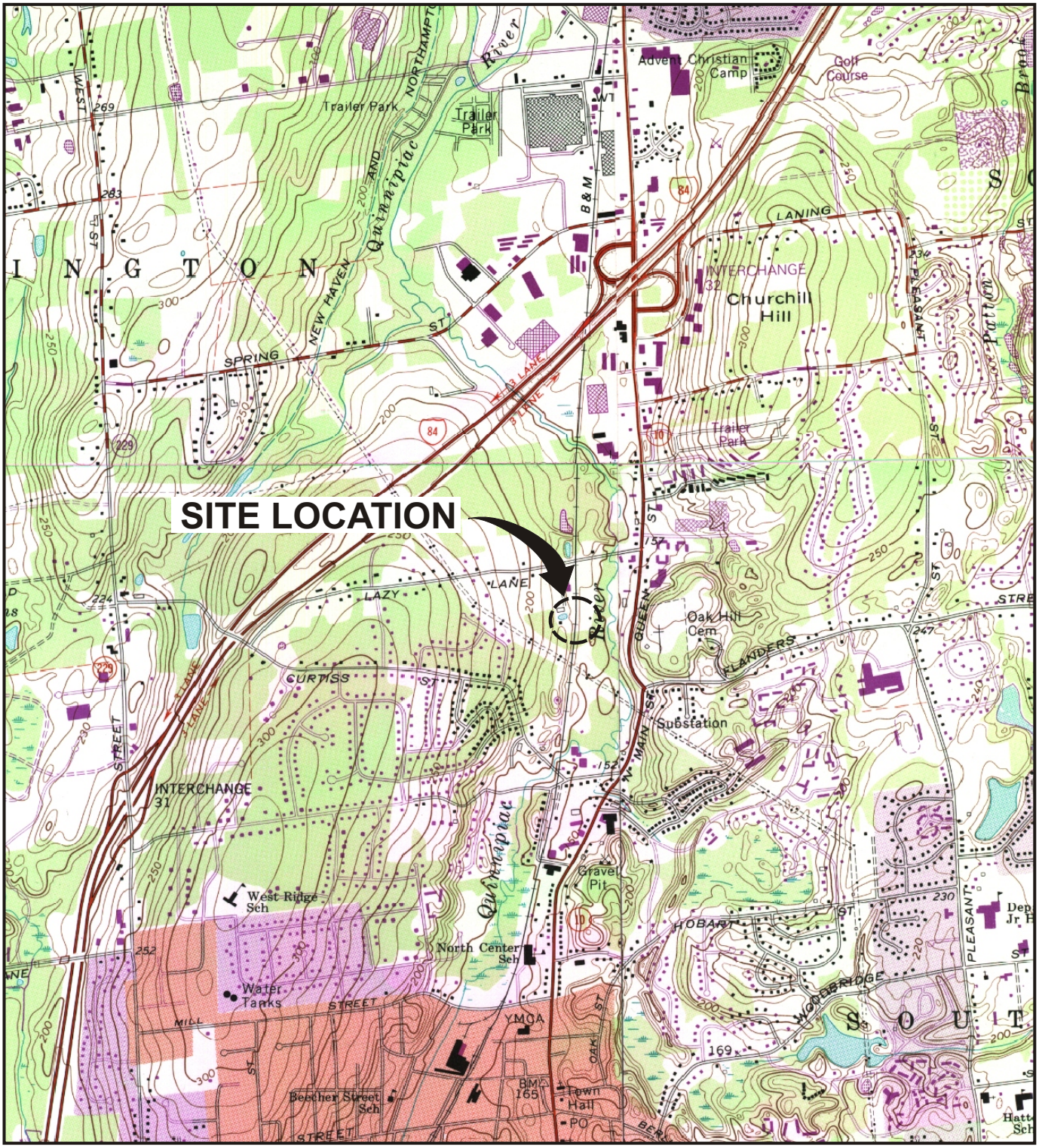
Figures



REFERENCE: SOUTHINGTON, CONN. USGS QUAD. 1968 PR 1992, MERIDEN, CONN. USGS QUAD. 1966 PR 1984, NEW BRITAIN, CONN. USGS QUAD. 1966 PR 1984, & BRISTOL, CONN. USGS QUAD 1967 PR 1984.

2000' 0 2000'

Approximate Scale: 1" = 2000'

Area Location

SRSNE SUPERFUND SITE
SOUTHINGTON, CONNECTICUT

QUALITY ASSURANCE PROJECT PLAN

SITE LOCATION MAP

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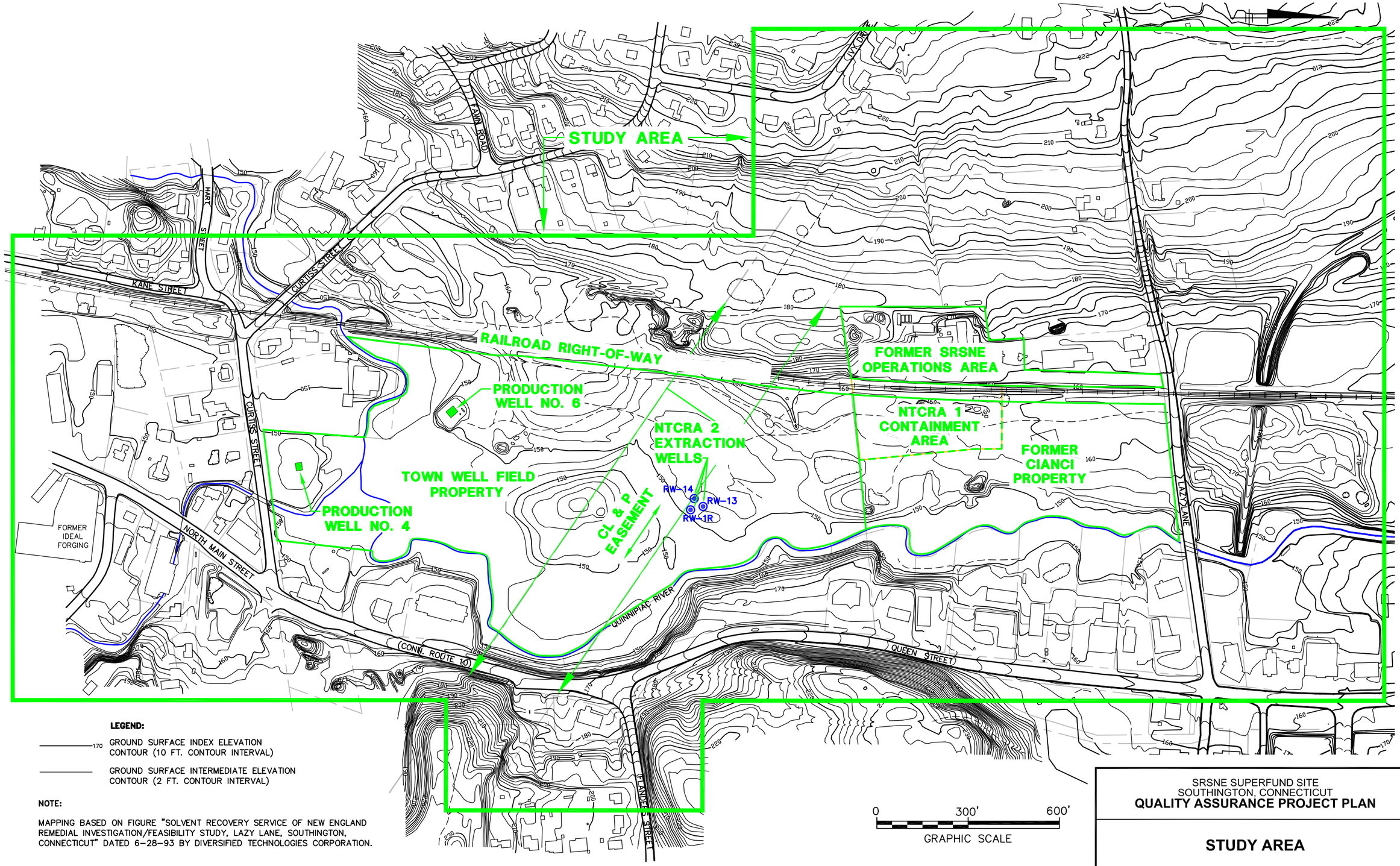
FIGURE
C-1

03/27/09 SYRACUSE, NY-ENV/CAD-DJH
B0054634/0000/20002/CDR/54634N01.CDR



LEGEND:

170 GROUND SURFACE INDEX ELEVATION CONTOUR (10 FT. CONTOUR INTERVAL)

GROUND SURFACE INTERMEDIATE ELEVATION CONTOUR (2 FT. CONTOUR INTERVAL)

NOTE:

MAPPING BASED ON FIGURE "SOLVENT RECOVERY SERVICE OF NEW ENGLAND REMEDIAL INVESTIGATION/FEASIBILITY STUDY, LAZY LANE, SOUTHINGTON, CONNECTICUT" DATED 6-28-93 BY DIVERSIFIED TECHNOLOGIES CORPORATION.

0 300' 600'

GRAPHIC SCALE

SRSNE SUPERFUND SITE
SOUTHINGTON, CONNECTICUT
QUALITY ASSURANCE PROJECT PLAN

STUDY AREA

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FIGURE
C-2

CITY: SYRACUSE, NY GROUP: ENVCAD DB: PGL GMS RCB PM: M. GEFELL LYR: ON=*;OFF=REF
G:\ENVCAD\SYRACUSE\ACTIB0054634\0000\20002\DWG\54634B01.DWG LAYOUT: C-2 SAVED: 3/27/2009 9:41 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: ----
XREFS: IMAGES: PROJECTNAME: ----
54634X01

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Worksheets

QAPP Worksheet #1 Title and Approval Page

Site Name/Project Name:	Solvents Recovery Service of New England, Inc./SRSNE Superfund Site
Site Location:	Lazy Lane, Town of Southington, CT in Hartford County
Document Title:	*Solvents Recovery Service of New England, Inc./SRSNE Superfund Site, Quality Assurance Project Plan – 2009*
Lead Organization:	USEPA Region 1
Preparer's Name and Organizational Affiliation:	Dennis K. Capria, ARCADIS
Preparer's Contact Information:	6723 Towpath Rd., P.O. Box 66, Syracuse, NY 13214-0066, 315.671.9299, Dennis.Capria@ARCADIS-US.com
Preparation Date:	April 2009
Project Coordinator:	
	Signature
	Bruce Thompson, *de maximis, Inc.*
Investigative Organization's Project Manager:	
	Signature
	Jeff Holden, ARCADIS
Investigative Organization's Project QA Officer:	
	Signature
	Dennis Capria, ARCADIS

QAPP Worksheet #1 Title and Approval Page

Lead Organization's Program Manager:	
	Signature
	Karen Lumino, USEPA Region 1

Document Control Number: **SRSNE-001**

QAPP Worksheet #2 QAPP Identifying Information

Site Name/Project Name:	Solvents Recovery Service of New England, Inc./SRSNE Superfund Site
Site Location:	Lazy Lane, Town of Southington, CT in Hartford County
Site Number/Code:	CTD009717604
Operable Unit:	NA
Contractor Name:	NA
Contractor Number:	NA
Contract Title:	NA
Work Assignment Number:	NA
Identify guidance used to prepare QAPP:	See the listed references.
Identify regulatory program:	Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
Identify approval entity:	USEPA Region 1 (with reasonable opportunity for review and comment by the CTDEP)
Indicate whether the QAPP is a generic or a project-specific QAPP?	This SRSNE QAPP is a project-specific QAPP to serve the needs of the Remedial Design and monitoring activities at the Site, as described in the Remedial Design Work Plan
List dates of scoping sessions that were held:	February 10, 11 and March 30, 2009. March 31, 2009 conference call (See Worksheet 9).

QAPP Worksheet #2 QAPP Identifying Information

List dates and titles of QAPP documents written for previous site work, if applicable:	
Quality Assurance Project Plan	Blasland, Bouck & Lee Inc. (BBL), Quality Assurance Project Plan, August 1996. The document was approved by USEPA Region 1.
List organizational partners (stakeholders) and connection with lead organization:	The SRSNE Site Group (an unincorporated association of Settling Defendants to an October 2008 Consent Decree and Statement of Work for Remedial Design/Remedial Action at the Site)
List data users:	USEPA Region 1 SRSNE Site Group and Contractors
Lead Organization's Program Manager:	Karen Lumino, USEPA Region 1

QAPP Worksheet #2 QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s) (per UFP QAPP 2005)	Required Information	Crosswalk to Related Information and Documents
Project Management and Objectives		
2.1 Title and Approval Page	- 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	- Table of Contents - QAPP Identifying Information	The Table of Contents is provided following the QAPP cover page. Worksheet #2 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	- Distribution List - Project Personnel Sign-Off Sheet	Worksheet #3 Distribution List and Worksheet #4 Project Personnel Sign-Off
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	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	Worksheet #5 Project Organization Chart, Worksheet #6 Communication Pathways, Worksheet #7 Personnel Responsibilities and Qualifications and Worksheet #8 Special Personnel Training Requirements
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History and Background - Site Maps (historical and present)	Worksheet #8 Special Personnel Training Requirements, Worksheet #9 Project Team Planning Sessions Participants Sheet and Worksheet #10 Problem Definition for Project DQOs Site history, maps and more detail concerning the project DQOs can be found in the *Remedial Design Work Plan,* April 2009

QAPP Worksheet #2 QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s) (per UFP QAPP 2005)	Required Information	Crosswalk to Related Information and Documents
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	- Site-Specific Project Quality Objectives (PQOs) - Measurement Performance Criteria Table	Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements and Worksheet #12-1 though #12-13 Measurement Performance Criteria for project analytes Details concerning the project objectives can be found in the *Remedial Design Work Plan,* April 2009
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	Worksheet #13 Secondary Data Criteria and Limitations
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	Worksheet #14 Summary of Project Tasks, Worksheet #15-1 through #15-3 Reference Limits and Evaluation for specific monitoring activities and Worksheet #16Project Schedule/Timeline More details concerning the project schedule can be found in the *Remedial Design Project Operations Plan* (RD POP)

QAPP Worksheet #2 QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s) (per UFP QAPP 2005)	Required Information	Crosswalk to Related Information and Documents
Measurement/Data Acquisition		
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 and Preservation 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	- 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	Worksheet #17 Sampling Design and Rationale, Worksheet #18Sampling Locations and Methods/SOP Requirements for the project, Worksheet #19 Analytical SOP Requirements (Sample Containers Preservation and Holding Times), Worksheet #20 Sample Quantities and Control Frequencies, Worksheet #21 Field Sampling SOP References and Worksheet #22 Field Equipment Calibration, Maintenance, Testing and Inspection More details concerning the sampling design and rationale can be found in the *Remedial Design Work Plan,* April 2009 The analytical SOPs can be found in Appendix C-1 of this QAPP

QAPP Worksheet #2 QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s) (per UFP QAPP 2005)	Required Information	Crosswalk to Related Information and Documents
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	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing and Inspection Table	Worksheet #23 Analytical SOP References, Worksheet #24 Analytical Instrument Calibration and Worksheet #25 Analytical Instrument and Equipment Maintenance, Testing and Inspection The analytical SOPs can be found in Appendix C-1 of this QAPP
3.3 Sample Collection Documentation, Handling, Tracking and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation Handling, Tracking and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody (COC) Form and Seal	Worksheet #27 Sample Custody Requirements More details concerning the field sampling procedures can be found in the *Field Sampling Plan for the SRSNE Superfund Site* (FSP) Attachment B to the RD POP . April 2009 An example of the COC form can be found in Figure C-1
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	- QC Samples Table - Screening/Confirmatory Analysis Decision Tree	Worksheet #28-1 through #28-16 present QC sample information for project analytes
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	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs	Worksheet #29 Project Documents and Records and Worksheet #30 Analytical Services Data Management is described in the Site Management Plan (Attachment A to the RDPOP)

QAPP Worksheet #2 QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s) (per UFP QAPP 2005)	Required Information	Crosswalk to Related Information and Documents
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table	Worksheet #31 Planned Project Assessments and Worksheet #32 Assessment Findings and Corrective Action Responses Laboratory Certifications can be found in Appendix C-1
4.2 QA Management Reports	- QA Management Reports Table	Worksheet #33 QA Management Reports
4.3 Final Project Report		

QAPP Worksheet #2 QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s) (per UFP QAPP 2005)	Required Information	Crosswalk to Related Information and Documents
Data Review		
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	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	Worksheet #34 Verification (Step I) Process, Worksheet #35 Validation (Steps IIa and IIb) Process, Worksheet #36 Validation (Steps IIa and IIb) Summary and Worksheet #37 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	None	NA

QAPP Worksheet #3 Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Karen Lumino	Remedial Project Manager	USEPA	617.918.1348		lumino.kare@epamail.epa.gov	SRSNE-001
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Ryan Santos	Project Manager	CTDEP	860.424.3865		ryan.santos@ct.gov	SRSNE-001
Bruce Thompson	Project Coordinator	de maximis, Inc.	860.298.0541	860.298.0561	brucet@demaximis.com	SRSNE-001
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QAPP Worksheet #3 Distribution List

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David Cornell	Field Team Coordinator	ARCADIS	315.671.9379	315.446.8053	david.cornell@arcadis-us.com	SRSNE-001
Julie Sueker	Monitored Natural Attenuation (MNA) Plan	ARCADIS	303.231.9115 ext 112		julie.sueker@arcadis-us.com	SRSNE-001
Michael Gefell	Monitoring Well Network Evaluation	ARCADIS	303.231.9115		michael.gefell@arcadis-us.com	SRSNE-001
Nadine Weinberg	Vapor Intrusion Study Work Plan	ARCADIS	207.828.0046		nadine.weinberg@arcadis-us.com	SRSNE-001
Dennis Capria	QA Coordinator	ARCADIS	315.671.9299	315.446.7485	dennis.capria@arcadis-us.com	SRSNE-001
Johanna Dubauskas	Laboratory Project Manager	TestAmerica Connecticut	203.929.8140	203.929.8142	johanna.dubauskas@testamericainc.com	SRSNE-001

QAPP Worksheet #3 Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
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Patrick McLoughlin	Laboratory QA Manager	Microseeps	412.826.2389	412.826.5251	pmcl@microseeps.com	SRSNE-001
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Douglas Weir	Laboratory QA Manager[1]	TestAmerica West Sacramento	916.373.5600	916.372.1059	doug.weir@testamericainc.com	SRSNE-001
Becky Mason	Laboratory Project Manager[1]	TestAmerica Westfield	413.572.4000	413.572.3707	becky.mason@testamericainc.com	SRSNE-001
Christine Reynolds	Laboratory QA Manager[1]	TestAmerica Westfield	413.572.4000	413.572.3707	christine.reynolds@testamericainc.com	SRSNE-001

QAPP Worksheet #3 Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Ron Pentkowski	Laboratory Project Manager[1]	TestAmerica Burlington	802.660.1990	802.660.1919	ron.pentkowski@testamericainc.com	SRSNE-001
Kirstin L. McCracken	Laboratory QA Manager[1]	TestAmerica Burlington	802.660.1990	802.660.1919	kirstinl.mccracken@testamericainc.com	SRSNE-001
Debra LaValle	Laboratory Project Manager[1]	TestAmerica Nashville	615.726.0177	615.726.3404	debra.lavalle@testamericaninc.com	SRSNE-001
Eric Smith	Laboratory QA Manager[1]	TestAmerica Nashville	615.726.0177	615.726.3404	eric.smith@testamericainc.com	SRSNE-001
Natalie Tafuni	Laboratory Project Manager[1]	TestAmerica Tampa	813.885.7427	813.885.7049	natalie.tafuni@testamericainc.com	SRSNE-001
Lori Mangrum	Laboratory QA Manager[1]	TestAmerica Tampa	813.885.7427	813.885.7049	lori.mangrum@testamericainc.com	SRSNE-001

Note: Copies of the QAPP will be distributed to the individuals above. The copies will consist of the following documents: QAPP, and any subsequent QAPP revisions and addenda.

(1) With the exception of the samples being submitted for the analysis of dissolved gases, which will be analyzed by Microseeps, all other samples will submit to TestAmerica Connecticut (TA-CT). TA-CT will be responsible for the submittal of all data deliverables and meeting turnaround times for any analysis which TA-CT will subcontract to a laboratory within their laboratory system. The contact TA laboratories that will be involved in the analysis of samples have been list primarily for contact information purposes.

QAPP Worksheet #4-1 Project Personnel Sign-Off (de maximis/ddms)

Organization/Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Bruce Thompson	Project Coordinator	860.298.0541		
John Hunt	Alternate Project Coordinator	617.957.5961		
Polly Newbold	QA Manager/Data Validator	908.479.1975		
Mark Packard	Database Manager	651.842.4209		

Note: The project personnel sign-off table above documents key project personnel who have read the applicable sections of the QAPP and will perform the tasks as described in the QAPP.

QAPP Worksheet #4-2 Project Personnel Sign-Off (ARCADIS)

Organization/Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Jeff Holden	Project Manager	860.533.9906		
David Cornell	Field Team Coordinator	315.671.9379		
Julie Sueker	Monitored Natural Attenuation (MNA) Plan	303.231.9115 ext 112		
Michael Gefell	Monitoring Well Network Evaluation	303.231.9115		
Nadine Weinberg	Vapor Intrusion Study Work Plan	207.828.0046		
Dennis Capria	QA Coordinator	315.671.9299		

Note: The project personnel sign-off table above documents key project personnel who have read the applicable sections of the QAPP and will perform the tasks as described in the QAPP.

QAPP Worksheet #4-3 Project Personnel Sign-Off (TestAmerica)

Organization/Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Johanna Dubauskas	Laboratory Project Manager-TA Connecticut	203.929.8140		
Dawn May	Laboratory QA Manager- TA Connecticut	203.929.8140		
David Herbert	Laboratory Project Manager- TA West Sacramento	916.373.5600		
Pamela Schemmer	Laboratory QA Manager- TA West Sacramento	916.373.5600		
Becky Mason	Laboratory Project Manager- TA Westfield	413.572.4000		
Christine Reynolds	Laboratory QA Manager-TA Westfield	413.572.4000		
Ron Pentkowski	Laboratory Project Manager- TA Burlington	802.660.1990		
Kirstin L. McCracken	Laboratory QA Manager-TA Burlington	802.660.1990		

QAPP Worksheet #4-3 Project Personnel Sign-Off (TestAmerica)

Organization/Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Debra LaValle	Laboratory Project Manager- TA Nashville	615.726.0177		
Eric Smith	Laboratory QA Manager- TA Nashville	615.726.0177		
Christina Fritz	Laboratory Project Manager- TA Tampa	813.885.7427		
Lori Mangrum	Laboratory QA Manager- TA Tampa	813.885.7427		

Note: The project personnel sign-off table above documents key project personnel who have read the applicable sections of the QAPP and will perform required activities in accordance with the QAPP.

QAPP Worksheet #4-4 Project Personnel Sign-Off (Microseeps)

Organization/Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Debbie Hallo	Laboratory Project Manager	412.826.2389		
Patrick McLoughlin	Laboratory QA Manager	412.826.2389		

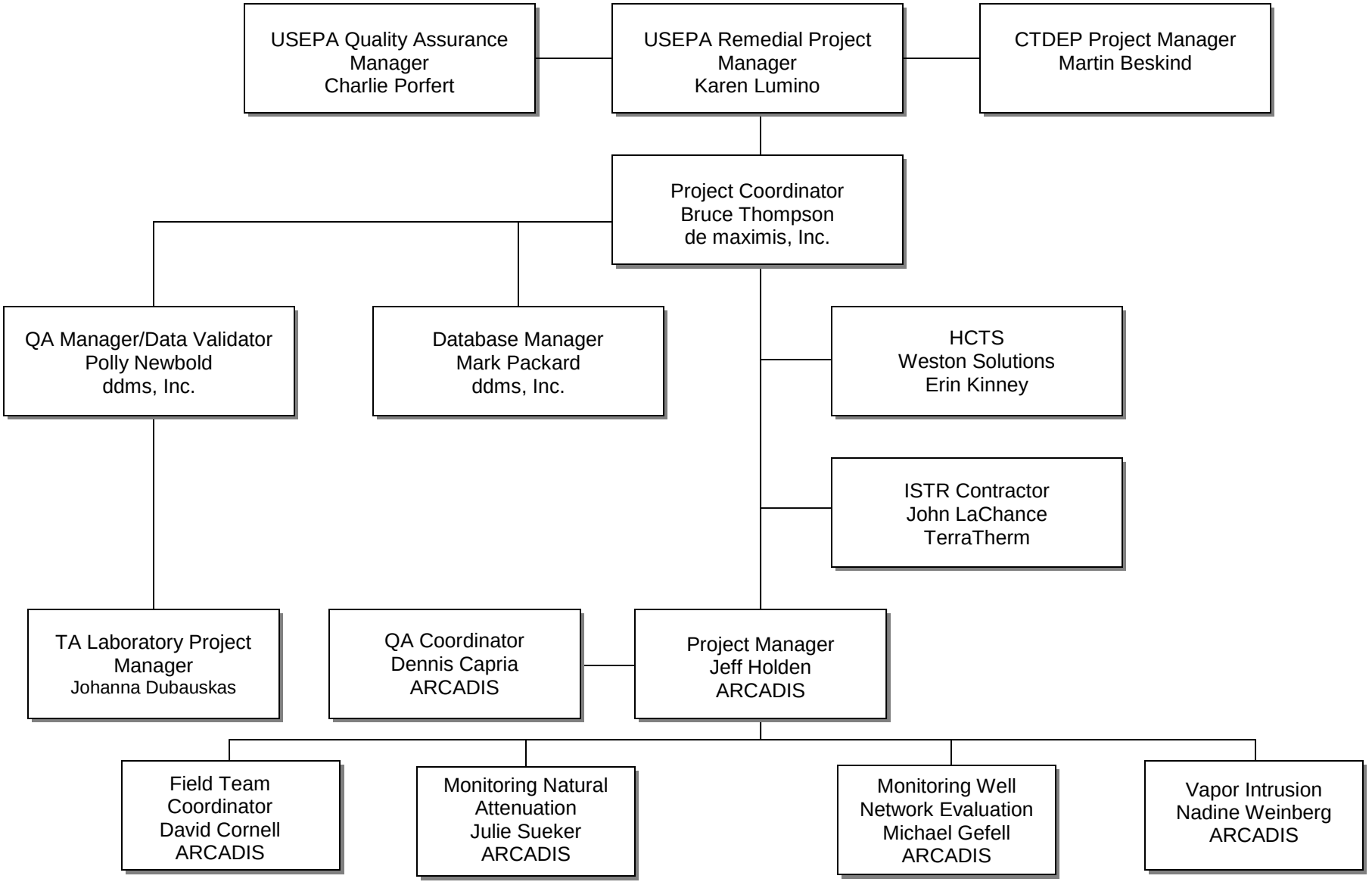
Note: The project personnel sign-off table above documents key project personnel who have read the applicable sections of the QAPP and will perform the tasks as described in the QAPP.

QAPP Worksheet #4-5 Project Personnel Sign-Off (TerraTherm)

Organization/Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
John LaChance	Project Manager	978.343.0300		

Note: The project personnel sign-off table above documents key project personnel who have read the applicable sections of the QAPP and will perform the tasks as described in the QAPP.

QAPP Worksheet #5 SRSNE Project Organization Chart



QAPP Worksheet #6 Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (e.g., Timing, Pathways)
Point of Contact with USEPA Remedial Project Manager (RPM)	Project Coordinator	Karen Lumino	617.918.1348	Planning documents will be provided to Karen Lumino, USEPA by Bruce Thompson, de maximis.
Manage all Project Phases	Project Coordinator	Bruce Thompson	860.298.0541	Bruce Thompson will be the liaison to the SRSNE Site Group and all agencies.
Coordinate Field Program	Field Team Coordinator	David Cornell	315.671.9379	To be notified of field-related questions or problems by phone, e-mail, or fax by COB the next business day.
QAPP changes in the field	Field Team Coordinator	David Cornell	315.671.9379	To be notified David Cornell by phone and e-mail of any changes to QAPP made in the field and the reasons within 2 business days. Will notify the Project Manager and the Project Coordinator of any such changes immediately.
Daily Field Progress Reports	Field Team Coordinator	David Cornell	315.671.9379	To be provided daily field progress reports. Will provide complete sets of daily field progress reports, sampling logs, chains-of-custody forms, and other information to the Field Program Coordinator.
Reporting Lab Data Quality Issues	Laboratory Project Manager	Johanna Dubauskas	203.929.8140	All QA/QC issues with project field samples will be reported by Johanna Dubauskas to Polly Newbold within 1 business day.

QAPP Worksheet #6 Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (e.g., Timing, Pathways)
Field and Analytical Corrective Actions	QA Coordinator/ QA Manager	Dennis Capria/ Polly Newbold	315.671.9299/ 908.479.1975	The need for corrective action for field and analytical issues will be determined by Dennis Capria/Polly Newbold in conjunction with the Project Coordinator, the Field Program Coordinator or the Laboratory QA Manager, as appropriate.
Release of Analytical Data	Data QA Manager	Polly Newbold	908.479.1975	No final analytical data can be released until validation is completed and Polly Newbold has approved the release.
QAPP Amendments	QA Coordinator	Dennis Capria	315.671.9299	Any major changes to the QAPP must be approved by Dennis Capria and the Project Coordinator and USEPA before the changes can be implemented.

QAPP Worksheet #7 Personnel Responsibilities and Qualifications

Name	Title	Organizational Affiliation	Education and Experience Qualifications
Karen Lumino	Remedial Project Manager	USEPA	Designated as the USEPA's Remedial Project Manager
Charles Porfert	QAPP Reviewer	USEPA	Designated as the USEPA's Project QA Manager
Bruce Thompson	Project Coordinator	de maximis, inc.	B.S., Oceanography, 18 years of experience
John Hunt	Alternate Project Coordinator	de maximis, inc.	B.S. in Geology, 16 years of experience
Polly Newbold	QA Manager/Data Validator	ddms, Inc.	BS in Textile Science, 27 years of experience
Mark Packard	Database Manager	ddms, Inc	BS Geology/ MS Resource Analysis; 13 Years of experience
John LaChance	Project Manager	TerraTherm, Inc.	BS Chemistry/Biology; MS Environmental Science; 20 years of experience
Jeff Holden	Project Manager	ARCADIS	BS Civil/Environmental Engineering, P.E., Licensed Environmental Professional (CT), 17 years of experience
Julie Sueker	Monitored Natural Attenuation (MNA) Plan	ARCADIS	B. Architecture, M.S. Civil Engineering, Ph.D Civil Engineering, P.E. (CO), Professional Hydrologist (P.H.); 18 years of experience
Michael Gefell	Monitoring Well Network Evaluation	ARCADIS	BA Geological Sciences, MS Geology, P.G.; 19 years of experience

QAPP Worksheet #7 Personnel Responsibilities and Qualifications

Name	Title	Organizational Affiliation	Education and Experience Qualifications
Nadine Weinberg	Vapor Intrusion Study	ARCADIS	BS Natural Resources, MEM Resource Ecology; 16 years of experience
David Cornell	Field Team Coordinator	ARCADIS	BA Geology; 12 years of experience
Dennis Capria	QA Coordinator	ARCADIS	BS, Biology; minor Chemistry; 20 years of experience
Johanna Dubauskas	Laboratory Project Manager	TestAmerica Connecticut	BA, Biology; 29 years of experience
Dawn May	Laboratory QA Manager	TestAmerica Connecticut	BS Environmental Science; 18 years of experience
Debbie Hallo	Laboratory Project Manager	Microseeps	6 years of experience
Patrick McLoughlin	Laboratory QA Manager	Microseeps	BS Chemistry, MS/Ph.D Physical Chemistry; 13 years of experience
David Herbert	Laboratory Project Manager	TestAmerica West Sacramento	BS Biochemistry; 19 years of experience
Doug Weir	Laboratory QA Manager	TestAmerica West Sacramento	BS/PhD Chemistry; 19 years of experience
Becky Mason	Laboratory Project Manager	TestAmerica Westfield	BS Natural Resource Economics; 8 years of experience

QAPP Worksheet #7 Personnel Responsibilities and Qualifications

Name	Title	Organizational Affiliation	Education and Experience Qualifications
Christine Reynolds	Laboratory QA Manager	TestAmerica Westfield	AS Environmental Science/BS Water Pollution Biology; 20 years of experience
Ron Pentkowski	Laboratory Project Manager	TestAmerica Burlington	AAS Ecology and Environmental Technology; 24 years of experience
Kirstin L. McCracken	Laboratory QA Manager	TestAmerica Burlington	B.A., Geography; 12 years of experience
Debra LaValle	Laboratory Project Manager	TestAmerica Nashville	AS, Medical Lab Technology; Applied Agriculture; 36 years of experience
Eric Smith	Laboratory QA Manager	TestAmerica Nashville	BS Chemistry; 15 years of experience
Natalie Tafuni	Laboratory Project Manager	TestAmerica Tampa	BA Biology; 19 years of experience
Lori Mangrum	Laboratory QA Manager	TestAmerica Tampa	BS Chemistry; 21 years of experience

Notes:

The responsibilities of the various team members are summarized below by organization.

Project Coordinator
Responsibilities and duties include:

- Communicate with SRSNE Site Group, USEPA, CTDEP, Project Team, and other stakeholders
- direct Project Team
- oversee all aspects of the RD/RA work
- provide approval for major project deliverables

QAPP Worksheet #7 Personnel Responsibilities and Qualifications

Task Managers

The investigation components will be managed by various Task Managers. Duties of each Task Manager include, as appropriate:

- manage relevant day-to-day activities
- develop, establish and maintain files on relevant site activities
- review data reductions from the relevant site activities
- perform final data review of field data reductions and reports on relevant site activities
- verify that corrective actions are taken for deficiencies cited during audits of relevant site activities
- perform overall QA/QC of the relevant portions of the site activities
- review relevant field records and logs
- instruct personnel working on relevant site activities

Field Program Coordinator

- coordinate field and laboratory schedules pertaining to relevant site activities
- request sample bottles from laboratory
- review field instrumentation, maintenance and calibration to meet quality objectives
- prepare reports pertaining to relevant field activities
- maintain field and laboratory files of notebooks/logs, data reductions and calculations; provide complete copies to the Project Coordinator.
-

Field Project Manager

Responsibilities and duties include:

- perform field procedures associated with the investigations as set forth in the Work Plan/Design Report
- perform field analyses and collect QA samples
- calibrate, operate and maintain field equipment
- reduce field data
- maintain sample custody
- prepare field records and logs

QA Manager

Responsibilities and duties include:

- review laboratory data packages
- oversee and interface with the analytical laboratory
- coordinate field QA/QC procedures with Task Managers (including audits of field activities), concentrating on field analytical measurements and practices to meet data quality objectives (DQOs)
- review field reports
- perform and review audit reports as necessary and appropriate
- prepare interim QA/QC compliance reports as necessary and appropriate
- prepare a QA/QC report in accordance with USEPA guidelines, including an evaluation of field and laboratory data, and data usability reports
- five percent QA/QC check of imported field and laboratory results versus the hardcopy

QAPP Worksheet #7 Personnel Responsibilities and Qualifications

Database Manager

- data collected in field will be transcribed from field form or notebooks and tabulated into database
- analytical results provided by the laboratory in the form of an electronic data deliverable (EDD) will imported into the database
- tabulation of the data to end users
- Report/Graphics preparation

QA Coordinator
Responsibilities and duties include:
- preparation of Quality Assurance Project Plan (QAPP)
- maintain QAPP

Analytical Laboratories

General responsibilities and duties of the analytical laboratories include:
- perform sample analyses and associated laboratory QA/QC procedures
- supply sampling containers and shipping cartons
- maintain laboratory custody of sample
- adhere to all protocols in the QAPP

Project Manager
Responsibilities and duties include:
- serve as primary communication link between ARCADIS and laboratory technical staff
- monitor workloads and maintain availability of resources
- oversee preparation of analytical reports
- supervise in-house chain of custody

Laboratory QA Manager
Responsibilities and duties include:
- supervise personnel reviewing and inspecting all project-related laboratory activities
- conduct audits of all laboratory activities

United States Environmental Protection Agency

Remedial Project Manager
Responsibilities and duties include:
- provide the USEPA's reviews and approvals of submitted documents

QAPP Worksheet #7 Personnel Responsibilities and Qualifications

- coordinate with other agency stakeholders
- monitor progress of site activities

QA Technical Staff
Responsibilities and duties include:

- review and approval of the QAPP
- review of the QA/QC portion of any submitted report
- perform field and laboratory audits, if necessary

QAPP Worksheet #8 Special Personnel Training Requirements

Project Function	Specialized Training	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Field Activities	40-hour HAZWOPER	Certified Training Professionals	NA	Field operations personnel	All field personnel associated with RD/RA activities involving potential for exposure to site-related COCs	Project offices of respective employers
Analytical Chemistry	NELAP Accreditation	Primary Accrediting State	NA	NA	TestAmerica Connecticut 128 Long Hill Cross Rd. Shelton, CT 06484 Johanna Dubauskas 203.929.8140	TestAmerica Connecticut 128 Long Hill Cross Rd. Shelton, CT 06484 Johanna Dubauskas 203.929.8140
Analytical Chemistry	NELAP Accreditation	Primary Accrediting State	NA	NA	Microseeps, Inc. 220 William Pitt Way Pittsburgh, PA 15238 Debbie Hallo 412.826.2389	Microseeps, Inc. 220 William Pitt Way Pittsburgh, PA 15238 Debbie Hallo 412.826.2389
Analytical Chemistry	NELAP Accreditation	Primary Accrediting State	NA	NA	TestAmerica Burlington 30 Community Drive, Suite 11 S. Burlington, VT 05403 Ron Pentkowski 802.660.1990	TestAmerica Burlington 30 Community Drive, Suite 11 S. Burlington, VT 05403 Ron Pentkowski 802.660.1990
Analytical Chemistry	NELAP Accreditation	Primary Accrediting State	NA	NA	TestAmerica W Sacramento 880 Riverside Pkwy W Sacramento, CA 95605 David Herbert 916.373.5600	TestAmerica W Sacramento 880 Riverside Pkwy W Sacramento, CA 95605 David Herbert 916.373.5600
Analytical Chemistry	NELAP Accreditation	Primary Accrediting State	NA	NA	TestAmerica Westfield 53 Southampton Rd. Westfield, MA 01085 Becky Mason 413.572.4000	TestAmerica Westfield 53 Southampton Rd. Westfield, MA 01085 Becky Mason 413.572.4000

QAPP Worksheet #8 Special Personnel Training Requirements

Project Function	Specialized Training	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Analytical Chemistry	NELAP Accreditation	Primary Accrediting State	NA	NA	TestAmerica Nashville 2960 Foster Creighton Dr. Nashville, TN 37204 Debra LaValle 615.726.0177	TestAmerica Nashville 2960 Foster Creighton Dr. Nashville, TN 37204 Debra LaValle 615.726.0177
Analytical Chemistry	NELAP Accreditation	Primary Accrediting State	NA	NA	TestAmerica Tampa 6712 Benjamin Rd., Suite 100 Tampa, FL 33634 Natalie Tafuni 813.885.7427	TestAmerica Tampa 6712 Benjamin Rd., Suite 100 Tampa, FL 33634 Natalie Tafuni 813.885.7427
Additional training/certification requirements are listed in the project HASP						

Note: Current HAZWOPER training certificates for ARCADIS personnel will be maintained in a file at the Highlands Ranch, Colorado office location and available online via ARCHIMEDES for each employee performing work at the Site where 40-hour training is required for the position assignment.

QAPP Worksheet #9 Project Team Planning Sessions Participants Sheet

Project Name: **SRSNE Superfund Remedial Design**	Site Name: **Solvents Recovery Service of New England, Inc./SRSNE Superfund Site**
Projected Date(s) of Sampling: June 2009 – December 2010	Site Location:
Project Manager: Bruce Thompson	de maximis' office in Windsor, CT, with some personnel attending by conference call
March 31, 2009	
Scoping Session Purpose: Review QAPP preparation requirements and approach.	

Name	Title	Affiliation	Phone	E-mail Address	Project Role
Karen Lumino	Remedial Project Manager	USEPA	617.918.1348	lumino.karen@epamail.epa.gov	Remedial Project Manager
Steve Mangion	Hydrogeologist	USEPA	617.918.1452	mangion.steve@epa.gov	Hydrogeologist
Charles Porfert	QA/QC Manager	USEPA	617.918.8313	porfert.charlie@epa.gov	QAPP Reviewer
Bruce Thompson	Project Coordinator	de maximis, inc.	860.298.0541	brucet@demaximis.com	Project Coordinator
John Hunt	Alternate Project Coordinator	de maximis, inc.	617.957.5961	jhunt@demaximis.com	Alternate Project Coordinator
Brandon Pizzoferrato	IQAT Field Coordinator	de maximis, inc.	--	--	IQAT Field Coordinator
Jeff Holden	Project Manager	ARCADIS	860.533.9906	jeffrey.holden@arcadis-us.com	Project Manager; Remedial Design Contractor

QAPP Worksheet #9 Project Team Planning Sessions Participants Sheet

Name	Title	Affiliation	Phone	E-mail Address	Project Role
Michael Gefell	Monitoring Well Network Evaluation	ARCADIS	303.231.9115	michael.Gefell@arcadis-us.com	GW Coordinator
Dennis Capria	QA Coordinator	ARCADIS	315.671.9299	dennis.capria@arcadis-us.com	QAPP Coordinator

QAPP Worksheet #10 Problem Definition — DQOs

Step 1: State the Problem:

As specified in the United States Environmental Protection Agency's (USEPA's) Record of Decision (ROD), the selected remedy for the SRSNE Site includes the in-situ treatment of subsurface source material (non-aqueous phase liquid [NAPL]) in the overburden aquifer; capping surface source material (contaminated soil and wetland soil); capturing groundwater that exceeds federal drinking water standards and other risk-based cleanup levels; institutional controls; and monitored natural attenuation of NAPL in the deep subsurface (bedrock) and contaminated groundwater throughout the plume including outside the capture zone, until cleanup levels are achieved across the entire Site.

The problem to be addressed at the SRSNE Site is potential current and future risks associated with NAPL in the subsurface, and soil, wetland soil, and groundwater affected by Site-related constituents. These remedial measures will mitigate uncontrolled migration of and exposure to SRSNE-related constituents of concern (COCs), and will allow for the restoration of the Site to beneficial uses including eventual use of the aquifer underlying the Site for drinking and other domestic uses in the long term.

Step 2: Identify the Goal of the Study:

Purposes for Monitoring Well Network

The proposed monitoring network associated with the general plume characterization will consist of 125 monitoring wells to be used for sampling and water level measurements, and 33 additional wells to be used for water-level measurements only. Some of the wells are proposed (i.e., do not presently exist); in the course of installing bedrock monitoring wells, coreholes will be advanced in 20-ft segments and subject to sampling using packer methods. Samples from each interval will be analyzed for VOC in order to identify the target screen interval for the well. The data obtained from monitoring this extensive monitoring network will be used to characterize the COC plume in terms of:

- Plume extent in all five hydrostratigraphic zones
- Temporal and spatial variations in plume chemistry and geometry
- Capture of all groundwater that exceeds federal drinking water standards and other risk-based levels.
- Progress in meeting the long-term remedial goal of groundwater restoration
- Effectiveness of institutional controls

QAPP Worksheet #10 Problem Definition — DQOs

Supplemental Containment Action Plan

The key goal for Supplemental Containment Action Plan include:

- Containment of the SRSNE-related COC plume above drinking water standards and risk-based levels.

Overburden NAPL Delineation Plan

The key goal of the Overburden NAPL Delineation Plan is to:

- Delineate the extent of NAPL in the northwest portion of the former SRSNE Operations Area; delineation of NAPL is necessary to identify the target zone subject to in-situ thermal treatment
- Identify procedures for collection of NAPL and/or NAPL-containing soils to support ISTR pre-design testing

Thermal Treatment Monitoring Plan

The key goal of the Thermal Treatment Monitoring Plan is to:

- Design, construct and operate an in-situ thermal treatment system to treat contamination in the Overburden NAPL area.

Thermal Treatment Performance Criteria

The key goals of the Thermal Treatment Performance Criteria plan are:

- Evaluate the performance of the in-situ thermal treatment system.
- Document that NAPL Cleanup Levels are attained in the thermal treatment zone.
- Evaluate the rate of mass removal from different segments of the treatment zone.
- Determine when appreciable recovery of NAPL contamination ceases.
- Demonstrate that the process discharge criteria have been maintained during operation of the in-situ thermal treatment system.

QAPP Worksheet #10 Problem Definition — DQOs

Vapor Treatment Needs Evaluation

The key goal of the Vapor Treatment Needs Evaluation is to:

- Evaluate commercially available and proven vapor treatment technologies suitable for treating both the range and anticipated mass load of Site COCs.

ISTR System Design Evaluation

The key goals of the ISTR System Design Evaluation are:

- Evaluate the potential for corrosion of subsurface and above ground system components by conducting a materials compatibility study.
- Perform numerical calculations upon which to base the sizing of the heating and treating equipment. The calculations will also be used to determine the sensitivity of heater spacing, vapor cap thickness (i.e., R-value), etc., on the total timeframe for thermal remediation.

NAPL Mobilization Assessment and Mitigation Plan

The key goal of the NAPL Mobilization Assessment and Mitigation Plan is to:

- Determine the potential for DNAPL mobilization and the safety measures that will be implemented to prevent mobilization and to mitigate it if it occurs.

Post-Excavation Confirmatory Sampling Plan

The key goal of the Post-Excavation Confirmatory Sampling Plan is to:

- Confirm extent of removal meets applicable SOW-specified cleanup levels for targeted removal areas on Cianci Property, plus any other areas that may be targeted for removal based on the results of sampling to be performed prior to excavation activities.

QAPP Worksheet #10 Problem Definition — DQOs

Habitat Restoration Work Plan

The key goals of the Habitat Restoration Work Plan include:

- Assessment and documentation of habitat types so that habitats affected by remediation activities can be restored to the extent possible.
- Minimize impacts to wetlands and floodplains.

Soil Investigation Plan

The key goals of the Soil Investigation Plan include:

- Establish background dioxin concentrations in soil.
- Assess potential presence/extent of dioxin in the vicinity of the targeted cap area
- Confirm/modify the limits of capping following ISTR implementation.
- Assess/delineate the targeted soil removal areas on the former Cianci Property.

Vapor Control System Evaluation

The key goal of the Vapor Control System Evaluation is to:

- Assess the potential need for vapor controls as a component of the RCRA “C” cap to be constructed in the former SRSNE Operations Area.

Vapor Intrusion Study Work Plan

The key goal of the Vapor Intrusion Study Work Plan is to:

- Evaluate the potential for migration of VOCs from groundwater into occupied structures at levels that exceed risk-based standards

QAPP Worksheet #10 Problem Definition — DQOs

Monitored Natural Attenuation Plan

The key goals of the Monitored Natural Attenuation Plan include:

- Set forth a remedy for COCs in site groundwater, including dissolved phase and residual NAPL-phase COCs in the overburden and bedrock aquifers, and presents the MNA Performance Monitoring Plan for the MNA portion of the overall Site remedial actions.

Pre-ISTR Preparation Plan

The key goal of the Pre-ISTR Preparation Plan is to:

- Provide concept-level design for certain activities to be conducted to prepare the Site for implementation of the in-situ thermal remediation component of the remedial approach.

Monitoring Well Network Evaluation and Groundwater Monitoring Program

The key goals of the Monitoring Well Network Evaluation and Groundwater Monitoring Program are:

- Modify groundwater monitoring network (e.g., abandon certain existing wells and install new wells) so that it is suitable for evaluating groundwater quality.
- Provide a groundwater sampling schedule, including frequency, analytical parameters and sampling methods.

Groundwater Containment and Treatment Evaluation and Optimization Study Work Plan

The key goal of the Groundwater Containment and Treatment Evaluation and Optimization Study Work Plan is to:

- Evaluate and optimize the performance of the groundwater extraction and treatment system after groundwater conditions return to equilibrium after in-situ thermal treatment.

QAPP Worksheet #10 Problem Definition — DQOs

Evaluation and Optimization Study Work Plan

The key goals of the Evaluation and Optimization Study Work Plan include:

- Evaluate and optimize the performance of the groundwater extraction and treatment system after groundwater conditions return to equilibrium after in-situ thermal treatment.

QAPP Worksheet #10 Problem Definition — DQOs

Step 3: Identify Information Inputs:
Information inputs incorporate both the concentration and distribution of COCs in site media. A fundamental basis for decision-making is that a sufficient number of data points of acceptable quality are available from the specific RD investigation associated with the specific RD Work Plan to support the decision. Thus, the necessary input for the decision is the proportion of non-rejected (usable) data points.
Step 4: Define the Boundaries of the Sampling:
The SRSNE Site consists of the SRSNE Operations Area (4 acres), the former Cianci Property (10 acres), a railroad easement (the Railroad Right-of-Way), and those areas where groundwater contamination has come to be located, including the Town Well Field Property. The former Cianci Property is located immediately east of the Operations Area across the Railroad Right-of-Way. It is bordered on the eastern edge by the Quinnipiac River. Investigations will also be performed to the east of the Quinnipiac River to determine the extent of the COC plume in this area.
Step 5: Develop the Analytic Approach:
Typically, the decision on whether data can be used will be based on the validation results. Following validation, the data will be flagged, as appropriate, and any use restrictions will be noted. The RD Work Plans have been devised so that the loss of any single data point will not hinder description of the distribution of constituents of concern or the development of a risk assessment. A decision rule is adopted that 90 percent of the data points not be rejected or deemed unusable as a condition for use of the data set for decision-making purposes. The usable data will be evaluated versus the performance standards. The required reporting limits are also documented in Worksheets 15-1 through 15-3 so that the lowest achievable detection limit will be reported by the laboratory.
Step 6: Specify Performance or Acceptance Criteria:
Based on the potential uses of data in the decision-making process, performance and acceptance criteria are specified in the SRSNE Remedial Design/Remedial Action (RD/RA) Statement of Work (SOW). The work plans required by the SOW identified the various sampling and analysis programs that this QAPP addresses. Corrective actions are described within this document. The representative nature of the sampling design has been facilitated by discussions among professionals familiar with the site and the appropriate government agencies.

QAPP Worksheet #10 Problem Definition — DQOs

Step 7: Develop the Plan for Obtaining Data:
The overall QA objective is to develop and implement procedures for field sampling — Chain-of-Custody, laboratory analysis and reporting — that will provide results to support the evaluation of site data consistent with requirements identified in the SRSNE RD/RA SOW. Specific procedures for sampling, chain of custody procedures, laboratory instrument calibration, laboratory analysis, data reporting, internal QC, audits, preventive maintenance of field equipment and corrective action are described in other sections of this QAPP and FSP. A DQO summary for the sampling investigation efforts is presented in the following subsection. The summary consists of stated DQOs relative to data uses, data types, data quantity, sampling and analytical methods, and data measurement performance criteria.

QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements

Who will use the data?
de maximis, ARCADIS, Weston Solutions, TerraTherm, their subcontractors and overseeing agencies will use the data to develop an RD/RA and support decision-making for the Site.
What will the data be used for?
Data generated during the RD will be used to: • Monitor changes in concentrations of constituents of concern (COCs) within the dissolved-phase plumes, plume size and shape, and the effectiveness of natural attenuation processes in three dimensions throughout the plume within the overburden and bedrock aquifers and to assess the impacts to the remedial design. • Assess background concentrations of dioxing in soil, as well as the potential presence and extent of dioxin in the Operations Area • Support conceptual and detailed remedial design for various components of the remedy (i.e., extent of capping, extent of excavation, material compatibility, etc.) • Evaluate potential VI-related risks • Identify appropriate health and safety measures • Assess the appropriate well screen depth intervals for bedrock wells • Demonstrate that the groundwater quality in the Severed Plume has not been adversely impacted by changes in site conditions, decline in equipment performance, and/or moving the hydraulic containment system

QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements

What type of data are needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)

The primary COCs and cleanup levels are listed in Tables L-1 and L-2 of the RD/RA SOW, July 2008. 1,4-Dioxane is also a site-related COC subject to investigation during the RD/RA phase. Laboratory analyses will be conducted at an off-site laboratory. Standard protocols for sample collection and handling, sample preparation, and analytical methods will be followed. Standard operating procedures are provided in this document and in the FSP.

How "good" do the data need to be in order to support the environmental decision?

The data need comply with the QA/QC requirements of this QAPP to be consistent with the large historical RI database and all CERCLA regulations.

Data Categories

Three data categories have been defined to address various analytical data uses and the associated QA/QC effort and methods required to achieve the desired levels of quality. These categories are:

Screening Data: Screening data affords a quick assessment of site characteristics or conditions. This DQO is applicable to data collection activities that involve rapid, non-rigorous methods of analysis and quality assurance. This objective is generally applied to physical and/or chemical properties of samples, degree of contamination relative to concentration differences, and preliminary health and safety assessment.

Screening Data with Definitive Confirmation: Screening data allows rapid identification and quantitation, although the quantitation can be relatively imprecise. This DQO is available for data collection activities that require qualitative and/or quantitative verification of a select portion of sample findings (10% or more). This objective can also be used to verify less rigorous laboratory-based methods.

Definitive Data: Definitive data are generated using analytical methods such as approved USEPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files.

It is anticipated that both the screening and definitive data categories will be used during the investigation. Field screening data (e.g., pH, dissolved oxygen, turbidity, temperature, specific conductance, oxidation-reduction potential) will be obtained during sampling to provide real-time quantitative data that will assist in evaluating monitoring well placement. Groundwater samples will be collected from temporary monitoring wells and hydropunch sampling points and will be sent to the laboratory to obtain definitive pH and metals data.

QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements

For this project, three levels of data reporting have been defined. They are as follows:
Level 1 – Minimal Reporting: Minimal or "results only" reporting is used for analyses that, either due to their nature (i.e., field monitoring) or the intended data use (i.e., preliminary screening), do not generate or require extensive supporting documentation.
Level 2 – Modified Reporting: Modified reporting is used for analyses that are performed following standard USEPA-approved methods and QA/QC protocols and that, based on the intended data use, require some supporting documentation but not, however, full "Contract Laboratory Program (CLP)-type" reporting.
Level 3 – Full Reporting: Full "CLP-type" reporting is used for those analyses that, based on intended data use, require full documentation.

How much data are needed? (number of samples for each analytical group, matrix and concentration)

The number of samples and analyses for each media are summarized in Worksheet #20 and described in the Remedial Design Work Plan.

Where, when, and how should the data be collected/generated?

Data collection will commence following submittal of the RDWP and RD POP. The SRSNE Site Group may perform well integrity assessments and limited soil investigations "at risk" prior to formal agency approval in order to accelerate the overall project schedule. The majority of sampling will be performed following approval of the RDWP and RD POP, presumably in 2009 and 2010. The SOW and RDWP also call for certain sampling events to be performed following completion of precursors (e.g., cap delineation sampling after ISTR; post-excavation sampling following soil removal, etc.) or on a routine schedule (e.g., groundwater monitoring rounds to support 5-year reviews). Accordingly, sampling activities will occur over several years. Groundwater samples should be collected at specified well locations and soil samples should be collected as closely as possible to target locations to meet project objectives. Specific sample locations and collection methods are specified in the respective RD work plans. Samples will be sent to a lab for analytical evaluation and data results will be returned to de maximis.

Who will collect and generate the data?

de maximis, ARCADIS and their subcontractors.

QAPP Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements

How will the data be reported?
The data will be reported by the laboratory in laboratory data packages, including PDF and electronic data deliverables (EDDs). Data will be validated and reported to the Agencies upon completion with monthly and annual reports. Data pertinent to a given RD/RA activity will also be presented in the report summarizing the completion of that activity. In addition, data will be posted to a dedicated project web site (Project Portal) for use and querying by project-related personnel, including representatives of regulatory agencies.
How will the data be archived?
All data will be archived digitally by de maximis.

QAPP Worksheet #12-1 Measurement Performance Criteria (VOCs Water)

Matrix	Water
Analytical Group	VOCs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-4, F-5 and/or F-6	TACT-1 and TAT-24	Precision — Overall	RPD <30%	Field duplicate	S&A
		Accuracy/Bias	%R, 70-130%	Surrogate	A
		Accuracy/Bias Contamination	< RL	Blanks (field, trip, equipment, method)	S&A
		Accuracy/Bias	%R 70-130%	LCS	A
		Accuracy/Bias	% Relative abundance, see Table 4 of SW846 8260	Instrument performance check: bromofluorobenzene (BFB)	A
		Precision	Area response & retention times, see CT RCP	Internal standard	A

QAPP Worksheet #12-1 Measurement Performance Criteria (VOCs Water)

Matrix	Water
Analytical Group	VOCs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Accuracy/Bias	%R, 70-130%	MS[3]	A
		Accuracy/Bias	%R, 70-130%	MSD or LCSD[3]	A
		Precision	RPD ≤30%	MS/MSD or LCS/LCSD[3]	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3]MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD are supplied.
[4] Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.

QAPP Worksheet #12-2 Measurement Performance Criteria (VOCs Soil)

Matrix	Soil
Analytical Group	VOCs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-7 and/or F-8, F-9	TACT-1	Precision — Overall	RPD < 50%	Field duplicate	S&A
		Accuracy/Bias	%R, 70-130%	Surrogate	A
		Accuracy/Bias Contamination	< RL	Blanks (field, trip, equipment, method)	S&A
		Accuracy/Bias	%R 70-130%	LCS	A
		Accuracy/Bias	% Relative abundance, see Table 4 of SW846 8260	Instrument performance check: bromofluorobenzene (BFB)	A
		Precision	Area response & retention times, see CT RCP	Internal standard	A

QAPP Worksheet #12-2 Measurement Performance Criteria (VOCs Soil)

Matrix	Soil
Analytical Group	VOCs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Accuracy/Bias	%R, 70-130%	MS[3]	A
		Accuracy/Bias	%R, 70-130%	MSD or LCSD[3]	A
		Precision	RPD <30%	MS/MSD or LCS/LCSD[3]	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3]MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD are supplied.
[4] Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.

QAPP Worksheet #12-3 Measurement Performance Criteria (SVOCs Water)

Matrix	Water
Analytical Group	SVOCs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-4, F-5 and/or F-6	TACT-3 and TACT-4	Precision — Overall	RPD < 30%	Field duplicate	S&A
		Accuracy/Bias	%R 30-130% for base neutrals; 15-110% for acid compounds	Surrogate	A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R 40-140% for base neutrals; 30-130% for acid compounds	LCS	A
		Accuracy/Bias	% Relative abundance, see Table 1C of CT RCP	Instrument performance check: decafluorotri-phenylphosphine (DFTPP)	A
		Precision	Area response & retention times, see CT RCP	Internal standard	A
		Accuracy/Bias	%R 40-140% for base neutrals; 30-130% for acid compounds	MS[3]	A
		Accuracy/Bias	%R 40-140% for base neutrals; 30-130% for acid compounds	MSD or LCSD[3]	A

QAPP Worksheet #12-3 Measurement Performance Criteria (SVOCs Water)

Matrix	Water
Analytical Group	SVOCs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Precision	RPD <20%	MS/MSD or LCS/LCSD [3]	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3]MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD are supplied.
[4] Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.

QAPP Worksheet #12-4 Measurement Performance Criteria (SVOCs Soil)

Matrix	Soil
Analytical Group	SVOCs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-7 and/or F-8	TACT-2 and TACT-3	Precision — Overall	RPD < 50%	Field duplicate	S&A
		Accuracy/Bias	%R 30-130%	Surrogate	A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R 40-140% for base neutrals; 30-130% for acid compounds	LCS	A
		Accuracy/Bias	% Relative abundance, see Table 1C of CT RCP	Instrument performance check: decafluorotri-phenylphosphine (DFTPP)	A
		Precision	Area response & retention times, see CT RCP	Internal standard	A
		Accuracy/Bias	%R 40-140% for base neutrals; 30-130% for acid compounds	MS[3]	A
		Accuracy/Bias	%R 40-140% for base neutrals; 30-130% for acid compounds	MSD or LCSD[3]	A

QAPP Worksheet #12-4 Measurement Performance Criteria (SVOCs Soil)

Matrix	Soil
Analytical Group	SVOCs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Precision	RPD <30%	MS/MSD or LCS/LCSD [3]	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3]MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD are supplied.
[4] Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.

QAPP Worksheet #12-5 Measurement Performance Criteria (PCBs Water)

Matrix	Aqueous
Analytical Group	PCBs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-4, F-5 and/or F-6	TACT-6 and TACT-7	Precision — Overall	RPD < 30%	Field duplicate	S&A
		Accuracy/Bias	%R 30-150%	Surrogate	A
		Accuracy/Bias Contamination	< Reporting limit (RL)	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R 40-140%	Laboratory control sample (LCS)	A
		Accuracy/Bias and Precision	Retention times, see CT RCP	Retention time windows	A
		Accuracy/Bias	%R 40-140%	Matrix spike (MS)[3]	A
		Accuracy/Bias	%R 40-140%	Matrix spike duplicate (MSD) or laboratory control sample duplicate (LCSD)[3]	A

QAPP Worksheet #12-5 Measurement Performance Criteria (PCBs Water)

Matrix	Aqueous
Analytical Group	PCBs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Precision	RPD <50%	MS/MSD or LCS/LCSD[3]	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3]MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD are supplied.
[4] Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.

QAPP Worksheet #12-6 Measurement Performance Criteria (PCBs Soil)

Matrix	Soil
Analytical Group	PCBs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-7 and/or F-8	TACT-7, and TACT-8	Precision — Overall	RPD < 50%	Field duplicate	S&A
		Accuracy/Bias	%R 30-150%	Surrogate	A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, method)	S&A
		Accuracy/Bias	%R 40-140%	LCS	A
		Accuracy/Bias and Precision	Retention times, see CT RCP	Retention time windows	A
		Accuracy/Bias	%R 40-140%	MS[3]	A
		Accuracy/Bias	%R 40-140%	MSD or LCSD[3]	A
		Precision	RPD <50%	MS/MSD or LCS/LCSD [3]	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3]MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD are supplied.
[4] Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.

QAPP Worksheet #12-7 Measurement Performance Criteria (Dioxin Soil)

Matrix	Soil
Analytical Group	Dioxins
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-7 and/or F-8	TAWS-21 and TAWS-22	Precision — Overall	RPD < 50%	Field duplicate	S&A
		Precision	Area response & retention times, method specified limit see analytical SOP	Internal standard	A
		Accuracy	%R – method specified limits	Labeled Compounds	A
		Accuracy/Bias Contamination	< RL	Blanks (equipment, method)	S&A
		Accuracy/Bias	%R 70-130%	Laboratory control sample (LCS)	A
		Accuracy/Bias and Precision	Retention times, method specified limit and see analytical SOP	Retention time windows	A
		Accuracy/Bias	%R 70-130%	Matrix spike (MS)[3]	A

QAPP Worksheet #12-7 Measurement Performance Criteria (Dioxin Soil)

Matrix	Soil
Analytical Group	Dioxins
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Accuracy/Bias	%R 70-130%	Matrix spike duplicate (MSD) or laboratory control sample duplicate (LCSD)[3]	A
		Precision	RPD <30%	MS/MSD or LCS/LCSD[3]	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3]MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD are supplied.

QAPP Worksheet #12-8 Measurement Performance Criteria (Metals Water)

Matrix	Aqueous
Analytical Group	Metals
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-4, F-5 and/or F-6	TACT-10, TACT-11 and TACT-13	Precision — Overall	RPD < 30%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, calibration, prep.)	S&A
		Accuracy/Bias	%R 90-110	Initial and Continuing calibration verification	A
		Precision — lab	%R 80-120	Interference check sample (A and AB)	A
		Accuracy/Bias	%R 75-125	MS (MSD)	A
		Precision	RPD <20%	Laboratory duplicate (or MS/MSD)	A

QAPP Worksheet #12-8 Measurement Performance Criteria (Metals Water)

Matrix	Aqueous
Analytical Group	Metals
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Accuracy/Bias	%R 80-120	LCS	A
		Accuracy/Bias	%R 75-125	Post-digestion spike	A
		Precision	% Difference (%D) < 10%	Serial dilution[3]	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3]Performed as needed only for analytes with concentration > 50 times the MDL.
[4] Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.

QAPP Worksheet #12-9 Measurement Performance Criteria (Metals 6000-7000 Soil)

Matrix	Soil
Analytical Group	Metals
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-7 and/or F-8	TACT-10, TACT-12 and TACT14	Precision — Overall	RPD < 50%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, calibration, prep.)	S&A
		Accuracy/Bias	%R 90-110	Initial and continuing calibration verification	A
		Precision — lab	%R 80-120	Interference check sample (A and AB)	A
		Accuracy/Bias	%R 75-125	MS (MSD)	A
		Precision	RPD <35%	Laboratory Duplicate (or MS/MSD)	A
		Accuracy/Bias	%R vendor's 95% confidence limits	LCS	A
		Accuracy/Bias	%R 75-125	Post-digestion spike	A

QAPP Worksheet #12-9 Measurement Performance Criteria (Metals 6000-7000 Soil)

Matrix	Soil
Analytical Group	Metals
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Precision	% Difference (%D) < 10%	Serial dilution[3]	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3]Performed as needed only for analytes with concentration > 50 times the MDL.
[4] Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.

QAPP Worksheet #12-10 Measurement Performance Criteria (Wet Chemistry, Water)

Matrix	Aqueous
Analytical Group	Wet Chemistry
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[3]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-4, F-5 and/or F-6	TACT-15, TACT-16, TACT-17, TAN-18 and TACT-20	Precision — Overall	RPD < 30%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, calibration, prep.)	S&A
		Accuracy/Bias	%R (90-110)	Initial and continuing calibration verification	A
		Accuracy/Bias	%R 75-125	MS	A
		Accuracy/Bias	%R 75-125	MSD	A
		Precision	%RPD < 20%	Laboratory Duplicate or MS/MSD	A
		Accuracy/Bias	%R 80-120	LCS	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3] Method Performance Criteria or lab-generated limits, whichever is more stringent.

QAPP Worksheet #12-11 Measurement Performance Criteria (Wet Chemistry, Soil)

Matrix	Soil
Analytical Group	Wet Chemistry
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[3]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-7 and/or F-8	TACT-19	Precision — Overall	RPD < 50%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, equipment, calibration, prep.)	S&A
		Accuracy/Bias	%R 90-110	Initial and continuing calibration verification	A
		Accuracy/Bias	%R 75-125	MS	A
		Accuracy/Bias	%R 75-125	MSD	A
		Precision	%RPD <35%	Laboratory Duplicate or MS/MSD	A
		Accuracy/Bias	%R 80-120%	LCS	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3] Method performance criteria or lab-generated limits, whichever is more stringent.

QAPP Worksheet #12-12 Measurement Performance Criteria (VOCs GC/FID, GC/TCD Water)

Matrix	Water
Analytical Group	VOCs GC/FID, GC/TCD
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-4, F-5 and/or F-6	TAW-9 and MS-5	Precision — Overall	RPD < 30%	Field duplicate	S&A
		Accuracy/Bias	%R 75-125	Surrogate (when applicable)	A
		Accuracy/Bias Contamination	< RL	Blanks (field, trip, equipment, method)	S&A
		Accuracy/Bias	%R 70-130	LCS	A
		Accuracy/Bias	%R, 50-150	MS[3]	A
		Accuracy/Bias	%R, same as LCS/MS	MSD or LCSD[3]	A
		Precision	RPD <30%	MS/MSD or LCS/LCSD[3]	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3]MS and MSD must be client-provided. LCS/LCSD performed when no MS/MSD are supplied.
[4]Method Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.

QAPP Worksheet #12-13 Measurement Performance Criteria (VOCs TO-15 Air)

Matrix	Air
Analytical Group	VOCs
Concentration Level	All

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[3]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
F-14, F-15 or F-16	TABR-23	Precision — Overall	RPD < 50%	Field duplicate	S&A
		Accuracy/Bias Contamination	< RL	Blanks (field, trip, equipment, method)	S&A
		Accuracy/Bias	%R 70 – 130%	LCS	A
		Accuracy/Bias	% Relative abundance, see Table 3 of TO-15	Instrument performance check: bromofluorobenzene (BFB)	A
		Precision	Area response & retention times, see analytical method	Internal standard	A
		Precision	RPD <25%	LCS/LCSD	A

Notes:
[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.
[3] Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.

QAPP Worksheet #13 Secondary Data Criteria and Limitations

Secondary Data	Data Source (Originating Organization, Report Title and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	How Data Will Be Used?	Limitations on Data Use
• Site geologic and hydrogeologic data • Groundwater quality data • Hydraulic gradients • Soil quality data • Wetland delineation • LNAPL chemical characteristics • Human health and ecological risk assessments	RI Report (HNUS, May 1994) (covers first 3 phases of RI)	USEPA	Site characterization	None
• Site geologic and hydrogeologic data • Groundwater quality data • VOC regulatory plumes (above drinking water standards) • MNA data and preliminary conceptual model • Hydraulic gradients • Soil quality data • Preliminary estimates of NAPL volume and VOC mass • DNAPL physical and chemical characteristics	Final RI Report (BBL, June 1998)	SRSNE Site Group	Site characterization	None

QAPP Worksheet #13 Secondary Data Criteria and Limitations

Secondary Data	Data Source (Originating Organization, Report Title and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	How Data Will Be Used?	Limitations on Data Use
• Supplemental soil data • Supplemental sediment data • Historical NAPL visual observations in soil or wells • Estimates of NAPL volume and mass • Human health risk assessment update • Soil, sediment, and groundwater regulatory screening results	FS Report (BBL and USEPA, May 2005)	SRSNE Site Group	Site characterization	None
• Groundwater containment and treatment system components	NTCRA 100% Ground-Water Containment and Treatment System Design Report (BBL, December 1994) - and - NTCRA 2 100% Ground-Water System Design Report (BBL, November 1999)	SRSNE Site Group	Site characterization	None

QAPP Worksheet #13 Secondary Data Criteria and Limitations

Secondary Data	Data Source (Originating Organization, Report Title and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	How Data Will Be Used?	Limitations on Data Use
• Groundwater containment and treatment system operating and monitoring data	Ongoing periodic Operation and Maintenance Reports prepared by Weston Solutions	SRSNE Site Group	Site characterization	None

QAPP Worksheet #14 Summary of Project Tasks

Sampling Tasks

- Groundwater sampling during soil boring to determine well screen intervals
- Groundwater monitoring; first comprehensive event
- Follow-up VI-related groundwater sampling at selected wells
- Soil screen for NAPL
- Post-excavation confirmatory soil sampling
- Soil investigation sampling for dioxin background; assess/delineate targeted soil removal and cap areas
- Possible soil gas and/or indoor air sampling to assess VI pathway, if warranted following groundwater sampling
- Pre- and post-thermal treatment soil sampling
- Groundwater sampling before, during and after thermal treatment
- Groundwater monitoring; subsequent comprehensive events

Analysis Tasks

- Groundwater monitoring samples will be processed, prepared and analyzed by:
    i. TestAmerica Connecticut (TACT) for VOCs, PAHs, PCBs, TAL metals, MNA parameters (except 1,4-dioxane, dissolved gases, alcohols and sulfide)
    ii. TestAmerica Tampa (TAT) for 1,4-dioxane
    iii. TestAmerica Nashville (TAN) for sulfide
    iv. TestAmerica Westfield (TAW) for alcohols
    v. Microseeps for dissolved gases

- Post-excavation confirmatory soil samples will be processed, prepared and analyzed by:

QAPP Worksheet #14 Summary of Project Tasks

i. TACT for SVOCs, PCBs, Pb, Mn, Cd, Cr, Be

- Soil investigation samples will be processed, prepared and analyzed by:
  i. TACT for SVOCs, PCBs, Pb, Mn, Cd, Cr, Be
  ii. TestAmerica West Sacramento (TAWS) for dioxins
- Vapor intrusion samples will be processed, prepared and analyzed by:
  i. TestAmerica Burlington (TAB) for VOCs
- Pre- and Post thermal treatment soil samples for cap delineation will be processed, prepared and analyzed by:
  i. TAWS for dioxins
- Groundwater samples from before, during and after thermal treatment will be processed, prepared and analyzed by:
  i. TACT for VOCs and MNA parameters (except dissolved gases and sulfide)
  ii. TAN for sulfide
  iii. Microseeps for dissolved gases

Quality Control Tasks

The samples will be collected, processed and waste disposed of as documented in field SOPs provided in the Field Sampling Plan. The QA samples are described in Worksheet #26.

Secondary Data

See Worksheet #13.

QAPP Worksheet #14 Summary of Project Tasks

Data Management Tasks

The Data Management Plan (demaximis) provided in the Site Management Plan (Attachment A to the RDPOP) describes data management tasks and procedures.

Documentation and Records

Field sample identification — described in the Field Sampling Plan (FSP).

- **Field documentation** — Field personnel will provide comprehensive documentation covering various aspects of field sampling, field analysis and sample COC. This documentation consists of a record that allows reconstruction of field events and sampling handling to aid in the data review and interpretation process. Documents, records and information relating to the performance of the field work will be retained in the project file.

- **Laboratory project files** — The laboratory will establish a file for pertinent data. The file will include correspondence, faxed information, phone logs and COC forms. The laboratory will retain project files and data packages for a period not less than 5 years. de maximis and/or its designated representative will retain copies of the analytical data reports according to the requirements of the AOC.

- **Laboratory logbooks** — Workbooks, bench sheets, instrument logbooks and instrument printouts will be used to trace the history of samples through the analytical process and to document important aspects of the work, including the associated quality controls. As such, logbooks, bench sheets, instrument logs, and instrument printouts will be part of the permanent record of the laboratory. Each page or entry will be dated and initialed by the analyst at the time of entry. Errors in entry will be crossed out in indelible ink with one stroke, corrected without the use of white-out or by obliterating or writing directly over the erroneous entry, and initialed and dated by the individual making the correction. Pages of logbooks that are not used will be completed by lining out unused portions. Information regarding the sample, analytical procedures performed and results of the testing will be recorded on laboratory forms or personal notebook pages by the analyst. These notes will be dated and will also identify the analyst, instrument used and instrument conditions. Laboratory notebooks will be periodically reviewed by the laboratory group leaders for accuracy, completeness and compliance with this QAPP. All entries and calculations will be verified by the laboratory group leader. If all entries on the pages are correct, the laboratory group leader will initial and date the pages. Corrective action will be taken for incorrect entries before the laboratory group leader signs.

- **Computer and hard copy storage** — All electronic files and deliverables will be retained by the laboratory for not less than 5 years; hard copy data packages (or electronic copies) will also be retained for not less than 5 years. de maximis and/or its designated representative will retain copies of the analytical data.

QAPP Worksheet #14 Summary of Project Tasks

- **Field data reporting** — Information collected in the field through visual observation, manual measurement and/or field instrumentation will be recorded in field notebooks or data sheets and/or on forms. Such data will be reviewed by the appropriate Field Program Manager for adherence to the Work Plan and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible and (as necessary) incorporated into the data evaluation process. If applicable, field data forms and calculations will be processed and included in appendices to the appropriate reports (when generated). The original field logs documents, and data reductions will be kept in the project file at the ARCADIS office in Manchester, CT.

- **Laboratory data reporting** — Data reports for all parameters will include, at a minimum, the following items:

  Narrative: Summary of activities that took place during sample analysis, including the following information:

  - laboratory name and address
  - date of sample receipt
  - cross reference of laboratory identification number to contractor sample identification
  - analytical methods used
  - deviations from specified protocol
  - corrective actions taken

  Included with the narrative will be any sample handling documents, including field and internal chain-of-custody forms, air bills, and shipping tags.

  Analytical Results: These will be reported according to analysis type and include the following information, as applicable:

  - sample identification (ID)
  - laboratory ID
  - date of collection
  - date of receipt
  - date of extraction
  - date of analysis

QAPP Worksheet #14 Summary of Project Tasks

- detection limits

Sample results on the report forms will be corrected for dilutions. Soil data will be reported on a dry weight basis. Unless otherwise specified, all results will be reported uncorrected for blank contamination.

The data associated with Contract Laboratory Program- (CLP-) equivalent reporting will be expanded to include supporting documentation necessary to provide a CLP-equivalent package. This additional documentation will include, but not be limited to, raw data required to recalculate any result, including instrument printouts and quantitation reports. The report also will include standards used in calibration and calculation of analytical results; sample extraction, digestion, and other preparation logs; standard preparation logs; instrument run logs; and moisture content calculations.

- **Data reporting levels are as follows**:

  - **Level 1** — **Minimal Reporting**: Minimal or "results only" reporting is used for analyses that, due either to their nature (i.e., field monitoring) or the intended data use (i.e., preliminary screening), do not generate or require extensive supporting documentation.

  - **Level 2** — **Modified Reporting**: Modified reporting is used for analyses that are performed following standard USEPA-approved methods and QA/QC protocols. Based on the intended data use, modified reporting may require some supporting documentation, but not full CLP or CLP-type reporting.

  - **Level 3** — **Full Reporting**: Full CLP or CLP-type reporting is used for those analyses that, based on the intended data use, require full documentation.

Assessment/Audit Tasks

Performance and systems audits will be completed in the field and laboratory during the site investigations, as described below and in Worksheets #31 and #32.

1. **Field Audits** — The following field performance and systems audits will be completed during this project.

   The appropriate Field Program Manager will monitor field performance. Field performance audit summaries will contain an evaluation of field activities to verify that the activities are performed according to established protocols. Field performance audits may be performed by the ARCADIS QA Coordinator (or his designee). The auditor(s) will review field reports and communicate concerns to the ARCADIS Project Manager and/or Field Program Managers, as appropriate.

QAPP Worksheet #14 Summary of Project Tasks

The number and frequency of field performance audits conducted will be determined independently by the Project Coordinator or Field Program Manager. The ARCADIS Project Coordinator will conduct field performance audits at a frequency of approximately one per month during field activities. The observations made during field performance audits and any recommended changes/deviations to the field procedures will be recorded and documented.

In addition, the Data QA Manager will review the rinse and trip blank data to identify potential deficiencies in field sampling and cleaning procedures. In addition, systems audits comparing scheduled QA/QC activities from this QAPP with actual QA/QC activities completed will be performed. The appropriate Field Program Manager and Data QA Manager will periodically confirm that work is being performed consistent with this QAPP and the Work Plan.

2. Laboratory Audits

Internal laboratory audits are conducted by the Laboratory QA Manager periodically. As part of the audit, the overall performance of the laboratory staff is evaluated and compared to the performance criteria outlined in the laboratory QA manual and SOPs. Results of the audits are summarized and issued to each department supervisor, Laboratory Manager and Laboratory Director. A systems audit of each laboratory is also performed by the Data QA Manager to determine whether the procedures implemented by each laboratory comply with the QA manual and SOPs.

As a participant in state and federal certification programs, the laboratory is audited by representatives of the regulatory agency issuing certification, in addition to the laboratory's internal audits. Audits are usually conducted annually and focus on laboratory conformance to the specific program protocols for which the laboratory is seeking certification. The auditor reviews sample handling and tracking documentation, analytical methodologies, analytical supportive documentation and final reports. The audit findings are formally documented and submitted to the laboratory for corrective action, if necessary.

ddms, Inc. reserves the right to conduct an on-site audit of the laboratory prior to the start of analyses for the project. Additional audits may be performed during the course of the project, as deemed necessary.

3. Corrective Action

Corrective actions are required when field or analytical data are not within the objectives specified in this QAPP. Corrective actions include procedures to promptly investigate, document, evaluate and correct data collection and/or analytical procedures. Field and laboratory

QAPP Worksheet #14 Summary of Project Tasks

corrective action procedures for the actions are described below.

a. Field Procedures

If, during field work, a condition is noted by the field crew that would have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause and corrective action implemented by the Field Team Coordinator or a designee will be documented on a Corrective Action Form and reported to the appropriate ARCADIS QA Coordinator, QA Manager and Project Coordinator.

Examples of situations that would require corrective actions are provided below:

- protocols as defined by the QAPP and/or Work Plan have not been followed
- equipment is not in proper working order or is not properly calibrated
- QC requirements have not been met
- issues resulting from performance or systems audits have not been resolved

Project personnel will continuously monitor ongoing work performance as part of daily responsibilities.

b. Laboratory Procedures

In the laboratory, when a condition is noted to have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause and corrective action taken will be documented and reported to the appropriate Project Manager, QA Coordinator and QA Manager.

Corrective action may be initiated, at a minimum, under the following conditions:

- protocols as defined by this QAPP have not been followed
- predetermined data acceptance standards are not obtained
- equipment is not in proper working order or calibrated
- sample and test results are not completely traceable
- QC requirements have not been met
- issues resulting from performance or systems audits have not been resolved

QAPP Worksheet #14 Summary of Project Tasks

Laboratory personnel will continuously monitor ongoing work performance as part of daily responsibilities. Corrective action is initiated at the point where the problem has been identified. At whatever level this occurs (analyst, supervisor, data review, or quality control), it is brought to the attention of the Laboratory QA Manager and, ultimately, the Laboratory Director. Final approval of any action deemed necessary is subject to the approval of the Laboratory Director.

Any corrective action deemed necessary based on system or performance audits, the analytical results of split samples, or the results of data review will be implemented. The corrective action may include sample re-extraction, re-preparation, re-analysis, cleanup, dilution, matrix modification, or other activities. The laboratory is to inform the QA Manager with in one business day as directed on Worksheet #6.

Data Review Tasks

See Worksheets #36 and #37.

QAPP Worksheet #15-1 Reference Limits and Evaluation - Groundwater

Analyte	Interim Cleanup Levels ug/L	Water (ug/L)	
		Laboratory MDL [4]	Laboratory RL
Volatile Organic Compounds (8260B)[1,7]			
1,1,1-Trichloroethane	0.5	0.085	0.5
1,1,1,2-Tetrachloroethane	0.5	0.073	0.5
1,1,2-Trichloro-1,2,2-trifluoroethane	--	0.059	0.5
1,1,2-Trichloroethane	0.5	0.16	0.5
1,1-Dichloroethane	0.5	0.062	0.5
1,1-Dichloroethene	0.5	0.14	0.5
1,2,4-Trichlorobenzene	0.5	0.06	0.5
1,2-Dibromo-3-chloropropane[5]	0.05	0.11	0.5
1,2-Dibromoethane	--	0.068	0.5
1,2-Dichlorobenzene	0.5	0.049	0.5
1,2-Dichloroethane	0.5	0.054	0.5
1,2-Dichloropropane	--	0.066	0.5
1,3-Dichlorobenzene	--	0.15	0.5
1,4-Dichlorobenzene	0.5	0.094	0.5
2-Butanone	5	0.55	2
2-Hexanone	5	0.16	2
4-Methyl-2-pentanone	5	0.049	2
Acetone	5	0.53	2
Benzene	0.5	0.065	0.5
Bromodichloromethane	--	0.057	0.5
Bromoform	--	0.085	0.5
Bromomethane[5]	0.5	0.33	1
Carbon disulfide	0.5	0.066	0.5
Carbon tetrachloride	0.5	0.057	0.5
Chlorobenzene	0.5	0.14	0.5
Chloroethane[5]	0.5	0.31	1
Chloroform	0.5	0.059	0.5
Chloromethane	0.5	0.1	0.5
cis-1,2-Dichloroethene	0.5	0.11	0.5
cis-1,3-Dichloropropene	--	0.17	0.5
Cyclohexane	--	0.05	0.5
Dibromochloromethane	--	0.043	0.5
Dichlorodifluoromethane	--	0.042	0.5
Ethylbenzene	0.5	0.04	0.5
Isopropylbenzene	--	0.054	0.5
Methyl acetate	--	0.22	0.5
Methyl tert-butyl ether	--	0.049	0.5
Methylcyclohexane	--	0.089	0.5
Methylene chloride[5]	0.5	0.091	2

QAPP Worksheet #15-1 Reference Limits and Evaluation - Groundwater

Analyte	Interim Cleanup Levels ug/L	Water (ug/L)	
		Laboratory MDL [4]	Laboratory RL
Volatile Organic Compounds (8260B)[1,7] continued			
Styrene	0.5	0.12	0.5
Tetrachloroethene	0.5	0.062	0.5
Toluene	0.5	0.054	0.5
trans-1,2-Dichloroethene	0.5	0.081	0.5
trans-1,3-Dichloropropene	0.5	0.051	0.5
Trichloroethene	0.5	0.14	0.5
Trichlorofluoromethane	--	0.053	0.5
Vinyl chloride	0.5	0.09	0.5
Xylenes (total)	0.5	0.019	1.5
Tetrahydrofuran[5]	0.5	0.31	1
1,4-Dioxane	--	--	1
Hexachlorobutadiene	0.45	0.063	0.5
Naphthalene	0.5	0.05	0.5
Semivolatile Organic Compounds (8270)[1,7]			
1,1'-Biphenyl	--	0.51	4
2,2'-oxybis(1-Chloropropane)	--	0.71	4
2,4,5-Trichlorophenol	--	0.54	10
2,4,6-Trichlorophenol	--	0.49	4
2,4-Dichlorophenol	--	0.55	4
2,4-Dimethylphenol	10	0.5	4
2,4-Dinitrophenol	--	1.12	25
2,4-Dinitrotoluene	--	0.3	4
2,6-Dinitrotoluene	--	0.42	4
2-Chloronaphthalene	--	0.49	4
2-Chlorophenol	--	0.61	4
2-Methylnaphthalene	--	0.47	4
2-Methylphenol	10	0.6	4
2-Nitroaniline	--	0.53	4
2-Nitrophenol	--	0.51	4
3,3'-Dichlorobenzidine	--	0.66	4
3-Nitroaniline	--	0.37	4
4,6-Dinitro-2-methylphenol	--	0.37	25
4-Bromophenyl-phenylether	--	0.49	4
4-Chloro-3-methylphenol	--	1.34	5
4-Chloroaniline	--	0.67	4
4-Chlorophenyl-phenylether	--	0.49	4
4-Methylphenol	10	0.39	4
4-Nitroaniline	--	0.28	4
4-Nitrophenol	--	0.38	10

QAPP Worksheet #15-1 Reference Limits and Evaluation - Groundwater

Analyte	Interim Cleanup Levels ug/L	Water (ug/L)	
		Laboratory MDL [4]	Laboratory RL
Semivolatile Organic Compounds (8270)[1,7] continued			
Acenaphthene	--	0.38	4
Acenaphthylene	--	0.47	4
Acetophenone	--	0.52	4
Anthracene	--	0.42	4
Atrazine	--	0.31	4
Benzaldehyde	--	1.5	10
Benzo(a)anthracene	--	0.37	4
Benzo(a)pyrene	--	0.37	4
Benzo(b)fluoranthene	--	0.38	4
Benzo(g,h,i)perylene	--	0.29	4
Benzoic Acid	10	0.43	4
Benzo(k)fluoranthene	--	1.67	25
bis(2-Chloroethoxy)methane	--	1.13	4
bis(2-Ethylhexyl)phthalate	10	0.5	4
Butylbenzylphthalate	--	0.48	4
Caprolactam	--	0.92	4
Carbazole	--	0.35	4
Chrysene	--	0.4	4
Dibenz(a,h)anthracene	--	0.32	4
Dibenzofuran	--	0.39	4
Diethylphthalate	--	0.42	4
Dimethylphthalate	--	0.33	4
Di-n-butyl phthalate	10	0.49	4
Di-n-octyl phthalate	10	0.45	4
Fluoranthene	--	0.42	4
Fluorene	--	0.48	4
Hexachlorobenzene	--	0.48	4
Hexachlorocyclopentadiene	--	0.75	4
Hexachloroethane	--	0.52	4
Indeno(1,2,3-cd)pyrene	--	0.41	4
Isophorone	10	0.38	4
Nitrobenzene	--	0.73	4
N-Nitrosodiphenylamine	--	0.41	4
N-Nitrosos-di-n-propylamine	--	0.35	4
Pentachlorophenol	--	1.21	25
Phenanthrene	--	0.39	4
Phenol	10	0.29	4
Pyrene	--	0.42	4

QAPP Worksheet #15-1 Reference Limits and Evaluation - Groundwater

Analyte	Interim Cleanup Levels ug/L	Water (ug/L)	
		Laboratory MDL [4]	Laboratory RL
PCB (8082)[1,7]			
Aroclor-1016	--	0.05	0.5
Aroclor-1221	--	0.05	0.5
Aroclor-1232	--	0.05	0.5
Aroclor-1242	--	0.05	0.5
Aroclor-1248	--	0.05	0.5
Aroclor-1254	0.5	0.082	0.5
Aroclor-1260	0.5	0.082	0.5
Total PCB	0.5	0.05	0.5
Alcohols (8015)[1,7]			
Ethanol	1000	NA	10
Isopropanol	1000	NA	10
Methanol	1000	NA	10
sec-Butanol	1000	NA	10
Inorganics (6010/7470)[1,7]			
Aluminum	--	47	500
Antimony	--	8.8	40
Arsenic	--	4.4	20
Barium	--	1.2	10
Beryllium	--	1.1	10
Cadmium	--	2.8	10
Calcium	--	62	500
Chromium	--	1	10
Cobalt	--	1.4	10
Copper	--	1.4	10
Iron	--	62	250
Lead	--	3	10
Magnesium	--	49	500
Manganese	--	2.3	15
Mercury	--	0.09	0.2
Nickel	--	1.4	10
Potassium	--	81	500
Selenium	--	3.2	30
Silver	--	1.3	10
Sodium	--	50	500
Thallium	--	8	30
Vanadium	--	1.2	10
Zinc	--	7	50

QAPP Worksheet #15-1 Reference Limits and Evaluation - Groundwater

Analyte	Interim Cleanup Levels ug/L	Water (ug/L)	
		Laboratory MDL [4]	Laboratory RL
MNA Parameters[6]			
Methane (AM20GAx)	1	0.023	0.1
Ethane (AM20GAx)	1	0.005	0.025
Ethene (AM20GAx)	1	0.008	0.025
Alkalinity (2320B)[3,5]	1000	160	2000
Chloride (EPA 300.0)[2]	1000	30	1000
Total & Dissolved Manganese (6010)[5,7]	10	2	15
Total & Dissolved Iron (6010)[5,7]	100	62	250
Nitrate-N (EPA 300.0)[2]	100	47	100
Nitrite-N (EPA 300.0)[2]	100	8.9	100
pH (9040)[1]	0.1 SU	NA	0.1 SU
Sulfate (EPA 300.0)[2]	1000	46	1000
Sulfide (4500 S2 D)[3]	1000	--	100
Total Organic Carbon (TOC) (9060)[1]	1000	100	1000

Notes:

1. USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste SW-846 3rd ed.* Washington, DC. 1996.
2. USEPA. National Exposure Research Laboratory (NERL) Methods
3. Standard Methods for the Examination of Water and Wastewater
4. Concentrations detected less than the RL but greater than the MDL must be reported with the appropriate qualifier.
5. With the exception of the compound 1,2-Dibromo-3-chloropropane, in cases where the laboratory reporting limit (RL) is greater than the Interim Cleanup Level (ICL), the laboratory method detection limit (MDL) does meet the ICL. The MDL demonstrates that the method and laboratory sensitivity is sufficient to detect the compound if present in a given sample. To be compliant with the USEPA methodology, non-detect sample results will be reported as non-detect at the RL and the analytical report will also include the MDL. Compounds detected between the MDL and RL will be reported with a J qualifier.
The compound 1,2-dibromo-3-chloropropane has never been detected at the site in the past and is not a constituent of concern. Therefore, it will be reported to the RL and MDL.
6. The criteria listed in the MNA parameters ICLs column are not ICLs but are the criteria listed in the MNA Plan (Attachment L to the RDWP).
7. Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

RL = Reporting limit.

MDL = Method detection limit.

ug/L = Micrograms per liter.

PCB = Polychlorinated biphenyl.

QAPP Worksheet #15-2 Reference Limits and Evaluation — Soil

Analyte	Soil Cleanup Level (mg/kg)	Soil (mg/kg)		
		Laboratory MDL [3]	Laboratory Low Level RL [1]	Laboratory Med. Level RL [1]
Volatile Organic Compounds (8260B)[2,5]				
1,1,1-Trichloroethane	4	0.00053	0.005	0.5
1,1,2,2-Tetrachloroethane	0.01	0.00052	0.005	0.5
1,1,2-Trichloro-1,2,2-trifluoroethane	--	0.00079	0.005	0.5
1,1,2-Trichloroethane	0.1	0.00037	0.005	0.5
1,1-Dichloroethane	1.4	0.0003	0.005	0.5
1,1-Dichloroethene	0.14	0.00058	0.005	0.5
1,2-Dichloroethene, Total	1.4	0.00075	0.005	0.5
1,2,4-Trichlorobenzene	--	0.00453	0.01	0.5
1,2-Dibromo-3-chloropropane	--	0.00076	0.005	0.5
1,2-Dibromoethane	--	0.00024	0.005	0.5
1,2-Dichlorobenzene	--	0.00058	0.005	0.5
1,2-Dichloroethane	--	0.00065	0.005	0.5
1,2-Dichloropropane	0.1	0.00067	0.005	0.5
1,3-Dichlorobenzene	--	0.00021	0.005	0.5
1,4-Dichlorobenzene	--	0.00067	0.005	0.5
2-Butanone	8	0.00159	0.01	0.5
2-Hexanone	--	0.0012	0.01	0.5
4-Methyl-2-pentanone	7	0.00055	0.005	0.5
Acetone	14	0.00224	0.02	1.25
Benzene	0.02	0.00057	0.005	0.5
Bromodichloromethane	--	0.0003	0.005	0.5
Bromoform	--	0.00061	0.005	0.5
Bromomethane	--	0.00208	0.005	0.5
Carbon disulfide	--	0.00041	0.005	0.5
Carbon tetrachloride	0.1	0.00095	0.005	0.5
Chlorobenzene	2	0.00059	0.005	0.5
Chlorodibromomethane	0.01	0.00035	0.005	0.5
Chloroethane	--	0.00098	0.005	0.5
Chloroform	0.12	0.00034	0.005	0.5
Chloromethane	--	0.00078	0.005	0.5
cis-1,2-Dichloroethene	--	0.00037	0.005	0.5
cis-1,3-Dichloropropene	--	0.00056	0.005	0.5
Cyclohexane	--	0.00069	0.005	0.5
Dichlorodifluoromethane	--	0.00035	0.005	0.5
Ethylbenzene	10.1	0.0007	0.005	0.5
Isopropylbenzene	--	0.00019	0.005	0.5
Methyl acetate	--	0.00044	0.005	0.5
Methyl tert-butyl ether	--	0.00021	0.005	0.5
Methylcyclohexane	--	0.00033	0.005	0.5
Methylene chloride	0.1	0.00109	0.02	0.5
Styrene	2	0.00015	0.005	0.5
Tetrachloroethene	0.1	0.00081	0.005	0.5

QAPP Worksheet #15-2 Reference Limits and Evaluation — Soil

Analyte	Soil Cleanup Level (mg/kg)	Soil (mg/kg)		
		Laboratory MDL [3]	Laboratory Low Level RL [1]	Laboratory Med. Level RL [1]
Volatile Organic Compounds (8260B)[2,5] continued				
Toluene	20	0.000074	0.005	0.5
trans-1,2-Dichloroethene	--	0.00039	0.005	0.5
trans-1,3-Dichloropropene	--	0.00027	0.005	0.5
Trichloroethene	0.1	0.00081	0.005	0.5
Trichlorofluoromethane	--	0.00015	0.005	0.5
Vinyl chloride	0.04	0.00023	0.005	0.5
Xylenes (total)	19.5	0.000486	0.005	0.5
Tetrahydrofuran	--	0.00616	0.02	0.5
1,4-Dioxane	--	0.0474	0.2	25
Semivolatile Organic Compounds (8270)[2,5]				
1,1'-Biphenyl	--	0.0595	0.27	--
2,2'-oxybis(1-Chloropropane)	--	0.0642	0.27	--
2,4,5-Trichlorophenol	--	0.0495	1.7	--
2,4,6-Trichlorophenol	--	0.0545	0.27	--
2,4-Dichlorophenol	--	0.056	0.27	--
2,4-Dimethylphenol	--	0.0438	0.27	--
2,4-Dinitrophenol	--	0.365	1.7	--
2,4-Dinitrotoluene	--	0.0511	0.27	--
2,6-Dinitrotoluene	--	0.0446	0.27	--
2-Chloronaphthalene	--	0.0574	0.27	--
2-Chlorophenol	--	0.0607	0.27	--
2-Methylnaphthalene	0.98	0.0618	0.27	--
2-Methylphenol	--	0.0488	0.27	--
2-Nitroaniline	--	0.053	1.7	--
2-Nitrophenol	--	0.0471	0.27	--
3,3'-Dichlorobenzidine	--	0.0555	0.67	--
3-Nitroaniline	--	0.0509	1.7	--
4,6-Dinitro-2-methylphenol	--	0.0244	1.7	--
4-Bromophenyl-phenylether	--	0.0496	0.27	--
4-Chloro-3-methylphenol	--	0.0485	0.27	--
4-Chloroaniline	1	0.0439	0.27	--
4-Chlorophenyl-phenylether	--	0.0571	0.27	--
4-Methylphenol	0.7	0.0644	0.27	--
4-Nitroaniline	--	0.0507	0.27	--
4-Nitrophenol	--	0.0603	1.7	--
Acenaphthene	--	0.0584	0.27	--
Acenaphthylene	--	0.0618	0.27	--
Acetophenone	--	0.0524	0.27	--
Anthracene	--	0.0596	0.27	--
Atrazine	--	0.0597	0.33	--
Benzaldehyde	--	0.0806	0.27	--
Benzo(a)anthracene	1	0.05	0.27	--

QAPP Worksheet #15-2 Reference Limits and Evaluation — Soil

Analyte	Soil Cleanup Level (mg/kg)	Soil (mg/kg)		
		Laboratory MDL [3]	Laboratory Low Level RL [1]	Laboratory Med. Level RL [1]
Semivolatile Organic Compounds (8270)[2,5] continued				
Benzo(a)pyrene	1	0.0375	0.27	--
Benzo(b)fluoranthene	1	0.0479	0.27	--
Benzo(g,h,i)perylene	--	0.0381	0.27	--
Benzo(k)fluoranthene	1	0.0432	0.27	--
bis(2-Chloroethoxy)methane	--	0.0555	0.27	--
bis(2-Ethylhexyl)phthalate	1	0.0534	0.27	--
Butylbenzylphthalate	--	0.0547	0.27	--
Caprolactam	--	0.0586	0.27	--
Carbazole	--	0.0537	0.27	--
Chrysene	1	0.0572	0.27	--
Dibenz(a,h)anthracene	--	0.034	0.27	--
Dibenzofuran	1	0.0588	0.27	--
Diethylphthalate	--	0.0626	0.27	--
Dimethylphthalate	--	0.0571	0.27	--
Di-n-butyl phthalate	14	0.0631	0.27	--
Di-n-octyl phthalate	2	0.0476	0.27	--
Fluoranthene	5.6	0.0599	0.27	--
Fluorene	--	0.0613	0.27	--
Hexachlorobenzene	--	0.0645	0.27	--
Hexachlorobutadiene	--	0.0573	0.27	--
Hexachlorocyclopentadiene	--	0.0838	0.67	--
Hexachloroethane	--	0.0525	0.27	--
Indeno(1,2,3-cd)pyrene	1	0.0369	0.27	--
Isophorone	--	0.0618	0.27	--
Naphthalene	--	0.0589	0.27	--
Nitrobenzene	--	0.0656	0.27	--
N-Nitrosodiphenylamine	--	0.067	0.27	--
N-Nitrosos-di-n-propylamine	--	0.0541	0.27	--
Pentachlorophenol	--	0.0332	1.7	--
Phenanthrene	4	0.0586	0.27	--
Phenol	--	0.0552	0.27	--
Pyrene	4	0.0663	0.27	--

QAPP Worksheet #15-2 Reference Limits and Evaluation — Soil

Analyte	Soil Cleanup Level (mg/kg)	Soil (mg/kg)		
		Laboratory MDL [3]	Laboratory Low Level RL [1]	Laboratory Med. Level RL [1]
PCB (8082)[2,5]				
Aroclor-1016	1	0.001317	0.017	--
Aroclor-1221	1	0.001317	0.017	--
Aroclor-1232	1	0.001317	0.017	--
Aroclor-1242	1	0.001317	0.017	--
Aroclor-1248	1	0.001317	0.017	--
Aroclor-1254	1	0.001441	0.017	--
Aroclor-1260	1	0.001441	0.017	--
Total PCB	1	--	--	--
Dioxins (8290)[2,4,5]				
2,3,7,8-TCDD	1,000	0.20	1	--
Total TCDD	--	--	1	--
1,2,3,7,8-PeCDD	--	0.54	5	--
Total PeCDD	--	--	5	--
1,2,3,4,7,8-HxCDD	--	0.64	5	--
1,2,3,6,7,8-HxCDD	--	0.50	5	--
1,2,3,7,8,9-HxCDD	--	0.54	5	--
Total HxCDD	--	--	5	--
1,2,3,4,6,7,8-HpCDD	--	0.50	5	--
Total HpCDD	--	--	5	--
OCDD	--	4.82	10	--
2,3,7,8-TCDF	--	0.14	1	--
Total TCDF	--	--	1	--
1,2,3,7,8-PeCDF	--	0.50	5	--
2,3,4,7,8-PeCDF	--	0.50	5	--
Total PeCDF	--	--	5	--
1,2,3,4,7,8-HxCDF	--	0.50	5	--
1,2,3,6,7,8-HxCDF	--	0.50	5	--
2,3,4,6,7,8-HxCDF	--	0.50	5	--
1,2,3,7,8,9-HxCDF	--	0.50	5	--
Total HxCDF	--	--	5	--
1,2,3,4,6,7,8-HpCDF	--	0.50	5	--
1,2,3,4,7,8,9-HpCDF	--	0.50	5	--
Total HpCDF	--	--	5	--
OCDF	--	1.32	10	--

QAPP Worksheet #15-2 Reference Limits and Evaluation — Soil

Analyte	Soil Cleanup Level (mg/kg)	Soil (mg/kg)		
		Laboratory MDL [3]	Laboratory Low Level RL[1]	Laboratory Med. Level RL[1]
Inorganics (6010)[2,5]				
Aluminum	--	63	100	--
Antimony	27	1.2	10	--
Arsenic	10	0.62	5	--
Barium	4,700	0.22	2	--
Beryllium	2	0.22	2	--
Cadmium	34	0.52	5	--
Calcium	--	11	200	--
Chromium	100	0.28	3	--
Cobalt	--	0.2	2	--
Copper	--	0.6	5	--
Iron	--	7	60	--
Lead	400	0.42	5	--
Magnesium	--	10	35	--
Manganese	--	0.2	6	--
Nickel	--	0.52	5	--
Potassium	--	17	200	--
Selenium	--	0.9	10	--
Silver	--	0.28	3	--
Sodium	--	11	200	--
Thallium	--	3.1	7	--
Vanadium	--	0.18	4	--
Zinc	--	1.5	20	--
Inorganics (7471)[2,5]				
Mercury	--	0.0148	0.05	--

Notes:

1. The target reporting limits are based on wet weight. Actual reporting limits will vary based on sample weight and moisture content.

2. USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste SW-846 3rd ed.* Washington, DC. 1996.

3. Concentrations detected less than the RL but greater than the MDL must be reported with the appropriate qualifier.

4. All units associated with Dioxin analysis are in pg/g.

5. Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

RL = Reporting limit.

MDL = Method detection limit.

mg/kg = Milligrams per kilogram.

pg/g = Picogram per gram.

PCB = Polychlorinated biphenyl.

QAPP Worksheet #15-3 Reference Limits and Evaluation — Air

Analyte	Soil Gas					Indoor Air			
	USEPA 1 x 10-6 Criteria ug/m3	CTDEP Target Conc (Res) ug/m^3	Laboratory RL ug/m^3	Laboratory MDL[2] ppbv	Laboratory RL ppbv	USEPA 1 x 10-6 Criteria ug/m3	CTDEP Target Conc (Res) ug/m^3	Laboratory RL ug/m^3	Laboratory RL ppbv
Volatile Organic Compounds TO15 [1]									
1,1,1-Trichloroethane	22000	382000	1.1	0.050	0.20	2200	500	0.05	0.01
1,1,2,2-Tetrachloroethane	0.4	8.2	1.4	0.050	0.20	0.042	0.011	0.07	0.01
1,1,2-Trichloro-1,2,2-trifluoroethane	300000	NA	1.5	0.050	0.20	30000	NA	--	--
1,1,2-Trichloroethane	1.5	1690	1.1	0.050	0.20	0.15	2.2	0.05	0.01
1,1-Dichloroethane	5000	56700	0.81	0.013	0.20	500	77	0.04	0.01
1,1-Dichloroethene	5000	7500	0.79	0.015	0.20	500	10	0.01	0.01
1,2,4-Trichlorobenzene	2000	NA	3.7	0.032	0.50	200	NA	--	--
1,2-Dibromoethane	0.1	3.84	1.5	0.012	0.20	0.011	0.0028	0.08	0.01
1,2-Dichlorobenzene	2000	55300	1.2	0.017	0.20	200	73	--	--
1,2-Dichloroethane	0.9	52.6	0.81	0.015	0.20	0.094	0.07	0.08	0.02
1,2-Dichloropropane	40	97.0	0.92	0.016	0.20	4	0.13	0.09	0.02
1,3-Dichlorobenzene	1100	55300	1.2	0.018	0.20	110	73	--	--
1,4-Dichlorobenzene	8000	18000	1.2	0.021	0.20	800	24	--	--
2-Butanone	10000	383000	1.5	0.064	0.50	1000	500 (1)	--	--
2-Hexanone	NA	NA	2.1	0.028	0.50	NA	NA	--	--
4-Methyl-2-pentanone	800.0	27800	2.1	0.064	0.50	80	37	--	--
Acetone	3500	135000	12	0.99	5.0	350	180	--	--
Benzene	3.1	2500	0.64	0.050	0.20	0.31	3.3 (2)	0.03	0.01
Bromodichloromethane	1.4	25.5	1.3	0.050	0.20	0.14	0.034	0.07	0.01
Bromoform	22	414	2.1	0.050	0.20	2.2	0.55	--	--
Bromomethane	50	NA	0.78	0.014	0.20	5.0	NA	0.09	0.02
Carbon disulfide	7000	NA	1.6	0.050	0.50	700	NA	--	--
Carbon tetrachloride	1.6	378	1.3	0.050	0.20	0.16	0.5 (2)	0.06	0.01
Chlorobenzene	600	28000	0.92	0.050	0.20	60	37	--	--
Chloroethane	100000	370000	1.32	0.10	0.50	10000	500 (1)	0.05	0.02
Chloroform	1.1	380	0.98	0.050	0.20	0.11	0.5 (2)	0.05	0.01
Chloromethane	24.0	10500	1	0.021	0.50	2.4	14	--	--
cis-1,2-Dichloroethene	350	13500	0.79	0.050	0.20	35	18	0.04	0.01
cis-1,3-Dichloropropene	6.1 (b)	160 (a)	0.91	0.050	0.20	0.61 (b)	0.21 (a)	0.05	0.01
Cyclohexane	NA	NA	0.69	0.012	0.20	NA	NA	0.03	0.01
Dibromochloromethane	1.0	NA	1.7	0.050	0.20	0.10	NA	0.10	0.01
Dichlorodifluoromethane	2000	69200	2.5	0.012	0.50	200	91	0.05	0.01
Ethylbenzene	22	40400	0.87	0.014	0.20	2.2	53	0.04	0.01
Methyl tert-butyl ether	30000	123000	1.8	0.013	0.20	3000	160	0.04	0.01
Methylene chloride	52	2260.00	1.7	0.030	0.50	5.2	3 (2)	--	--
Styrene	10000	39600	0.85	0.050	0.20	1000	52	--	--
Tetrachloroethene	8.1	3800	1.4	0.017	0.20	0.81	5 (2)	0.07	0.01
Toluene	4000	158000	0.75	0.050	0.20	400	210	0.04	0.01
trans-1,2-Dichloroethene	700	28100	0.79	0.050	0.20	70	37	0.04	0.01
trans-1,3-Dichloropropene	6.1 (b)	160 (a)	0.91	0.064	0.20	0.61 (b)	0.21 (a)	0.05	0.01

QAPP Worksheet #15-3 Reference Limits and Evaluation — Air

Analyte	Soil Gas					Indoor Air			
	USEPA 1 x 10-6 Criteria ug/m3	CTDEP Target Conc (Res) ug/m^3	Laboratory RL ug/m^3	Laboratory MDL^2 ppbv	Laboratory RL ppbv	USEPA 1 x 10-6 Criteria ug/m3	CTDEP Target Conc (Res) ug/m^3	Laboratory RL ug/m^3	Laboratory RL ppbv
Trichloroethene	0.2	750	1.1	0.014	0.20	0.022	1 (2)	0.05	0.01
Trichlorofluoromethane	7000	291000	1.1	0.050	0.20	700	370	0.06	0.01
Vinyl chloride	2.8	105	0.51	0.025	0.20	0.28	0.14	0.05	0.02
m,p-Xylene	70000	165000	2.2	0.023	0.50	7000	220 (b)	0.09	0.02
o-Xylene	70000	165000	0.87	0.050	0.20	7000	220 (b)	0.04	0.01
Xylenes (total)	70000	165000	0.87	0.15	0.20	7000	220	0.09	0.02

Notes:

1 USEPA Compendium Method TO-15, *Determination of Volatile Organic Compounds (VOCs) in Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS)* . January 1999.

2. Concentrations detected less than the RL but greater than the MDL must be reported with the appropriate qualifier.

(a) 1,3-Dichloropropene used as a surrogate
(b) Total used as a surrogate
From CTDEP Guidance
(1) Based on ceiling value
(2) Based on background concentration

QAPP Worksheet #16 Project Schedule/Timeline

Activities	Organization	Anticipated Date(s) of Initiation	Anticipated Date of Completion	Deliverable	Deliverable Due Date
RDWP/RD POP	ARCADIS	April 2009	November 2010	Yes	November 2010
QAPP/FSP, HASP	ARCADIS	April 2009	November 2010	Yes	November 2010
Pre-Design Investigations	ARCADIS	May 2009	October 2009	Yes	TBD
Annual State of Compliance Reports	de maximis	October 2009	NA	Yes	October 30 each year

NOTE: Additional detail regarding project schedule is provided in Section 2 of the RD POP.

QAPP Worksheet #17 Sampling Design and Rationale

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

RD/RA Monitoring Well Network

Groundwater sampling results obtained from the proposed monitoring wells will be used to delineate the SRSNE-related COC plume in all five hydrostratigraphic zones plus the severed plume area, and support MNA evaluations, vapor intrusion study, NAPL mobilization assessment, post-ISTR equilibrium conditions, and demonstration of HCTS performance. Periodic sampling of wells within the plume will provide additional data to supplement historical data – the composite data set will demonstrate the temporal and spatial variations in plume chemistry and geometry, and progress in meeting long-term groundwater restoration goals. Plume delineation results will also provide a basis to confirm that the institutional controls relating to groundwater remain protective. The monitoring well network will also be used to demonstrate that all groundwaters that exceeds federal drinking water standards and other risk-based levels is being captured.

Soil and Wetland Soil in Operations Area, Railroad Right-of-Way, Cianci Property

Characterization/Delineation Sampling

Sample locations selected to characterize target areas and provide data to confirm or modify preliminary cap or excavation limits. Delineation samples in Cianci Property removal areas intended to delineate prior isolated sample locations exceeding cleanup levels. Dioxin background samples collected at multiple locations where access is available and Site-related impacts are not anticipated. Initial dioxin characterization sample locations selected in consideration of likely source location (former open-pit incinerator), primary wind direction, and preliminary cap limits.

Post-Excavation Confirmation Sampling

Sidewall sampling – one sample per 50 linear feet of excavated perimeter with a minimum of three perimeter samples for each excavation area. Sample depths depend on excavation depth(s).

Bottom sampling – one sample per 1,000 square feet of excavation in each area where bottom sampling is necessary per CT RSRs. Bottom sampling is not necessary if:

- an area is being excavated based on an RDEC exceedance, and excavation extends to a depth below which, after backfill placement, soils will be rendered “inaccessible” by more than four feet of soil fill

QAPP Worksheet #17 Sampling Design and Rationale

• an area is being excavated based on PMC exceedance and excavation extends to the depth of the seasonal low water table.
Thermal Treatment Verification Sampling
Grid-based sampling system (a component of the Remedial Action phase) developed to represent entire treatment area, target centroids between heater wells (which represent hardest area to treat), and multiple depth intervals throughout the overburden.
Vapor Intrusion Sampling
Specific locations selected to fill data gaps in current delineation and that represent areas where buildings exist such that vapor intrusion could occur. Two groundwater sampling events will provide temporal and seasonal representation of groundwater quality.
Overburden NAPL Area
Locations selected to provide delineation around one sample location (PTB-30) where delineation has not been achieved. Locations will first target delineation within property boundary, and then proceed to adjacent property if delineation is not complete within the SRSNE property. Efforts to collect NAPL and/or NAPL-containing soils to support ISTR characterization and compatibility testing will focus on areas where NAPL was previously observed in prior studies.

QAPP Worksheet #18 Sampling Locations and Methods/SOP Requirements

Sampling Area/ID Number	Matrix	Sample Type and Number: Depth Intervals	Analytical Group	Concentration Level	Number of Samples (plus field duplicates)[1]	Sampling SOP Reference Number[2]	Rationale for Sampling Location
Groundwater Monitoring							
"C" Wells	Water	Grab water samples	VOCs, alcohols, 1,4-dioxane, TAL metals, PAHs, PCBs	Low	Approx 80 + 4 field duplicates	F-4, F-5 and/or F-6	First comprehensive sampling event
"R" Wells	Water	Grab water samples	VOCs, alcohols, 1,4-dioxane, TAL metals, PAHs, PCBs, MNA parameter	Low	Approx 25 + 1 field duplicates		
"N" Wells	Water	Grab water samples	VOCs, alcohols, 1,4-dioxane, TAL metals, PAHs, PCBs, MNA parameter	Low	Approx 10 + 1 field duplicates		
"M" Wells	Water	Grab water samples	TAL metals, MNA parameters	Low	Approx 5		
"B" Wells	Water	Grab water samples	TAL metals	Low	Approx 3		
Post-Excavation Confirmatory Sampling							
Former Cianci Property	Soil	Grab soil samples (sidewall and bottom) (1-4')	SVOCs, PCBs, Metals	Low	SVOCs: Approx 13 + 1 field duplicate PCBs: Approx 30 + 2 field duplicates Metals: Approx 40 + 2 field duplicates	F-7, F-8 and/or F-9	Confirm soils impacted above ROD/SOW-specified cleanup levels have been removed following excavation

QAPP Worksheet #18 Sampling Locations and Methods/SOP Requirements

Sampling Area/ID Number	Matrix	Sample Type and Number: Depth Intervals	Analytical Group	Concentration Level	Number of Samples (plus field duplicates)[1]	Sampling SOP Reference Number[2]	Rationale for Sampling Location
Soil Investigation Plan							
Former Cianci Property	Soil	Grab soil samples (0-4')	SVOCs, PCBs, Metals	Low	SVOCs/PCBs: Approx 22 + 2 field duplicates Metals: Approx 14 + 1 field duplicate	F-7, F-8 and/or F-9	Confirm or modify the horizontal extent of removal in each of the five targeted areas of soil removal
		Grab soil samples (0-1')	Dioxin	Low	Phase I – 2 + 1 field duplicate; Phase II - 3	F-7, F-8 and/or F-9	Cap Delineation, general assessment of dioxin presence
Former SRSNE Operations Area	Soil	Grab soil samples (0-1')	Dioxin	Low	Approx 3	F-7, F-8 and/or F-9	Determination of background dioxin concentrations
			Phase I – Dioxin Phase II – Dioxin	Low	Phase I - 4; Phase II – 7	F-7, F-8 and/or F-9	Cap Delineation, general assessment of dioxin presence
Railroad Right-of-Way	Soil	Grab soil samples (0-1')	Dioxin	Low	Approx 12 + 1 field duplicate	F-7, F-8 and/or F-9	Cap Delineation, general assessment of dioxin presence
Town Well Field Property	Soil	Grab soil sample (0-1')	Dioxin	Low	1	F-7, F-8 and/or F-9	Determination of background dioxin concentrations

QAPP Worksheet #18 Sampling Locations and Methods/SOP Requirements

Sampling Area/ID Number	Matrix	Sample Type and Number: Depth Intervals	Analytical Group	Concentration Level	Number of Samples (plus field duplicates)[1]	Sampling SOP Reference Number[2]	Rationale for Sampling Location
Pre-ISTR Preparation Plan							
Railroad Right-of-Way	Soil	Grab soil samples (0-2', 2-4')	VOCs, SVOCs, PCBs, Metals	Low	Approx 20 + 1 field duplicate	F-7, F-8 and/or F-9	Characterization for H&S and grading considerations during culvert design and relocation of fiber optic cable; Cap delineation
Overburden NAPL Delineation							
Former SRSNE Operations Area	Soil	Visual Assessment Only	NA	NA	Visual Assessment Only	F-7, F-8 and/or F-9	Delineate NAPL in and near the northwest portion of the Overburden NAPL Area
Former SRSNE Operations Area and Former Cianci Property	NAPL and/or NAPL-containing soil	NAPL and/or NAPL-containing soil	NA	NA	One gallon of NAPL; or two 40-mil vials of NAPL, plus two to three 5-gallon containers of NAPL-containing soils; or two to three 5-gallon containers of NAPL-containing soils	F-7, F-8 and/or F-18	To support NAPL characterization and corrosion testing

QAPP Worksheet #18 Sampling Locations and Methods/SOP Requirements

Sampling Area/ID Number	Matrix	Sample Type and Number: Depth Intervals	Analytical Group	Concentration Level	Number of Samples (plus field duplicates)[1]	Sampling SOP Reference Number[2]	Rationale for Sampling Location
Vapor Intrusion Study							
Within 100 feet of existing buildings	Soil Gas	Grab samples, depth TBD	VOCs	Low	TBD	F-14, F15, and/or F-16	Compare groundwater data to USEPA/CTDEP criteria; compare groundwater data to USEPA site-specific groundwater target concentrations; and conduct Johnson & Ettinger modeling and site-specific risk assessment calculations

Notes: 1. One blind duplicate sample will be collected for every 20 samples.
2. Sampling SOP reference number from QAPP Worksheet #21.
3. Supplemental turbidity monitoring may be necessary to identify potential problems with the resuspension control system.

QAPP Worksheet #19 Analytical SOP Requirements (Sample Containers, Preservation and Holding Times)

Parameter	Analytical and Preparation Method[9]/SOP Reference	Method[9]	Bottle Type [6]	Minimum Required Sample Volume [7]	Preservation	Holding Time [5]
Groundwater; Initial Comprehensive Sampling						
VOCs	SW846 8260B/TACT-1	8260B [2]	2 x 40-ml glass vials	NA [8]	HCl to pH<2, Cool to 4°C±2°C	14 days to analysis
1,4-Dioxane	SW846 8260B/TAT-24	8260B [2]	2 x 40-ml glass vials	NA [8]	Cool to 4°C±2°C	7 days to analysis
SVOCs	SW846 8270/TACT-2, TACT-4	8270 [2]	2 x 1-L amber glass bottles with Teflon®-lined lid	NA [8]	Cool to 4°C±2°C	7 days to extraction 40 days to analysis
PCB	SW846 8082/TACT-6, TACT-7	8082 [2]	2 x 1-L amber glass bottles with Teflon®-lined lid	NA [8]	Cool to 4°C±2°C	7 days to extraction 40 days to analysis
Alcohols	SW846 8015/TAW-9	8015 [2]	2 x 40-ml glass vials	NA [8]	Cool to 4°C±2°C	14 days to analysis
Dissolved Gases	AM20GAx/MS-5	AM20GAx	2 x 40-ml glass vials	NA [8]	Trisodium Phosphate, Cool to 4°C±2°C	14 days to analysis
TAL Metals - Total	SW846 6010/7470/TACT-10, TACT-11 and TACT-13	6010/7470 [2]	1 x 500ml plastic bottle	NA [8]	HNO_3 to pH<2	180 days to analysis Mercury - 28 days to analysis
TAL Metals - Dissolved	SW846 6010/7470/TACT-10, TACT-11 and TACT-13	6010/7470 [2]	1 x 500ml plastic bottle		HNO_3 to pH<2 after field filtering	180 days to analysis Mercury - 28 days to analysis
Alkalinity	SM2320B/TACT-16	SM2320B [3]	1 x 1-L plastic bottle	NA [8]	Cool to 4°C±2°C	14 days to analysis
Chloride	EPA 300.0/TACT-15	300.0 [1]		NA [8]		28 days to analysis
Sulfate						28 days to analysis
Nitrate-N						48 hours to analysis
Nitrite-N						48 hours to analysis
Sulfide	SM4500 S2D/TAN-18	SM4500 S2D [3]	1 x 125 ml plastic bottle	NA [8]	Zinc acetate + NaOH pH>9	7 days to analysis
Dissolved Iron & Manganese	SW846 6010/TACT-10, TACT-11	6010 [2]	1 x 125 ml plastic bottle	NA [8]	HNO_3 to pH<2 after field filtering	180 days to analysis
TOC	SW846 9060/TACT-20	9060 [2]	2 x 40-ml glass vials	NA [8]	H_2SO_4 to pH<2, Cool to 4°C	28 days to analysis
Groundwater; Pre-Thermal and Post-Thermal Treatment						
VOCs	SW846 8260B/TACT-1	8260B [2]	2 x 40-ml glass vials	80 ml	HCl to pH<2, Cool to 4°C±2°C	14 days to analysis
Dissolved Gases	AM20GAx/MS-5	AM20GAx	1 x 40-ml glass vial	40 ml	Trisodium Phosphate, Cool to 4°C±2°C	14 days to analysis
Alkalinity	SM2320B/TACT-16	SM2320B [3]	1 x 125 ml plastic bottle	75 ml	Cool to 4°C±2°C	14 days to analysis
Chloride	EPA 300.0/TACT-15	300.0 [1]				28 days to analysis
Sulfate						28 days to analysis
Nitrate-N						48 hours to analysis
Nitrite-N						48 hours to analysis
Sulfide	SM4500 S2D/TAN-18	SM4500 S2D [3]	1 x 60 ml plastic bottle	60 ml	Zinc acetate + NaOH pH>9	7 days to analysis
Total Iron & Manganese	SW846 6010/TACT-10, TACT-11	6010 [2]	1 x 125 ml plastic bottle	100 ml	HNO_3 to pH<2	180 days to analysis
Dissolved Iron & Manganese	SW846 6010/TACT-10, TACT-11	6010 [2]	1 x 125 ml plastic bottle	100 ml	HNO_3 to pH<2 after field filtering	180 days to analysis
TOC	SW846 9060/TACT-20	9060 [2]	1 x 40-ml glass vial	40 ml	H_2SO_4 to pH<2, Cool to 4°C	28 days to analysis

QAPP Worksheet #19 Analytical SOP Requirements (Sample Containers, Preservation and Holding Times)

Parameter	Analytical and Preparation Method[9]/SOP Reference	Method[9]	Bottle Type [6]	Minimum Required Sample Volume [7]	Preservation	Holding Time [5]
Groundwater; Annual VOC Sampling						
VOCs	SW846 8260B/TACT-1	8260B [2]	2 x 40-ml glass vials	80 ml	HCl to pH<2, Cool to 4°C±2°C	14 days to analysis
Groundwater; Biennial MNA Sampling						
Dissolved Gases	AM20GAx/MS-5	AM20GAx	1 x 40-ml glass vial	40 ml	Trisodium Phosphate, Cool to 4°C±2°C	14 days to analysis
Alkalinity	SM2320B/TACT-16	SM2320B [3]	1 x 125 ml plastic bottle	75 ml	Cool to 4°C±2°C	28 days to analysis
Chloride	EPA 300.0/TACT-15	300.0 [1]				28 days to analysis
Sulfate						28 days to analysis
Nitrate-N						48 hours to analysis
Nitrite-N						48 hours to analysis
Sulfide	SM4500 S2D/TAN-18	SM4500 S2D [3]	1 x 60 ml plastic bottle	60 ml	Zinc acetate + NaOH pH>9	7 days to analysis
Total Iron & Manganese	SW846 6010/TACT-10, TACT-11	6010 [2]	1 x 125 ml plastic bottle	100 ml	HNO_3 to pH<2	180 days to analysis
Dissolved Iron & Manganese	SW846 6010/TACT-10, TACT-11	6010 [2]	1 x 125 ml plastic bottle	100 ml	HNO_3 to pH<2 after field filtering	180 days to analysis
TOC	SW846 9060/TACT-20	9060 [2]	1 x 40-ml glass vial	40 ml	H_2SO_4 to pH<2, Cool to 4°C	28 days to analysis
Groundwater; Five Year Review Sampling of 7 BG Wells						
TAL Metals - Total	SW846 6010/7470/TACT-10, TACT-11 and TACT-13	6010/7470 [2]	1 x 125 ml plastic bottle	75 ml	HNO_3 to pH<2	180 days to analysis Mercury - 28 days to analysis
TAL Metals - Dissolved	SW846 6010/7470/TACT-10, TACT-11 and TACT-13	6010/7470 [2]	1 x 125 ml plastic bottle	75 ml	HNO_3 to pH<2 after field filtering	180 days to analysis Mercury - 28 days to analysis
Groundwater; Five Year Review Sampling of 132 Wells						
VOCs	SW846 8260B/TACT-1	8260B [2]	2 x 40-ml glass vials	80 ml	HCl to pH<2, Cool to 4°C±2°C	14 days to analysis
1,4-Dioxane	SW846 8260B/TAT-24	8260B [2]	2 x 40-ml glass vials	80 ml	Cool to 4°C±2°C	7 days to analysis
TAL Metals - Total	SW846 6010/7470/TACT-10, TACT-11 and TACT-13	6010/7470 [2]	1 x 125 ml plastic bottle	75 ml	HNO_3 to pH<2	180 days to analysis Mercury - 28 days to analysis
TAL Metals - Dissolved	SW846 6010/7470/TACT-10, TACT-11 and TACT-13	6010/7470 [2]	1 x 125 ml plastic bottle	75 ml	HNO_3 to pH<2 after field filtering	180 days to analysis Mercury - 28 days to analysis
Dissolved Gases	AM20GAx/MS-5	AM20GAx	1 x 40-ml glass vial	40 ml	Trisodium Phosphate, Cool to 4°C±2°C	14 days to analysis
Alkalinity	SM2320B/TACT-16	SM2320B [3]	1 x 125 ml plastic bottle	75 ml	Cool to 4°C±2°C	14 days to analysis
Chloride	EPA 300.0/TACT-15	300.0 [1]				28 days to analysis
Sulfate						28 days to analysis
Nitrate-N						48 hours to analysis
Nitrite-N						48 hours to analysis
Sulfide	SM4500 S2D/TAN-18	SM4500 S2D [3]	1 x 60 ml plastic bottle	60 ml	Zinc acetate + NaOH pH>9	7 days to analysis
Dissolved Iron & Manganese	SW846 6010/TACT-10, TACT-11	6010 [2]	1 x 125 ml plastic bottle	100 ml	HNO_3 to pH<2 after field filtering	180 days to analysis
TOC	SW846 9060/TACT-20	9060 [2]	1 x 40-ml glass vial	40 ml	H_2SO_4 to pH<2, Cool to 4°C	28 days to analysis

QAPP Worksheet #19 Analytical SOP Requirements (Sample Containers, Preservation and Holding Times)

Parameter	Analytical and Preparation Method[9]/SOP Reference	Method[9]	Bottle Type [6]	Minimum Required Sample Volume [7]	Preservation	Holding Time [5]
Soil						
VOCs	SW846 8260B/TACT-1	8260B [2]	3-EnCore™ samplers One 60 ml plastic bottle	NA	Cool to 4°C±2°C	48 hours to preservation 14 days to analysis
SVOCs	SW846 8270/TACT-2, TACT-3	8270 [2]	1 x 8-oz glass jar with Teflon®-lined lid	NA	Cool to 4°C±2°C	14 days to extraction
PCB	SW846 8082/TACT-7, TACT-8	8082 [2]				40 days to analysis
Dioxins	SW846 8290/TAWS-21, TAWS-22	8290 [2]	1 x 4-oz glass jar with Teflon®-lined lid	NA	Cool to < 4°C	30 days to extraction 45 days to analysis
Metals	SW846 6010/7471/TACT-10, TACT-12 and TACT-14	6010/7471 [2]	1 x 4-oz glass jar with Teflon®-lined lid	NA	Cool to 4°C±2°C	180 days to analysis Mercury - 28 days to analysis
Air Monitoring						
VOCs	EPA TO-15/TABR-23	TO-15 [4]	Canister	NA	NA	14 days to analysis

Notes:
1. USEPA. *Methods for Chemical Analysis of Water and Wastes* . EPA/600/4-79/020. EMSL-Cincinnati. 1983.
2. USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste SW-846.* 3rd ed. Washington, DC. 1996.
3. Standard Methods for the Examination of Water and Wastewater
4. USEPA. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. 2nd Edition. EPA/625/R-96/010b. January 1999
5. All holding times are measured from date of collection.
6. Bottle types for initial comprehensive groundwater sampling event based on low-flow sampling methods. Bottle types for subsequent groundwater sampling events based on no-purge sampling with HydraSleeves™. If low-flow methods are employed for subsequent groundwater sampling events, then bottle types consistent with those used during the initial comprehensive sampling event will be used.
7. Applicable to subsequent sampling events in which HydraSleeve™ is the sample collection method.
8. During low-flow sampling, all specified bottles should be filled completely.
9. Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

°C = Degrees Celsius.
PCB = Polychlorinated biphenyl.
TOC = Total organic carbon.

QAPP Worksheet #20 Sample Quantities and Control Frequencies

Parameter	Laboratory [1]	Analytical and Preparation SOP[2,5]	Estimated Environ. Sample Quantity[3]	Field QC Analyses						Laboratory QC Sample						Total
				Trip Blank		Rinse Blank		Field Duplicate		Matrix Spike		Matrix Spike Duplicate		Lab Duplicate		
				Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	
Groundwater; Initial Comprehensive Sampling																
VOCs	TA Connecticut	TACT-1	115	1/cooler	TBD	1/day	TBD	1/20	6	1/20	6	1/20	6	NA	--	133
1,4-Dioxane	TA Tampa	SW846 8260B/TAT-24	115	1/cooler	TBD	1/day	TBD	1/20	6	1/20	6	1/20	6	NA	--	133
SVOCs	TA Connecticut	TACT-2, TACT-4	115	NA	--	1/day	TBD	1/20	6	NA	6	1/20	6	NA	--	133
PCBs	TA Connecticut	TACT-6, TACT-7	115	NA	--	1/day	TBD	1/20	6	1/20	6	1/20	6	NA	--	133
Alcohols	TA Westfield	TAW-9	115	NA	--	1/day	TBD	1/20	6	1/20	6	1/20	6	NA	--	133
Dissolved Gases	Microseeps	MS-5	40	NA	--	NA	--	1/20	2	1/20	2	1/20	2	NA	--	46
TAL Metals	TA Connecticut	TACT-10, TACT-11 and TACT-13	123	NA	--	1/day	TBD	1/20	6	1/20	6	NA	--	1/20	6	141
Alkalinity	TA Connecticut	TACT-16	40	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	46
Chloride	TA Connecticut	TACT-15	40	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	46
Sulfate	TA Connecticut		40	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	46
Nitrate-N	TA Connecticut		40	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	46
Nitrite-N	TA Connecticut		40	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	46
pH	NA	F-1	40	NA	--	NA	--	1/20	2	NA	--	NA	--	NA	--	42
Sulfide	TA Nashville	TAN-18	40	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	46
Dissolved Iron & Manganese	TA Connecticut	TACT-10, TACT-11	40	NA	--	1/day	TBD	1/20	2	1/20	2	NA	--	1/20	2	46
TOC	TA Connecticut	TACT-20	40	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	46
Groundwater; Pre-Thermal and Post-Thermal Treatment																
VOCs	TA Connecticut	TACT-1	10	1/cooler	TBD	1/day	TBD	1/20	1	1/20	1	1/20	1	NA	--	13
Dissolved Gases	Microseeps	MS-5	10	NA	--	NA	--	1/20	1	1/20	1	1/20	1	NA	--	13
Alkalinity	TA Connecticut	TACT-16	10	NA	--	NA	--	1/20	1	1/20	1	NA	--	1/20	1	13
Chloride	TA Connecticut	TACT-15	10	NA	--	NA	--	1/20	1	1/20	1	NA	--	1/20	1	13
Sulfate	TA Connecticut		10	NA	--	NA	--	1/20	1	1/20	1	NA	--	1/20	1	13
Nitrate-N	TA Connecticut		10	NA	--	NA	--	1/20	1	1/20	1	NA	--	1/20	1	13
Nitrite-N	TA Connecticut		10	NA	--	NA	--	1/20	1	1/20	1	NA	--	1/20	1	13
pH	NA	F-1	10	NA	--	NA	--	1/20	1	NA	--	NA	--	NA	--	11
Sulfide	TA Nashville	TAN-18	10	NA	--	NA	--	1/20	1	1/20	1	NA	--	1/20	1	13
Total & Dissolved Iron & Manganese	TA Connecticut	TACT-10, TACT-11	10	NA	--	1/day	TBD	1/20	1	1/20	1	NA	--	1/20	1	13
TOC	TA Connecticut	TACT-20	10	NA	--	NA	--	1/20	1	1/20	1	NA	--	1/20	1	13
Groundwater; Annual VOC Sampling																
VOCs	TA Connecticut	TACT-1	25	1/cooler	TBD	1/day	TBD	1/20	2	1/20	2	1/20	2	NA	--	31

QAPP Worksheet #20 Sample Quantities and Control Frequencies

Parameter	Laboratory [1]	Analytical and Preparation SOP[2,5]	Estimated Environ. Sample Quantity[3]	Field QC Analyses						Laboratory QC Sample						Total
				Trip Blank		Rinse Blank		Field Duplicate		Matrix Spike		Matrix Spike Duplicate		Lab Duplicate		
				Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	
Groundwater; Biennial MNA Sampling																
Dissolved Gases	Microseeps	MS-5	30	NA	--	NA	--	1/20	2	1/20	2	1/20	2	NA	--	36
Alkalinity	TA Connecticut	TACT-16	30	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	36
Chloride	TA Connecticut	TACT-15	30	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	36
Sulfate	TA Connecticut		30	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	36
Nitrate-N	TA Connecticut		30	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	36
Nitrite-N	TA Connecticut		30	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	36
pH	NA	F-1	30	NA	--	NA	--	1/20	2	NA	--	NA	--	NA	--	32
Sulfide	TA Nashville	TAN-18	30	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	36
Total & Dissolved Iron & Manganese	TA Connecticut	TACT-10, TACT-11	30	NA	--	1/day	TBD	1/20	2	1/20	2	NA	--	1/20	2	36
TOC	TA Connecticut	TACT-20	30	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	36
Groundwater; Five Year Review Sampling of 8 BG Wells																
TAL Metals	TA Connecticut	TACT-10, TACT-11 and TACT-13	8	NA	--	1/day	1	1/20	1	1/20	1	NA	--	1/20	1	12
Groundwater; Five Year Review Sampling of 132 Wells																
VOCs	TA Connecticut	TACT-1	115	1/cooler	TBD	1/day	TBD	1/20	6	1/20	6	1/20	6	NA	--	133
1,4-Dioxane	TA Tampa	SW846 8260B/TAT-24	115	1/cooler	TBD	1/day	TBD	1/20	6	1/20	6	1/20	6	NA	--	133
TAL Metals	TA Connecticut	TACT-10, TACT-11 and TACT-13	115	NA	--	1/day	TBD	1/20	6	1/20	6	NA	--	1/20	6	133
Dissolved Gases	Microseeps	MS-5	35	NA	--	NA	--	1/20	2	1/20	2	1/20	2	NA	--	41
Alkalinity	TA Connecticut	TACT-16	35	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	41
Chloride	TA Connecticut	TACT-15	35	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	41
Sulfate	TA Connecticut		35	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	41
Nitrate-N	TA Connecticut		35	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	41
Nitrite-N	TA Connecticut		35	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	41
pH	NA	F-1	35	NA	--	NA	--	1/20	2	NA	--	NA	--	NA	--	37
Sulfide	TA Nashville	TAN-18	35	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	41
Dissolved Iron & Manganese	TA Connecticut	TACT-10, TACT-11	35	NA	--	1/day	TBD	1/20	2	1/20	2	NA	--	1/20	2	41
TOC	TA Connecticut	TACT-20	35	NA	--	NA	--	1/20	2	1/20	2	NA	--	1/20	2	41
Soil Investigation																
SVOCs	TA Connecticut	TACT-2, TACT-3	22	NA	--	1/day	TBD	1/20	2	1/20	2	1/20	2	NA	--	28
PCBs	TA Connecticut	TACT-7, TACT-8	22	NA	--	1/day	TBD	1/20	2	1/20	2	1/20	2	NA	--	28
Dioxins	TA W Sacramento	TAWS-21, TAWS-22	32	NA	--	1/day	TBD	1/20	2	1/20	2	1/20	2	NA	--	38
TAL Metals	TA Connecticut	TACT-10, TACT-12 and TACT-14	14	NA	--	1/day	TBD	1/20	1	1/20	1	NA	--	1/20	1	17
Post-Excavation Confirmatory Sampling																
SVOCs	TA Connecticut	TACT-2, TACT-3	13	NA	--	1/day	TBD	1/20	1	1/20	1	1/20	1	NA	--	16
PCBs	TA Connecticut	TACT-7, TACT-8	30	NA	--	1/day	TBD	1/20	2	1/20	2	1/20	2	NA	--	36
Metals	TA Connecticut	TACT-10, TACT-12 and TACT-14	40	NA	--	1/day	TBD	1/20	2	1/20	2	NA	--	1/20	2	46

QAPP Worksheet #20 Sample Quantities and Control Frequencies

Parameter	Laboratory [1]	Analytical and Preparation SOP[2,5]	Estimated Environ. Sample Quantity[3]	Field QC Analyses						Laboratory QC Sample						Total
				Trip Blank		Rinse Blank		Field Duplicate		Matrix Spike		Matrix Spike Duplicate		Lab Duplicate		
				Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	
Pre-ISTR Preparation Sampling																
VOCs	TA Connecticut	TACT-1	20	1/cooler	TBD	1/day	TBD	1/20	1	1/20	1	1/20	1	NA	--	23
SVOCs	TA Connecticut	TACT-2, TACT-3	20	NA	--	1/day	TBD	1/20	1	1/20	1	1/20	1	NA	--	23
PCBs	TA Connecticut	TACT-7, TACT-8	20	NA	--	1/day	TBD	1/20	1	1/20	1	1/20	1	NA	--	23
TAL Metals	TA Connecticut	TACT-10, TACT-12 and TACT-14	20	NA	--	1/day	TBD	1/20	1	1/20	1	NA	--	1/20	1	23
Air																
VOCs	TA Burlington	TABR-23	TBD	NA	--	NA	--	1/20	TBD[4]	NA	--	NA	--	1/20	TBD	TBD

Notes:

1. See Worksheet #30 for contact information.
2. See WS#23 for SOP title, revision number, date details.
3. Sample counts are an approximation.
4. Field duplicates will consist of co-located samples for air analysis.
5. Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

1/day = One rinse blank per day or one per 20 samples, whichever is more frequent. Rinse blanks not required when dedicated sampling equipment is used.
Freq = Frequency.
No. = Number.

QAPP Worksheet #21 Field Sampling SOP References

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
F-1	FSP– 'Down-Hole Groundwater Field Parameter Measurement' SOP #B-1-12, Rev. 0, 3/10/09	ARCADIS	See SOP for specific equipment needs	N	Describes water quality measurement procedures and the required equipment
F-2	FSP–'Soil Description' SOP #B-1-6, Rev. 0, 5/20/08	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure for characterizing soil samples.
F-3	FSP – 'Water-Level and NAPL Thickness Measurement Procedures' SOP #B-1-13, Rev. 0, 2/27/09	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure for measuring water level and NAPL thickness and the required equipment
F-4	FSP – 'Hydropunch ® Groundwater Sampling Procedures' SOP #B-1-7, Rev. 1, 3/3/09	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure for groundwater sampling and the required equipment
F-5	FSP – 'Low Flow Purging and Groundwater Sampling' SOP #B-1-10, Rev. 4, November 6, 2009	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure for groundwater sampling and the required equipment
F-6	FSP – 'Groundwater Sampling with HydraSleeves™' SOP #B-1-11, Rev. 1, February 2010	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure for groundwater sampling with HydraSleeves™
F-7	FSP – 'Surface and Subsurface Soil Sampling using Manual Methods' SOP #B-1-14, Rev. 1, 3/6/09	ARCADIS	See SOP for specific equipment needs	N	Describes the procedures for soil sampling and the required equipment
F-8	FSP — 'Soil Drilling and Sample Collection' SOP #B-1-3, Rev. 1, 3/3/09	ARCADIS	See SOP for specific equipment needs	N	Describes the procedures for soil sampling and the required equipment

QAPP Worksheet #21 Field Sampling SOP References

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
F-9	FSP— 'Extraction Preservation of Soil/Sediment for VOCs' SOP #B-1-4, Rev. 1, 4/9/08	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure for preserving soil and sediment samples and handling
F-10	FSP — 'Investigation-Derived Waste Handling and Storage' SOP #B-1-21, Rev. 3, November 6, 2009	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure for Derived Waste sampling and the required equipment
F-11	FSP — 'Chain of Custody, Handling, Packing and Shipping' SOP #B-1-19, Rev. 2, 3/6/09	ARCADIS	See SOP for specific equipment needs	N	Describes field sample handling, packaging, shipping and chain of custody procedures
F-12	FSP — 'Equipment Cleaning - Field' SOP #B-1-22,	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure for field equipment cleaning
F-13	FSP – 'Heavy Equipment Decontamination' SOP #B-1-23,	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure for heavy equipment cleaning and decontamination
F-14	FSP – 'Sub-Slab Soil-Gal Sampling and Analysis using USEPA Method TO-15 – Permanent Probe Approach' SOP #B-1-17, Rev. 1, 11/14/08	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure for Sub-Slab Soil-Gas Sampling
F-15	FSP – 'Indoor Air Sampling and Analysis using USEPA Method TO-15' SOP #B-1-18, Rev. 0, 3/30/06	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure of indoor air sampling
F-16	FSP – 'Sub-Slab Soil-Gas Sampling – Temporary Ports' SOP #B-1-15, Rev. 2, 11/14/08	ARCADIS	See SOP for specific equipment needs	N	Describes the procedure for Sub-Slab Soil-Gas Sampling using Temporary Ports

QAPP Worksheet #21 Field Sampling SOP References

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
F-17	FSP – 'USEPA Calibration of Field Instruments' SOP B-1-20, 6/3/98	USEPA	See SOP for specific equipment needs	N	Describes procedure for the calibration of field instruments for groundwater parameter measurements
F-18	FSP – 'DNAPL Contingency Plan' SOP B-1-5, Rev. 3, November 5, 2009	ARCADIS	See SOP for specific equipment needs	N	Describes procedures to be performed when NAPL is encountered during drilling and/or sampling procedures

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

Field Equipment	Calibration Activity/ Frequency	Maintenance Activity	Testing Activity	Inspection Activity	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Combination Water Quality Meter	F-1	As required by manufacturer specifications	Temperature, conductivity, pH, turbidity, DO	Check all membranes and sensors, cable and check battery charge	F-1	F-1	F-1	F-1
Digital Camera	NA	NA	NA	Batteries charge, acceptable memory and general camera function	NA	NA	NA	NA
PID	NA	As required by manufacturer specification	Background VOC detection	Batteries charge	NA	NA	NA	NA
Dust monitor	NA	As required by manufacturer specification	Background Dust Monitoring	Batteries charge	NA	NA	NA	NA
Micromanometer	NA	As required by manufacturer specification	Sub Slab vapor sampling	Batteries charge	NA	NA	NA	NA

Note: [1]SOPs are found in the Field Sampling Plan (FSP).

QAPP Worksheet #23 Analytical SOP References

SOP Reference Number[1,2]	Title, Revision Date, and/or Number[3]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
F-1	FSP– 'Down-Hole Groundwater Field Parameter Measurement' SOP #B-1-12, Rev. 0, 3/10/09	Definitive	Temperature, pH, turbidity, conductivity, DO	Combination water quality meter	ARCADIS Field Team	N
F-2	FSP–'Soil Description' SOP #B-1-6, Rev. 0, 5/20/08	Screening	Core characterization	USGS method	ARCADIS Field Team	N
F-3	FSP – 'Water-Level and NAPL Thickness Measurement Procedures' SOP #B-1-13, Rev. 0, 2/27/09	Screening	Water and NAPL measurements	Staff gauge	ARCADIS Field Team	N

QAPP Worksheet #23 Analytical SOP References

SOP Reference Number[1,2]	Title, Revision Date, and/or Number[3]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
TACT-1	'SOP for GC/MS Volatiles, SW846 8260B' CT-MSS-28, Rev. 8, 8/31/07	Definitive	Volatiles in soils water	Gas Chromatogram/ Mass Spectrometry (GC/MS)	TestAmerica Connecticut	N
TACT-2	'SOP for GC/MS Semivolatiles, SW846 8270C' CT-MSS-27, Rev. 11, 12/01/08	Definitive	Semivolatiles in water and soil	Gas Chromatogram/ Mass Spectrometry (GC/MS)	TestAmerica Connecticut	N
TACT-3	'SOP for Prep of Soils for BNA Analysis, SW846 3541' CT-SPS-65, Rev. 2, 1/30/08	Definitive	Semivolatiles preparation for soils	Gas Chromatogram/ Mass Spectrometry (GC/MS)	TestAmerica Connecticut	N
TACT-4	'SOP for Extraction of Aqueous Semivolatile Samples' CT-CVS-13, Rev. 9, 1/30/08	Definitive	Semivolatiles preparation for waters	Gas Chromatogram/ Mass Spectrometry (GC/MS)	TestAmerica Connecticut	N
MS-5	'Analytical Method MS20GAx SOP for the Analysis of Biodegradation Indicator Gases' SOP-AM20GAX, Rev. 9, 11/21/08 and 'SOP for the Preparation of Samples for the Analysis of Biodegradation Indicator Gases' SOP-PM01C, Rev. 5, 1/20/09	Definitive	Methane, Ethane, Ethene	GC/FID;GC/TCD	Microseeps	N

QAPP Worksheet #23 Analytical SOP References

SOP Reference Number[1,2]	Title, Revision Date, and/or Number[3]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
TACT-6	'Prep of Water Pesticide/PCB extracts, SW846 3510C/3520C' CT-SPS-12, Rev. 7, 11/07/07	Definitive	PCB preparation for waters	GC/ECD	TestAmerica Connecticut	N
TACT-7	'SOPs for GC Method 8082 PCBs' Rev. 8, 9/24/07	Definitive	PCBs in water and soil	GC/ECD	TestAmerica Connecticut	N
TACT-8	'SOP for Prep of Soil Samples for GC Analysis, SW846 3541' CT-SPS-66, Rev. 2, 1/30/08	Definitive	PCB preparation for soils	GC/ECD	TestAmerica Connecticut	N
TAW-9	'DAI – Water Miscible Organic Compounds, SW846 8015B' WE-SVO-004, Rev. 0, 2/06/09	Definitive	Alcohols in water	GC/FID	TestAmerica Westfield	N
TACT-10	'SOP for ICP Metals Analysis, SW846 6010B' CT-MES-20, Rev. 6, 10/30/07	Definitive	Metals, except mercury	ICP-AES	TestAmerica Connecticut	N
TACT-11	'SOP for Metals Digestion-Aqueous, SW846 3010A' CT-MES-9, Rev. 10, 2/28/08	Definitive	Preparation of waters for metals, except mercury	ICP-AES	TestAmerica Connecticut	N
TACT-12	'SOP for Metals Digestion-Soils, SW846 3050B' CT-MES-10, Rev. 10, 2/28/08	Definitive	Preparation of soils for metals, except mercury	ICP-AES	TestAmerica Connecticut	N
TACT-13	'SOP for Mercury-Aqueous, Hot Block Digestion, SW846 7470A' CT-MES-31, Rev. 7, 10/30/07	Definitive	Mercury	Mercury auto-analyzer	TestAmerica Connecticut	N

QAPP Worksheet #23 Analytical SOP References

SOP Reference Number[1,2]	Title, Revision Date, and/or Number[3]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
TACT-14	'SOP for Mercury-Solids, Hot Block Digestion, SW846 7471A' CT-MES-32, Rev. 5, 10/30/07	Definitive	Mercury	Mercury auto-analyzer	TestAmerica Connecticut	N
TACT-15	'Inorganic Anions by Ion Chromatography, EPA 300.0' CT-CVS-61, Rev. 4, 11/14/08	Definitive	Chloride, sulfate, nitrate, nitrite in water	Lachat Autoanalyzer	TestAmerica Connecticut	N
TACT-16	'Alkalinity, pH and conductivity in water – Autotitrator' CT-CVS-07, Rev. 2 7/30/07	Definitive	Alkalinity in water	Autotitrator	TestAmerica Connecticut	N
TACT-17	'SOP for pH in Water, SM4500H+B, SW846 9040B' CT-CVS-09, Rev. 3, 11/05/08	Definitive	pH in water	pH Meter	TestAmerica Connecticut	N
TAN-18	'Methods 376.2 & SM4500-S2 D: Sulfide(Colorimetric, Methylene Blue)' SOP#376.2/SA07-180, Rev. 3, 6/15/07	Definitive	Sulfide in water	Colorimetric	TestAmerica Nashville	N
TACT-19	'SOP for TOC, SW846 9060, Lloyd Kahn' CT-CVS-74, Rev. 1, 9/12/08	Definitive	TOC in soils	TOC Analyzer	TestAmerica Connecticut	N
TACT-20	'SOP for Total Organic Carbon-Water' CT-CVS-66, Rev. 3, 5/30/07	Definitive	TOC in water	TOC Analyzer – Phoenix 8000	TestAmerica Connecticut	N

QAPP Worksheet #23 Analytical SOP References

SOP Reference Number[1,2]	Title, Revision Date, and/or Number[3]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
TAWS-21	'Preparation of Samples for Analysis of Polychlorinated Dioxins and Furans for Analysis HRGC/HRMS, SW846 8290A' WS-IDP-0005, Rev. 1, 10/2/08	Definitive	Preparation of soil samples for dioxins	HRGC/HRMS	TestAmerica West Sacramento	N
TAWS-22	'Analysis of Samples for Polychlorinated Dioxins and Furans by HRGC/HRMS, SW846 8290A' WS-ID-0005, Rev. 7, 10/2/08	Definitive	Dioxins in soil	HRGC/HRMS	TestAmerica West Sacramento	N
TABR-23	'Volatile Organic Compounds in Ambient Air, EPA TO14/TO15' BR-AT-004, Rev. 6, 3/30/09	Definitive	Volatiles in air	GC/MS	TestAmerica Burlington	N
TAT-24	'Determination of Volatile Organics by GC/MS, SW846 8260B' TP-VM-001, Rev. 4, 2/15/09	Definitive	1,4-Dioxane in water	Gas Chromatogram/ Mass Spectrometry (GC/MS)	TestAmerica Tampa	N

Notes: [1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).
[2]Specify the appropriate reference letter or number from the Field Sampling SOP References table (Worksheet #21).
[3]Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

QAPP Worksheet #24 Analytical Instrument Calibration

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Combined water quality meter	See F-1	See F-1	See F-1	See F-1	Analyst	F-1
GC with dual ECD, auto sampler and data system.	Five-point calibration of Aroclors 1016 and 1260 mixture in concentration range that brackets linear range of detector. Using the PCB Calculator Program, calibrate each Aroclor by identifying seven most prominent peaks for that particular Aroclor. All other Aroclors are quantitated based on one-point standard calibration.	After initial calibration, a check standard of Aroclor 1016/1260 mixture is analyzed every 12-hour shift with the continuing calibration standard, which is analyzed after every 20 samples or end of sequence.	Initial calibration RSD for 1016/1260 $\leq$ 20% or linear regression >0.99.	If routine maintenance does not return the instrument performance to meet the QC requirements, a new calibration must be performed.	Analyst	TACT-7
	Continuing calibration — before sample analysis, one standard (midpoint).	1016/1260 mixture is analyzed every 12-hour shift with the continuing calibration standard, which is analyzed after every 20 samples or end of sequence.	Check standard or continuing calibration standard must not exceed a percent difference of $\pm$15.			

QAPP Worksheet #24 Analytical Instrument Calibration

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Analytical Balance	See Lab QA Manual	Daily.	NA.	Inspect system, correct problem, rerun calibration and affected samples.	Analyst	See Lab QA Manual
Spectrophotometer	Construct a calibration curve of absorbance vs concentration (4 standards).	Before sample analysis when check standard is outside confidence limits. Also, after major instrument maintenance.	Analyze check standard after every analytical batch. Check standard is outside 95 percent confidence limit indicated by manufacturer	Fix problem and recalibrate.		TAN-18
GC/MS for 8260	Instrument performance check (tune).	Prior to initial and continuing calibration.	As per method.	Retune instrument.	Analyst	TACT-1 and TAT-24
	Initial calibration — prior to sample analysis, a minimum of 5 concentration levels for all compounds.	Prior to sample analysis 5 points for all compounds. Yearly.	Each compound Relative Response Factor (RRF) RSD $\leq$ 30% for CCCs and $\leq$15% for all other compounds or linear $r^2 \geq$ 0.99 and RRF≥0.05.	Inspect system, correct problem, rerun calibration and affected samples if RSD failure > 20%of target list.		
	Continuing calibration — before sample analysis, 1 standard (midpoint).	Before sample analysis and every 12 hours.	Each compound percent difference $\leq$ 20% for CCCs and $\leq$30% for all other compounds or linear and Response Factor (RF)$\geq$0.05.	Inspect system, correct problem, rerun calibration and affected samples if %D >30% for failure >10% of target compounds		

QAPP Worksheet #24 Analytical Instrument Calibration

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/MS for 8270	Instrument performance check (tune).	Prior to initial and continuing calibration.	As per method.	Retune instrument.	Analyst	TACT-2
	Initial calibration — prior to sample analysis, a minimum of 5 concentration levels for all compounds.	Prior to sample analysis, 5 points for all compounds. Yearly.	Each compound Relative Response Factor (RRF) RSD $\leq$ 30% for CCCs and $\leq$15% for all other compounds or linear $r^2 \geq$ 0.99 and RRF≥0.05.	Inspect system, correct problem, rerun calibration and affected samples if RSD failure > 20%of target list.		
	Continuing calibration — before sample analysis, 1 standard.	Before sample analysis and every 12 hours.	Each compound percent difference $\leq$ 20% for CCCs and $\leq$30% for all other compounds or linear and Response Factor (RF)$\geq$0.05.	Inspect system, correct problem, rerun calibration and affected samples if %D >30% for failure >10% of target compounds		
HRGC/HRMS for 8290	Instrument performance check (tune).	Prior to initial and continuing calibration.	As per method.	Retune instrument.	Analyst	TAWS-22
	Initial calibration — prior to sample analysis, a minimum of 5 concentration levels for all compounds.	Prior to sample analysis, 5 points for all compounds. Yearly.	Each compound RRF RSD $\leq$ 35% for all compounds and RR RSD $\leq$20%.	Inspect system, correct problem, rerun calibration and affected samples if RSD > 50%.		
	Continuing calibration — before sample analysis, 1 standard.	Before sample analysis and every 12 hours.	Each compound RRF percent difference (%D) $\leq$ 35% and RR %D $\leq$20%.	Inspect system, correct problem, rerun calibration and affected samples if %D> 80%.		
GC/FID for 8015	Initial calibration — prior to sample analysis, a minimum of 5 concentration levels for all compounds.	Prior to initial and continuing calibration.	Each compound Calibration (CF)$\leq$ 20% for all compounds or linear $r^2 \geq$ 0.99.	Inspect system, correct problem, rerun calibration and affected samples if CF > 20% or linear $r^2 \geq$ 0.99.	Analyst	TAW-9
	Continuing calibration — before sample analysis, 1 standard (midpoint).	Prior to sample analysis, 5 points for all compounds. Yearly.	Each compound percent difference $\leq$ 15%.	Inspect system, correct problem, rerun calibration and affected samples if %D> 15%.		

QAPP Worksheet #24 Analytical Instrument Calibration

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/MS for TO-15	Instrument performance check (tune).	Prior to initial and continuing calibration and every 24 hours.	As per method.	Retune instrument.	Analyst	TABR-23
	Initial calibration — prior to sample analysis, a minimum of 5 concentration levels for all compounds.	Prior to sample analysis 5 points for all compounds. Yearly.	Each compound Relative Response Factor (RRF) RSD ≤ 30% for all compounds with 2 exceptions up to 40%.	Inspect system, correct problem, rerun calibration and affected samples.		
	Continuing calibration — before sample analysis, 1 standard (midpoint).	Daily after the tune standard.	Each compound percent difference ≤30% for all compounds.	Inspect system, correct problem, rerun calibration and affected samples.		
ICP-AES	Minimum 1 calibration standard and calibration blank. 1 standard (midpoint).	Daily/continuing.	Initial calibration — coefficient of variation≥.995. Continuing calibration — +/- 10% difference.	Inspect system, correct problem, rerun calibration and affected samples.	Analyst	TACT-10
Hg cold vapor	Initial calibration — 5 concentration levels. Continuing calibration — 1 standard.	Daily, or on continuing calibration failure. Continuing, every 10 samples.	Initial calibration -≥.995 coefficient of variation. Continuing calibration — +/- 20% difference.	Inspect system, correct problem, rerun calibration and affected samples.	Analyst	TACT-13 and TACT-14
Differential thermal conductivity for Lloyd Kahn TOC	Initial calibration — 5 concentration levels. Continuing calibration — 1 standard.	Daily, or on continuing calibration failure. Continuing, every 10 samples.	Initial calibration — coefficient of variation≥.995. Laboratory control sample 75-125%.	Inspect system, correct problem, rerun calibration and affected samples.	Analyst	TACT-19
Catalytic combustion chamber with infrared detector for water TOC	Initial calibration — 5 concentration levels. Continuing calibration — 1 standard.	Daily, or on continuing calibration failure. Continuing, every 10 samples.	Initial calibration — coefficient of variation≥.995. Laboratory control sample 85-115%.	Inspect system, correct problem, rerun calibration and affected samples.	Analyst	TACT-20

QAPP Worksheet #24 Analytical Instrument Calibration

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Lachat Ion Chromatograph	Initial calibration — 6 concentration levels. Continuing calibration — 1 standard.	Daily, or on continuing calibration failure. Continuing, every 10 samples.	Initial calibration — coefficient of variation≥.995. Laboratory control sample 85-115%.	Inspect system, correct problem, rerun calibration and affected samples.	Analyst	TACT-15
pH meter	Initial calibration with two buffers that bracket pH of samples at room temperature.	Daily	Slope reading after calibration should be between 94-102%.	If slope falls out of range of slope reading, troubleshoot and fix problem according to user's manual.	Analyst	TACT-16 and TACT-17

Note: [1]Specify the appropriate SOP reference numbers correspond to from the Analytical SOP s contained in Appendix C-1.

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GC/MS	• replace pump oil as needed • change gas line dryers as needed • ion source cleaning and filament replacement • replace injection port liner weekly or as needed • clip column • replace GC column as needed • manual tuning • replace electron multiplier • provide that gas supply is sufficient and delivery pressure is adequate • bake out lines and column	VOCs and SVOCs	Check connections, bake out instrument, leak test	See TACT-1, TACT-2, TABR-23 and TAT-24	See TACT-1, TACT-2, TABR-23 and TAT-24	Inspect system, correct problem, rerun calibration and affected samples	Analyst	See TACT-1, TACT-2, TABR-23 and TAT-24
Purge and Trap Concentrator	• replace trap as needed • decontaminate system after high concentration samples • check for system leaks • provide that gas supply is sufficient and delivery pressure is adequate	VOCs	Check connections, bake out instrument, leak test	See MS-5 and TAW-9	See MS-5 and TAW-9	Inspect system, correct problem, rerun calibration and affected samples	Analyst	See MS-5 and TAW-9

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GC/ECD and/or GC/FID	• change septa weekly or as needed • change gas line dryers as needed • replace injection port liner weekly or as needed • clip column • replace GC column as needed • clean/replace detector as needed • provide that gas supply is sufficient and delivery pressure is adequate	PCBs	Check connections, bake out instrument, leak test	See TACT-7	See TACT-7	Inspect system, correct problem, rerun calibration and affected samples	Analyst	See TACT-7
Ion Chromatograph	• change column • change guard column • change analytical column • replace eluents	Chloride, sulfate, nitrate, nitrite	Check connections	See TACT-15	See TACT-15	Inspect system, correct problem, rerun calibration and affected samples	Analyst	See TACT-15
ICP	• change capillary and pump tubing • check liquid argon tank • replace and realign plasma torch • clean nebulizer and spray chamber	All metals except mercury	Check connections, replace worn equipment	See TACT-10	See TACT-10	Inspect system, correct problem, rerun calibration and affected samples	Analyst	See TACT-10
CVAAS	• clean tubing and quartz cell as needed • clean aspirator as necessary • check level of mercury scrubber solution • replace lamps • provide that gas supply is sufficient and delivery pressures are adequate	Mercury	Check connections, replace worn equipment	See TACT-13 and TACT-14	See TACT-13 and TACT-14	Inspect system, correct problem, rerun calibration and affected samples	Analyst	See TACT-13 and TACT-14

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Oven	• Thermometers checked	NA	Compare to NIST-certified thermometer	Record temperature twice daily, calibrate thermometer yearly	NA	NA	Analyst	NA
Balance	• Professional Service Contract	All	NA	3 times /year	NA	NA	Service Contractor	NA
pH Meter	• change buffer fluid • clean electrodes • rinse electrodes	NA	Inspect probe for debris	Daily	See TACT-16 and TACT-17	Inspect system, correct problem, rerun calibration and affected samples	Analyst	See TACT-16 and TACT-17

Note: Specify the appropriate SOP reference numbers that correspond from the Analytical SOPs contained in Worksheet #23.

QAPP Worksheet #26-1 Sample Handling System (TACT)

Sample Collection, Packaging and Shipment
Sample Collection (Personnel/Organization): TBD/ARCADIS
Sample Packaging (Personnel/Organization): TBD/ARCADIS
Coordination of Shipment (Personnel/Organization): TBD/ARCADIS
Type of Shipment/Carrier: ARCADIS delivery or TestAmerica courier to TestAmerica Connecticut (TACT); TACT to subcontract to appropriate TA facilities
Sample Receipt and Analysis
Sample Receipt (Personnel/Organization): Johanna Dubauskas/TACT
Sample Custody and Storage (Personnel/Organization): Johanna Dubauskas/TACT
Sample Preparation (Personnel/Organization): Johanna Dubauskas/TACT
Sample Determinative Analysis (Personnel/Organization): Johanna Dubauskas/TACT
Sample Archiving
Field Sample Storage (no. of days from sample collection): 30 days from submittal of final report
Sample Extract/Digestate Storage (no. of days from extraction/digestion): 60 days
Biological Sample Storage (no. of days from sample collection): N/A
Sample Disposal
Personnel/Organization: Johanna Dubauskas/TACT
Number of Days from Analysis: 60-day minimum from submittal of final report.

Note: TACT is responsible for all sample receipt, analysis, archiving, and disposal of sample that are to be analyzed by another laboratory within the TA laboratory system.

QAPP Worksheet #26-2 Sample Handling System (Microseeps)

Sample Collection, Packaging and Shipment
Sample Collection (Personnel/Organization): TBD/ARCADIS
Sample Packaging (Personnel/Organization): TBD/ARCADIS
Coordination of Shipment (Personnel/Organization): TBD/ARCADIS
Type of Shipment/Carrier: ARCADIS delivery to Microseeps via express courier shipment
Sample Receipt and Analysis
Sample Receipt (Personnel/Organization): Debbie Hallo/Microseeps
Sample Custody and Storage (Personnel/Organization): Debbie Hallo/Microseeps
Sample Preparation (Personnel/Organization): Debbie Hallo/Microseeps
Sample Determinative Analysis (Personnel/Organization): Debbie Hallo/Microseeps
Sample Archiving
Field Sample Storage (no. of days from sample collection): 30 days from analysis
Sample Extract/Digestate Storage (no. of days from extraction/digestion): 30 days
Biological Sample Storage (no. of days from sample collection): N/A
Sample Disposal
Personnel/Organization: Debbie Hallo/Microseeps
Number of Days from Analysis: 30-day minimum from analysis

QAPP Worksheet #27 Sample Custody Requirements

Sample Handling and Custody Requirements

Field and laboratory personnel will, at all times, be aware of the need to maintain all samples, whether in the field or in the laboratory, under strict chain of custody and in a manner to retain physical properties and chemical composition. This Worksheet details sample handling and custody requirements from collection to ultimate disposal.

Sample Handling (Sample Packaging, Shipping Containers and Sample Shipment, Sample Custody)

Sample packaging and shipment procedures are designed so that the samples will arrive at the laboratory, with the chain-of-custody, intact.

Samples will be packaged for shipment as outlined below:

- Securely affix the sample label to the container with clear packing tape.
- Check the cap on the sample container to confirm that it is properly sealed.
- Wrap the sample container cap with clear packing tape to prevent the label from becoming loose.
- Complete the chain-of-custody form with the required sampling information and confirm that the recorded information matches the sample labels. NOTE: If the designated sampler relinquishes the samples to other sampling or field personnel for packing or other purposes, the sampler will complete the chain-of-custody prior to this transfer. The appropriate personnel will sign and date the chain-of-custody form to document the sample custody transfer.
- Using duct tape, secure the outside drain plug at the bottom of the cooler.
- Wrap sample containers in bubble wrap or other cushioning material.
- Place 1 to 2 inches of cushioning material at the bottom of the cooler.
- Place the sealed sample containers into the cooler.
- Place ice in plastic bags and seal. Place loosely in the cooler.
- Fill the remaining space in the cooler with cushioning material.
- Place chain-of-custody forms in a plastic bag and seal. Tape the forms to the inside of the cooler lid.
- Close the lid of the cooler, lock and secure with duct tape.
- Wrap strapping tape around both ends of the cooler at least twice.
- Mark the cooler on the outside with the shipping address and return address, affix “Fragile” labels and draw (or affix) arrows indicating “this side up.” Cover the labels with clear plastic tape.
- Place a signed custody seal over the sample cooler lid.

Samples will be packaged by the field personnel and transported as low-concentration environmental samples. Samples collected for VOCs analysis using EnCore® sample containers must be shipped on the day they are collected. Other samples will be hand delivered or delivered by an express carrier within 24

QAPP Worksheet #27 Sample Custody Requirements

Sample Handling (Sample Packaging, Shipping Containers and Sample Shipment, Sample Custody) Continued

hours of the time of collection. Shipments will be accompanied by the chain-of-custody form identifying the contents. The original form will accompany the shipment; copies will be retained by the sampler for the sampling office records. If the samples are sent by common carrier, a bill of lading will be used. Receipts or bills of lading will be retained as part of the permanent project documentation. Commercial carriers are not required to sign off on the chain-of-custody form as long as the forms are sealed inside the sample cooler, and the custody seals remain intact.

Sample custody seals and packing materials for filled sample containers will be provided by the analytical laboratory. The filled, labeled and sealed containers will be placed in a cooler on ice and carefully packed to eliminate the possibility of container breakage.

Additional procedures for packing, handling and shipping environmental samples are presented in the Remedial Design Work Plan.

Field Custody Procedures

The objective of field sample custody is to protect samples from tampering from the time of sample collection through time of transport to the analytical laboratory. Persons will have custody of samples when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

Field custody documentation consists of both field logbooks and field chain-of-custody forms.

Field logbooks will provide the means of recording the data collecting activities that are performed. As such, entries will be described in as much detail as possible so that persons going to the site could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in a secure location when not in use. Each logbook will be identified by the project-specific document number. The title page of each logbook will contain the following:

- person to whom the logbook is assigned
- logbook number
- project name
- project start date
- end date

QAPP Worksheet #27 Sample Custody Requirements

Field Custody Procedures Continued

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather conditions, names of all sampling team members present, level of personal protection being used and signature of the person making the entry will be provided. The names of visitors to the site and field sampling or investigation team personnel, as well as the purpose of their visit, will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. Entries will be made in ink, with no erasures. If an incorrect entry is made, the information will be crossed out with one strike mark. The initials of the person making the correction and the date of the correction will be noted next to the correction. Whenever a sample is collected or a measurement is made, a detailed description of the location of the station will be recorded. The number of the photographs taken, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in FSP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description.

Sample Labels

Preprinted sample labels will be affixed to sample bottles prior to delivery at the sampling site. The following information is required on each sample label:

- project name
- date collected
- time collected
- location
- sampler
- analysis to be performed
- preservative
- sample number

QAPP Worksheet #27 Sample Custody Requirements

Chain of Custody Record

Completed chain-of-custody forms will be required for all samples to be analyzed. Chain-of-custody forms will be initiated by the sampling crew in the field. The chain-of-custody forms will contain the unique sample identification number, sample date and military time, sample description, sample type, preservation (if any) and analyses required. The original chain-of-custody form will accompany the samples to the laboratory. Copies of the chain-of-custody will be made prior to shipment (or multiple copy forms will be used) for field documentation. The chain-of-custody forms will remain with the samples at all times. The samples and signed chain-of-custody forms will remain in the possession of the sampling crew until the samples are delivered to the express carrier (e.g., Federal Express), hand delivered to a mobile or permanent laboratory, or placed in secure storage.

Sample labels will be completed for each sample using waterproof ink. The labels will include the information listed in the section above. The completed sample labels will be affixed to each sample bottle and covered with clear tape.

Whenever samples are split with a government agency or other party, a separate chain-of-custody will be prepared for those samples and marked to identify the party with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

QAPP Worksheet #27 Sample Custody Requirements

Laboratory Custody Procedures
Upon sample receipt, laboratory personnel will be responsible for sample custody. The original field chain-of-custody form will accompany all samples requiring laboratory analysis. The laboratory will use chain-of-custody guidelines described in the USEPA guidance documents. Samples will be kept secured in the laboratory until all stages of analysis are complete. All laboratory personnel having samples in their custody will be responsible for documenting and maintaining sample integrity. Immediately upon sample receipt, the laboratory sample custodian will verify the integrity of the cooler seal, open the cooler, record cooler temperature on chain of custody, and compare the contents against the field chain-of-custody. If a sample container is missing, a sample container is received broken, the sample is in an inappropriate container, or the sample has not been preserved by appropriate means, ARCADIS will be notified. The laboratory sample custodian will be responsible for logging the samples in, assigning a unique laboratory identification number to each sample, labeling the sample bottle with the laboratory identification number, and moving the sample to an appropriate storage location to await analysis. The project name, field sample code, date sampled, date received, analysis required, storage location and date, and action for final disposition will be recorded in the laboratory tracking system. Relevant custody documentation will be placed in the project file.

QAPP Worksheet #28-1 QC Samples — VOCs (Water) (8260B)

Matrix	Water	**Analytical Method/ SOP Reference**	SW846 8260B/TACT-1 and TAT-24	**No. of Sample Locations**	Numerous	
Analytical Group	VOCs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut and TestAmerica Tampa			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 30%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	RPD < 30%
Surrogates	3 per sample	%R, 70-130%	Reanalyze sample	Lab personnel	Accuracy/bias	%R, 70-130%
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reanalyze batch	Lab personnel	Accuracy/bias contamination	< RL
Trip blanks	1 per cooler containing VOC samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL

QAPP Worksheet #28-1 QC Samples — VOCs (Water) (8260B)

Matrix	Water	**Analytical Method/ SOP Reference**	SW846 8260B/TACT-1 and TAT-24	**No. of Sample Locations**	Numerous	
Analytical Group	VOCs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut and TestAmerica Tampa			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
LCS/LCSD*	1/batch	%R 70-130%	Qualify data as needed or reanalyze batch	Lab personnel	Precision	%R 70-130%
Instrument check: BFB	1/calibration	% Relative abundance	Reanalyze batch	Lab personnel	Accuracy/bias	% Relative abundance
Internal standard	At least three/sample	Area response & retention times, see CT RCP	Reanalyze sample	Lab personnel	Precision	Area response & retention times, see CT RCP
MS	1/batch	%R 70-130%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 70-130%
MSD	1/batch	%R 70-130%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 70-130%

QAPP Worksheet #28-1 QC Samples — VOCs (Water) (8260B)

Matrix	Water	**Analytical Method/ SOP Reference**	SW846 8260B/TACT-1 and TAT-24	**No. of Sample Locations**	Numerous	
Analytical Group	VOCs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut and TestAmerica Tampa			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
MS/MSD and LCS/LCSD	1/batch	RPD <30%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision	RPD ≤30%

Note: *LCS/LCSD used when MS/MSD not client-supplied.
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD.
Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.
Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

QAPP Worksheet #28-2 QC Samples — VOCs (Soil) (8260B)

Matrix	Soil	**Analytical Method/ SOP Reference**	SW846 8260B/TACT-1	**No. of Sample Locations**	Numerous	
Analytical Group	VOCs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-7 and F-8	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 50%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	RPD < 50%
Surrogates	3 per sample	%R, 70-130%	Reanalyze sample	Lab personnel	Accuracy/bias	%R, 70-130%
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reanalyze batch	Lab personnel and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Trip blanks	1 per cooler containing VOC samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
LCS/LCSD*	1/batch	%R 70-130%	Qualify data as needed or reanalyze batch	Lab personnel	Precision	%R 70-130%

QAPP Worksheet #28-2 QC Samples — VOCs (Soil) (8260B)

Matrix	Soil	**Analytical Method/ SOP Reference**	SW846 8260B/TACT-1	**No. of Sample Locations**	Numerous	
Analytical Group	VOCs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-7 and F-8	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Instrument check: BFB	1/calibration	% Relative abundance	Reanalyze batch	Lab personnel	Accuracy/bias	% Relative abundance
Internal standard	At least three/sample	Area response & retention times, see CT RCP	Reanalyze sample	Lab personnel	Precision	Area response & retention times, see CT RCP
MS	1/batch	%R 70-130%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 70-130%
MSD	1/batch	%R 70-130%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 70-130%
MS/MSD and LCS/LCSD	1/batch	RPD ≤30%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision	RPD ≤30%

Note: *LCS/LCSD used when MS/MSD not client-supplied.
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD.
Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.
Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

QAPP Worksheet #28-3 QC Samples — SVOCs (Water) (8270)

Matrix	Water	**Analytical Method/ SOP Reference**	SW846 8270/TACT-2 and TACT-4	**No. of Sample Locations**	Numerous	
Analytical Group	SVOCs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 30%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	RPD < 30%
Surrogates	8 per sample	%R 30-130% for base neutrals; 15-110% for acid compounds	Reanalyze sample	Lab personnel	Accuracy/bias	%R 30-130% for base neutrals; 15-110% for acid compounds
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reanalyze batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
LCS/LCSD*	1 per analytical batch	%R 40-140% for base neutrals; 30-130% for acid compounds	Qualify data as needed or reanalyze batch	Lab personnel	Accuracy/bias	%R 40-140% for base neutrals; 30-130% for acid compounds
Instrument check: bromofluorobenzene	1/calibration	% Relative abundance, see Table 1C of CT RCP	Reanalyze batch	Lab personnel	Accuracy/bias	% Relative abundance, see Table 1C of CT RCP

QAPP Worksheet #28-3 QC Samples — SVOCs (Water) (8270)

Matrix	Water	**Analytical Method/ SOP Reference**	SW846 8270/TACT-2 and TACT-4	**No. of Sample Locations**	Numerous	
Analytical Group	SVOCs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Internal standard	At least 6/sample	Area response & retention times, see CT RCP	Reanalyze sample	Lab personnel	Precision	Area response & retention times, see CT RCP
MS	1/batch	%R 40-140% for base neutrals; 30-130% for acid compounds	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 40-140% for base neutrals; 30-130% for acid compounds
MSD	1/batch	%R 40-140% for base neutrals; 30-130% for acid compounds	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 40-140% for base neutrals; 30-130% for acid compounds
MS/MSD and LCS/LCSD	1/batch	RPD ≤20%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision	RPD ≤20%

Note: *LCS/LCSD used when MS/MSD not client-supplied.
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD. Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.
Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

QAPP Worksheet #28-4 QC Samples — SVOCs (Soil) (8270)

Matrix	Soil	**Analytical Method/ SOP Reference**	SW846 8270/TACT-2 and TACT-3	**No. of Sample Locations**	Numerous	
Analytical Group	SVOCs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 50%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	RPD < 50%
Surrogates	6 per sample	%R 30-130%	Reanalyze sample	Lab personnel	Accuracy/bias	%R 30-130%
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reanalyze batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
LCS/LCSD*	1 per analytical batch	%R 40-140% for base neutrals; 30-130% for acid compounds	Qualify data as needed or reanalyze batch	Lab personnel	Accuracy/bias	%R 40-140% for base neutrals; 30-130% for acid compounds
Instrument check: bromofluorobenzene	1/calibration	% Relative abundance, see Table 1C of CT RCP	Reanalyze batch	Lab personnel	Accuracy/bias	% Relative abundance, see Table 1C of CT RCP

QAPP Worksheet #28-4 QC Samples — SVOCs (Soil) (8270)

Matrix	Soil	**Analytical Method/ SOP Reference**	SW846 8270/TACT-2 and TACT-3	**No. of Sample Locations**	Numerous	
Analytical Group	SVOCs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Internal standard	At least 6/sample	Area response & retention times, see CT RCP	Reanalyze sample	Lab personnel	Precision	Area response & retention times, see CT RCP
MS	1/batch	%R 40-140% for base neutrals; 30-130% for acid compounds	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 40-140% for base neutrals; 30-130% for acid compounds
MSD	1/batch	%R 40-140% for base neutrals; 30-130% for acid compounds	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 40-140% for base neutrals; 30-130% for acid compounds
MS/MSD and LCS/LCSD	1/batch	RPD ≤30%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision	RPD ≤30%

Note: *LCS/LCSD used when MS/MSD not client-supplied.
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD.
Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.
Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

QAPP Worksheet #28-5 QC Samples — PCBs Water (8082)

Matrix	Water	**Analytical Method/ SOP Reference**	SW846 8082/TACT-6 and TACT-7	**No. of Sample Locations**	Numerous	
Analytical Group	PCBs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	Test America Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 30%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	RPD < 30%
Surrogates	2 per sample	%R 30-150%	Reanalysis or reextraction/ reanalysis of sample	Lab personnel	Accuracy/bias	%R 30-150%
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reextraction/ reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
Laboratory control sample/ laboratory control* sample duplicate	1 per analytical batch	%R 40-140%	Reanalysis or re-extraction/reanalysis of batch	Lab personnel	Accuracy/bias	%R 40-140%
MS/MSD	1/batch	%R 40-140%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 40-140%
MS/MSD and LCS/LCSD	1/batch	RPD ≤50%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision	RPD ≤50%

Note: *LCS/LCSD used when MS/MSD not client-supplied
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD.
Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.
Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

QAPP Worksheet #28-6 QC Samples — PCBs (Soil) (8082)

Matrix	Soil	**Analytical Method/ SOP Reference**	SW846 8082/TACT-7 and TACT-8	**No. of Sample Locations**	Numerous	
Analytical Group	PCBs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-7 and F-8	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 50%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	RPD < 50%
Surrogates	2 per sample	%R 30-150%	Reanalysis or reextraction/ reanalysis of sample	Lab personnel	Accuracy/bias	%R 30-150%
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reextraction/ reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
Laboratory control sample/ laboratory control* sample duplicate	1 per analytical batch	%R 40-140%	Reanalysis or reextraction/ reanalysis of batch	Lab personnel	Accuracy/bias	%R 40-140%
MS/MSD	1/batch	%R 40-140%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 40-140%

QAPP Worksheet #28-6 QC Samples — PCBs (Soil) (8082)

Matrix	Soil	**Analytical Method/ SOP Reference**	SW846 8082/TACT-7 and TACT-8	**No. of Sample Locations**	Numerous	
Analytical Group	PCBs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-7 and F-8	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
MS/MSD and LCS/LCSD	1/batch	RPD ≤50%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision	RPD ≤50%

Note: *LCS/LCSD used when MS/MSD not client-supplied.
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD.
Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.
Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

QAPP Worksheet #28-7 QC Samples — PCDDs and PCDFs Soil (8290)

Matrix	Soil	**Analytical Method/ SOP Reference**	SW846 8290/ TAWS-21 and TAWS-22	**No. of Sample Locations**	Numerous	
Analytical Group	PCDDs and PCDFs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-7 and F-8	**Analytical Organization**	TestAmerica West Sacramento			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 100%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	RPD < 100%
Internal Standards/ Recovery Standards	9 IS/2 RS per sample	Method specified %R limits	Reanalysis or re-extraction/ reanalysis of sample	Lab personnel	Accuracy/bias	Method specified %R limits
Method blanks	1 per analytical batch	< RL	Qualify data as needed or re-extraction/reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
LCS/LCSD	1 per analytical batch	%R 70-130%	Reanalysis or re-extraction/reanalysis of batch	Lab personnel	Accuracy/bias	%R 70-130%
MS/MSD	1/batch	%R 70-130%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 70-130%

QAPP Worksheet #28-7 QC Samples — PCDDs and PCDFs Soil (8290)

Matrix	Soil	**Analytical Method/ SOP Reference**	SW846 8290/ TAWS-21 and TAWS-22	**No. of Sample Locations**	Numerous	
Analytical Group	PCDDs and PCDFs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-7 and F-8	**Analytical Organization**	TestAmerica West Sacramento			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
MS/MSD and LCS/LCSD	1/batch	RPD ≤30%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision	RPD ≤30%

Note: *LCS/LCSD used when MS/MSD not client-supplied.
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD.
Measurement Performance Criteria is method specified or lab-generated limits, whichever is more stringent.
Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

QAPP Worksheet #28-8 QC Samples — Metals Water (6000/7000)

Matrix	Water	**Analytical Method/ SOP Reference**	SW846 6010/7470 TACT10, TACT-11 and TACT-13	**No. of Sample Locations**	Numerous	
Analytical Group	Metals	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 30%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	RPD < 30%
Method blanks	Numerous	< Reporting limit (RL)	Qualify data as needed or reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
Calibration verification standards	Numerous	%R 90-110%	Reanalysis of batch	Lab personnel	Accuracy/bias contamination	%R 90-110%
Reporting Limit standard (CRI)	2/run	%R 70-130% Sb/As/Co/Tl %R 50-150%	Qualify data as needed or reanalysis of batch	Lab personnel	Accuracy/bias contamination	%R 70-130% Sb/As/Co/Tl %R 50-150%
Interference check sample (A and AB)	2/run	%R 80-120%	Qualify data as needed or reanalysis of batch	Lab personnel	Precision — lab	%R 80-120%
Matrix spike	1/batch	%R 75-125%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 75-125%
Laboratory duplicate	1 per 20 field samples of similar matrix	RPD < 20%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision — overall	RPD < 20%

QAPP Worksheet #28-8 QC Samples — Metals Water (6000/7000)

Matrix	Water	**Analytical Method/ SOP Reference**	SW846 6010/7470 TACT10, TACT-11 and TACT-13	**No. of Sample Locations**	Numerous	
Analytical Group	Metals	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Laboratory control sample (LCS)	1/batch	%R 80 – 120%	Qualify data as needed or reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 80 – 120%
Post digestion spike	1/batch	%R 75-125%	Qualify data as needed	Lab personnel	Accuracy/bias	%R 75-125%
Serial dilution	1/batch	% difference (%D) < 10%	Qualify data as needed	Lab personnel	Precision	% difference (%D) < 10%

NOTE: *LCS/LCSD used when MS/MSD not client-supplied
Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.
Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

QAPP Worksheet #28-9 QC Samples — Metals Soil (6000/7000)

Matrix	Soil	**Analytical Method/ SOP Reference**	SW846 6010/7471 TACT-10, TACT-12, and TACT-14	**No. of Sample Locations**	Numerous	
Analytical Group	Metals	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-7 and F-8	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 50%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	RPD < 50%
Method blanks	Numerous	< Reporting limit (RL)	Qualify data as needed or reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Calibration verification standards	Numerous	%R 90-110%	Reanalysis of batch	Lab personnel	Accuracy/bias contamination	%R 90-110%
Reporting Limit standard (CRI)	2/run	%R 70-130% Sb/As/Co/Tl %R 50-150%	Qualify data as needed or reanalysis of batch	Lab personnel	Accuracy/bias contamination	%R 70-130% Sb/As/Co/Tl %R 50-150%
Interference check sample (A and AB)	2/run	%R 80-120%	Qualify data as needed or reanalysis of batch	Lab personnel	Precision — lab	%R 80-120%
Matrix spike	1/batch	%R 75-125%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 75-125%
Laboratory duplicate	1 per 20 field samples of similar matrix	RPD < 35%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision — overall	RPD < 35%

QAPP Worksheet #28-9 QC Samples — Metals Soil (6000/7000)

Matrix	Soil	**Analytical Method/ SOP Reference**	SW846 6010/7471 TACT-10, TACT-12, and TACT-14	**No. of Sample Locations**	Numerous	
Analytical Group	Metals	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-7 and F-8	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Laboratory control sample (LCS)	1/batch	%R vendor's 95% confidence limits	Qualify data as needed or reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R vendor's 95% confidence limits
Post digestion spike	1/batch	%R 75-125%	Qualify data as needed	Lab personnel	Accuracy/bias	%R 75-125%
Serial dilution	1/batch	% difference (%D) < 10%	Qualify data as needed	Lab personnel	Precision	% difference (%D) < 10%

NOTE: *LCS/LCSD used when MS/MSD not client-supplied
Measurement Performance Criteria based on CT Reasonable Confidence Protocols (RCP). Criteria will be CT RCPs or lab-generated limits, whichever is more stringent.
Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

QAPP Worksheet #28-10 QC Samples — VOCs GC/FID Water (8015 & RSK-175)

Matrix	Water	**Analytical Method/ SOP Reference**	SW846 8015; RSK175/ MS-5 and TAW-9	**No. of Sample Locations**	Numerous	
Analytical Group	Light Hydrocarbons	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	Test America Westfield Microseeps (RSK175)			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 30%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	RPD < 30%
Surrogate (8015C)	1 per sample	%R 75-125	Reanalyze sample	Lab personnel	Accuracy/bias	%R 75-125
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reextraction/ reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
Laboratory control sample/ laboratory control* sample duplicate	1 per analytical batch	%R 70-130	Reanalysis or re-extraction/reanalysis of batch	Lab personnel	Accuracy/bias	%R 70-130
MS/MSD	1/batch	%R 50-150	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 50-150
MS/MSD and LCS/LCSD	1/batch	RPD ≤30%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision	RPD ≤30%

Note: *LCS/LCSD used when MS/MSD not client-supplied
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD.
Method Performance Criteria or lab-generated limits, whichever is more stringent.
Laboratories are required to run the latest State-certified, industry-standard version of the specified method.

QAPP Worksheet #28-11 QC Samples — Anions Water (300.0)

Matrix	Water	**Analytical Method/ SOP Reference**	EPA 300.0/TACT-15	**No. of Sample Locations**	Numerous	
Analytical Group	Sulfate, Chloride, Nitrate, Nitrite	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 30%	Qualify data as needed	Polly Newbold, ddms	Precision - overall	RPD < 30%
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
Laboratory control sample	1 per analytical batch	%R 80-120	Reanalysis of batch	Lab personnel	Accuracy/bias	%R 80-120
MS	1 per 20 field samples of similar matrix	%R 75-125	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 75-125
Laboratory duplicate	1 per 20 field samples of similar matrix	%RPD ≤20%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision — overall	%RPD ≤20%

Note: *LCS/LCSD used when MS/MSD not client-supplied.
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD.
Method Performance Criteria or lab-generated limits, whichever is more stringent.

QAPP Worksheet #28-12 QC Samples — Wet Chemistry Water

Matrix	Water	**Analytical Method/ SOP Reference**	EPA 300.0, 310.1, 376.2, SW846 9040B/ TACT-15, TACT-16, TACT-17 & TAN-18	**No. of Sample Locations**	Numerous	
Analytical Group	Anions, pH, Alkalintiy, Sulfide	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut & TestAmerica Nashville			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 30%	Qualify data as needed	Polly Newbold, ddms	Precision - overall	RPD < 30%
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
Laboratory control sample	1 per analytical batch	%R 80-120	Reanalysis of batch	Lab personnel	Accuracy/bias	%R 80-120
MS (if possible)	1 per 20 field samples of similar matrix	%R 75-125	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 75-125
Laboratory duplicate	1 per 20 field samples of similar matrix	%RPD ≤20%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	%RPD ≤20%

Note: *LCS/LCSD used when MS/MSD not client-supplied.
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD.
Method Performance Criteria or lab-generated limits, whichever is more stringent.

QAPP Worksheet #28-13 QC Samples — TOC Water (9060)

Matrix	Water	**Analytical Method/ SOP Reference**	SW846 9060/ TACT-20	**No. of Sample Locations**	Numerous	
Analytical Group	TOC	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-4, F-5 and/or F-6	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 30%	Qualify data as needed	Polly Newbold, ddms	Precision - overall	RPD < 30%
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
Laboratory control sample	1 per analytical batch	%R 80-120	Reanalysis of batch	Lab personnel	Accuracy/bias	%R 80-120
MS	1 per 20 field samples of similar matrix	%R 75-125	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 75-125
Laboratory duplicate	1 per 20 field samples of similar matrix	%RPD ≤20%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision — overall	%RPD ≤20%
Laboratory quadruplicate analysis	1 per 20 field samples of similar matrix	%RSD lab-generated limits	Qualify data as needed	Lab personnel	Precision — overall	%RSD lab-generated limits

Note: *LCS/LCSD used when MS/MSD not client-supplied.
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD.
Method Performance Criteria or lab-generated limits, whichever is more stringent.

QAPP Worksheet #28-14 QC Samples — TOC Soil (9060)

Matrix	Soil	**Analytical Method/ SOP Reference**	SW846 9060/ TACT-19	**No. of Sample Locations**	Numerous	
Analytical Group	TOC	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-7 and F-8	**Analytical Organization**	TestAmerica Connecticut			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 50%	Qualify data as needed	Polly Newbold, ddms	Precision - overall	RPD < 50%
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reanalysis of batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Equipment blanks	1 per 20 field samples	< RL	Qualify data as needed	Polly Newbold, ddms	Accuracy/bias contamination	< RL
Laboratory control sample	1 per analytical batch	%R 80-120	Reanalysis of batch	Lab personnel	Accuracy/bias	%R 80-120
MS	1 per 20 field samples of similar matrix	%R 75-125	Qualify data as needed	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 75-125
Laboratory duplicate	1 per 20 field samples of similar matrix	%RPD ≤35%	Qualify data as needed	Lab and/or Polly Newbold, ddms	Precision — overall	%RPD ≤35%
Laboratory quadruplicate analysis	1 per 20 field samples of similar matrix	%RSD lab-generated limits	Qualify data as needed	Lab personnel	Precision — overall	%RSD lab-generated limits

Note: *LCS/LCSD used when MS/MSD not client-supplied.
An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, MS/MSD, and LCS/LCSD.
Method Performance Criteria or lab-generated limits, whichever is more stringent.

QAPP Worksheet #28-15 QC Samples — VOCs (Air) (TO-15)

Matrix	Air	**Analytical Method/ SOP Reference**	EPA TO-15/TABR-23	**No. of Sample Locations**	Numerous	
Analytical Group	VOCs	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-14, F-15 or F-16	**Analytical Organization**	TestAmerica Burlington			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 50%	Qualify data as needed	Polly Newbold, ddms	Precision — overall	RPD < 50%
Method blanks	1 per analytical batch	< RL	Qualify data as needed or reanalyze batch	Lab and/or Polly Newbold, ddms	Accuracy/bias contamination	< RL
Laboratory control sample/ laboratory control* sample duplicate	1 per analytical batch	%R 70 – 130%	Qualify data as needed or reanalyze batch	Lab and/or Polly Newbold, ddms	Accuracy/bias	%R 70 – 130%
LCS/LCSD	1/batch	RPD ≤25%	Qualify data as needed or reanalyze batch	Lab and/or Polly Newbold, ddms	Precision	RPD ≤25%
Instrument check: BFB	1 per 24 hours	See method for % Relative abundance	Reanalyze batch	Lab personnel	Accuracy/bias	% Relative abundance
Internal standard	At least three/sample	Area response ±40% & retention times ±0.33 min.	Reanalyze sample	Lab personnel	Precision	Area response & retention times

Note: An analytical batch is defined as no more than 20 analytical sample including field samples, blanks, LCS/LCSD.
Measurement Performance Criteria is based on CT RCPs. See CT RCPs for details and exceptions.
Method Performance Criteria or lab-generated limits, whichever is more stringent

QAPP Worksheet #28-16 QC Samples — Temperature, pH, Turbidity, Conductivity, DO and Specific Conductance (Water)

Matrix	Water	**Analytical Method/ SOP Reference**	F-1 and F-17	**No. of Sample Locations**	Numerous	
Analytical Group	Temperature, pH, Turbidity, Conductivity, DO and Specific Conductance	**Sampler's Name**	NA			
Concentration Level	All	**Field Sampling Organization**	ARCADIS Sampling Personnel			
Sampling SOP	F-1 and F-17	**Analytical Organization**	ARCADIS			
QC Sample	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action**	**Person(s) Responsible for Corrective Action**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Field duplicate	1 per 20 field samples of similar matrix	RPD < 50%	Reanalyze sample or recalibrate and reanalyze sample	ARCADIS Sampling Personnel	Precision — overall	RPD < 50%

QAPP Worksheet #29 Project Documents and Records

Sample Collection Documents and Records	On-site Analysis Documents and Records[1]	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
- Field Notes - Sampling Logs - Chain-of-Custody Records - Air Bills - Custody Seals	- Equipment Calibration Logs - Field Data Records - Field Instrument Maintenance Logs	- Sample Receipt, Custody and Tracking Records - Standard Traceability Logs - Equipment Calibration Logs - Sample Prep Logs - Run Logs - Equipment Maintenance, Testing and Inspection Logs - Corrective Action Forms - Reported Field Sample Results - Reported Results for Standards, QC Checks and QC Samples - Instrument Printouts (raw data) for Field Samples, Standards, QC Checks and QC Samples - Data Package Completeness Checklists - Sample Disposal Records - Extraction/Cleanup Records - Raw Data (stored on disk or CD-R) - Analytical Reports to Polly Newbold, ddms	- Data Validation Checklists/reports - Data Quality Assessments	- FSP - HASP - QAPP - Data Management Plan - Pilot Study Summary Reports - Risk Assessments - Routine Monitoring Reports - Record of Decision documents - Proposed Plans - Feasibility Studies - Long-Term Monitoring Reports

QAPP Worksheet #30 Analytical Services

Matrix	Analytical Group	Concentration Level	Analytical SOP	Data Package Turnaround Time (calendar days)	Laboratory/Organization (name and address, contact person and telephone number)	Backup Laboratory/Organization (name and address, contact person and telephone number)
Groundwater	Volatiles, Semivolatiles, PCBs, Metals, TOC, Wet Chemistry	All	TACT-1, TACT-2, TACT-4, TACT-7, TACT-8, TACT-10, TACT-11, TACT-13, TACT-15, TACT-16, TACT-17, TACT-20	10 days for EDD and PDF of Level 2, and 20 days for Level 3 Data Packages	TestAmerica Connecticut 128 Long Hill Cross Rd. Shelton, CT 06484 203.929.8140	NA
Groundwater	1.4-Dioxane	All	TAT-24	10 days for EDD and PDF of Level 2, and 20 days for Level 3 Data Packages	TestAmerica Connecticut[1] Analysis to be completed by: TestAmerica Tampa 6712 Benjamin Rd Suite 100 Tampa, FL 33634 813.885.7427	NA
Groundwater	Dissolved Gases	All	MS-5	10 days for EDD and PDF of Level 2, and 20 days for Level 3Data Packages	Microseeps, Inc. 220 William Pitt Way Pittsburgh, PA 15238 412.826.2389	NA
Groundwater	Alcohols	All	TAW-9	10 days for EDD and PDF of Level 2, and 20 days for Level 3 Data Packages	TestAmerica Connecticut[1] Analysis to be completed by: TestAmerica Westfield 53 Southampton Rd. Westfield, MA 01085 413.572.4000	NA

QAPP Worksheet #30 Analytical Services

Matrix	Analytical Group	Concentration Level	Analytical SOP	Data Package Turnaround Time (calendar days)	Laboratory/Organization (name and address, contact person and telephone number)	Backup Laboratory/Organization (name and address, contact person and telephone number)
Groundwater	Sulfide	All	TAN-18	10 days for EDD and PDF of Level 2, and 20 days for Level 3 Data Packages	TestAmerica Connecticut[1] Analysis to be completed by: TestAmerica Nashville 2960 Foster Creighton Dr Nashville, TN 37204 615.726.0177	NA
Soil	Volatiles, Semivolatiles, PCBs, Metals, TOC	All	TACT-1, TACT-2, TACT-7, TACT-8, TACT-10, TACT-12, TACT-14, TACT-19	10 days for EDD and PDF of Level 2, and 20 days for Level 3 Data Packages	Analysis to be completed by: TestAmerica Connecticut 128 Long Hill Cross Rd. Shelton, CT 06484 203.929.8140	NA
Soil	Dioxins	All	TAWS-22	10 days for EDD and PDF of Level 2, and 20 days for Level 3 Data Packages	TestAmerica Connecticut[1] Analysis to be completed by: TestAmerica Sacramento 880 Riverside Parkway West Sacramento, CA 95605 916.373.5600	NA
Ambient Air	Volatiles	All	TABR-23	10 days for EDD and PDF of Level 2 and 20 days for Level 3 Data Packages	TestAmerica Connecticut[1] Analysis to be completed by: TestAmerica Burlington 30 Community Drive, Suite 11 South Burlington, VT 05446 802.660.1990	NA

Note: (1) With the exception of the samples being submitted for the analysis of dissolved gases which will be analyzed b y Microseeps all other samples will submit to TestAmerica Connecticut (TACT). TACT will be responsible for the submittal of all data deliverables and meeting turnaround times for any analysis which TACT will subcontract to a laboratory within their laboratory system. Each type of analysis to be performed has been outlined which laboratory within the TA laboratory system will perform the analysis. Therefore, prior to any subcontracting of analytical services contrary to outlined in this QAPP, TA-Connecticut must obtain written approval by project QA Manager.

QAPP Worksheet #31 Planned Project Assessments

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CAs) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Field Audit (Groundwater Sampling Program)	1 per year	Internal	de maximis and ARCADIS	TBA, Field Team Leader, ARCADIS	David Cornell, Field Team Coordinator, ARCADIS	Jeff Holden, Project Manager, ARCADIS	Bruce Thompson, Project Coordinator, de maximis
Laboratory Audit of TestAmerica Connecticut (TACT)	As necessary based on laboratory performance	External	ddms and ARCADIS	Polly Newbold QA Manager/Validator ddms and Dennis Capria, QA Coordinator, ARCADIS	Johanna Dubauskas, Laboratory Project Manager, TACT	Dawn May, Laboratory QA Manager, TACT	Bruce Thompson, Project Coordinator, de maximis
Laboratory Audit of Microseeps	As necessary based on laboratory performance	External	ddms and ARCADIS	Polly Newbold QA Manager/Validator ddms and Dennis Capria, QA Coordinator, ARCADIS	Debbie Hallo, Project Manager, Microseeps	Patrick McLoughlin, Laboratory QA Manager, Microseeps	Bruce Thompson, Project Coordinator, de maximis
Laboratory Audit	Per Laboratory Quality Assurance Program	Internal	TestAmerica and Microseeps	Laboratory QA Manager	Laboratory QA Manager	Laboratory Project Manager	Polly Newbold QA Manager/Validator ddms and Dennis Capria, QA Coordinator, ARCADIS

QAPP Worksheet #31 Planned Project Assessments

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CAs) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Field Inspections	Intermittent	Internal	de maximis and ARCADIS	TBA, Field Team Leader, ARCADIS	David Cornell, Field Team Coordinator, ARCADIS	Jeff Holden, Project Manager, ARCADIS	Bruce Thompson, Project Coordinator, de maximis
Safety Audits	Annually and Field Assessment based on > 400 field hours/ quarter	Internal	de maximis and ARCADIS	Corporate H&S Staff, Regional H&S Manager or Regional H&S Specialist	David Cornell, Field Team Coordinator, ARCADIS	Jeff Holden, Project Manager, ARCADIS	Bruce Thompson, Project Coordinator, de maximis

QAPP Worksheet #32 Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Field Sampling Technical Systems Audit	Written Audit Report	Jeff Holden, Project Manager, ARCADIS, Bruce Thompson, Project Coordinator, de maximis and Karen Lumino, USEPA	72 hours after audit	Letter	David Cornell, Field Team Coordinator, ARCADIS	48 hours after notification
Contract Laboratory Technical Audit (external)	Written Audit Report	Johanna Dubauskas (TA CT Project Manager), Debbie Hallo (Microseeps Project Manager), Jeff Holden, Project Manager, ARCADIS, Bruce Thompson, Project Coordinator, de maximis, Polly Newbold QA Manager/Validator, ddms, Dennis Capria, QA Coordinator, ARCADIS and Karen Lumino, USEPA	1 week after audit	Letter	Dawn May (TACT Laboratory QA Manager) and Patrick McLoughlin (Microseeps Laboratory QA Manager)	48 hours after notification
Field Inspection	Memorandum	David Cornell, Field Team Coordinator, ARCADIS	2 days	Memorandum	Jeff Holden, Project Manager, ARCADIS and Bruce Thompson, Project Coordinator, de maximis	48 hours after notification

QAPP Worksheet #32 Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Contract Laboratory Technical Audit (internal)	Memorandum	Johanna Dubauskas (TACT Project Manager), Debbie Hallo (Microseeps Project Manager), and Polly Newbold QA Manager/Validator, ddms, and Dennis Capria, QA Coordinator, ARCADIS	2 days	Memorandum	Dawn May (TACT Laboratory QA Manager) and Patrick McLoughlin (Microseeps Laboratory QA Manager)	48 hours after notification

QAPP Worksheet #33 QA Management Reports

Type of Report	Frequency (e.g., daily, weekly monthly, quarterly, annually)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Field Sampling Technical Systems Audit Report	1/year	NA	David Cornell, ARCADIS (Field Program Coordinator)	Jeff Holden, Project Manager, ARCADIS and Bruce Thompson, Project Coordinator, de maximis
Contract Laboratory Technical Audit Report	As necessary during project	NA	Polly Newbold QA Manager/Validator, ddms and Dennis Capria, QA Coordinator, ARCADIS	Jeff Holden, Project Manager, ARCADIS and Bruce Thompson, Project Coordinator, de maximis
Data Validation Reports	As specified in the Data Assessment section based on intended use of the data and required percentage to meet project DQOs	As generated throughout project	Polly Newbold QA Manager/Validator, ddms	Jeff Holden, Project Manager, ARCADIS and Bruce Thompson, Project Coordinator, de maximis
Data Quality Summary Reports	As appropriate for data use and as required for report completion	As generated throughout project	Polly Newbold QA Manager/Validator, ddms	Jeff Holden, Project Manager, ARCADIS and Bruce Thompson, Project Coordinator, de maximis

QAPP Worksheet #34 Verification (Step I) Process

Verification Input	Description	Internal/ External	Responsible for Verification (name, organization)
Chain-of-custody and shipping forms	Chain-of-custody forms and shipping documentation will be reviewed by laboratory upon receipt of samples for verification against the sample coolers they represent. Chain-of-custody form will be signed by all parties that had custody of samples, with the exception of commercial carriers.	External	Johanna Dubauskas, TACT Debbie Hallo, Microseeps
Field notes and sampling logs	All field notes and sampling logs will be reviewed internally and placed in the project file.	Internal	Polly Newbold QA Manager/Validator, ddms
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	Internal	Dawn May, TACT Patrick McLoughlin, Microseeps Doug Weir, TA Sacramento Christine Reynolds, TA Westfield Kirstin L. McCracken, TA Burlington Eric Smith, TA Nashville Lori Mangrum, TA Tampa
Laboratory data	All final data packages will be verified for content upon receipt.	External	Polly Newbold QA Manager/Validator, ddms

QAPP Worksheet #35 Validation (Steps IIa and IIb) Process

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
Step IIa	Sampling methods and procedures	Establish that required sampling methods were used and that any deviations were noted. Provide that the sampling procedures and field measurements met performance criteria and that any deviations were documented.	David Cornell, ARCADIS
Step IIa	Analytical method and procedures	Establish that required analytical methods were used and that any deviations were noted. The laboratory will provide that QC samples met performance criteria and that any deviations were documented in the report narrative.	Dawn May, TACT Patrick McLoughlin, Microseeps Doug Weir, TA Sacramento Christine Reynolds, TA Westfield Kirstin L. McCracken, TA Burlington Eric Smith, TA Nashville Lori Mangrum, TA Tampa
Step IIa Modified	Analytical method and procedures	Review associated blanks for potential contamination and verify that all preparations and analyses have been performed within applicable holding times.	Polly Newbold, ddms
Step IIb	Documentation of QAPP QC sample results	Establish that all QAPP-required QC samples were collected and analyzed.	Polly Newbold, ddms

QAPP Worksheet #35 Validation (Steps IIa and IIb) Process

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
Step IIb	Project quantitation limits	Determine that the project quantitation limits were achieved, as outlined in the QAPP.	Polly Newbold, ddms
Step IIb	Performance criteria	Tier III data validation for each parameter class for the first laboratory data package for a given sampling event, and for chemical results that are deemed "important" - for that site, important meant site boundary determination, clean-up compliance, and remedial decision verification (e.g., background samples). All remaining data went through Tier II validation (review of case narrative, QC summary forms, sample re-analysis, and secondary dilutions).	Polly Newbold, ddms
Step IIb	Validation Report	Summarize data verification and validation components included in the Performance Review. Include qualified data and explanation of all qualifiers.	Polly Newbold, ddms

QAPP Worksheet #36 Validation (Steps IIa and IIb) Summary

Step IIa/IIb	Matrix	Analytical Group	Data Purpose	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	Aqueous/soil	VOCs, SVOCs, PCBs, Alcohols, Dissolved Gases	Contaminant delineation, risk assessment, confirmation of remediation	Low, medium, high	USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, October 1999; USEPA Region I Volatile/Semi-volatile Data Validation Guidelines 1996; ; USEPA Region I Pesticide/PCB Data Validation Guidelines 2004; CT Reasonable Confidence Protocols November 2007; method criteria; QAPP criteria; and professional judgment	Polly Newbold QA Manager/Validator, ddms
IIa and IIb	Soil	Dioxins	Contaminant delineation, risk assessment, confirmation of remediation	Low, medium, high	USEPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins and Chlorinated Dibenzofurans Data Review September 2005; method criteria; QAPP criteria; and professional judgment	Polly Newbold QA Manager/Validator, ddms
IIa and IIb	Aqueous/soil	Metals, general chemistry parameters	Contaminant delineation, risk assessment, confirmation of remediation	Low, medium, high	USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, USEPA Region I Inorganic Data Validation Guidelines 2008; CT Reasonable Confidence Protocols; method criteria; QAPP criteria; and professional judgment	Polly Newbold QA Manager/Validator, ddms

QAPP Worksheet #36 Validation (Steps IIa and IIb) Summary

Step IIa/IIb	Matrix	Analytical Group	Data Purpose	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	Air	VOCs	Contaminant delineation, risk assessment, confirmation of remediation	Low, medium, high	USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, October 1999; USEPA Region I Volatile/Semi-volatile Data Validation Guidelines 1996; method criteria; QAPP criteria; and professional judgment	Polly Newbold QA Manager/Validator, ddms

Note: Tier III data validation will be performed for each parameter class for the first laboratory data package for a given sampling event, and for chemical results that support site boundary determination, clean-up compliance, and remedial decision verification (e.g., background samples). All remaining data will be Tier II validation (review of case narrative, QC summary forms, sample re-analysis, and secondary dilutions).

QAPP Worksheet #37 Usability Assessment

The Data Usability Assessment will be performed by ddms for data associated with delineation, risk assessment or confirmation of remedial achievement. Documentation generated during the usability assessment will consist of data validation checklists with a brief summary of overall data usability.

The Data Usability Assessment process involves data verification and data validation. Data verification is the process by which laboratory results are checked to provide that the proper quality control steps were performed and key items have met QC objectives (both analytical and contractual). The key items checked in an ddms data verification include:

- sample collection, handling and analysis procedures
- field sampling, handling and analysis activities will be documented (e.g., QC signatures in field logs, QC checklist)
- sampling, handling, on-site analytical and off-site laboratory data will be verified internally at the data generator level
- laboratory data (e.g., laboratory-qualified data)
- sampling, on-site analytical and off-site laboratory data
- data package deliverable completeness
- review of case narrative
- present all analytical results
- QC sample data summaries
- applicable raw data

All required data deliverables must be present in the data package in order to proceed to the next step of data validation.

Data validation entails a review of the sample collection, handling, field analysis and QC data, and the raw data to verify that the laboratory was operating within required limits; analytical results were correctly transcribed from the instrument read-outs; and which (if any) environmental samples were related to out-of-control QC samples. The objective of data validation is to identify any questionable or invalid laboratory measurements.

The data quality indicators (DQIs) used to evaluate conformance with the project DQOs are presented below.

QAPP Worksheet #37 Usability Assessment

DQIs are generally defined in terms of six parameters:

1. representativeness
2. comparability
3. completeness
4. precision
5. accuracy
6. sensitivity

Each parameter is defined below. Specific objectives for the site actions are presented in other sections of this QAPP, as referenced below.

Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent site conditions, and is dependent on sampling and analytical variability and the variability of environmental media at the site. Actions have been designed to assess the presence of chemical constituents at the time of sampling. The QAPP presents the rationale for sample quantities and location. This QAPP presents field sampling and laboratory analytical methodologies. Use of the prescribed field and laboratory analytical methods with associated holding times and preservation requirements are intended to provide representative data.

Comparability

Comparability is the degree of confidence with which one data set can be compared to another. Comparability between phases of the actions (if additional phases are required) will be maintained through consistent use of the sampling and analytical methodologies set forth in this QAPP, established QA/QC procedures and use of appropriately trained personnel.

QAPP Worksheet #37 Usability Assessment

Completeness

Completeness is defined as a measure of the amount of valid data obtained from an event and/or investigation compared to the total amount that was obtained. This will be determined upon final assessment of the analytical results. Completeness of a field or laboratory data set will be calculated by comparing the number of valid sample results generated to the total number of results generated.

$$\text{Completeness} = \frac{\text{Number valid results}}{\text{Total number of results generated}} \times 100$$

As a general guideline, overall project completeness is expected to be at least 90 percent. The assessment of completeness will require professional judgment to determine data usability for intended purposes.

Precision

Precision is a measure of the reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the objectives of the action. To maximize precision, sampling and analytical procedures will be followed. All work for the site actions will adhere to established protocols presented in the QAPP. Checks for analytical precision will include the analysis of MS/MSDs, laboratory duplicates and field duplicates. Checks for field measurement precision will include duplicate field measurements.

The precision of data will be measured by calculating the Relative Percent Difference (RPD) by the following equation:

$$\text{RPD} = \frac{(A-B)}{(A+B)/2} \times 100$$

Where:

A = Analytical result from one of two duplicate measurements

B = Analytical result from the second measurement

QAPP Worksheet #37 Usability Assessment

Accuracy

Accuracy is a measure of how close a measured result is to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, reference standards, MSs, blank spikes and surrogate standards will be used to assess the accuracy of the analytical data.

Accuracy will be calculated in terms of percent recovery as follows:

$$\% \text{ Recovery} = \frac{A-X}{B} \times 100$$

Where:

A = Value measured in spiked sample or standard

X = Value measured in original sample

B = True value of amount added to sample or true value of standard

Sensitivity

Sensitivity is a quantitative measurement to determine if the analytical laboratory's procedures/methodologies and their associated MDLs can satisfy the project requirements as they relate to the project action limits. MDLs are updated annually by the laboratory. The current MDLs for the analytical laboratories are presented in Worksheet #15.

Data Validation and Usability

ddms will validate all data generated using the USEPA's National Functional Guidelines (USEPA 1999; 2004), USEPA Region I Data Validation Guidelines Volatile/Semi-volatile (December 1996), Pesticides/PCBs (February 2004), and Inorganic (November 2008), and Connecticut Reasonable Confidence Protocols (RCPs)(November 2007). The reporting limits, hold times, preservatives and QA/QC is consistent with CT RCPs to the extent possible. Where it can't comply with CT RCPs, alternate approaches were developed in consideration of site-specific factors and the requirements of the lead regulatory agency (USEPA). These

QAPP Worksheet #37 Usability Assessment

procedures and criteria may be modified, as necessary, to address project-specific and method-specific criteria, control limits and procedures. Data validation will consist of data screening, checking, reviewing, editing and interpretation to document analytical data quality and to determine whether the quality is sufficient to meet the DQOs.

The data validator will verify that reduction of laboratory measurements and laboratory reporting of analytical parameters is in accordance with the procedures specified for each analytical method and/or as specified in this QAPP. Any deviations from the analytical method or any special reporting requirements apart from those specified in this QAPP will be detailed on COC forms.

Upon receipt of laboratory data, the following procedures will be executed by the data validator:

- Evaluate completeness of data package.
- Verify that field COC forms were completed and that samples were handled properly.
- Verify that holding times were met for each parameter. Holding time exceedances, should they occur, will be documented. Data for all samples exceeding holding time requirements will be flagged as either estimated or rejected. The decision as to which qualifier is more appropriate will be made on a case-by-case basis.
- Verify that parameters were analyzed according to the methods specified.
- Review QA/QC data (i.e., confirm that duplicates, blanks and spikes were analyzed on the required number of samples, as specified in the method and verify that duplicate and MS recoveries are acceptable).
- Investigate anomalies identified during review. When anomalies are identified, they will be discussed with the Project Manager and/or Laboratory Manager, as appropriate.
- If data appear suspect, investigate the specific data of concern. Calculations will be traced back to raw data. If calculations do not agree, the cause will be determined and corrected.

Deficiencies discovered as a result of the data review, as well as the corrective actions implemented in response, will be documented and submitted in the form of a written report addressing the following topics, as applicable to each method:

- assessment of the data package

QAPP Worksheet #37 Usability Assessment

- description of any protocol deviations
- failures to reconcile reported and/or raw data
- assessment of any compromised data
- overall appraisal of the analytical data
- table of site name, sample quantities, matrix and fractions analyzed

It should be noted that qualified results do not necessarily invalidate data. The goal to produce the best possible data does not necessarily mean that data must be produced without QC qualifiers. Qualified data can provide useful information.

During the review process, laboratory qualified and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results will be qualified with the following codes in accordance with the USEPA National Functional Guidelines:

Validation qualifiers:

U The analyte/compound was analyzed for, but not detected. The associated value is the compound quantitation limit.

UJ The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.

J The compound was positively identified; however, the associated numerical value is an estimated concentration only.

JN The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.

R The sample results are rejected.

Typical laboratory Qualifiers

Concentration (C) qualifiers:

U The analyte/compound was analyzed for but not detected. The associated value is the compound quantitation limit.

QAPP Worksheet #37 Usability Assessment

Inorganics:

B The reported value was obtained from a reading less than the required reporting limit (RL), but greater than or equal to the instrument.

Quantitation (Q) qualifiers:

Inorganics:

E The reported value is estimated due to the presence of interference.
N Spiked sample recovery not within control limits.
* Duplicate analysis not within control limits.

Organics:

J The compound was positively identified; however, the associated numerical value is an estimated concentration only.
B The compound has been found in the sample as well as its associated blank; its presence in the sample may be suspect.
N The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification.
P The lower of the two values is reported when the percent difference between the results of two GC columns is greater than 25 percent.
E The compound was quantitated above the calibration range.
D Concentration is based on a diluted sample analysis.
C Identification confirmed by gas chromatography/mass spectrometry (GC/MS).

QAPP Worksheet #37 Usability Assessment

Two facts will be noted to all data users. First, the "R" flag means that the associated value is unusable. In other words, due to significant QC problems, the analysis is invalid and provides no information as to whether the compound is present or not. "R" values should not appear on data tables because they cannot be relied upon, even as a last resort. The second fact is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

Resolution of any issues regarding laboratory performance or deliverables will be handled between the laboratory and the data validator. Suggestions for reanalysis may be made by the QAC at this point.

Validation Reports

The data validation reports will identify all deficiencies and the potential impact on the results. The Validation and Database Project Team will amend qualifiers generated during the validation process to the database. The validation checklists and the database will be the primary location of all applicable data qualifiers. The original values and laboratory qualifiers are archived and accessible. Qualifiers will not be applied to the hard copy analytical reports.

Field Data Review

Field data are generated from in-field measurement, which may include a geophysical survey, well development, groundwater sampling and surface-water sampling. The quality objective for the in-field measurement activities is to obtain accurate measurements of sample characteristics, including pH, conductivity, temperature, turbidity, dissolved oxygen and/or redox potential, using appropriate equipment. Data are recorded in field logbooks or on field sampling sheets and calibration logs. Calibration logs will be reviewed with other field documentation to identify any potential impacts to data quality and usability. Field logbooks are reviewed as part of the QC inspections.

Reconciliation with Data Usability Requirements

The data results will be examined to determine the performance that was achieved for each data usability criterion. The performance will then be compared with the project objectives and DQOs. Deviations from objectives will be noted. Additional action may be warranted when performance does not meet performance objectives for critical data. Options for corrective action relating to incomplete information, questionable results, or inconsistent data may include any or all of the following:

- retrieval of missing information

QAPP Worksheet #37 Usability Assessment

- request for additional explanation or clarification
- reanalysis of sample from extract (when appropriate)
- recalculation or reinterpretation of results by the laboratory

These actions may improve the data quality, reduce uncertainty and eliminate the need to qualify or reject data.

If these actions do not improve the data quality to an acceptable level, the following additional actions may be taken:

- extrapolation of missing data from existing data points
- use of historical data
- evaluation of the critical/noncritical nature of the sample

If the data gap cannot be resolved by these actions, the data bias and potential for false negatives and positives can be evaluated. If the resultant uncertainty level is unacceptable, the following action must be taken:

- additional sample collection and analysis

ARCADIS

Appendices

ARCADIS

Appendix C-1

Laboratory Quality Assurance Management Plans, SOPs and Certifications (included on CD only)

ARCADIS

Appendix C-2

Chain of Custody

ARCADIS
Infrastructure, environment, facilities

ID#:

CHAIN OF CUSTODY & LABORATORY ANALYSIS REQUEST FORM

Page ___ of ___

Lab Work Order #

Send Results to:

Contact & Company Name:	Telephone:
Address:	Fax:
City State Zip	E-mail Address:
Project Name/Location (City, State):	Project #:
Sampler's Printed Name:	Sampler's Signature:

Preservative								
Filtered (✓)								
# of Containers								
Container Information								

PARAMETER ANALYSIS & METHOD

Keys

Preservation Key:
A. H_2SO_4
B. HCL
C. HNO_3
D. NaOH
E. None
F. Other: _____
G. Other: _____
H. Other: _____

Container Information Key:
1. 40 ml Vial
2. 1 L Amber
3. 250 ml Plastic
4. 500 ml Plastic
5. Encore
6. 2 oz. Glass
7. 4 oz. Glass
8. 8 oz. Glass
9. Other: _____
10. Other: _____

Matrix Key:
SO - Soil | SE - Sediment | NL - NAPL/Oil
W - Water | SL - Sludge | SW - Sample Wipe
T - Tissue | A - Air | Other: _____

Sample ID	Collection Date	Collection Time	Type (✓) Comp	Type (✓) Grab	Matrix								**REMARKS**

Special Instructions/Comments:

☐ **Special QA/QC Instructions(✓):**

Laboratory Information and Receipt		**Relinquished By**	**Received By**	**Relinquished By**	**Laboratory Received By**
Lab Name:	Cooler Custody Seal (✓)	Printed Name:	Printed Name:	Printed Name:	Printed Name:
☐ Cooler packed with ice (✓)	☐ Intact ☐ Not Intact	Signature:	Signature:	Signature:	Signature:
Specify Turnaround Requirements:	Sample Receipt:	Firm:	Firm/Courier:	Firm/Courier:	Firm:
Shipping Tracking #:	Condition/Cooler Temp: _____	Date/Time:	Date/Time:	Date/Time:	Date/Time:

Distribution: **WHITE – Laboratory returns with results** **YELLOW – Lab copy** **PINK – Retained by ARCADIS**