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Superfund Records Center
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US ARMY CORPS
OF ENGINEERS
New England District

Contract No. DACW33-01-D-0004
Delivery Order No. 01
September 2002

FINAL QUALITY ASSURANCE PROJECT PLAN — ADDENDUM

Interim Data Collection Remedial Investigation And Feasibility Study Centredale Manor Restoration Project Site North Providence, Rhode Island

Addendum to Tasks 19-22 QAPP (5/23/2001)

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SDMS DocID 35828

1.0 TITLE AND APPROVAL PAGE (EPA WORKSHEET #1)

Site Name/Project Name: *Centredale Manor Restoration Project Superfund Site Baseline Risk Assessment, Initial Project Planning and Support*
Site Location: *Centredale Manor, Lyman Mill Pond and Allendale Pond, North Providence, Rhode Island*

Document Title: *Centredale Manor Tasks 19–22 Quality Assurance Project Plan – Addendum*

Lead Organization (Agency, State, Tribe, Federal Facility, PRP, or Grantee): *Battelle Duxbury Operations*

Preparer's Name and Organizational Affiliation: *Deirdre Dahlen/Battelle Duxbury Operations*

Preparer's Address and Telephone Number: *397 Washington Street, Duxbury, MA 02332 (781) 934-5253*

Preparation Date (Day/Month/Year): *9/27/02*

Investigative Organization's Project Manager: Wm Steinhauer 9/26/02

Signature/Date

William Steinhauer/Battelle Duxbury Operations 9/27/02

Printed Name/Organization

Investigative Organization's Project QA Officer: Mark Guilmain 9-25-02

Signature/Date

Mark Guilmain/Battelle Duxbury Operations 9/25/02

Printed Name/Organization

Lead Organization's Project Manager: Wm Steinhauer 9/26/02

Signature/Date

William Steinhauer/Battelle Duxbury Operations 9/27/02

Printed Name/Organization

Approval Signature:

Signature/Date

Andy Beliveau/ QA Officer

Printed Name/Title

EPA Region 1

Approval Authority

Other Approval Signatures:

Signature/Date

Laureen Borochaner/USACE NAE Project Officer

Printed Name/Title

Document Control Number: *Not applicable.*

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2.0 CONTENTS AND DOCUMENTATION FORMAT

2.1 Table of Contents

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ATTACHMENTS

FIGURES

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TABLES

GLOSSARY OF TERMS

Term	Definition	Term	Definition
Types of plans/documents		*Sampling Locations*	
FSP	Field sampling plan	LPX	Lyman Mill Pond
QAPP	Quality assurance project plan (also referred to as sampling and analysis plan, SAP)	CMS	Centredale Manor Site
SOP	Standard Operating Procedure		
SOW	Statement of Work	*Laboratories*	
		AMS	Applied Marine Sciences, Inc.
Field Terms		BATD	Battelle Duxbury
AOC	Area of Concern	BCO	Battelle Columbus
COC	Chain of custody	MSL	Battelle Marine Sciences Laboratory
DI	Deionized	STLP	Severn Trent Laboratories Pittsburgh
DU	Field sample duplicate (referred to as REPLICATE in database)		
FOL	Field operations leader	*Analytical Terms*	
GPS	Global positioning system	B2EHP	Bis (2-ethylhexyl) phthalate
IDW	Investigation derived waste	CC	Continuing calibration
PID	Photoionization Detector	CCV	Continuing calibration verification
PIP	Project Implementation Plan	COPC	Chemicals of potential concern
PPE	Personal Protective Equipment	CVAA	Cold vapor atomic absorption
RB	Rinsate blank	CVAF	Cold vapor atomic fluorescence
TOW/TOC	Top of Wall/Top of Casing	DCM	Dichloromethane (also referred to as methylene chloride)
USCS	Unified Soil Classification System	DUP	Laboratory (analytical) sample duplicate
WWTP	Waste Water Treatment Plant	EDD	Electronic data deliverable
VDS	Vapor diffusion sampler	EMDL	Estimated method detection limit
VOA	Volatile Organic Analyte	FIAS	Flow- injection atomic spectroscopy
TB	Trip Blank	GC/ECD	Gas chromatography/electron capture detection
Sample Types		GC/HRMS	Gas chromatography/high resolution mass spectrometry
SO	Soil (also referred to as SS in FSP)		
GW	Groundwater	GC/MS	Gas chromatography/mass spectrometry

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GLOSSARY OF TERMS (cont)

Term	Definition	Term	Definition
Analytical Terms (cont)			
GFAA	Graphite furnace atomic absorption	OPR	Ongoing precision and recovery
GPC	Gel permeation chromatography	PAH	Polycyclic aromatic hydrocarbons
HCX	1,2,4,5,7,8-hexachloroxanthene	PCB	Polychlorinated biphenyls
Hg	Mercury	PB	Procedural blank
HPLC	High performance liquid chromatography	PD	Percent difference
IC	Initial calibration	QC	Quality control
ICP/AES	Inductively coupled plasma/atomic emission spectroscopy	QL	Quantitation limit
ICP/MS	Inductively coupled plasma/mass spectrometry	RIS	Recovery internal standard
ICV	Initial calibration verification	RPD	Relative percent difference
ICS	Independent control standard	RRF	Relative response factor
LCS	Laboratory control sample	RSD	Relative standard deviation
MB	Method blank	SIS	Surrogate internal standard
MDL	Method detection limits	SRM	Standard reference material
MeHg	Methyl mercury	SVOC	Semivolatile organic compound
MPC	Measurement performance criteria	TOC	Total organic carbon
MS	Matrix spike	VOC	Volatile organic compound
MSD	Matrix spike duplicate		

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This is a Project-Specific Quality Assurance Project Plan.

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EPA-NE QAPP Worksheet #2

Site Name/Project Name: Centredale Manor
Site Location: Centredale Manor, Lyman Mill Pond and Allendale Pond, North Providence, Rhode Island
Site Number/Code: 016P
Operable Unit:
Contractor Name: Battelle Duxbury Operations
Contractor Number: DACW33-01-D-0004
Contract Title: Centredale Manor Restoration Project Superfund Site
Work Assignment Number: Delivery Order #01
Anticipated date of QAPP Implementation: August 2002

1. Identify Guidance used to prepare QAPP: *Region I, EPA-NE Compendium QAPP Guidance, Draft Final September 1998*

2. Identify EPA Program: *Superfund*

3. Identify approval entity: *EPA-NE or State: U.S. Army Corps of Engineers, New England Division and EPA-NE* or other entity:

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

5. List dates of scoping meetings that were held: April 24, 2002

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

Title	Approval Date
Sampling and Analysis Plan Woonasquatucket River Sediment Investigation, Centredale Manor Site, North Providence, Rhode Island. (prepared by Tetra Tech NUS, Inc.)	September 1999
Task 15 QAPP, Centredale Manor Restoration Project Superfund Site Baseline Risk Assessment, Initial Project Planning and Support (prepared by Battelle Duxbury Operations)	November 2000
Tasks 19-22 QAPP, Centredale Manor Restoration Project Superfund Site Baseline Risk Assessment, Initial Project Planning and Support (prepared by Battelle Duxbury Operations)	May 2001

7. List organizational partners (stakeholders) and connection with EPA and/or State:
U.S. Army Corps of Engineers, New England District
EPA Region I
State of Rhode Island

8. List data users:
U.S. Army Corps of Engineers, New England District
EPA Region I

9. If any required QAPP Elements (1-20), Worksheets and/or Required Information are not applicable the project, then circle the omitted QAPP Elements, Worksheets and Required Information on the attached Table. Provide an explanation for their exclusion below:
EPA-NE QAPP Worksheet #7 - No special training required
EPA-NE QAPP Worksheet #23a and #23b – No applicable QC samples associated with field screening analyses
EPA-NE QAPP Worksheet #25 – Evaluation of historical data for usability described in Harding (2001)[1] and Battelle (2002a)[2]

[1] Harding 2001. Final Work Plan for the Human Health and Ecological Risk Assessment for the Centredale Manor Restoration Project Superfund Site. March 15, 2001.

[2] Battelle 2002a. Summary of Data Needs for the Centredale Manor Restoration Superfund Site RI/FS. February 25, 2002.

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EPA-NE QAPP Worksheet # 2a

Bold QAPP Elements, Worksheets and/or Required Information that are not applicable to the project and provide an explanation on EPA-NE QAPP Worksheet #2, Item 9.

REQUIRED EPA QA/R-5 QAPP ELEMENTS	REQUIRED EPA-NE QAPP ELEMENTS and CORRESPONDING EPA-NE QAPP SECTIONS	EPA-NE QAPP Worksheet #	REQUIRED INFORMATION
Project Management and Objectives			
A1	1.0 Title and Approval Page	1	- Title and Approval Page
A2	2.0 Table of Contents and Document Format 2.1 Table of Contents 2.2 Document Control Format 2.3 Document Control Numbering System 2.4 EPA-NE QAPP Worksheet #2	2	- Table of Contents - EPA-NE QAPP Worksheet
A3	3.0 Distribution List and Project Personnel Sign-off Sheet	3 4	- Distribution List - Project Personnel Sign-off Sheet
A4, A8	4.0 Project Organization 4.1 Project Organizational Chart 4.2 Communication Pathways 4.2.1 Modifications to Approved QAPP 4.3 Personnel Responsibilities and Qualifications 4.4 Special Training Requirements/ Certification	5a 5b 6 7	- Organizational Chart - Communication Pathways - Personnel Responsibilities and ~~Qualifications Table~~ - **Special Personnel Training Requirements Table**
A5	5.0 Project Planning/Project Definition 5.1 Project Planning Meetings 5.2 Problem Definition/Site History and Background	8a 8b	- Project Scoping Meeting Attendance Sheet with Agenda and other Project Planning Meeting Documentation - Problem Definition/Site History and Background - EPA-NE DQO Summary Form - Site Maps (historical and present)
A6	6.0 Project Description and Schedule 6.1 Project Overview 6.2 Project Schedule	9a 9b 9c 9d 10	- Project Description - Contaminants of Concern and Other Target Analytes Table - Field and Quality Control Sample Summary Table - Analytical Services Table - System Designs - Project Schedule Timeline Table
A7	7.0 Project Quality Objectives and Measurement Performance Criteria 7.1 Project Quality Objectives 7.2 Measurement Performance Criteria	11a 11b	- Project Quality Objectives/Decision Statements - Measurement Performance Criteria Table

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EPA-NE QAPP Worksheet # 2a (continued)

REQUIRED EPA QA/R-5 QAPP ELEMENTS	REQUIRED EPA-NE QAPP ELEMENTS and CORRESPONDING EPA-NE QAPP SECTIONS		EPA-NE QAPP Worksheet #	REQUIRED INFORMATION
Measurement/Data Acquisition				
B1	8.0 8.1	Sampling Process Design Sampling Design Rationale	12a 12b	- Sampling Design and Rationale - Sampling Locations, Sampling and Analysis Method/SOP Requirements Table - Sample Location Map
B2, B6, B7, B8	9.0 9.1 9.2 9.3 9.4 9.5 9.6	Sampling Procedures and Requirements Sampling Procedures Sampling SOP Modifications Cleaning and Decontamination of Equipment/Sample Containers Field Equipment Calibration Field Equipment Maintenance, Testing and Inspection Requirements Inspection and Acceptance Requirements for Supplies/Sample Containers	13 12b 14 15	- Sampling SOPs Project Sampling SOP Reference Table - Sampling Container, Volumes and Preservation Table - Field Sampling Equipment Calibration Table Cleaning and Decontamination SOPs - Field Equipment Maintenance, Testing and Inspection Table
B3	10.0 10.1 10.1.1 10.1.2 10.2 10.3	Sample Handling, Tracking and Custody Requirements Sample Collection Documentation Field Notes Field Documentation Management System Sample Handling and Tracking System Sample Custody	 16	- Sample Handling, Tracking and Custody SOPs - Sample Handling Flow Diagram - Sample Container Label (Sample Tag) - Chain-of-Custody Form and Seal
B4, B6, B7, B8	11.0 11.1 11.2 11.3 11.4 11.5	Field Analytical Method Requirements Field Analytical Methods and SOPs Field Analytical Method/SOP Modifications Field Analytical Instrument Calibration Field Analytical Instrument/ Equipment Maintenance, Testing and Inspection Requirements Field Analytical Inspection and Acceptance Requirements for Supplies	 17 18 19	- Field Analytical Methods/SOPs - Field Analytical Method/SOP Reference Table - Field Analytical Instrument Calibration Table - Field Analytical Instrument/Equipment Maintenance, Testing and Inspection Table

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EPA-NE QAPP Worksheet # 2a (continued)

REQUIRED EPA QA/R-5 QAPP ELEMENTS	REQUIRED EPA-NE QAPP ELEMENTS and CORRESPONDING EPA-NE QAPP SECTIONS	EPA-NE QAPP Worksheet #	REQUIRED INFORMATION
B4, B6, B7, B8	12.0 Fixed Laboratory Analytical Method Requirements 12.1 Fixed Laboratory Analytical Methods and SOPs 12.2 Fixed Laboratory Analytical Method/SOP Modifications 12.3 Fixed Laboratory Instrument Calibration 12.4 Fixed Laboratory Instrument/ Equipment Maintenance, Testing and Inspection Requirements 12.5 Fixed Laboratory Inspection and Acceptance Requirements for Supplies	20 21	- Fixed Laboratory Analytical Methods/SOPs - Fixed Laboratory Analytical Method/SOP Reference Table - Fixed Laboratory Instrument Maintenance and Calibration Table
B5	13.0 Quality Control Requirements 13.1 Sampling Quality Control 13.2 Analytical Quality Control 13.2.1 Field Analytical QC 13.2.2 Fixed Laboratory QC	 22a 22b **23a** **23b** 24a 24b	**Sampling** - Field Sampling QC Table - ~~Field Sampling QC Table cont.~~ **Analytical** - **Field Analytical QC Sample Table** - **Field Analytical QC Sample Table cont.** - **Field Screening/Confirmatory Analysis Decision Tree** - Fixed Laboratory Analytical QC Sample Table - Fixed Laboratory Analytical QC Sample ~~Table cont.~~
B9	14.0 Data Acquisition Requirements	**25**	- **Non-Direct Measurements Criteria and Limitations Table**
A9, B10	15.0 Documentation, Records and Data Management 15.1 Project Documentation and Records 15.2 Field Analysis Data Packa Deliverables 15.3 Fixed Laboratory Data Package Deliverables 15.4 Data Reporting Formats 15.5 Data Handling and Management 15.6 Data Tracking and Control	26	- Project Documentation and Records Table - Data Management SOPs
Assessment/Oversight			
C1	16.0 Assessments and Response Actions 16.1 Planned Assessments 16.2 Assessment Findings and Corrective Action Responses 16.3 Additional QAPP Non-Conformances	27a 27b 27c	- Assessment and Response Actions - Project Assessment Table - Project Assessment Plan - Audit Checklists
C2	17.0 QA Management Reports	28	- QA Management Reports Table

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EPA-NE QAPP Worksheet # 2a (continued)

REQUIRED EPA QA/R-5 QAPP ELEMENTS	REQUIRED EPA-NE QAPP ELEMENTS and CORRESPONDING EPA-NE QAPP SECTIONS		EPA-NE QAPP Worksheet #	REQUIRED INFORMATION
Data Validation and Usability				
D1	18.0	Verification and Validation Requirements		- Validation Criteria Documents *
D2	19.0	Verification and Validation Procedures	29a 29b 29c	- Data Evaluation Process - Data Validation Summary Table - Data Validation Modifications
D3	20.0	Data Usability/Reconciliation with Project Quality Objectives	30	- Data Usability Assessment

* Include Data Validation Criteria Document as an attachment to the QAPP if Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses will not be used for validating project data.

Note: Required project-specific information should be provided in tabular format, as much as practicable. However, sufficient written discussion in text format should accompany these tables. Certain sections, by their nature, will require more written discussion than others. In particular, Section 8.0 should provide an in-depth explanation of the sampling design rationale and Sections 18-20 should describe the procedures and criteria that will be used to verify, validate and assess data usability.

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EPA-NE QAPP Worksheet #3 - Rev. 10/99

Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Document Control Number
Laureen Borochaner	Project Manager	U.S. Army Corps of Engineers, New England District	978-318-8802	NA
David Mark	RI/FS Technical Lead	U.S. Army Corps of Engineers, New England District	978-318-8512	NA
David DuLong	Chief Engineering/ Planning Division	U.S. Army Corps of Engineers, New England District	978-318-8500	NA
Anna Krasko	Remedial Project Manager	EPA Region I	617-918-1232	NA
Cornell Rosiu	Work Assignment Manager	EPA Region I	617-918-1345	NA
Andy Beliveau	QA Officer	EPA Region I	617-918-8607	NA
Karen Foster	Program Manager	Battelle Duxbury	781-952-5370	NA
William Steinhauer	Project Manager	Battelle Duxbury	781-952-5319	NA
Patty White	RI/FS Task Manager	Battelle Duxbury	781-952-5279	NA
Mark Guilmain	Project QA Coordinator	Battelle Duxbury	781-952-5316	NA
Deirdre Dahlen	Sample Analysis Task Manager	Battelle Duxbury	781-952-5253	NA
Karen Tracy	Dioxin/Furan/HCX Task Leader	Battelle Columbus	614-424-4028	NA
Zachary J. Willenberg	QA Officer	Battelle Columbus	614-424-5795	NA
Linda Bingler	Metals and MeHg Task Leader	Battelle Marine Sciences Laboratory (MSL)	360-681-3627	NA
Deborah Coffey	QA Officer	Battelle MSL	360-681-3645	NA
Ken Davis	Grain Size and TOC Task Leader	Applied Marine Sciences, Inc.	281-554-7272	NA
Jennifer Davis	QA Manager	Applied Marine Sciences, Inc.	281-554-7272	NA
Dave Dunlap	Project Manager Supervisor	Severn Trent Laboratories (STL) Pittsburgh	412-820-8380	NA
Patrick Conlon	QA Manager	STL Pittsburgh	412-820-8380	NA
Sarah Shah	Harding ESE Project Manager	Harding ESE	781-245-6606	NA
Mark Phaneuf	Field Sampling Task Leader	Harding ESE	781-245-6606	NA
Willard Murray	QA Officer	Harding ESE	781-245-6606	NA

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EPA-NE QAPP Worksheet #4 - Rev. 10/99

Project Personnel Sign-Off Sheet

Organization: Battelle Duxbury

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read	QAPP Acceptable as Written
Karen Foster	Program Manager	781-952-5370			
William Steinhauer	Project Manager	781-952-5319			
Patty White	RI/FS Task Manager	781-952-5279			
Rosanna Buhl	Program QA Manager	781-952-5309			
Mark Guilmain	Project QA Coordinator	781-952-5316			
Deirdre Dahlen	Sample Analysis Task Manager	781-952-5253			
Robert Beimer	Laboratory Manager	781-952-5332			
Jessica Fahey	Laboratory Sample Custodian	781-952-5270			
Roxanne Brackett	Sample Preparation Chemist	781-952-5241			
Dan Bardon	SVOC (PAHs) Task Leader/ GC/MS Analyst	781-952-5251			
Jonathan Thorn	Chlorinated Pesticide /PCB Aroclors Task Leader/ GC/ECD Analyst	781-952-5271			

Organization: Battelle Columbus

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read	QAPP Acceptable as Written
Karen Tracy	Dioxin/Furan/HCX Task Leader	614-424-4028			
Zachary J. Willenberg	QA Officer	614-424-5795			
Mary E. Schrock	Laboratory Manager	614-424-4976			
Mark F. Misita	Sample Preparation Chemist	614-424-7884			
Henry H. Pham	Sample Preparation Chemist and Sample Custodian	614-424-7849			
Susan Winnard	Sample Preparation Chemist	614-424-4365			
Wesley H. Baxter	Sample Preparation Chemist	614-424-7849			
Joseph E. Tabor	GC/HRMS Analyst	614-424-5130			

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EPA-NE QAPP Worksheet #4 (continued) - Rev. 10/99

Project Personnel Sign-Off Sheet

Organization: Battelle Marine Sciences Laboratory (MSL)

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read	QAPP Acceptable as Written
Linda Bingler	Metals and MeHg Task Leader	360-681-3627			
Deborah Coffey	QA Officer	360-681-3645			
Carolynn Suslick	Sample Custodian	360-681-3624			
Chuck Apts	Sample Preparation and ICP/MS Analyst	360-681-3625			
Jordana Wood	Sample Preparation; ICP/AES, GFAA, and FIAS Analyst	360-681-3622			
Mary Ann Deuth	Sample Preparation and CVAA and CVAF Analyst	360-681-4572			

Organization: Applied Marine Sciences, Inc.

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read	QAPP Acceptable as Written
Ken Davis	Grain Size and TOC Task Leader; Sample Custodian	281-554-7272			
Jennifer Davis	QC Manager	281-554-7272			
Mike Seymour	Analyst	281-554-7272			

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EPA-NE QAPP Worksheet #4 (continued) - Rev. 10/99

Project Personnel Sign-Off Sheet

Organization: Severn Trent Laboratories (STL) Pittsburgh

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read	QAPP Acceptable as Written
Keith Dudeck	VOC Task Leader/Analyst	412-820-8380			
Sharon Bacha	SVOC Task Leader/Analyst	412-820-8380			
Patrick Conlon	QA Manager	412-820-8380			
Dave Dunlap	Project Manager Supervisor	412-820-8380			
Anthony Lee	Sample Custodian	412-820-8380			
Albert "Rusty" Vicinie	Laboratory Manager	412-820-8380			
Larry Matko	Sample Preparation Chemist	412-820-8380			

EPA-NE QAPP Worksheet #4 (continued) - Rev. 10/99

Project Personnel Sign-Off Sheet

Organization: Harding ESE

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read	QAPP Acceptable as Written
Sarah Shah	Harding ESE Project Manager	781-245-6606			
Mark Phaneuf	Field Operations Leader and Site Safety Officer	781-245-6606			
Andrew Sutton	Staff Geologist	781-245-6606			
Jason Naiden	Staff Scientist	781-245-6606			
Willard Murray	QA Officer	781-245-6606			

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EPA-NE QAPP Worksheet #5a - Rev. 10/99

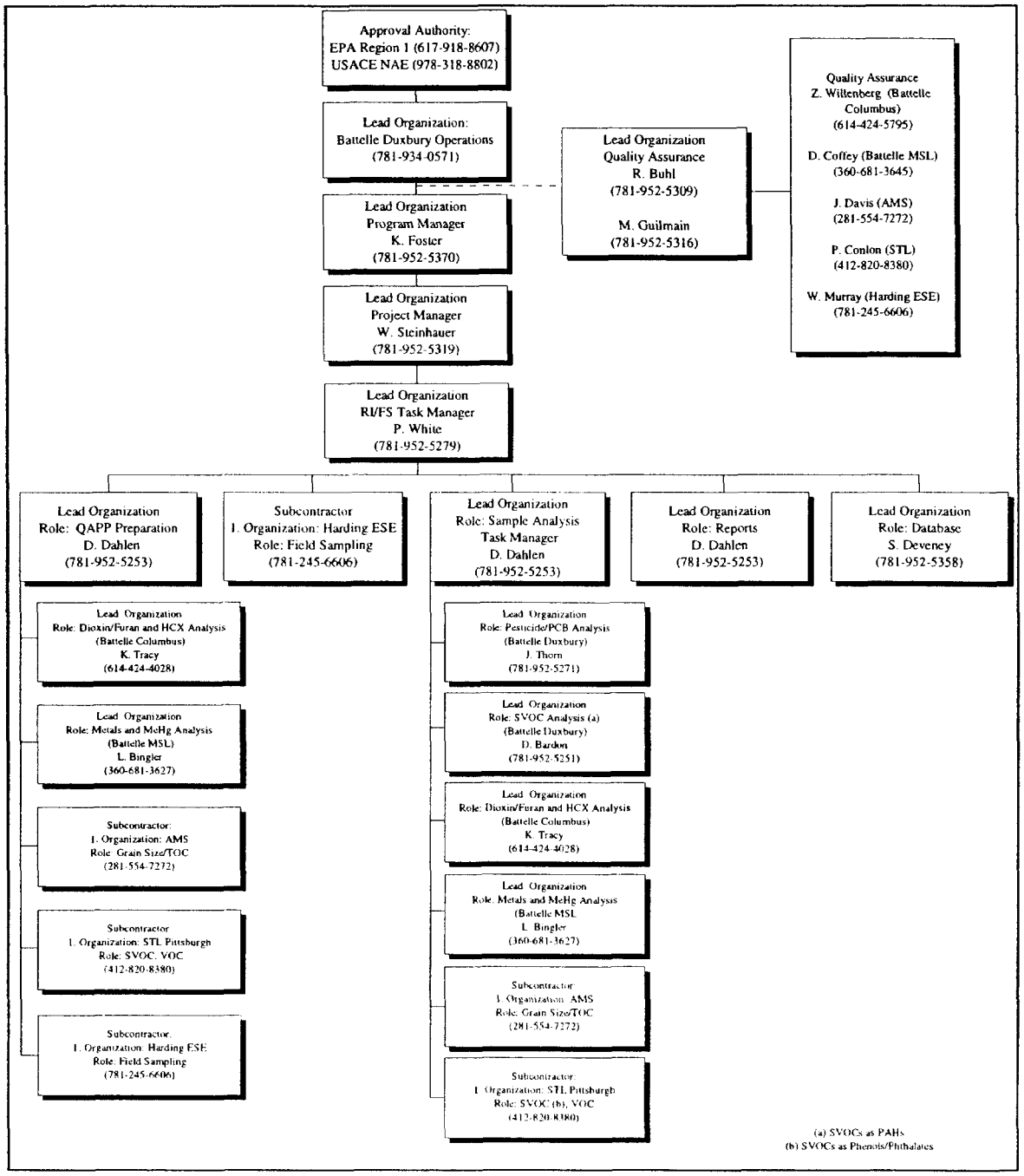

Figure 1. Project Organizational Chart.

EPA-NE QAPP Worksheet #5b - Rev. 10/99

Communication Pathways

Communication pathways will follow the project organization chart (Figure 1). Ms. Laureen Borochaner is the USACE NAE Project Manager. Mr. William Steinhauer is Battelle's Project Manager and is responsible for the technical oversight, overall quality and conduct of the project. He will be the primary contact with the USACE NAE Project Manager. Mr. Steinhauer will ensure that the objectives of the project are met within budget and on schedule. Ms. Patty White will serve as the Remedial Investigation (RI)/Feasibility Study (FS) Task Manager. Task Managers/Leaders responsible for field sampling and analysis activities will report directly to Ms. Patty White.

Mr. Mark Guilmain will serve as Battelle's Program Quality Assurance (QA) Officer, and is responsible for identifying areas for corrective action, coordinating the QA activities such as systems and data audits, and preparing reports to management for this project. He will be assisted by the QA Officers/Managers at each of the participating laboratories.

As indicated in Figure 1, Task Leaders have been assigned for each of the major project tasks (*e.g.*, QAPP Preparation). The Task Leaders will serve as the point of contact and will direct task activities and monitor task performance to ensure adherence to technical standards, budget, and schedule. They also will be responsible for apprising Ms. Patty White of progress and notifying him of any significant problems or delays.

The need for corrective action may be identified during analysis, during QA reviews, or during management reviews. EPA Worksheets #21 and #24a define the corrective action(s) options for quality control data and calibration exceedences. Corrective action implemented in response to QA audits is documented as part of the analyst's response to the audit. Battelle SOP 4-035 describes Battelle Duxbury's formal Corrective Action program. All internal corrective action is followed up by the QA Officer. Corrective action related to changes in scope, analytical techniques, or financial variances are formally communicated to Ms. Borochaner by Mr. Steinhauer.

All communications will be conducted using electronic mail, phone, telefaxes, and/or reports.

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EPA-NE QAPP Worksheet #6 - Rev. 10/99

Personnel Responsibilities and Qualifications Table

Name (a)	Organizational Affiliation	Responsibilities	Location of Personnel Resumes, if not included	Education and Experience Qualifications
William Steinhauer	Battelle Duxbury	Responsible for the technical oversight, overall quality and conduct of the project for lead organization		Supplied with May 23, 2001 QAPP
Patty White	Battelle Duxbury	Oversee RI/FS		See attached (Attachment H)
Rosanna Buhl	Battelle Duxbury	Oversee QA/QC activities performed for lead organization		Supplied with May 23, 2001 QAPP
Mark Guilmain	Battelle Duxbury	Coordinates QA/QC activities performed for lead organization (Battelle Duxbury)		As above
Deirdre Dahlen	Battelle Duxbury	Responsible for preparing QAPP addendum and overseeing technical conduct of sample analyses.		As above
Robert Beimer	Battelle Duxbury	Manager of Organics Laboratory		See attached (Attachment H)
Jessica Fahey	Battelle Duxbury	Responsible for laboratory custody of samples	Not available[1]	Norton High School- 1995 graduate Wheaton College, Norton , MA- 1999 graduate, BA in Environmental Science Wheaton College- Field Assistant: May 1999- Sept 1999 Tufts University- Field and Lab Technician: Feb.2000-Sept 2000 Children's Hospital- Lab Technician: Sept 2000- Feb 2001 Tufts University- Field and Lab Research Assistant: Mar. 2001- October 2001 **Battelle**- October 2001- present (Sample Custodian since Dec. 2001)

EPA-NE QAPP Worksheet #6 - Rev. 10/99

Personnel Responsibilities and Qualifications Table

Name (a)	Organizational Affiliation	Responsibilities	Location of Personnel Resumes, if not included	Education and Experience Qualifications
Roxanne Brackett	Battelle Duxbury	Prepare environmental samples for SVOCs (PAHs) and Chlorinated Pesticide/PCB Aroclors analyses		Supplied with May 23, 2001 QAPP
Dan Bardon	Battelle Duxbury	Analyze environmental samples for SVOCs (PAHs); prepare and validate final tables and submit data package(s) to QA for data audit		Supplied with May 23, 2001 QAPP
Jonathan Thorn	Battelle Duxbury	Analyze environmental samples for Chlorinated Pesticide/PCB Aroclors; prepare and validate final tables and submit data package(s) to QA for data audit		As above
Karen Tracy	Battelle Columbus	Responsible for assisting with QAPP preparation; overseeing technical conduct of dioxin/furan and HCX analyses: and prepare and validate final tables and submit data package(s) to QA for data audit		Supplied with May 23, 2001 QAPP
Zachary J. Willenberg	Battelle Columbus	Oversee QA/QC activities performed for Battelle Columbus; audit data		See attached (Attachment H)
Mary E. Schrock	Battelle Columbus	Dioxin Laboratory Manager		Supplied with May 23, 2001 QAPP
Henry Pham	Battelle Columbus	Responsible for sample preparation and laboratory custody of samples		As above
Mark Misita	Battelle Columbus	Responsible for sample preparation for dioxin/furan/HCX analyses; assist with analysis of the samples by HRGC/HRMS		As above
Susan Winnard	Battelle Columbus	Responsible for sample preparation for dioxin/furan/HCX HRMS analyses		As above

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EPA-NE QAPP Worksheet #6 - Rev. 10/99

Personnel Responsibilities and Qualifications Table

Name (a)	Organizational Affiliation	Responsibilities	Location of Personnel Resumes, if not included	Education and Experience Qualifications
Wesley H. Baxter	Battelle Columbus	Responsible for sample preparation for dioxin/furan/HCX HRMS analyses	Not available[1]	Minerva High School (Middleburg Hgts., OH), 1995; Ohio State University – Spring 2001 expected graduation with B.A. Chemistry; 1.5 years experience with sample preparation for Dioxin/Furan, PCBs and Pesticides by GC/HRMS, Battelle Columbus.
Joseph E. Tabor	Battelle Columbus	Analyze environmental samples for dioxin/furan/HCX by HRGC/HRMS		Supplied with May 23, 2001 QAPP
Linda Bingler	Battelle Marine Sciences Laboratory (MSL)	Responsible for assisting with QAPP preparation; overseeing technical conduct of metals and MeHg analyses		Supplied with May 23, 2001 QAPP
Deborah Coffey	Battelle MSL	Oversee project QA/QC activities; audit technical systems and data		As above
Carolynn Suslick	Battelle MSL	Responsible for laboratory custody of samples		As above
Chuck Apts	Battelle MSL	Analyze environmental samples for metals by ICP/MS		As above
Jordana Wood	Battelle MSL	Analyze environmental samples for metals by ICP/AES, GFAA, and FIAS		As above
Mary Ann Deuth	Battelle MSL	Analyze environmental samples for mercury		As above
Ken Davis	Applied Marine Sciences	Prepare and analyze samples for grain size and TOC		Supplied with May 23, 2001 QAPP
Jennifer Davis	Applied Marine Sciences	QC Manager		See attached (Attachment H)
Mike Seymour	Applied Marine Sciences	Analyst		Supplied with May 23, 2001 QAPP
Keith Dudeck	Severn Trent Laboratory (STL) Pittsburgh	VOC Task Leader/Analyst		See attached (Attachment H)
Sharon Bacha	STL Pittsburgh	SVOC Task Leader/Analyst		See attached (Attachment H)
Dave Dunlap	STL Pittsburgh	Project Manager Supervisor		See attached (Attachment H)

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Personnel Responsibilities and Qualifications Table

Name (a)	Organizational Affiliation	Responsibilities	Location of Personnel Resumes, if not included	Education and Experience Qualifications
Anthony Lee	STL Pittsburgh	Sample Receipt		See attached (Attachment H)
Patrick Conlon	STL Pittsburgh	QA Manager		See attached (Attachment H)
Albert Vicinie	STL Pittsburgh	Laboratory Manager		See attached (Attachment H)
Larry Matko	STL Pittsburgh	Sample Preparation for SVOC (phenols and phthalates) analysis		See attached (Attachment H)
Sarah Shah	Harding ESE	Project Manager responsible for oversight of Harding ESE activities.		Supplied with May 23, 2001 QAPP
Mark Phaneuf	Harding ESE	On-site coordination of field work.		See attached (Attachment H)
Andrew Sutton	Harding ESE	Sample Collection		See attached (Attachment H)
Jason Naiden	Harding ESE	Sample Collection		See attached (Attachment H)
Willard Murray	Harding ESE	QA Officer		See attached (Attachment H)

(a) If the individual identified here is not available at the time of project commencement, then alternate staff – with comparable training – will perform project work.
[1] Resume not available. Education summarized in next column.

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EPA-NE QAPP Worksheet #8a - Rev. 10/99

Project Planning Meetings

EPA Regulation Program: RCRA FIFRA TSCA CERCLA DW CWA CAA (underline one)	**Site Name**: Centredale Manor
Program (Brownfields, NPDES, etc.): Superfund	**Site Location**: North Providence, Rhode Island
Project Date(s) of Sampling: September, 2002	**CERCLA Site/Spill Identifier No.**: 016P
Project Manager: William Steinhauer	**Operable Unit**:
	Other Site Number/Code: 016P
	Phase: ERA SA/SI Pre-RI RI (phase I, etc.) FS RD RA post-RA (underline one)
	Other phase:

Date of Meeting: April 24, 2002
Meeting Location: A Technical Project Planning Meeting for the Centredale Manor Superfund Project was held at the Corps of Engineers New England District offices. Meeting attendees are listed below.

Name	Project Role	Affiliation	Phone #	e-Mail Address
Anna Krasko	RPM	EPA New England	617-918-1232	krasko.anna@epa.gov
Laureen Borochaner	PM	USACE-NAE	978-318-8802	laureen.a.borochaner@usace.army.mil
Helen Mead	Risk Assessor	USACE HTRW CX	402-697-2589	helen.e.mead@usace.army.mil
Cliff Opdyke	Risk Assessor	USACE-NAE	978-318.8164	cliff.a.opdyke@usace.army.mil
Marie Wojtas	Chemist	USACE-NAE	978-318-8175	marie.a.wojtas@usace.army.mil
Kirk Bargerhuff	Biologist/Risk Ass. Tech. Review	USACE-NAE-EP	978-318-8029	kirk.e.bargerhuff@usace.army.mil
Scott Michalak	Geotechnical Engineer HTRW	USACE-NAE	978-318-8350	scott.c.michalak@usace.army.mil
Louis Maccarone	State RPM	RIDEM	401-222-2797	lmaccaro@dem.state.ri.us
Chau Vu	HH Risk Assessor	EPA New England	617-918-1446	vu.chau@epa.gov
Andy Beliveau	QA Chemist	EPA New England	617-918-8607	beliveau.andy@epa.gov
Cornell Rosiu	Eco	EPA	617-918-1345	rosiu.cornell@epa.gov
Norman Richardson	Eco Risk	Harding ESE	781-213-5633	narichardson@mactec.com
Mike Murphy	Risk Assessment	Harding ESE	781-213-5600	mjmurphy@mactec.com
Pamela Wasel	Human Health Risk Assessment	Harding ESE	781-213-5626	pawasel@mactec.com
Mike Crain	Co Facilitator	USACE HTRW CX	402-697-2657	michael.e.crain@usace.army.mil
Rose Schmidt	Geologist	USACE-NAE	978-318-8345	rosemary.a.schmidt@usace.army.mil
Deirdre Dahlen	Chemist	Battelle	781-952-5253	dahlend@battelle.org
William Steinhauer	Project Manager	Battelle	781-952-5319	steinhauer@battelle.org
David Mark	Env Engrg Technical Lead	USACE-NAE	978-318-8512	david.w.mark@usace.army.mil
Sarah Shah	PM	Harding ESE	781-213-5637	spshah@mactec.com
Steve White	Facilitator	USACE HTRW CX	402-697-2660	stephen.j.white@usace.army.mil
Patty White	Geologist, RI/FS	Battelle	781-952-5279	whitepj@battelle.org

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EPA-NE QAPP Worksheet #8a - Rev. 10/99 (continued)
Project Planning Meetings

Meeting Purpose. The purpose of the meeting was to discuss several issues related to the draft Data Evaluation Report (Task 23), the Baseline Ecological Risk Assessment and the Human Health Risk Assessment (Tasks 24 and 25), and to reach agreement on objectives and data needs for the Remedial Investigation/Feasibility Study (Task 30). Steve White and Mike Crain of the USACE HTRW Center of Expertise facilitated the meeting. These notes are a compilation of notes taken during the meeting by Mike, Steve and Helen Mead (HTRW-CX Risk Assessor), Battelle staff, and Harding ESE staff. Action items are summarized at the end of these minutes.

Note that only issues associated with the RI/FS (Task 30) are pertinent to this QAPP addendum.

Meeting Minutes.

Task 23 - Discussion of EPA Comments on Draft Data Evaluation Reports

The following deviations from the BERA work plan were noted:

- Contractor was unable to collect all the fish species planned (no largemouth bass were collected in Allendale Pond)
- Contractor was unable to collect as many specimens of some species as was planned in Assapumpset Brook and Pond
- Contractor was unable to collect the planned mass of emerging insects.

Harding has concluded that the deviations will not affect their completion of the BERA and the BCRA.

Harding has received comments on the Data Evaluation Report from EPA. Comments from Anna Krasko addressed background site information. The comments are resolved. Comments were also received from Andy Beliveau. Andy had two major concerns:

1) Validity of the data indicating the detection of HCX virtually everywhere, including in samples from the reference areas.

   Action – Andy Beliveau and Battelle will review the validation reports to evaluate whether the presence of HCX in the reference areas is likely to be representative of actual conditions or is an artifact of the analytical results. Final decisions will be communicated to the full project team.

2) Report should explain the meaning of Project Action Goals (PAGs) and there may be a need to revisit how PAGs were originally set. PAGs are set to meet risk assessment needs. Although quantitation limits should be less than PAGs, Mike Murphy, Harding ESE said that existing data for compounds (dioxins, furans, and PCBs) with quantitation limits greater than PAGs should meet risk assessment needs. Because the frequency of detection for these compounds was approximately 100%, there were no non-detects less than the quantitation limit.

   Action – Additional discussion of the project action goals (PAGs) will be included in the final report. The discussion should include an explanation of why the PAGs were developed, what they represent, and how they were used.

Harding will send responses to the comments on the Draft Data Evaluation Report to the reviewers prior to finalizing the report. William Steinhauer said that data from the fish that NAE Mike Penko collected from Allendale and downstream Lyman Mill need to be incorporated for use in the risk assessment.

EPA-NE QAPP Worksheet #8a - Rev. 10/99 (continued)
Project Planning Meetings

Meeting Minutes (cont).

Harding ESE is waiting for the 3rd party data validation to be completed before they finalize the report. The last batch of validated data is due to Harding by June 17th. Once the data are validated, only the validated data will be used in the risk assessments. A summary of the differences between the validated and unvalidated data will not be included in the final report. The remaining comments provided by Andy Beliveau and Anna Krasko will be incorporated into the final report.

Task 24/25 - Discussion of Risk Assessments, HHRA Issues

HCX Toxicity Values
Harding ESE handed out copies of a letter dated April 18, 2002 from Harding ESE to Ms. Chau Vu titled "Proposed Toxicity Values for HCX (in support of Task 25).

There are currently no EPA-published toxicity values for HCX. Nor has ORD developed a cancer slope factor for HCX since our last meeting in February 2001. ORD recommends using 2,3,7,8-TCDD and its cancer slope factor as a surrogate for HCX.

It was reported that a previously published article by Visvanathan et. al. (1987) suggests that the toxicity of HCX is 1,000,000 times less than the value suggested by ORD. C. Rosiu will forward a copy of the article to L. Borochaner for distribution to the project team.

Preliminary results of the research conducted by Mark Hahn of the Woods Hole Oceanographic Institute (in-vitro toxicity studies of HCX on rainbow trout) indicate that the toxicity of HCX is 5000 times less than the value suggested by ORD. These research results would suggest a TEF value of 0.001. Dr. Hahn's results will be published in a journal article. A conference call is scheduled for the week of April 29 to discuss the results of the Woods Hole HCX toxicity studies. The call will include a discussion of the results of the study, other available information, and the options for identification of slope factors and TEFs for HCX. It was agreed that a cancer slope factor and TEFs would not be formally identified and confirmed in the conference call. The discussion would include an evaluation of data relative to the data and methods used in the World Health Organization (WHO) derivation of TEFs.

Once the basis for establishing HCX toxicity for the project is established, the articles to support the decision will be included in the appendix of the BERA/BCRA reports, including:

- a copy of a letter from Dr. Hahn at Woods Hole regarding the results of his study in the HHRA report.
- a copy of the Visvanathan et. al. (1987) journal article

The risk assessment documents will need to document the thought process that was followed in developing the TEF for HCX and show that it is consistent with the process used by WHO in developing the TEF for dioxin.

Exposure Assumptions and Fish Consumption Rates
Harding ESE handed out copies of a letter dated April 23, 2002 from Harding ESE to Ms. Chau Vu titled "Proposed Exposure Assumptions (in support of Task 25) Human Health Biota Consumption Risk Assessment". Chau will review the letter and schedule a call with Harding to discuss it. Harding needs approval of the exposure parameters in the letter.

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EPA-NE QAPP Worksheet #8a - Rev. 10/99 (continued)
Project Planning Meetings

Meeting Minutes (cont).

Additional time is need for EPA to review the proposed fish consumption rates. EPA has concerns about the use of fish consumption rates that are consistent with subsistence fishing. They question whether subsistence fishing is occurring in Allendale and Lyman Mill Ponds. Harding clarified that those consumption rates would be appropriate for determining to what levels the river would need to be restored to allow its unrestricted use, which would include subsistence fishing. Andy Beliveau indicated that there has been some information collected in the past that indicated that subsistence fishing was occurring on other reaches of the river but it is unclear whether it is occurring in the Allendale and Lyman Mill reaches. There was some debate about whether the fishery resource was capable of supporting subsistence fishing. Mike Murphy said that an M.S. study of the area showed decreasing fishing in the river because it was more convenient and productive to fish in the ocean. Anna Krasko felt that the use of consumption rates from subsistence fishing was appropriate due to uncertainty about how the demographics of the area may change in the future and the need to be reasonably conservative in the assumptions made about future uses of the resource. A conference call will be conducted to discuss these issues and determine exposure assumptions and fish consumption rates. Participants will include C. Vu and C. Opdyke. Decisions made will be documented and forwarded to L. Borochaner for distribution to the project team.

There is currently a fishing advisory in effect at the site; therefore the risk assessment will be based on future exposure scenarios (fishable/swimmable). Conservative assumptions will be used because the neighborhood demographics always have the potential to change (Southeast Asian subsistence anglers).

Dioxin Cancer Slope Factor and TEFs
A discussion was held concerning the appropriate Cancer Slope Factor to use for dioxin. Mike Murphy indicated that they were currently using the last EPA-published CSF of $1.6x10^{-5}$. The draft reassessment of dioxin toxicity by EPA contains a lower proposed CSF of $1x10^{-6}$ and Mike thought that the lower number might be more appropriate. However, the draft dioxin reassessment guidance is not scheduled to be issued for at least 90 days. Chau explained that the current EPA practice is to use the current published slope factor in the report and include calculations using the lower proposed CSF in an appendix or as part of a discussion of uncertainty.

EPA requested that both the published and the proposed CSFs for dioxin be used during the risk assessments. The risk assessment results will be based on the published CSF; however results using the proposed CSF will be presented in the appendix of the report.

1998 TEFs will be used for dioxin (TEFs are based on the conclusions of the World Health Organization meeting in Stockholm, Sweden, June 15-18 1997 (Van den Berg et al., 1998)).

Number and Types Fish Sampled and Chemical Evaluations
During fish sampling conducted last summer, the sampling teams were not able to collect all of the desired fish species (e.g., no largemouth bass were collected at Allendale Pond) and were not able to collect as many specimens of some of the species as was specified in the work plan (e.g., reduced sampling at Assapumpset Brook and Pond). Deviations are detailed in the draft evaluation report.

Harding solicited input from the rest of the team regarding determination of the 95%UCL for the resulting fish concentration data given that the number of data points for some species will be significantly less than was anticipated. Cornell Rosiu indicated that they should go ahead and calculate the 95% UCL for the smaller datasets and then if the maximum concentration is less than the UCL, use the maximum value as the exposure concentration. The same procedure should be used for all the datasets regardless of the number of samples.

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Project Planning Meetings

Meeting Minutes (cont).

Norm Richardson raised a question regarding whether the fish data will fit a normal or lognormal distribution. He suggested that if the sample populations are not distributed normally, percentiles may also be calculated to estimate the upper bound exposure. Further, there was some discussion of the possible benefit of using non-parametric statistics to determine exposure point concentrations for these circumstances. Cornell indicated that he was not opposed to considering a non-parametric analysis. At Cliff Opdyke's suggestion, Harding ESE will develop a proposed decision tree outlining a process to examine the data distribution and determine the appropriate statistical protocols. Harding ESE will submit the proposed decision tree to Laureen Borochaner, Cornell Rosiu, Chau Vu, and Cliff Opdyke for review and comments.

Task 24/25 - Discussion of Risk Assessments, BERA Issues

Development of Biota-Sediment Accumulation Factors (BSAFs)
The implications of the Allendale Dam breach on the development of the BSAFs were discussed. It is not clear whether fish samples collected in Lyman Mill Pond were primarily exposed to the sediment conditions in Allendale or Lyman Mill Ponds. Also fish collected in Lyman Mill pond may have been exposed to higher concentrations of contaminants in suspended sediments washed into the pond from upstream. This issue may not be a significant concern because tissue and sediment concentrations in Allendale and Lyman Mill Ponds appear to be similar based on the preliminary review of the data. This was identified as an uncertainty with respect to the development of sediment PRGs.

The potential implications of the migration of fish from areas where their exposure doses were received were also briefly discussed and may need to be revisited during the process of calculating BSAFs. Cornell said that because site sediment and fish data must be in proximity in space and time to be valid to use in developing a BSAF, movement of fish and/or sediment as a result of the breach could be problematic. Cornell pointed out that one use of the BSAFs is to calculate fish concentrations from sediment concentrations and since we have actual fish data, the exposure concentrations due to fish consumption can be determined without using the BSAFs. The only problem might be for largemouth bass since no actual fish data will be available. In that case a BSAF calculated from another reach of the river (e.g., Lyman Mill Pond) will have to be used. The other potential problem would be with trying to back-calculate sediment PRGs from an allowable fish concentration.

Norm will look at the relationship between sediment concentrations and fish concentrations in both the Lyman Mill reach and the Allendale reach and evaluate whether there appear to be inconsistencies. BSAFs can also be derived for other reaches of the river and compared to the Lyman Mill and Allendale BSAFs.

Measurement Endpoint Inference Weights
The measurement endpoint inference weights will be reviewed based on the quality and quantity of data collected during the BERA/Summer 2001 BCRA Field Investigation. In particular, some recently published studies provide additional information to consider that might allow some of the assigned weightings to be refined. Harding ESE will revise tables 5-1 to 5-7 in the BERA/BCRA Work Plan. A red-lined version of the table will be provided to EPA and USACE with rationale for the modifications for their review. Weightings will be reviewed and approved by EPA.

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EPA-NE QAPP Worksheet #8a - Rev. 10/99 (continued)
Project Planning Meetings

Meeting Minutes (cont).

Ongoing Work by the PRPs
The degree and extent of dioxin impact to the residential soils appears to be more widespread that presented in the EE/CA. Elevated dioxin concentrations appear to be present (i) continuously along the eastern banks of Allendale and Lyman Mill Ponds, (ii) around the foundations of some of the residences, (iii) and vertically from the ground surface to beyond the water table. As a result of the more widespread contamination above the action level of 1 ppb, isolated excavations as anticipated in the NTCRA may not be practical. However, the immunoassay field kits used by the PRPs can result in 20% false positives and there were only a limited number of fixed laboratory confirmation samples, so these estimates may be overly conservative.

LEA has extended their evaluation from the 10-year flood plain to the 100-year floodplain. Based on the abundance of dioxin impacted soil, LEA is of the opinion that dioxin impacted soil resulted from erosion and deposition of sediments as well as placement of impacted soil during historic excavation and filling activities.

USACE will provide a copy of the LEA report to Harding ESE.

Task 30 - Remedial Investigation Data Review

The remainder of the meeting was spent discussing the upcoming RI/FS. Laureen Borochaner had prepared some project planning worksheets for the group to utilize by completing preliminary information and providing copies to the group. Steve White utilized these worksheets to capture additional information that the group developed through their discussions. The notes that follow are generally elaboration on the points documented in the worksheets.

Phase I – Identify Current Project

a. **Existing Site Information** – There are 4 administrative records associated with the project. These contain many more documents than are listed on the planning worksheets. The EPA web page for the Centredale site contains an index listing of all the documents in each of the admin records. With the addition of the documents annotated on the worksheets, the group felt that documents that are significant to planning the RI effort were listed on the worksheet.

b. **Potential Points of Compliance** – Actual points of compliance are difficult to define until the PRGs are established. After the PRGs are established, the affected reach of the river can be defined. In a general sense, it was agreed that the point of compliance for soils and sediment would be the limit of the area where health-based and ecological standards are exceeded. For residential soils the standard is expected to be 1 ppb for dioxin, but other contaminants may also be a factor where dioxin is less than 1 ppb. Areas that contain less than 1 ppb dioxin have other COCs that exceed Rhode Island Standards, but it is not known if these standards are ARARs. A formal determination of ARARs is needed. A point of compliance for groundwater has not been defined.

Phase II – Determine Data Needs.
This part of the discussion was based on Battelle's report "Summary of Data Needs for the Centredale Manor Restoration Superfund Site RI/FS" dated February 25, 2002. Table 2 of that report was used to focus the discussions. The following notes reference the Item/Matrix lines in that table, which has been revised to include consensus decisions from the meeting.

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Project Planning Meetings

Meeting Minutes (cont).

a. **Source Identification**- Sources appear to have been adequately defined through a variety of means including examination of aerial photographs and historical records, interviews, geophysical surveys, and sampling of surface/subsurface soil and groundwater. Better definition of the source area would be difficult due to disturbance of the site by past flooding and construction. The group agreed that no reasonable amount of additional data would significantly decrease the degree of uncertainty of the source delineation. However, additional sources may be identified during excavation activities.

b. **Site Physical Characteristics and Contaminant Fate and Transport** – The site is complex due to the numerous cycles of flooding, inundation, draining, breaching, etc. It will be important to characterize the distribution of sediments that are likely to be contaminated.

A flood survey of Allendale Pond was conducted by USACE. However additional information on sediment stability will be needed to support the FS and ROD. This information includes an evaluation of hydrodynamics and sediment stability in Allendale Pond, Lyman Mill Pond, connecting stream channels, and downstream areas. These studies will aid in determining the stability of contaminated sediments in the river and identifying the locations of fine-grained sediments that would be more likely to be contaminated with dioxin. Proposed studies include investigation and modeling sediment transport and stability, mapping stream channels and depositional areas, and bathymetric surveys.

The hydrodynamics and depositional areas will change now that Allendale Dam has been restored. Grain-size analysis data for samples collected from Allendale Pond during the Time Critical Removal may be useful in determining historical depositional areas.

The vertical extent of impacted sediments has not yet been determined. EPA's Emergency Response Team (ERT) plans to collect and analyze sediment cores during Summer 2002. The objectives of the study are to determine the sediment stratigraphy and vertical contaminant distribution. The number of samples that will be taken for lab analysis will be limited. HCX may be used as a chemical indicator to avoid the expense of performing numerous dioxin analyses. Results from this study could be used to 1) develop a correlation between contaminant concentrations, grain size and organic carbon and 2) evaluate the vertical extent of contamination and 3) evaluate the degree of natural recovery (i.e., natural burial by cleaner sediment). It is likely that the sediments with higher chemical concentrations are deeper than the surface intervals that were previously sampled because of the recent deposition of cleaner sediments.

EPA is interested in evaluating whether there is a correlation between TOC and dioxin in aquatic sediments. If there is a correlation, then assessment costs could be reduced by conducting analysis for TOC and then predicting corresponding dioxin concentrations.

The applicability of the OSWER guidance "Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites" was discussed. It was generally agreed that this guidance would likely apply to Centredale since any remedy for sediment would likely affect more than 5 acres or 10,000 cy of sediment.

There was group consensus that a qualitative assessment of river hydrodynamics and sediment stability was needed in order to satisfy the OSWER guidance. A conference call will be set up between EPA, the Corps, and Battelle to discuss the scope of the study. Cornell will involve the appropriate EPA experts in that discussion, as will Laureen Borochaner for the Corps.

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EPA-NE QAPP Worksheet #8a - Rev. 10/99 (continued)
Project Planning Meetings

Meeting Minutes (cont).

c. **Source Area Residential Use Soils** – It was agreed that a human health risk assessment did not need to be performed for the source area residential soils because the interim caps and parking lots are expected to remain in place. However, the existing interim caps and parking lots will need to be evaluated to determine whether they are sufficient as a long-term remedy. A geotechnical evaluation will be needed.

The second item in the attached table under Source Area Residential Use Soils concerns delineating dioxin contamination west of the tailrace centerline and east of Centredale Manor. Anna Krasko feels that there are enough existing data to evaluate the need for remediation but that additional data will likely be needed for design. Some members of the team are concerned that the existing data may not be sufficient to adequately estimate the volume of contaminated soil in the area, which could introduce a high degree of uncertainty into the FS. There was also uncertainty about how much data currently exists in the area. As a result Anna directed Battelle to evaluate all the existing data for the area in question to establish the fill history and determine whether the extent of contamination is sufficiently delineated.

The third item under Source Area Residential Use Soils concerns collecting additional soil data to delineate the extent of contamination under the Brook Village parking lot. Goldman Environmental Consultants (GEC) has already collected samples in that area in 1999. No additional data collection activities are planned because the area is under a paved parking lot that will be evaluated in the FS.

The fourth item under Source Area Residential Use Soils was defining the extent of NAPL in soil in the vicinity of Well MW-05S. The group determined that existing data were sufficient to move forward with evaluation of a remedy for this area.

d. **Commercial Use Soils** – The original data gap identified refers to the Lyman Mill area. There is some uncertainty about the extent of commercial properties that may need to be sampled. EPA requested that a total of 5-6 additional samples may be collected from the northeast corner of Lyman Mill Pond and in the undeveloped area along the west bank of Lyman Mill Pond. Battelle will conduct a site visit to observe site conditions and develop the sampling requirements as part of preparation of the RI Work Plan.

No additional sampling will be conducted at the asphalt plant or other commercial properties.

e. **Groundwater** – One more round of groundwater sampling will be conducted to confirm previous results, evaluate future land use for indoor air issues, and monitor migration of contamination. Samples from all wells will be analyzed for VOCs and the sample from Well MW-05S will also be analyzed for dioxin. Note that NAPL and elevated dioxin concentrations were identified in soil (4-6 ft bgs) and in groundwater in TTNUS Well MW-05S. The current data are sufficient to select a remedy.

f. **Sediment** – It was concluded that additional surface sediment sampling would not contribute to the ability to make decisions regarding the need for remediation at this time. Additional surface sediment samples might be needed after PRGs are developed to fully define the area affected above the PRGs. Vertical sediment sampling at this time would be beneficial to help estimate affected sediment volumes for the FS since currently there is little or no data regarding the depth of contamination in the pond sediment. No surface sediment sampling will be planned at this time. The vertical sampling that EPA is planning to execute through ERT will generate the data on vertical contaminant distribution in sediment.

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EPA-NE QAPP Worksheet #8a - Rev. 10/99 (continued)

Project Planning Meetings

Meeting Minutes (cont).

Additional RI/FS Related Topics

a. **Schedule for Developing PRGs** – During the RI planning discussions, several decision points were identified that were dependent on the PRGs, which have yet to be determined. Harding will look at the schedule for the BERA and HHRA and look for ways to accelerate development of the PRGs.

b. **West Bank Downstream of Allendale Dam** – Cornell Rosiu raised a concern about a wooded area just downstream of Allendale Dam along the west bank. He questioned whether this area had been previously characterized. After some discussion it was established that Tetra Tech NUS had collected a limited number of samples in this area last year and that the data should be in the Draft Technical Memorandum – Source Area Investigation, January 2002. Laureen Borochaner will provide these results directly to the project team.

c. **Tailrace Around Allendale Dam** – Include this area as part of the sediment analysis.

d. **Tailrace Around the Source Area** - There are some data from this area including two samples collected by LEA that were split with EPA, LEA immunoassay data, and some data in TTNUS's database. EPA will provide the most recent version of the database that includes TTNUS groundwater data and LEA data.

e. **Quality Assurance Project Plan** – If necessary, an addendum to the QAPP will be prepared to include new matrices, analysis parameters and associated DQOs.

f. **Sampling and Analysis Plan** – The Sampling and Analysis Plan for this work should refer to the existing QAPP and include only an addendum to document collection of additional samples. Planned additional collections included commercial samples (full analytical suite) and groundwater monitoring (VOCs and dioxin [Well MW-05S only]).

g. **RI and FS Work Plans** – A RI/FS Work Plan will include RI data gap sampling as follows: 1) additional residential soil sampling as required west of the tailrace centerline near Centredale Manor (sample design to be based on outcome of existing data evaluation); 2) commercial soil sampling in areas where a complete exposure pathway appears to exist; and 3) collection of groundwater samples from all monitoring wells and analysis for VOCs (all samples) and dioxin (Well MW-05S only). The FS-related part of the Work Plan will address 1) evaluating the integrity of interim caps and parking lots in the source area; and 2) defining the extent of NAPL in soil around Well MW-05S to establish the limits of a remedial action. RI/FS activities associated with evaluating hydrodynamics and sediment stability will be determined in a follow-up conference call.

h. **Schedule** – The Corps HTRW CX will try to get notes from the meeting to Laureen by the middle of the week of April 29. Battelle with then submit a memorandum for record of the meeting within 5 working days afterward.

i. **Other Action Items** – Laureen Borochaner had the following additional action items following the meeting:
   - Obtain and distribute a copy of the Corps flood report on the Allendale reach.
   - Obtain and distribute the latest update of the project database from Tetra Tech NUS.
   - Obtain and distribute Tetra Tech NUS' QAPP for groundwater sampling. Ann Krasko indicated that it is in the administrative record.

Battelle will also have follow-up discussions with Andy Beliveau regarding the detections of HCX in the reference area.

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EPA-NE QAPP Worksheet #8a - Rev. 10/99 (continued)
Project Planning Meetings

Meeting Minutes (cont).

Action Items

Harding ESE

- Prepare draft meeting minutes for submittal to Battelle
- Prepare response to comments for Draft Data Evaluation Report
- Begin preparation of the final report once the EDD for all the third party validated data is received.
- Coordinate a conference call to discuss exposure assumptions with Chau Vu and Cliff Opdyke
- Consider adding commercial exposure to Human Health Risk Assessment
- Determine whether other pathways should be addressed in Human Health Risk Assessment
- Prepare decision flow diagram for 95% UCL
- Revise measurement endpoint inference weight tables (5-1 to 5-7) from work plan. A red-lined version of the tables will be provided to EPA and USACE with rationale for the modifications for their review.
- Evaluate project schedule to determine whether the PRGs can be completed earlier than currently scheduled.

Battelle

- Review the data from the area west of the tailrace along with boring logs to assess the stratigraphy and extent of fill material and to more clearly define the data gaps.
- Review HCX data with A. Beliveau.
- Update RI Data Gap Table. Revised table will be attached to the meeting minutes.
- Prepare RI/FS Schedule.

EPA

Anna Krasko -

- Provide the most recent version of the database that includes TTNUS groundwater data, LEA data, and TTNUS data from the wooded wetland immediately downstream of Allendale Dam to Battelle and Harding ESE.

Cornell Rosiu -

- Provide copies of journal articles for HCX toxicity to Laureen for distribution to team
- Conduct a conference call to discuss the basis for determination of HCX toxicity and determine the methods that will be used in the BERA and BCRA.
- Prepare SOW for sediment coring study

USACE

- Provide copy of LEA report to Harding ESE
- Provide copy of USACE flood inundation report to Battelle
- Coordinate conference call to discuss SOW for hydrodynamics studies
- Obtain an updated copy of TTNUS' database
- Provide a copy of TTNUS' QAPP for the groundwater sampling to Battelle

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EPA-NE QAPP Worksheet #8b - Rev. 10/99

Problem Definition/Site History and Background

Site History and Background[3]

The Centredale Manor Site is a multi-unit apartment complex that houses elderly and handicapped adults. It is located at 2074 Smith Street (Route 44) in Centredale, a village of North Providence, Rhode Island. The Centredale Manor apartment building and adjacent apartment building known as "Brook Village," are located on the site of the former Metro-Atlantic Chemical Corporation, which operated from the 1940s to the 1970s in a former mill complex on the site. The Woonasquatucket River follows the west boundary of the site. The remains of a raceway for the former mill complex are present on the eastern boundary of the site.

Historical records of Metro Atlantic Chemical researched by Weston (March 1999) indicate that the site manufactured hexachlorophene and that there were shipments of trichlorophenols to the site. The mill complex was destroyed by fire in the late 1970's and the apartment buildings were constructed in 1982. During construction of the apartment buildings 400 drums and 6,000 cubic yards of contaminated soil were removed from the site. Labels indicated that the drums contained caustics, halogenated solvents, PCBs, and inks.

A study conducted in June 1996 by the EPA Narragansett Laboratories and the Providence Urban Initiative Program (EPA, 1996) determined that elevated levels of dioxin were present in fish collected from the River. A subsequent study of the Woonasquatucket River conducted by the USEPA OEME in June 1998 found elevated concentrations of dioxin and polychlorinated biphenyls (PCBs) in sediments in portions of the river and impoundments adjacent to the downstream of Centredale Manor (EPA, July 1998). Soil and sediment sampling conducted by EPA START personnel in September 1998 found dioxin at concentrations up to 10.1 ppb in sediments collected directly behind the Allendale dam that had a water depth of at least six feet (Weston, March 1999). Allendale Pond was an impoundment located immediately downstream of the Centredale Manor Site. The impoundments dam breached in 1991 exposing the sediments. Further sampling conducted in February 1999 on the Centredale Manor property also found elevated concentrations of dioxin in soils and sediment. Additional historical information on the Centredale Manor Site is available in the Expanded Site Inspection Report, prepared by Weston (March, 1999).

Contaminants of concern include dioxin, 1,2,4,5,7,8-hexachloroxanthene (HCX), 2,3,6,7-tetrachloroxanthene (TCX) and PCBs.

Objectives

The purpose of this study is to collect residential soils, commercial soils, and groundwater samples from selected locations along the Woonasquatucket River (Figures 2, 3, and 4). Samples will be analyzed for a wide suite of chemical parameters, identified in EPA-NE QAPP Worksheet #9a, in support of the Remedial Investigation (RI)/Feasibility Study (FS).

[3] Site history and background taken verbatim from the *Sampling and Analysis Plan Woonasquatucket River Sediment Investigation, Centredale Manor Site North Providence, Rhode Island* (Tetra Tech, 1999). Note – references cited in Tetra Tech SAP not available.

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Problem Definition/Site History and Background

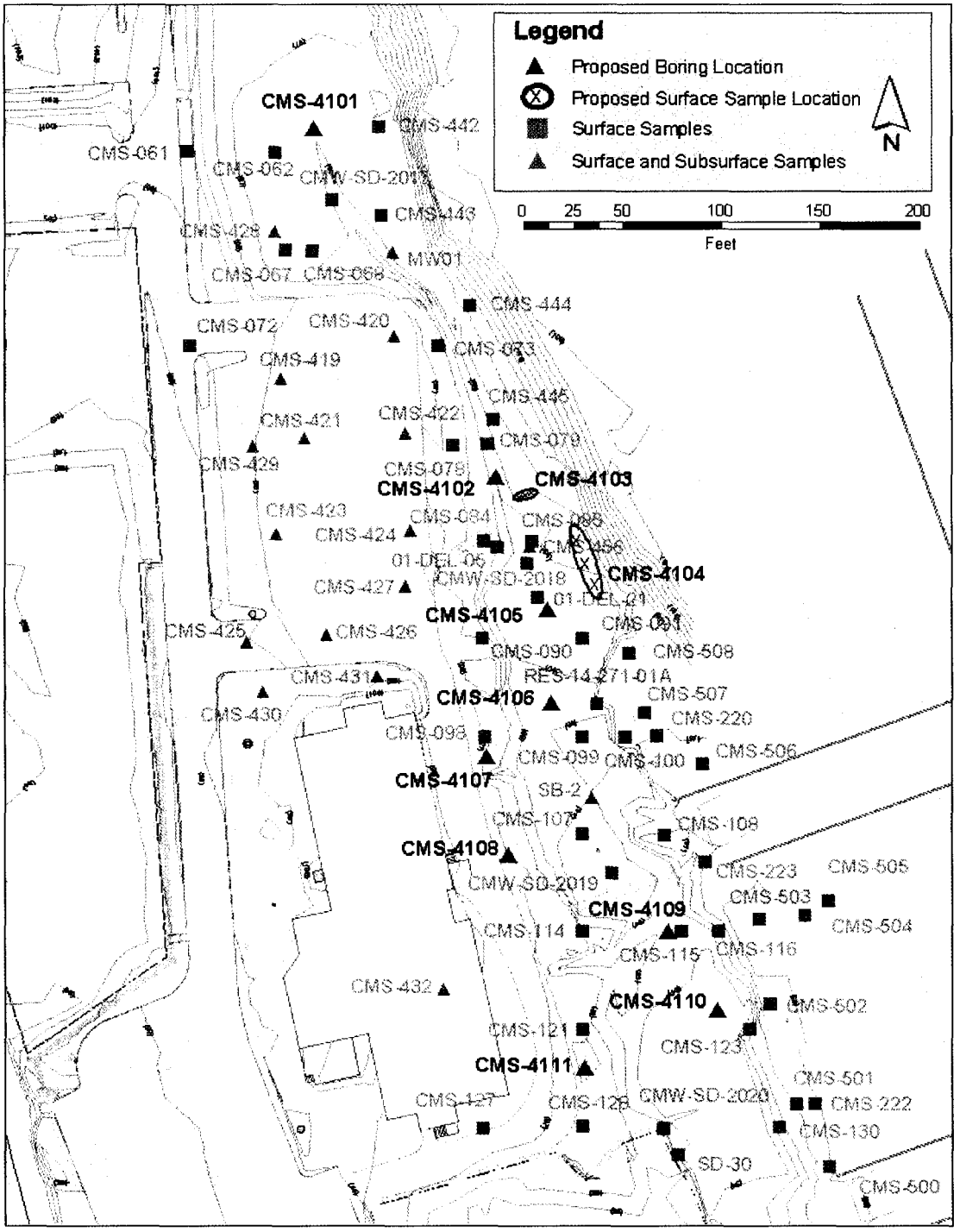

Figure 2. Tailrace Boring Locations.

Original includes color coding.

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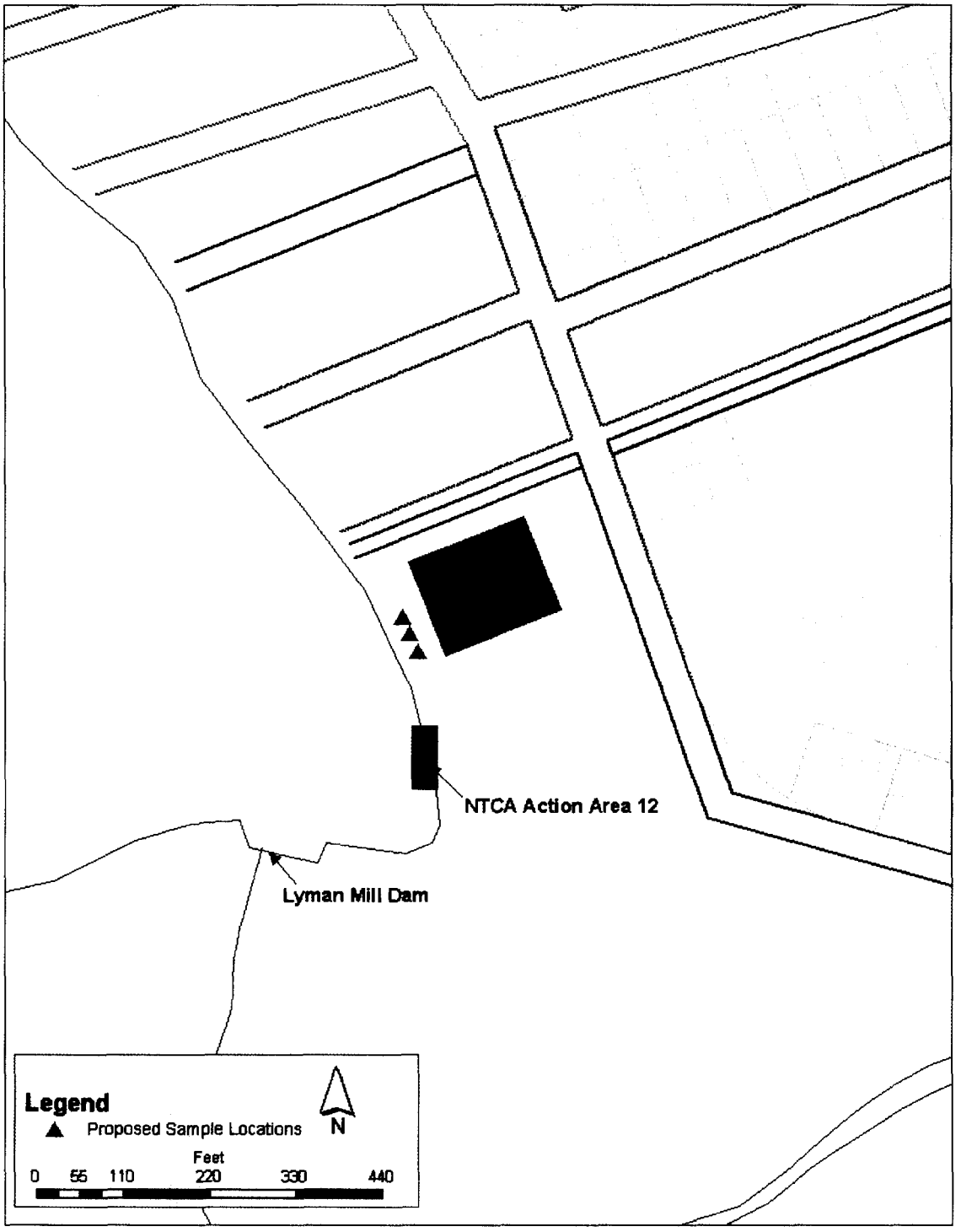

Figure 3. Commercial Soil Locations.

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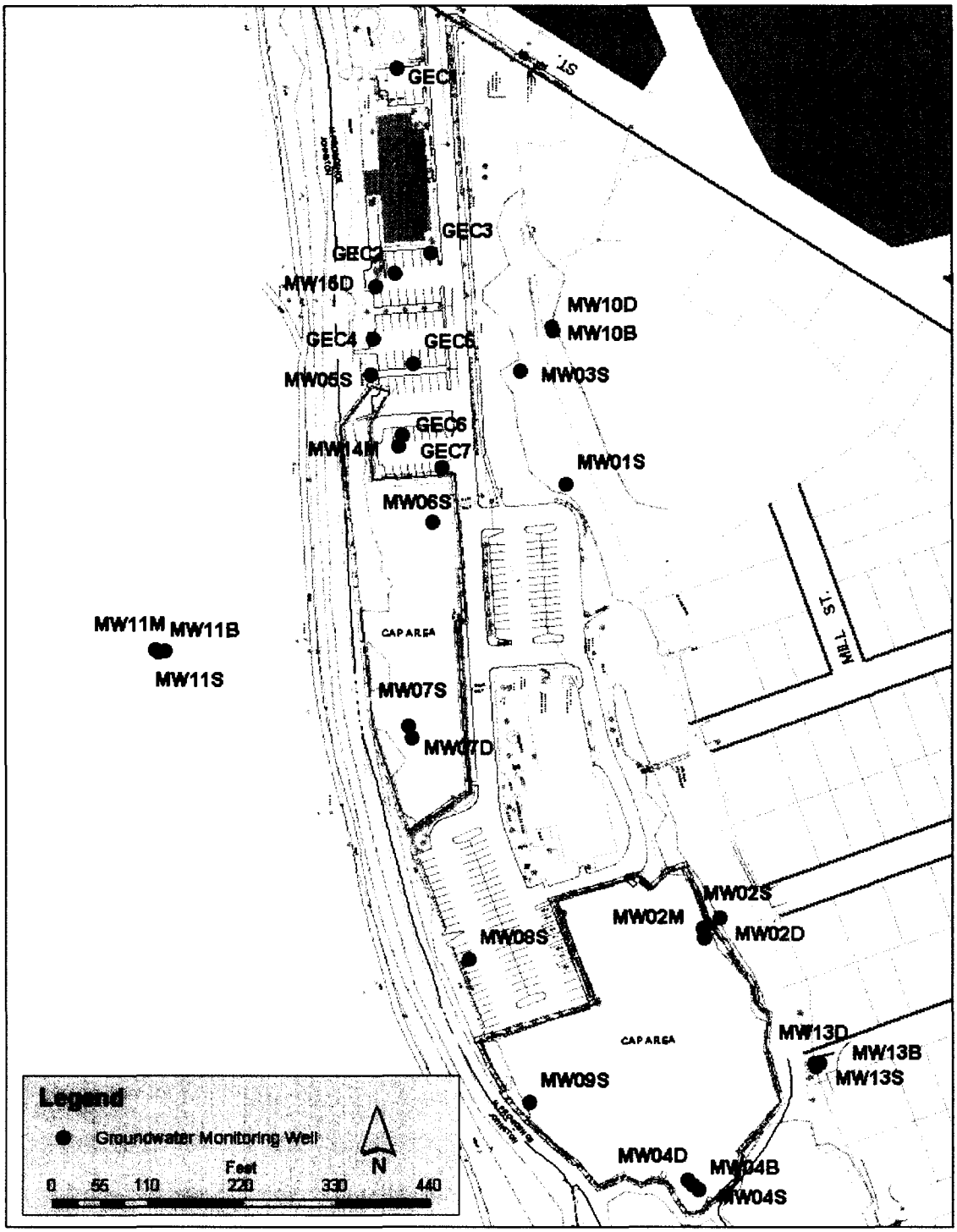

Figure 4. Monitoring Well Locations

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Project Description and Schedule

Sampling Tasks:
Samples will be collected from a Dioxin superfund site. ***Unused sample*** *are regulated for F-listed waste and should be shipped back to Battelle Duxbury.*

Field sampling activities, including sampling locations and collection techniques, are discussed in detail in the Field Sampling Plan (Battelle, 2002b[4]); a general overview of sampling activities is also described in EPA-NE QAPP Worksheet #12a. Briefly, residential soils, commercial soils, and groundwater samples from multiple sampling locations located along the Woonasquatucket River (Figures 2, 3, and 4), will be collected for physical and chemical testing (Table 1). Additional details regarding sample collection are provided in EPA-NE QAPP Worksheets #9c and #12b.

Table 1. Sampling Locations, Numbers of Samples, Required Analytical Parameters, and Performing Laboratories

Sample Matrix	Sampling Locations	Total Number of Study Samples (a)	Analysis Parameters	Performing Laboratory
Residential Soils (also referred to as Tailrace borings)	11	26 (1, 2 or 3 per location)	Dioxin/Furan and Percent Moisture	Battelle Columbus
		2	Moisture, PCB Aroclor, Pesticides, SVOC (b)	Battelle Duxbury
		2	Moisture, Metals (c) and MeHg	Battelle Sequim
		2	Moisture, SVOC (b)	STL Pittsburgh
		2	Grain size, TOC	Applied Marine Sciences, Inc.
		18 (2 each at 9 locations)	Archival	Battelle Duxbury
Commercial Soils	3	3	Moisture, PCB Aroclor, Pesticides, SVOC (b)	Battelle Duxbury
	3	3	Dioxin/Furan, HCX	Battelle Columbus
	3	3	Moisture, Metals (c) and MeHg	Battelle Sequim
	3	3	Moisture, SVOC (b)	STL Pittsburgh
	3	3	Grain size, TOC	Applied Marine Sciences, Inc.
Groundwater	1	1	Dioxin/Furan (d)	Battelle Columbus
	33	33	VOCs	STL Pittsburgh

(a) Not including field QC.
(b) SVOC analysis includes PAHs, phenols, and phthalates. PAHs analyzed by Battelle Duxbury; Phenols and phthalates analyzed by STL Pittsburgh.
(c) Target metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc.
(d) Only groundwater from Well MW-05S will be analyzed for dioxin/furans and HCX at Battelle Columbus

[4] Battelle 2002b. Interim Data Collection RI/FS Final Field Sampling Plan Addendum. September 27, 2002.

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Project Description and Schedule

Sample Storage and Holding Times for Chemical Analyses:
All samples will be shipped by overnight carrier on ice from the field to participating laboratories. Upon arrival at the laboratory, samples will be logged into laboratory's sample tracking system and the laboratory will maintain possession of the original sample custody logs that accompany the samples. Samples will be prepared for physical and chemical testing within specified holding times (Table 2).

Table 2. Sample Type, Storage and Holding Time Requirements for Chemical Parameters

Sample Type	Sample Shipping Conditions (from Field to Labs)	Laboratory Storage Conditions	Holding Times
PE Samples (a)	Ambient	Follow directions received with PE samples	Follow directions received with PE samples
Soil (c)	Cold (<6 °C)	Frozen (at, or below, –20 °C)	SVOCs (PAHs), Pest/PCB: 1 year (b) (40 days for extracts)
			Dioxins/Furans (w/ HCX): 1 year
			Metals: 6 mo Hg: 28 d (60-d for digestate)
		Refrigerated (at approximately 4±2 °C)	MeHg: 28 d (60-d for digestate)
			Grains size, TOC: 28 d (b)
			SVOCs (phenols/phthalates): 14 d
Groundwater		Refrigerated (at approximately 4±2 °C)	Dioxin/Furan: 1 year (d) (40 days for extracts)
			VOCs: 14-d preserved to a pH <2 with HCl.

(a) PE samples will be shipped to participating laboratories for those parameters where there is no available SRM, but there is an available PE sample (i.e., SVOCs phenols and phthalates).
(b) EPA, 1992. EMAP Estuaries 1992 Virginian Province Quality Assurance Project Plan.
(c) Holding times as listed for soils are also applicable to sediments.
(d) Per EPA Method 1613, Rev.B for dioxin/furan, aqueous samples may be stored for up to one year if stored as described in the method.

Sample Disposition – As noted above, samples will be collected from a Dioxin superfund site and unused sample are regulated for F-listed waste. As a result, rather than archiving samples for 6-mo past delivery of final data (standard procedure at Battelle), unexpended samples will be returned to the site upon completion of the sample analysis task (*i.e.*, final data through internal QA).

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Project Description and Schedule

Soil Analysis Tasks:
Residential soils will be tested for dioxin/furan and moisture content; a sub-set of the residential soils (two total) will also be analyzed for the full suite of chemical and physical parameters (Table 1). Commercial soils will be analyzed for the full suite of physical and contaminant parameters identified in Table 1. Definitive data will be produced for each analytical task.

All analytical tasks will be performed in a fixed laboratory following standard operating procedures (SOPs). SOPs were provided previously (Battelle, 2001)[5]. SOPs for new analytical parameters and/or laboratories that did not participate in summer 2001 sampling/analysis (e.g., STL Pittsburgh) are provided with this QAPP Addendum (Attachment K). General descriptions of analytical methods are described below.

Moisture Content

Moisture content will be determined at Battelle (Duxbury, Columbus and Sequim) and STL following standard operating procedures. NOTE – samples designated for organic analysis, and are determined to have low solids content (<30% solids), must be pre-treated to remove excess water before using sample material for extraction and analysis; see discussion below for how to handle low solids content samples. Low solids content samples for metals analysis do not require special handling given that the samples will be freeze-dried before digestion and analysis.

At Battelle Duxbury, moisture determination will be performed following SOP 5-192. Briefly, 1 to 5-g of well-mixed soil is weighed into a pre-weighed, pre-baked, aluminum weighing pan. The pan is placed in a drying oven and dried overnight at ca. 105 °C. After approximately 24 h, the pan is removed from the drying oven and allowed to cool at room temperature for at least 30 min. The pan is reweighed and percent moisture determined as defined in Section 4.0 of the SOP.

> *Soil samples with percent solids <30%*
> Samples with <30% solids will be centrifuged to remove excess water. Briefly, approximately 100 g of well-mixed soil will be centrifuged for approximately 2 minutes at 1,000 RPMs. The overlying water will be decanted and discarded. The remaining soil will be mixed well and an aliquot (10 to 30 g) removed for extraction following Battelle SOP 5-192. An additional aliquot will be removed for dry weight determination. Sample results will be reported on dry weight basis.

PCB Aroclor, Chlorinated Pesticides and Semivolatile Organic Compounds

Soil samples (Table 1) will be extracted for chlorinated pesticides/PCB Aroclors and SVOCs (PAHs) following Battelle Duxbury SOP 5-192. This method was developed by Battelle in support of NOAA's National Status and Trends Mussel Watch Project (Peven and Uhler, 1993a). Briefly, approximately 10 to 30 g of wet soil material will be weighed into a extraction vessel and spiked with the surrogate internal standard (SIS) compounds. Next, the sample will be extracted three times with 100 mL dichloromethane (DCM) using shaker techniques. After each extraction, the sample will be centrifuged, and the solvent

[5] Battelle 2001. Tasks 19-22 QAPP Field Sampling, Chemical and Toxicity Testing. May 23, 2001. 509 pgs + app.

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EPA-NE QAPP Worksheet #9a – Rev. 10/99 (continued)

Project Description and Schedule

extract decanted into a receiving vessel. The combined extract will be dried over sodium sulfate, concentrated to approximately 2 to 3 mLs using Kuderna-Danish and nitrogen evaporation techniques. Sample extracts may be treated with activated copper to remove elemental sulfur. The extract will then be processed through an alumina cleanup column:

- Packing: 40 g F20 (2% deactivated) alumina, in DCM
- Elution: 275 mL DCM (to ensure Endrin aldehyde elution)

Size-exclusion high-performance liquid chromatography (HPLC) will be used to further clean the concentrated extract (SOP 5-191). This procedure removes common contaminants including elemental sulfur that interfere with instrumental analysis. The post-HPLC extract will be concentrated under nitrogen to approximately 1 mL, fortified with recovery internal standards (RIS) that are used for quantification, and split for SVOC (PAHs) and chlorinated pesticides/PCB Aroclors analyses by GC/MS and GC/ECD, respectively. The extract for GC/ECD analysis will be solvent exchanged into hexane prior to analysis.

Note that a routine set of quality control samples will be prepared and analyzed with each batch of 20 or fewer samples (defined in EPA-NE QAPP Worksheets #9a and #24a) to monitor data quality in terms of accuracy and precision. In particular, it should be noted that two laboratory control samples (LCS) will be prepared with each analytical batch of samples. One of the LCS samples will be spiked with a universal matrix spike solution that includes chlorinated pesticides, individual PCB congeners[6] (18 congeners), and PAHs. (This same solution will also be used to fortify the matrix spike (MS) and matrix spike duplicate (MSD) QC samples contains.) The second LCS sample will be fortified with an alternative MS solution that contains Aroclor 1016 and Aroclor 1260 only. The second LCS will be used to demonstrate data quality in terms of accuracy for PCBs as Aroclors (as opposed to congeners).

GC/ECD Analysis — Chlorinated Pesticides/PCB Aroclors will be analyzed by GC/ECD (Hewlett Packard 5890 Series 2 GC) using a 60-m DB5 column and hydrogen as the carrier gas (Battelle SOP 5-128). A minimum of a five-point calibration curve will be used for pesticide analysis ranging from approximately 0.004 to 0.3 µg/mL. A single point calibration at approximately 2 µg/mL will be used for Technical Chlordane and PCB Aroclors analysis. And a single point calibration at approximately 4 µg/mL will be used for Toxaphene analysis

Aroclor will be determined as the most predominant Aroclor formulation, or mixture of two major Aroclor formulations. If, based on the review of the data, it appears that the PCB composition of the samples is dominated by one Aroclor, then that formulation will be used for quantitation. If the PCB composition appears to be primarily a combination of two Aroclor formulations (*e.g.*, Aroclors 1248/1254 or 1254/1260), then a standard of those mixtures will be analyzed and used for quantitation and data reporting.

GC/MS Analysis — SVOCs (PAHs) will be analyzed by GC/MS in the SIM mode using a 60-m DB5 column and a Hewlett Packard 5972 (or 5973) detector (Battelle SOP 5-157).

[6] PCB congener analysis is not required for this study. PCB congeners are simply being fortified into the LCS because the laboratory universal MS solution contains PCB congeners along with the target pesticides required for this study. LCS secovery data will only be reported for the target pesticides, not PCB congeners. Aroclor recovery data will be reported for the second LCS.

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Project Description and Schedule

Concentrations for all target analytes will be determined by the method of internal standard, using RISs for quantification. Sample results will be reported on a dry weight basis. Total PCB will be calculated as the sum of the detected Aroclors and total PAH will be calculated as the sum of detected PAHs. *All totals calculations will be determined by the **database** using final, validated data.* Note that in cases where an individual Aroclor or PAH is not detected, a value of 0.0 will be used in the summation.

Dioxin/Furan and HCX

Soil samples (Table 1) will be extracted and analyzed for the seventeen 2,3,7,8-substituted PCDD/PCDF (commercial and residential soils) and HCX (commercial soils only) following the general procedures in EPA Method 1613, Revision B, as described in Battelle Columbus SOPs ASAT.II-001-02 and ASAT.II-002-02 with modifications noted below. *The analysis of soil samples for TCX is not required for this phase (RI/FS support) of the project.*

Approximately 1- 10 g (wet weight) of each soil will be spiked with isotopically labeled analogs of fifteen of the seventeen 2,3,7,8-substituted PCDD/PCDF. Samples will be extracted with methylene chloride (or toluene) in a Soxhlet apparatus for a minimum of sixteen hours. Alternatively samples may be extracted by an Accelerated Solvent Extraction (ASE) procedure (SOP ASAT.II-009-00). The entire extract will be put through cleanup (acid and base partitioning) for those analytes.

All extracts for PCDD/PCDF/HCX analysis will be spiked with $^{37}Cl_4$-2,3,7,8-TCDD cleanup standard, partitioned against acid solutions, and processed through acid/base silica, alumina, and carbon Celite columns. Extracts will be spiked with $^{13}C_{12}$-1,2,3,4-TCDD/$^{13}C_{12}$-1,2,3,7,8,9-HxCDD recovery standard and concentrated to a final volume of 20 µL.

Sample extracts will be analyzed by high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS) in the selected ion monitoring mode (SIM) at a resolution of approximately 10,000. Initial analysis for PCDD/PCDF and HCX will be on a DB-5 or equivalent column. Because 2,3,7,8-TCDF is not completely separated from all of the other TCDF isomers on the DB-5 column, second column confirmation of 2,3,7,8-TCDF levels above the lowest calibration level in the initial analysis will be carried out on a DB-Dioxin or DB-225 column. All analytes will be quantified by isotope dilution or by the method of internal standards using surrogate compounds.

Concentrations of the seventeen 2,3,7,8-substituted PCDD/PCDF in soil will be reported on a dry weight basis. Total concentrations of dioxins and furans in a given level of chlorination will be calculated by summing the concentrations of all isomers identified within the level of chlorination, including both 2,3,7,8-substituted and non-2,3,7,8-substituted isomers.

2,3,7,8-TCDD Toxic Equivalents (TEQ) values will be determined in the database, using final, validated data. The TEQ values will be calculated by multiplying concentrations for each isomer by its Toxicity Equivalency Factor (TEF). The TEQs for each isomer detected within a sample will be summed to report a total TEQ value for each sample. The TEF values used will be based on the ESAT (1998)[7].

[7] The TEF values used by ESAT are the ones published in Environmental Health Perspectives, volume 106, Number 12, December

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Project Description and Schedule

HCX will be determined by the analysis of an initial calibration curve (performed in 2001). HCX will be identified and quantitated in the following way:

- Peaks at ion mass 387.8365 and 389.8325 need to co-elute within two seconds.
- Ratio of peak areas for ion masses M+4/M+6 must be 2.31 ± 15%.
- The signal to noise ratio of peaks at the M+4 and M+6 ion masses must be > 2.5.
- Response factors for HCX will be generated using either $^{13}C_{12}$-1,2,3,7,8,9-HxCDF or $^{13}C_{12}$-1,2,3,7,8,9-HxCDD as the internal standard for quantitation.

Soils will be reported on a dry weight basis, using percent moisture data to convert the wet weight data to a dry weight basis.

Metals

Soil samples (Table 1) will be freeze-dried at MSL, then homogenized using a Spex Ball Mill. Percent moisture will be determined following Battelle MSL SOP MSL-C-003.

Soil samples will be digested following MSL SOP MSL-I-004, soil evaporation digestion using nitric acid and/or nitric acid/hydrogen peroxide. In some instances, certain metals are better quantified using an aqua regia digestion, following MSL SOP MSL-I-006-01, mixed acid digestion.

Samples will be analyzed for metals following SOP-MSL-I-022 (ICP/MS), SOP MSL-I-027 (ICP/AES), SOP MSL-I-030-00 (FIAS), and/or SOP MSL-I-029 (GFAA). Samples will be analyzed by CVAA for Hg following MSL SOP MSL-I-016. Results will be reported on a dry weight basis.

MeHg

Soil samples (Table 1) will be distilled or extracted into a clean water matrix prior to analysis. Samples will be analyzed following MSL SOP MSL-I-015 (CVAF). Results will be reported on a dry weight basis.

Grain Size

This method covers the quantitative determination of the distribution of particle sizes in soils. The distribution of particle sizes larger than 74μm (retained on the No. 200 sieve) is determined by sieving, while the distribution of particle sizes smaller than 74μm is determined using a hydrometer to secure the necessary data.

Each sample is homogenized using a stainless steel spatula. Separate grain size and water content aliquots are secured. The grain size aliquot is treated with 30% hydrogen peroxide to remove organic matter, and dispersed in a solution of sodium hexametaphosphate. The course-grained fraction (>74μm) is separated from the fine-grained fraction (<74μm) by sieving the sample through a No.200 sieve. The portion

1998, "Toxic Equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife."

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Project Description and Schedule

remaining on the No. 200 sieve is washed into a beaker and dried. This dried fraction is sorted through a series of nested sieves to provide the distribution of course-grained particles.

The fraction passing the No. 200 sieve is washed into a hydrometer cylinder and brought to volume. The sample is stirred and hydrometer readings are taken at 2, 5, 15, 60, 250, and 1440 minute intervals. The resulting data are combined with the sieve data to generate a grain size distribution curve. Percent, gravel and sand values may be calculated directly from the sieve data, while the silt and clay values are read from the graph.

Total Organic Carbon

This method covers the determination of total organic carbon in sediment and soil samples. An aliquot of sample is secured and dried at low temperature (70°C). The sample is ground and acidified with dilute solution (pH<2) of HCl to remove inorganic carbon. The sample is rinsed with distilled water until the pH is 7. The sample is dried to remove water. A small aliquot of sample is weighed into a precombusted sample boat and combusted at 900°C in a stream of oxygen to convert organic substances to CO_2. The CO_2 stream is scrubbed to remove interferants such as water vapor, NO_X and SO_X, and swept into the coulometer cell. The amount of CO_2 produced is measured, recorded digitally, and printed as a hard copy report.

Semi-Volatile Organics (phenols and phthalates)

Soil samples (Table 1) will be analyzed for SVOCs – as phenols and phthalates – at STL Pittsburgh. Soil extraction procedures will follow SOP C-OP-001-PT. The solid sample will be mixed with anhydrous sodium sulfate and extracted 3 times using 1:1 methylene chloride:acetone using an ultrasonic horn for 3 minutes (each extraction). The extracts will be combined, dried and concentrated to a 1.0 ml final volume.

Extracts will then be analyzed for phenols and phthalates by GC/MS following SOP C-MS-0001-PT. Semivolatile compounds will be introduced to the GC/MS by injecting the sample extract into a GC with a narrow-bore fused silica capillary column. Analytes eluted from the capillary column will be introduced into the mass spectrometer by direct connection. Identification of target analytes will be accomplished by comparing their mass spectra with the electron impact spectra of authentic standards. Quantification will be accomplished by comparing the response of a major (quantitation) ion relative to an internal standard with a 5-point calibration curve. Results will be reported on a dry weight basis.

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Project Description and Schedule

Groundwater Analysis Tasks:
All groundwater samples will be analyzed for VOCs; groundwater from Well MW-05S will also be analyzed for dioxin/furans. Definitive data will be produced for each analytical task. All analytical tasks will be performed in a fixed laboratory following SOPs. SOPs were previously supplied with the 2001 QAPP (Battelle, 2001)[8]. SOPs for laboratories that did not participate in summer 2001 sampling/analysis (e.g., STL Pittsburgh) are provided with this QAPP Addendum (Attachment K). General descriptions of analytical methods are described below.

Volatile Organic Compounds

Groundwater samples will be analyzed for VOCs at STL Pittsburgh following SOP C-MS-0002-PT. Samples will be prepared for analysis using the purge-and-trap procedure described in the SOP. A low-level initial calibration with a 5-mL purge volume will be used. Purged sample components will be trapped in a tube containing suitable sorbent materials. After purging is complete, the tube will be back flushed with helium to desorb trapped sample components. The analytes will be desorbed directly to a large bore capillary for analysis.

Compounds will be identified using GC/MS instruments following SOP C-MS-0002-PT. Qualitative identifications will be confirmed by analyzing standards under the same conditions used for samples and comparing resultant mass spectra and GC retention times. Each compound will be quantified by relating the MS response for an appropriate selected ion produced by that compound to the MS response ion produced by an internal standard.

Dioxin/Furan

Groundwater from Well MW-05S will be extracted (using liquid-liquid technique) and analyzed for the seventeen 2,3,7,8-substituted PCDD/PCDF following the general procedures in EPA Method 1613, Revision B, as described in Battelle Columbus SOPs ASAT.II-001-02 and ASAT.II-002-02.

Quality Control Tasks:
A routine set of fixed laboratory quality control (QC) samples will accompany every set of samples processed and analyzed for this project. The type and frequency of fixed laboratory QC samples are defined in EPA-NE QAPP Worksheet #24a. *MS, MSD and DUP samples must be prepared from Centredale project samples.*

In general, batch QC samples for chemical testing include:

- one procedural/method blank (PB, MB)
- one laboratory control sample (LCS)
- one matrix spike/matrix spike duplicate set (MS/MSD)
- one standard reference material (SRM), where available
- multiple surrogate internal standards (SIS) per sample
- one laboratory (analytical) sample duplicate (DUP)

[8] Battelle 2001. Tasks 19-22 QAPP Field Sampling, Chemical and Toxicity Testing. May 23, 2001. 509 pgs + app.

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Secondary Data:
Not applicable.

Data Management Tasks:
GC/MS data (and organics data at STL) will be acquired and reduced on Hewlett-Packard PC based chemstation minicomputers with dedicated chromatography software (Battelle: EnviroQuant; STL: Target). GC/ECD data will be acquired and reduced by the Thermo Lab Systems XCHROME System. The dioxin/furan/HCX data generated by GC/HRMS will be acquired on a Alpha station personal work station 600AU using VG OPUS and OPUSquan software. All GC/MS, GC/ECD, and GC/HRMS data files will be transferred electronically to a PC so that the data can be incorporated into an electronic database or spreadsheets for final quantification and tabular result presentation. ICP/MS, ICP/AES, FIAS, GFAA and CVAA/CVAF data are acquired electronically with hardcopy reports and data are electronically transferred to a spreadsheet.

Data generated for grain size are hand entered; all other physical chemistry measurements (TOC, % total solids) are acquired on instrument software and downloaded to spreadsheets.

The appropriate analyst/data manager assigned to the project team will perform all data reduction. The final reduction of analytical chemistry data will account for the size of the processed sample and dilution factors. Data provided by participating laboratories will be requested in an electronic data deliverable (EDD).

Electronic Data Deliverable – Final laboratory data will be reported in an EDD, using a normalized Excel spreadsheet (Excel 97 or higher). An example EDD, along with EDD specifications, is provided in Attachment I. Required EDD fields are also summarized in Table 3. The EDD must be submitted in a uniform manner to the Battelle Data Management Team. The EDD is based on a universal spreadsheet format, ensuring consistency with all laboratories involved in the data interchange.

There should be one file submitted per SDG or laboratory batch. All data should be formatted as values (no formulas). There should not be any blank rows, hidden columns and hidden rows in the file.

The first line of each file will be the column header. The column names will be the same as the database field names and must exactly match the spelling provided in Table 3.

Additional details regarding field formats are specified in Attachment I. Field formats should be reviewed carefully prior to submitting the EDD to Battelle. A field reported as *Null* cannot have spaces or returns. A number field must be reported with a number or *Null*. For example, if a text value, such as "N/A" or a space, is reported in the Results field the data will not be acceptable to the database and the EDD will be rejected.

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Project Description and Schedule

The EDD must satisfy certain uniqueness requirements in order to prevent duplication of results in the database. These fields are not null fields in the database, therefore, the EDD must provide a value for these fields. The following fields define a unique data point for reported laboratory results:

NSAMPLE
CLASS
EPASAMNO
PARAMETER

Table 3. EDD Required Fields

EDD Field	Definition
NSAMPLE	Sample ID from sample custody records
EPASAMNO	Same as NSAMPLE
LAB_ID	Laboratory ID assigned upon sample receipt/login *This must be a unique ID; do not use the same ID repeatedly (e.g., blanks)*
LABORATORY	Laboratory Name BATD = Battelle Duxbury; BCO = Battelle Columbus; MSL = Battelle Sequim; STLP = STL Pittsburgh; AMS = Applied Marine Sciences, Inc.
LAB_QC_TYPE	PB = procedural blank; MB = method blank; LCS = laboratory control sample (or ongoing precision and recovery sample); MS = matrix spike; MSD = matrix spike duplicate; SRM = standard reference material; DUP = laboratory duplicate; N = study sample (including field QC)
SAMP_DATE	Collection date from custody records; Format DD-MON-YY
EXTR_DATE	Laboratory extraction/digestion date; Format DD-MON-YY
ANAL_DATE	Laboratory analysis date; Format DD-MON-YY
CASE	Not applicable; leave as NULL in EDD
SDG	Sample delivery group ID or analytical batch ID
PARAMETER	Target analyte (e.g., NAPHTHALENE); see EPA-NE QAPP Worksheet #9b
CAS_NO	Chemical Abstract Service number; see EPA-NE QAPP Worksheet #9b
CLASS	PEST/PCB = PCB Aroclor/pesticides; OS = SVOCs (PAH, phenols, phthalates); DIOXIN = Dioxin/furan and HCX; M = metals and MeHg; OV = volatiles; GS = grain size; TOC = TOC;WET = % moisture
METHOD	BATD_SOP_5_128 = PCB Aroclor/pesticides; BATD5-157 = PAH; MOD 1613B = Dioxin/furan/HCX; L-xx (where xx = SOP number from worksheet #20); SW846 8270C = phenols and phthalates; SW846 8260B = volatiles
LAB_RESULT	Laboratory result, presented on a dry weight (soil) or volume (groundwater) basis.

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Table 3. EDD required fields (cont)

EDD Field	Definition
UNITS	**NG/G_DRYWT** for PCB Aroclor/pesticides and SVOCs (PAHs) **UG/KG_DRYWT** for SVOCs (phenols, phthalates) **PG/G_DRYWT** for dioxin/furan/HCX **UG/G_DRYWT** for metals and MeHg **PCT_DRY** for grain size and TOC **PG/L** for dioxin/furan/HCX **UG/L** for VOCs **PCT_REC** for LCS, MS and MSD **PCT_DIFF** for SRM
QUAL	Varies (see Table 5)
IDL	Not applicable; leave as NULL in EDD
MDL	**Sample specific** detection limit, as follows MDL for PCB Aroclor, pesticides and PAHs EDL for dioxin/furan; RL for HCX QL for metals and MeHg RL for phenols, phthalates, and VOCs RL for grain size, TOC
CRDL_CRQL	Not applicable; leave as NULL in EDD
DIL_FACTOR	Dilution factor performed **after** original instrumental analysis
PCT_MOIST	Percent moisture *Each lab that determines percent moisture (e.g., Battelle Duxbury) will report results in the EDD; lab's not determining percent moisture will leave this field null.*
COMMENTS	Include pertinent sample specific information, if applicable.
FRACTION	T = total for soils and waters; D = dissolved (if applicable)

MDL = method detection limit; RL = reporting limit; EDL = estimated detection limit; QL = quantitation limit

Laboratory results reported in the EDD will include:

- Soil results on a dry weight basis
- Water results on a volume basis
- Blank results – reported on a concentration basis to two decimal places.
- Internal standard results (e.g., SISs, labeled PCDD/PCDF) – recovery reported as whole numbers.
- MS, MSD and LCS results – recovery of target contaminants reported whole numbers.

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- SRM results – percent difference (PD) between the achieved (detected) and certified values. All PD results will be reported to one decimal place. *Note* – for SVOCs (PAHs) and Pest/PCBs analysis the PD is determined from the range of certified values (see EPA-NE QAPP Worksheet #24a).
- PE[9] results – reported on a concentration basis to two decimal places.

Supplemental QC results that will be reported in the project file, but not in the EDD, will include:

- The relative percent difference (RPD) between the MS and MSD results – reported to one decimal place.
- The RPD of the duplicate sample analysis – reported to one decimal place.

Sample-specific detection limits will also be reported (see EPA-NE QAPP Worksheet #30). Results reported to two decimal places.

Chemistry reports will also include a QA/QC narrative that define the QC criteria that were to be met along with results that were achieved. QA/AC narratives are further described in EPA-NE QAPP Worksheet #9a, Data Usability Assessment Tasks.

Documentation and Records:
Documentation associated with laboratory analyses will include sample receipt and log-in records, sample processing logs, sample preparation records, analytical instrument printouts, and equipment logs. Initially, all data will be recorded either (1) electronically onto a computer storage media from laboratory systems or (2) manually into laboratory notebooks or on established data forms. All notes will be written in ink. Corrections to hand-entered data will be initialed, dated and justified. Complete forms, laboratory notebooks, or other forms of hand-entered data will be signed and dated by the individual entering the data. It will be the responsibility of the Laboratory Manager and/or Task Leader to ensure that all data entries and hand calculations are verified. Sample preparation laboratory records will be maintained in bound laboratory record books. In addition to these documentation procedures, sample logs associated with field and laboratory custody and tracking will be maintained in project files.

Data Packages:
Analytical Task Leaders will prepare a project-specific data package (project records). All packages will receive secondary review either by another analyst or the laboratory supervisor. In addition, a minimum 10% of the data packages (5% for STL; 100% for Battelle Columbus, Battelle MSL and AMS) will be submitted to the Quality Assurance Unit (QAU) for an independent Quality Assurance review.

[9] Only applicable PE sample will be SVOCs (phenols, phthalates) in soil.

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Data packages are considered a deliverable and will be maintained by the laboratory. Content and format of data packages prepared at Battelle Duxbury are defined below. *Note* – while the format of data packages prepared by participating laboratories may vary, the content will be consistent and will contain pertinent raw data elements (Attachment J) necessary for third party validation. The format of data packages prepared at Battelle Duxbury is as follows.

One copy of each HRMS data package, including raw data, will be submitted to EPA-NE for Tier III validation. One copy of all other analytical data packages will be submitted to Environmental Standards for Tier II validation. Percent moisture data will not receive third party validation. Raw data required for the third party validation are defined in Attachment J.

Table 4. Content of Data Packages Prepared at Battelle Duxbury

Section	Contents
Title Page	Project name; analysis parameter; Batch ID; matrix; approvals
Signature Page	Name (printed, signature, and initials) of laboratory staff
Workplan	Project-specific memorandums
Tables	Final hardcopy of Excel report tables
Misc. Docs.	Documentation of project-specific issues (corrective action, changes in scope, etc...)
Sample Prep	Hardcopy of sample preparation records
Calibrations	Initial and continuing calibration reports
Sample Data	Quantification reports for authentic and QC samples
Chromatograms	Sample chromatograms
Unused Data	File copy of data not used or reported

Assessment/Audit Tasks:
Quality assurance encompasses all planned and systematic activities necessary to assure management that the products generated, and the services performed by Battelle meet the quality standards established in this QAPP. The primary mechanism for accomplishing this goal is audits. Audits refer to the formal assessment of conformance to the QA Program and its effectiveness. During an audit, the agreement with QA policy documents (*e.g.,* SOPs) is evaluated, deficiencies are identified, and corrective action is taken. Ideally, audits also serve to increase awareness and understanding of QA policies and procedures. Mr. Mark Guilmain will serve as Battelle's QA Officer and is responsible for identifying areas for corrective action, coordinating the QA activities such as systems and data audits, and preparing reports to management for this project. QA Officers at participating laboratories will be responsible for coordinating and performing QA activities at participating laboratories. The identity of auditors and their qualification are presented in EPA-NE QAPP Worksheet #6. The following QA audits are planned for this project.

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Project Description and Schedule

- A technical system (initiation) audit is conducted as part of the review of this QAPP to (1) ensure that the work assignment scope and all required elements are addressed adequately, (2) verify that all required SOPs are approved and current, and (3) to verify that all participants have the required qualifications and documented training to perform their assigned tasks.
- Performance audits are independent checks of routinely obtained data. One Certified or Standard Reference Material (CRM or SRM, respectively) will be incorporated into each batch of chemistry samples (as applicable) to assess the accuracy and precision with which target analytes of known concentration are recovered from a representative matrix. The acceptance criteria are discussed in EPA-NE QAPP Worksheet #11b.

Data reports, submitted to USACE NAE, will be verified by the appropriate Laboratory Analyst and Laboratory Supervisor and validated by the Project Manager. The Quality Assurance Unit (QAU) will conduct independent audits on a minimum of 10% of the data reports (see Battelle SOP 6-027). These audits will reconstruct representative data from each sample based on sample processing records, instrument calibration factors (*e.g.*, response factors) and output (*e.g.*, area counts), and sample manipulations and spiking. Samples will be tracked from receipt and processing through analysis and reporting to ensure that the reported data are accurate, complete, and traceable.

Participating laboratories are responsible for reporting results of QA audits to the appropriate analytical Task Leader, Laboratory Manager, and/or the Laboratory Project Manager (EPA-NE QAPP Worksheet #27b). Each laboratory is responsible for ensuring that audit reports are responded to and appropriate corrective action implemented and documented in the project file, and approved by management. Audit reports at Battelle will define any errors, deficiencies, or deviations from the QAPP. The responsible analyst documents the corrective action on the audit report and submits the audit report to the Project Manager for review and approval. Battelle audit reports are available for review at the respective facility.

Data reports, submitted to USACE NAE, will receive a review by a senior scientist and the Quality Assurance Unit.

Data Verification and Validation Tasks:
Data validation discussed in this QAPP describes what Battelle and other participating laboratories will perform internally. Data validation is the responsibility of those immediately responsible for overseeing and/or performing analyses, data entry, data reduction, and data reporting. The data validator will verify final report tables for accuracy and completeness (*i.e.*, calculation, manual entries). Battelle's procedures for data validation and review activities are described in SOPs 6-027 (Battelle Duxbury), SOPs ASAT.II-003 and ASAT.II-010 (Battelle Columbus), and MSL-Q-005 (Battelle MSL).

A series of reviews by technical personnel will be implemented to ensure that the data generated for this project meet the data quality objectives. These reviews will include the following activities.

- Data and related project records will be reviewed by laboratory personnel at the end of each working day to ensure that analytical activities are completely and adequately documented.

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- The Task Leaders will be responsible for reviewing analytical results and supporting documentation. The results of QC sample analyses will be compared to pre-established criteria as a measure of data acceptability.
- All hand-entered or transcribed data will be 100% validated.
- All calculations performed manually will be checked for accuracy. Calculations performed by software will be checked at a frequency sufficient to verify their accuracy.

All data will be validated to ensure that the measurement performance criteria (MPCs) described in EPA-NE QAPP Worksheet #11b have been met, instrument calibration and maintenance requirements also specified in EPA-NE QAPP Worksheet #21 have been met, and that the data are complete, accurate, and traceable.

All data that do not meet the listed MPCs will be submitted to the Project Manager, or his designee, for review and assessment of the potential impact of the results. Affected samples may be reanalyzed at the Project Manager's, or his designee, discretion. Data that are accepted outside these criteria will be flagged with the appropriate data qualifier (Table 5), and the rationale for accepting the analysis will be thoroughly documented.

Third Party Validation — PCDD/PCDF/HCX HRMS data will receive Tier III validation by EPA-NE. All other analytical chemistry data packages (excluding percent moisture) will receive Tier II validation by Environmental Standards.

Table 5. Data Reporting Qualifiers

Data Qualifier[1]	Definition	Data Qualifier[1]	Definition
J	Detected at a concentration above the method detection limit (MDL) and below the reporting and/or quantitation limit (RL or QL)[2]; *see Worksheet #9b*	B	Analyte detected in the laboratory blank; concentration found in study samples is less than the blank action level (*see EPA-NE QAPP Worksheets #11b*).
U	Not detected, or detected at a level below the detection limit (MDL, QL or RL) reported, *see Worksheet #9b*	~	QC value outside the accuracy or precision criteria goal (EPA-NE QAPP Worksheet #11b) – but meets contingency criteria.
#	Result from second column confirmation analysis	&	QC value outside the accuracy or precision criteria goal (EPA-NE QAPP Worksheet #11b).
T	Holding time exceeded	X	Estimated, due to lack of a compound specific response factor
E	Estimate; significant matrix interference.		

[1] For STL, only the J and U qualifiers (and definitions) apply. Other qualifiers, and their definitions, will be included in the analytical report.
[2] Detection Limits (MDLs, EDLs, RLs, QLs) are defined in EPA-NE QAPP Worksheet #9b; Achieved detection limits will be reported with the data.

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Project Description and Schedule

Data Usability Assessment Tasks:
The review of quality control data is a critical step in the data validation process because quality control data that are within the QAPP acceptance criteria indicate that the sample processing and analysis systems are in control. Quality control data will be evaluated for usability as described in Figure 5 (EPA-NE QAPP Worksheet #30). EPA-NE QAPP Worksheet #24a describes the type of quality control samples that will be analyzed with each analytical batch and corrective action for out-of-control quality control data and instrumentation calibrations. All quality control data that do not meet the measurement performance criteria will be flagged (Table 5) and brought to the attention of the Task Leader and the Project Manager, who will determine the appropriate corrective action (*e.g.*, reanalysis or data reported with qualifiers).

QA/QC narratives will present quality control criteria and the quality control results. They will be prepared for each analytical batch and will describe any MPC exceedances and what, if any, impact they may have on the overall data.

Further data usability will be performed by the data validators, who will perform a Tier II (all chemistry data excluding HRMS data) or Tier III (all HRMS data) validation of the data following USEPA Region 1 guidelines.

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EPA-NE QAPP Worksheet #9b - Rev. 10/99

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Soil
Region I Matrix Code (from EPA-NE DQO Summary Form): SO
Analytical Parameter: Chlorinated Pesticides and PCB Aroclors
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP: L-9

Analyte	CAS Number	Project Action HH Goal* (ng/g dry weight)	Project Action ECO Goal* (ng/g dry weight)	Analytical Method[1]		Achievable Laboratory Limits[2] (DRY WT – ng/g)	
				MDLs	Method Practical QLs (wet wt – ng/g)	MDLs[3]	RLs[4]
4,4'-DDD	50-29-3	0.52	Not available	Not available	Not available	0.045	0.44
4,4'-DDE	72-54-8	0.367	As above	As above	As above	0.041	0.44
4,4'-DDT	72-55-9	1.69	0.52	As above	As above	0.042	0.44
Aldrin	309-00-2	0.101	Not available	As above	As above	0.029	0.44
alpha-BHC	319-84-6	0.0587	As above	As above	As above	0.024	0.44
alpha-Chlordane	5103-71-9	0.575 **	1260 **	As above	As above	0.033	0.44
beta-BHC	319-85-7	0.205	Not available	As above	As above	0.05	0.44
delta-BHC	319-86-8	7.92	As above	As above	As above	0.041	0.44
Dieldrin	60-57-1	0.00903	4	As above	As above	0.044	0.44
Endosulfan I	959-98-8	44.9	Not available	As above	As above	0.046	0.44
Endosulfan II	33213-65-9	44.9	As above	As above	As above	0.045	0.44
Endosulfan Sulfate	1031-07-8	44.9	As above	As above	As above	0.047	0.44
Endrin	72-20-8	6.5	As above	As above	As above	0.04	0.44
Endrin Aldehyde	7421-93-4	6.5	As above	As above	As above	0.065	0.44
Endrin Ketone	53494-70-5	6.5	As above	As above	As above	0.044	0.44
gamma-BHC	58-89-9	0.284	As above	As above	As above	0.03	0.44
gamma-Chlordane	5103-74-2	0.575 **	1260 **	As above	As above	0.035	0.44
Heptachlor	76-44-8	0.214	As above	As above	As above	0.037	0.44
Heptachlor Epoxide	1024-57-3	0.106	As above	As above	As above	0.035	0.44
Methoxychlor	72-43-5	361	Not available	As above	As above	0.051	0.44
Technical chlordane	57-74-9	Not available	As above	As above	As above	Not available	11.1 [b]
Toxaphene	8001-35-2	As above	As above	As above	As above	As above	11.1 [b]

EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Soil
Region I Matrix Code (from EPA-NE DQO Summary Form): SO
Analytical Parameter: Chlorinated Pesticides and PCB Aroclors
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP: L-9

Analyte	CAS Number	Project Action HH Goal* (ng/g dry weight)	Project Action ECO Goal* (ng/g dry weight)	Analytical Method[1]		Achievable Laboratory Limits[2] (DRY WT – ng/g)	
				MDLs	Method Practical QLs (wet wt – ng/g)	MDLs[3]	RLs[4]
Aroclor-1016	12674-11-2	12.6	447	Not available	Not available	Not available	11.1
Aroclor-1221	1104-28-2	12.6	447	As above	As above	As above	11.1 [b]
Aroclor-1232	11141-16-5	12.6	447	As above	As above	As above	11.1 [b]
Aroclor-1242	53469-21-9	12.6	447	As above	As above	As above	11.1 [b]
Aroclor-1248	12672-29-6	12.6	447	As above	As above	As above	11.1 [b]
Aroclor-1254	11097-69-1	12.6	447	As above	As above	As above	11.1 [b]
Aroclor-1260	11096-82-5	12.6	447	As above	As above	As above	11.1
Aroclor-1268	11100-14-4	12.6	447	As above	As above	As above	11.1 [b]
Aroclor, Total [a]	Not applicable	Not available	Not available	As above	As above	Not applicable	Not applicable

[2] Data will be evaluated against sample specific MDLs (YR2000) and RLs; see EPA-NE Worksheet #30. Non-detects, or values detected at a level below the sample specific MDL, will be reported as the sample specific MDL and U flagged. Values detected above the sample specific MDL and below the sample specific RL will be reported and J flagged.

[1] MDLs and RLs are not cited in EPA methods 8081 or 8082.
[3] Achievable MDLs are from a seven replicate MDL study (in sediment) and are based on a sample size of 32.6-g average sample size (dry). MDLs for some compounds are not available.
[4] RLs determined from the low calibration standard and adjusted for sample processing volumes and factors. RL = [(low calibration std., 0.01 to 0.004 ng/µL) * (pre-injection volume, 1000 µL) * (dilution factor, 1.667)] / (Sample dry wt., 15-g). Actual RLs will vary depending upon sample processing factors; actual RLs will be reported with the data.
[a] Total Aroclor = sum of the detected Aroclors. Total Aroclor will be determined by the **database**, using final validated data.
[b] Single point calibration is used for this target, RL is derived from low calibration standard of Aroclor 1016 and Aroclor 1260.

* Recommended detection limits used to support the human health (HH) biota consumption risk assessment and the baseline ecological (ECO) risk assessment. These values were provided by Harding ESE for perspective rather than as a requirement for the analytical methods. If detection limits cannot be achieved, this will be addressed in the uncertainty discussions in the risk assessment. Goals presented to three significant figures. Used Sediment detection limits for Soil.

** Recommended detection limit for Chlordane used for both alpha- and gamma-chlordane.

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EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Soil
Region I Matrix Code (from EPA-NE DQO Summary Form): SO
Analytical Parameter: SVOCs (PAHs)
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP: L-10

Analyte[a]	CAS Number	Project Action HH Goal* (ng/g dry weight)	Project Action ECO Goal* (ng/g dry weight)	Analytical Method[1]		Achievable Laboratory Limits[2] (DRY WT – ng/g)	
				MDLs	Method Estimated QLs (wet wt – ng/g)	MDLs[3]	RLs[4]
Biphenyl	92-52-4	Not available	Not available	Not applicable	Not applicable	0.017	1.11
2-Methylnaphthalene	91-57-6	1130	10700	As above	As above	0.037	1.11
Acenaphthene	83-32-9	3380	3010	As above	As above	0.016	1.11
Acenaphthylene	208-96-8	3380	3010	As above	As above	0.026	1.11
Anthracene	120-12-7	16900	3010	As above	As above	0.024	1.11
Benzaldehyde	100-52-7	Not available	Not available	As above	As above	Not available	1.11
Benz[a]anthracene	56-55-3	1.8	3010	As above	As above	0.017	1.11
Benzo[a]pyrene	50-32-8	0.18	3010	As above	As above	0.021	1.11
Benzo[b]fluoranthene	205-99-2	1.8	3010	As above	As above	0.018	1.11
Benzo[g,h,i]perylene	191-24-2	1690	3010	As above	As above	0.013	1.11
Benzo[k]fluoranthene	207-08-9	18	3010	As above	As above	0.013	1.11
Chrysene	218-01-9	180	3010	As above	As above	0.013	1.11
Dibenz[a,h]anthracene	53-70-3	0.18	548000	As above	As above	0.018	1.11
Dibenzofuran	132-64-9	3290	Not available	As above	As above	0.091	1.11
Fluoranthene	206-44-0	2260	4790	As above	As above	0.025	1.11
Fluorene	86-73-7	2260	121000	As above	As above	0.023	1.11
Indeno[1,2,3-cd]pyrene	193-39-5	1.8	3010	As above	As above	0.01	1.11
Naphthalene	91-20-3	1130	3010	As above	As above	1.5	1.11
Phenanthrene	85-01-8	1690	329000	As above	As above	0.03	1.11
Pyrene	129-00-0	1690	87700	As above	As above	0.02	1.11
Total PAH[b]	NA	NA	NA	As above	As above	NA	NA

[2] Data will be evaluated against sample specific MDLs (YR2000) and RLs; see EPA-NE Worksheet #30. Non-detects, or values detected at a level below the sample specific MDL, will be reported as the sample specific MDL and U flagged. Values detected above the sample specific MDL and below the sample specific RL will be reported and J flagged.

[1] Method 8270C is full scan method; Battelle will analyze samples by SIM; therefore EPA method MDLs/RLs are not applicable.
[3] Achievable MDLs are from a seven replicate MDL study and are based on a sample size of 32.6-g average sample size (dry). MDLs for some compounds are not available.
[4] RLs determined from the low calibration standard and adjusted for sample processing volumes and factors. RL = [(low calibration std., 0.01 to 0.008 ng/µL) * (pre-injection volume, 1000 µL) * (dilution factor, 1.667)] / (Sample dry wt., 15-g). Actual RLs will vary depending upon sample processing factors – actual RLs will be reported with the data.
[a] Bolded PAHs represent the EPA 16 PAH priority pollutants.
[b] Total PAH = sum of the detected PAHs; in cases where an individual PAH is not detected, 0.0 will be used in the summation. Total PAH will be determined by the **database**, using final validated data.
* Recommended detection limits; full footnote description provide on Chlorinated Pesticides and PCB Arolocr worksheet #9b.

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EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Soil
Region I Matrix Code (from EPA-NE DQO Summary Form): SO
Analytical Parameter: Moisture
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP: L-13

Analyte	CAS Number	Project Action HH Goal* (ng/g dry weight)	Project Action ECO Goal* (ng/g dry weight)	Analytical Method		Achievable Laboratory Limits (WET WT)	
				MDLs	Method QLs	MDLs	RLs[1]
Moisture	Not available	Not applicable	Not applicable	Not applicable	Not applicable	Not available	0.03%

[1] RLs determined from the maximum sensitivity of the balance and adjusted for sample processing volumes.
RL =[(maximum sensitivity of the balance, 0.01 g) / (Sample wet wt., 30-g)] *100%.

* Recommended detection limits; full footnote description provide on Chlorinated Pesticides and PCB Arolocr worksheet #9b.

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Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Soil
Region I Matrix Code (from EPA-NE DQO Summary Form): SO
Analytical Parameter: Dioxin/Furan and HCX
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP[1]: L-23

Analyte	CAS Number	Project Action HH Goal* (pg/g dry weight)	Project Action ECO Goal* (pg/g dry weight)	Analytical Method[1]		Achievable Laboratory Limits (DRY WT – pg/g)	
				MDLs	Method QLs[2]	MDLs[3]	RLs[3]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	0.0684	0.008	NA	2	1.0	1.0
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	0.587	0.057	As above	2	0.8	1.0
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321-76-4	0.0821	0.009	As above	10	4.8	5.0
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	4.11	0.467	As above	10	2.6	5.0
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	0.0747	0.008	As above	10	2.8	5.0
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227-28-6	2.05	0.233	As above	10	5.8	5.0
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653-85-7	4.11	0.467	As above	10	6.2	5.0
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408-74-3	4.11	0.467	As above	10	2.0	5.0
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	1.37	0.156	As above	10	3.6	5.0
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	2.05	0.233	As above	10	1.8	5.0
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	1.37	0.156	As above	10	2.8	5.0
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	1.37	0.156	As above	10	2.6	5.0
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822-46-9	205	23.3	As above	10	1.4	5.0
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	2050	233	As above	10	2.2	5.0
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	41.1	4.67	As above	10	1.6	5.0
Octachlorodibenzo-p-dioxin	3268-87-9	41100	4670	As above	20	5.4	10
Octachlorodibenzofuran	39001-02-0	137000	15600	As above	20	10.8	10
1,2,4,5,7,8-Hexachloro-9-Xanthene (HCX)	NA	0.00137	132	As above	NA	NA	NA
Total HpCDD	37871-00-4	NA	NA	As above	NA	NA	NA
Total HpCDF	38998-75-3	As above	As above	As above	NA	NA	NA
Total HxCDD	34465-46-8	As above	As above	As above	NA	NA	NA
Total HxCDF	55684-94-1	As above	As above	As above	NA	NA	NA
Total PeCDD	36088-22-9	As above	As above	As above	NA	NA	NA
Total PeCDF	30402-15-4	As above	As above	As above	NA	NA	NA
Total TCDD	41903-57-5	As above	As above	As above	NA	NA	NA
Total TCDF	55722-27-5	As above	As above	As above	NA	NA	NA

Actual data will be evaluated against Estimated Detection Limits (EDLs); see EPA-NE Worksheet #30. Values detected at a level below the EDL will be J flagged; Non-detects will be reported as the EDL and U flagged.

[1] Method 1613B.
[2] Analytical method MDLs and RLs documented in validated methods. These limits are based on a sample size of 10 g wet weight and an average sample % dry weight of 50% to give a final sample size of 5 g dry weight.
[3] Achievable MDLs and RLs are limits that an individual laboratory can achieve when performing a specific analytical method. These limits are based on an average sample size of 5 g dry weight. The MDL values are from a seven replicate MDL study performed in 2002 (using Automated Solvent Extraction technique); and the RL values are based on the lowest calibration standard, sample size (10g wet weight and an average sample % dry weight of 50% to give a final sample size of 5 g dry weight, and extract volume 20µL).

* Recommended detection limits; full footnote description provide on Chlorinated Pesticides and PCB Arolocr worksheet #9b.

EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Soil
Region I Matrix Code (from EPA-NE DQO Summary Form): SO
Analytical Parameter: Metals
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP: 1638/L-42 (ICP/MS); SW6010B/L-44 (ICP/AES); SW846 7062 and 7742/L-111 (FIAS); SW700 series/L-45 (GFAA); 245.5, 1631c/L-41 (CVAA) (multiple analysis methods may be used to optimize detection limits and reduce interferences)

Analyte	CAS Number	Project Action HH Goal* (µg/g dry weight)	Project Action ECO Goal* (µg/g dry weight)	Analytical Method[1]		Achievable Laboratory Limits[2] (DRY WT - µg/g)	
				MDLs[3]	Method QLs[3]	MDLs[4]	QLs[4]
Aluminum	7429-90-5	549	Not available	2.4	9.6	1	4
Antimony	7440-36-0	0.329	As above	NA	NA	0.02	0.08
Arsenic	7440-38-2	0.097	As above	NA	NA	0.5	2
Barium	7440-39-3	384	As above	0.07	0.28	0.01	0.04
Beryllium	7440-41-7	1.65	As above	0.014	0.056	0.004	0.016
Cadmium	7440-43-9	0.0294	As above	0.184	0.736	0.178	0.71
Chromium	7440-47-3	0.772 **	As above	0.376	1.5	0.24	0.96
Cobalt	7440-48-4	7.41	As above	0.376	1.5	0.336	1.34
Copper	7440-50-8	9.56	As above	0.29	1.16	0.097	0.388
Iron	7439-89-6	Not available	As above	0.328	1.31	0.28	1.12
Lead	7439-92-1	0.396	As above	NA	NA	0.1	0.4
Manganese	7439-96-5	288	As above	0.074	0.296	0.016	0.064
Mercury	7439-97-6	0.000727	As above	NA	NA	0.002	0.008
Molybdenum	13939-06-5	Not available	As above	0.424	1.7	0.4	1.6
Nickel	7440-02-0	3.58	As above	0.8	3.2	0.78	3.12
Selenium	7782-49-2	0.271	As above	NA	NA	0.265	1.06
Silver	7440-22-4	1.37	As above	0.376	1.5	0.089	0.356
Thallium	7440-28-0	0.00165	As above	NA	NA	0.02	0.08
Vanadium	7440-62-2	2.22	As above	0.4	1.6	0.27	1.08
Zinc	7440-66-6	6.86	As above	0.096	0.384	0.096	0.384

[2] Data will be evaluated against Laboratory Achieved MDLs and QLs; see EPA-NE Worksheet #30. Non-detects, or values detected at a level below the MDL, will be reported as the QL and U flagged. Values detected above the MDL and below the QL will be reported and J flagged. Undetected metals (based on the instrument detection limit) will be reported as the QL and U flagged.

NA – Not available.
[1] Methods 1638, 1640; 200.7, SW6010B; 200.9, SW700 series; 245.5.
[3] Analytical method MDLs and QLs documented in validated methods. These limits are based on a sample size of 0.2 to 1.0 g dry weight. QLs are usually 3-10 times higher than the MDLs.
[4] Achievable MDLs are from a seven replicate MDL study and are based on a sample size of 0.2 to 1.0 g dry weight. QLs are based on 4 × the achievable laboratory MDL.

* Recommended detection limits; full footnote description provide on Chlorinated Pesticides and PCB Arolocr worksheet #9b.

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EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Soil
Region I Matrix Code (from EPA-NE DQO Summary Form): SO
Analytical Parameter: Methyl Mercury
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP[1]: Bloom (1989)/L-40

Analyte	CAS Number	Project Action HH Goal* (µg/g dry weight)	Project Action ECO Goal* (µg/g dry weight)	Analytical Method[1]		Achievable Laboratory Limits (WET WT - µg/g)[2]	
				MDLs	Method QLs	MDLs[3]	QLs[3]
Methyl Mercury	22967-92-6	0.000242	0.001	NA	NA	0.00005	0.0002

[2] **Data will be evaluated against Laboratory Achieved MDLs and QLs; see EPA-NE Worksheet #30. Non-detects, or values detected at a level below the MDL, will be reported as the QL and U flagged. Values detected above the MDL and below the QL will be reported and J flagged. Undetected metals (based on the instrument detection limit) will be reported as the QL and U flagged.**

NA – Not available.
[1] Method Bloom (1989).
[3] Achievable MDLs are from a seven replicate MDL study and are based on a sample size of approx. 0.1 to 1.0 g wet weight. QLs are based on 4 × the achievable laboratory MDL.

* Recommended detection limits; full footnote description provide on Chlorinated Pesticides and PCB Arolocr worksheet #9b.

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EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Soil
Region I Matrix Code (from EPA-NE DQO Summary Form): SO
Analytical Parameter: Grain Size
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP[1]: L-46

Analyte	CAS Number	Project Action HH Goal* (dry weight)	Project Action ECO Goal* (dry weight)	Analytical Method[1]		Achievable Laboratory Limits (DRY WT - %)	
				MDLs	Method QLs	MDLs	RLs[2]
% gravel	Not available	Not applicable	Not applicable	NA	NA	NA	0.01
% coarse sand	As above	As above	As above	NA	NA	NA	0.01
% medium sand	As above	As above	As above	NA	NA	NA	0.01
% fine sand	As above	As above	As above	NA	NA	NA	0.01
% silt	As above	As above	As above	NA	NA	NA	0.01
% clay	As above	As above	As above	NA	NA	NA	0.01
grain size distribution curve	As above	As above	As above	NA	NA	NA	NA
Data will be evaluated against Laboratory Achieved RLs. Values detected at a level below the RL will be J flagged; Non-detects will be reported as the RL and U flagged.							

NA – Not available/applicable.

[1]ASTM D422

[2] The reporting limit (RL) for sieve fraction is 0.01%; for the fine fraction (hydrometer analysis) readings are taken at 0.5 gram intervals and reported at 0.01%. Note that a weight percent less than 0.01% can be measured gravimetrically, but it has no relevance in characterizing the sediment type.

* Recommended detection limits; full footnote description provide on Chlorinated Pesticides and PCB Arolocr worksheet #9b.

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EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Soil
Region I Matrix Code (from EPA-NE DQO Summary Form): SO
Analytical Parameter: TOC
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP[1]: L-49

Analyte	CAS Number	Project Action HH Goal* (dry weight)	Project Action ECO Goal* (dry weight)	Analytical Method[1]		Achievable Laboratory Limits (DRY WT - %)	
				MDLs	Method QLs	MDLs[2]	RLs[2]
% TOC	Not available	Not applicable	Not applicable	0.1%	not provided	range from 0.001% to 0.01%	
Data will be evaluated against Laboratory Achieved RLs. Values detected at a level below the RL will be J flagged; Non-detects will be reported as the RL and U flagged.							

[1] Method 9060.
[2]Achievable MDLs and RLs are limits that an individual laboratory can achieve when performing a specific analytical method

* Recommended detection limits; full footnote description provide on Chlorinated Pesticides and PCB Arolocr worksheet #9b.

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EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Soil
Region I Matrix Code (from EPA-NE DQO Summary Form): SO
Analytical Parameter: SVOCs (phthalates and phenols)
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP: L-61

Analyte	CAS Number	Project Action HH Goal* (ng/g dry weight)	Project Action ECO Goal* (ng/g dry weight)	Analytical Method[1]		Achievable Laboratory Limits[2] ug/Kg-Wet WT (ug/Kg-Dry WT)	
				MDLs[3]	Method Estimated QLs (wet wt – ng/g)[2]	MDLs[4]	RLs[4]
2,4,5-Trichlorophenol	95-95-4	Not available	Not available	Not provided	660	32 (64)	330 (660)
2,4-Dinitrophenol	51-28-5	As above	As above	As above	3300	500 (1000)	1600 (3200)
2-Nitrophenol	88-75-5	As above	As above	As above	3300	45 (90)	330 (660)
4-Methylphenol	106-44-5	As above	As above	As above	660	74 (148)	330 (660)
4-Nitrophenol	100-02-7	As above	As above	As above	3300	23 (46)	1600 (3200)
Bis (2-ethylhexyl)phthalate	117-81-7	As above	As above	As above	660	32 (64)	330 (660)
Butyl benzyl phthalate	85-68-7	As above	As above	As above	660	35 (70)	330 (660)
Carbazole	86-74-8	As above	As above	As above	Not provided	29 (58)	330 ((660)
di-n-Butyl phthalate	84-74-2	As above	As above	As above	Not determined	30 (60)	330 (660)
di-n-Octyl phthalate	117-84-0	As above	As above	As above	660	29 (58)	330 (660)
Pentachlorophenol	87-86-5	As above	As above	As above	3300	23 (46)	1600 (3200)
Phenol	108-95-2	As above	As above	As above	660	36 (72)	330 (660)

[2] Data will be evaluated against Laboratory Achieved MDLs and RLs; see EPA NE Worksheet #30. Non-detects and values detected at a level below the MDL will be reported as the RL and U flagged. Values detected at a level above the MDL and below the RL will be reported and J flagged.

[1] Method 8270C.
[3] Analytical method MDLs and RLs documented in validated methods. RLs are usually 3-10 times higher than the MDLs.
[4] Achievable MDL values determined per 40CFR Part 136. Achieved MDLs and RLs presented on a dry weight basis () assume 50% moisture.

* Recommended detection limits; full footnote description provide on Chlorinated Pesticides and PCB Arolocr worksheet #9b.

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EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Groundwater
Region I Matrix Code (from EPA-NE DQO Summary Form): GW
Analytical Parameter: Dioxin/Furan
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP[1]: L-23

Analyte	CAS Number	Project Action Goal (pg/L) (based on chronic ambient water quality criteria)	Analytical Method[1]		Achievable Laboratory Limits (pg/L)	
			MDLs	Method QLs[2]	MDLs[3]	RLs[3]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	10	NA	10	8.0	5
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	Not applicable	As above	10	6.6	5
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321-76-4	As above	As above	50	25.9	25
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	As above	As above	50	28.6	25
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	As above	As above	50	21.0	25
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227-28-6	As above	As above	50	29.1	25
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653-85-7	As above	As above	50	32.4	25
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408-74-3	As above	As above	50	31.4	25
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	As above	As above	50	25.3	25
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	As above	As above	50	24.8	25
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	As above	As above	50	28.9	25
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	As above	As above	50	21.9	25
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822-46-9	As above	As above	50	28.2	25
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	As above	As above	50	26.1	25
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	As above	As above	50	30.2	25
Octachlorodibenzo-p-dioxin	3268-87-9	As above	As above	100	48.2	50
Octachlorodibenzofuran	39001-02-0	As above	As above	100	54.8	50

Actual data will be evaluated against Estimated Detection Limits (EDLs); see EPA-NE Worksheet #30. Values detected at a level below the EDL will be J flagged; Non-detects will be reported as the EDL and U flagged.

[1] Method 1613B.
[2] Analytical method MDLs and RLs documented in validated methods. These limits are based on a sample size of 1 liter.
[3] Achievable MDLs and RLs are limits that an individual laboratory can achieve when performing a specific analytical method. These limits are based on a sample size 1 liter. The MDL values are from a seven replicate MDL study and the RL values are based on the lowest calibration standard, sample size (1 liter and extract volume 20µL).

RLs are less than the MDL in many cases because the low calibration level used here is ½ that of the EPA method low calibration level; also note that data are evaluated using EDLs, not MDLs or RLs.

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EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Groundwater
Region I Matrix Code (from EPA-NE DQO Summary Form): GW
Analytical Parameter: VOC
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP[1]: L-60

Analyte	CAS Number	Project Action HH Goal* (µg/L)	Project Action AL Goal * (µg/L)	Analytical Method[1] (µg/L)		Achievable Laboratory Limits[2] (µg/L)	
				MDLs[3]	Method QLs[3]	MDLs[4]	RLs[4]
1,1,1,2-Tetrachloroethane	630-20-6	Not available	22	0.05	1	0.50	1
1,1,1-Trichloroethane	71-55-6	As above	Not available	0.04	1	0.55	1
1,1,2,2-Tetrachloroethane	79-34-5	1.7	10	0.2	1	0.43	1
1,1,2-Trichloroethane	79-00-5	6.0	20	0.10	1	0.44	1
1,1-Dichloroethane	75-34-3	Not available	Not available	0.04	1	0.46	1
1,1-Dichloroethene	75-35-4	As above	As above	0.12	1	0.51	1
1,1-Dichloropropene	563-58-6	As above	As above	0.10	1	0.68	1
1,2,3-Trichlorobenzene	87-61-6	As above	As above	0.03	1	0.68	1
1,2,3-Trichloropropane	96-18-4	As above	As above	0.32	1	0.37	1
1,2,4-Trichlorobenzene	120-82-1	As above	1.7	0.04	1	0.65	1
1,2,4-Trimethylbenzene	95-63-6	As above	Not available	0.09	1	0.36	1
1,2-Dibromo-3-Chloropropane	106-43-4	As above	As above	0.50	1	0.80	1
1,2-Dibromoethane	106-93-4	As above	As above	0.10	1	0.28	1
1,2-Dichlorobenzene	95-50-1	2700	1.8	0.05	1	0.48	1
1,2-Dichloroethane	107-06-2	3.8	131	0.02	1	0.49	1
1,2-Dichloropropane	78-87-5	5.2	58	0.04	1	0.46	1
1,3,5-Trimethylbenzene	108-67-8	Not available	Not available	0.05	1	0.33	1
1,3-Dichlorobenzene	541-73-1	400	8.7	0.12	1	0.32	1
1,3-Dichloropropane	142-28-9	Not available	6.7	0.04	1	0.44	1
1,4-Dichlorobenzene	106-46-7	400	1.2	0.03	1	0.38	1
2,2-Dichloropropane	594-20-7	Not available	Not available	0.08	1	0.53	1
2-Chlorotoluene	74-87-3	As above	As above	0.08	1	0.64	1
4-Chlorotoluene	95-49-8	As above	As above	0.06	1	0.41	1
Benzene	71-43-2	12	5.9	0.03	1	0.40	1
Bromobenzene	108-86-1	Not available	Not available	0.11	1	0.50	1
Bromochloromethane	74-97-5	As above	As above	0.09	1	0.71	1
Bromodichloromethane	75-27-4	2.7	As above	0.03	1	0.30	1
Bromoform	75-25-2	43	33	0.20	1	0.55	1
Bromomethane	74-83-9	48	Not available	0.03	1	0.63	2

EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Groundwater
Region I Matrix Code (from EPA-NE DQO Summary Form): GW
Analytical Parameter: VOC
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP[1]: L-60

Analyte	CAS Number	Project Action HH Goal* (µg/L)	Project Action AL Goal * (µg/L)	Analytical Method[1] (µg/L)		Achievable Laboratory Limits [2] (µg/L)	
				MDLs[3]	Method QLs[3]	MDLs[4]	RLs[4]
Carbon tertachloride	56-23-5	2.5	30	0.02	1	0.67	1
Chlorobenzene	108-90-7	680	18	0.03	1	0.24	1
Chloroethane	124-48-1	Not available	Not available	0.10	1	0.65	2
Chloroform	75-00-3	57	32	0.03	1	0.49	1
Chloromethane	67-66-3	Not available	Not available	0.13	1	0.50	2
cis-1,2-Dichloroethene	156-59-2	As above	As above	0.12	1	0.29	1
cis-1,3-Dichloropropene	10061-01-5	Not available	Not available	Not Provided	1	0.36	1
Dibromochloromethane	96-12-8	4.1	As above	0.05	1	0.51	1
Dibromomethane	74-95-3	Not available	As above	0.24	1	0.55	1
Dichlorodifluoromethane	75-71-8	As above	As above	0.10	1	0.50	2
Ethylbenzene	100-41-4	3100	36	0.03	1	0.50	1
Hexachlorobutadiene	87-68-3	4.4	Not available	0.10	1	0.72	1
Isopropylbenzene	98-82-8	Not available	As above	0.15	1	0.31	1
m&p-Xylene	108-38-3 106-42-3	As above	As above	0.13 0.05	1	0.50	2
Methylene Chloride	75-09-2	47	214	0.03	1	0.36	2
Naphthalene	91-20-3	Not available	2.6	0.04	1	0.40	1
n-Butylbenzene	104-51-8	As above	Not available	0.11	1	0.39	1
n-Propylbenzene	103-65-1	As above	As above	0.04	1	0.55	1
o-Xylene	95-47-6	As above	As above	0.11	1	0.50	1
p-Isopropyltoluene	99-87-6	As above	As above	0.12	1	0.33	1
sec-Butylbenzene	135-98-8	As above	As above	0.13	1	0.30	1
Styrene	100-42-5	As above	As above	0.04	1	0.26	1
tert-Butylbenzene	98-06-6	As above	As above	0.14	1	0.33	1
Tetrachloroethene	127-18-4	As above	As above	0.14	1	0.36	1
Toluene	108-88-3	6800	14	0.11	1	0.22	1
Total Volatile Organics [5]	NA	Not available	Not available	NA	NA	NA	NA
Total Xylenes [5]	NA	As above	As above	NA	NA	0.96	3
trans-1,2-Dichloroethene	156-60-5	As above	As above	0.06	1	0.37	1

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EPA-NE QAPP Worksheet #9b - Rev. 10/99 (continued)

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Medium/Matrix: Groundwater
Region I Matrix Code (from EPA-NE DQO Summary Form): GW
Analytical Parameter: VOC
Concentration Level: Low
Field Analytical or Fixed Laboratory Method/SOP[1]: L-60

Analyte	CAS Number	Project Action HH Goal* (µg/L)	Project Action AL Goal * (µg/L)	Analytical Method[1] (µg/L)		Achievable Laboratory Limits [2] (µg/L)	
				MDLs[3]	Method QLs[3]	MDLs[4]	RLs[4]
trans-1,3-Dichloropropene	10061-02-6	As above	As above	Not Provided	1	0.38	1
Trichloroethene	79-01-6	Not available	Not available	0.19	1	0.39	1
Trichlorofluoromethane	75-69-4	As above	As above	0.08	1	0.93	2
Vinyl Chloride	75-01-4	20	As above	0.17	1	0.50	2

[2] Data will be evaluated against Laboratory Achieved MDLs and RLs. Non-detects and values detected at a level below the MDL will be reported as the RL and U flagged. Values detected at a level above the MDL and below the RL will be reported and J flagged.

[1] Method 8260B
[3] Analytical method MDLs and RLs documented in validated methods. RLs are usually 3-10 times higher than the MDLs.
[4] Achievable MDL values determined following 40CFR Part 136.
[5] Totals will be determined in the database (not at the laboratory level), using final validated data.

* Project Action Human Health (HH) Goals from RIDEM Human Health Criteria for Class A waters (Water and Fish Consumption); Project Action Aquatic Life (AL) Goals from RIDEM Aquatic Life Criteria for Freshwater Chronic. These values are provided for perspective rather than as a requirement for the analytical methods. If detection limits cannot be achieved, this will be addressed in the uncertainty discussions in the risk assessment. These goals are not to be used as remedial action limits.

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EPA-NE QAPP Worksheet #9c - Rev. 10/99

Field and Quality Control Sample Summary Table

Medium/ Matrix	Analytical Parameter	Conc. Level	Analytical Method/ SOP Reference[1]	No. of Sampling Locations[2]	No. of Field Dup Pairs	Organic		Inorganic		No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks[3]	No. of SRM or PE Samples[4]	Total No. of Samples to Lab[5]
						No. of MS	No. of MSD	No. of MS	No. of MSD					
Soil	Archival	Low	NS&T/L-13	9 residential borings (9 × 2 samples per boring)	0	0	0	0	0	0	0	0	0	18
Soil	Pest/PCB/ SVOC (PAH) [a]	Low	NS&T/L-9 NS&T/L-10	2 residential 3 commercial	1	1 MS/MSD set per analytical batch [d]		0	0	0	0	1	1 SRM per analytical batch	7
Soil	Dioxin/ Furan/ HCX [c]	Low	1613B/L-23	11 residential (1, 2 or 3 each at 11 locations = 26 samples) 3 commercial	2	1 MS/MSD set per analytical batch [d]		0	0	0	0	0	1 SRM per analytical batch	31
Soil	Metals [a]	Low	L-41, L-42, L-44, L-45. L-111	2 residential 3 commercial	1	0	0	1 MS/MSD set per analytical batch [d]		0	0	1	1 SRM per analytical batch	7
Soil	MeHg [a]	Low	NA/L-40	2 residential 3 commercial	1	0	0	1 MS/MSD set per analytical batch [d]		0	0	0	1 SRM per analytical batch	6
Soil	Grain Size	Low	ASTM D422/L-46	2 residential 3 commercial	1	0	0	0	0	0	0	0	0	6
Soil	TOC	Low	9060/L-49	2 residential 3 commercial	1	0	0	0	0	0	0	0	1 SRM per analytical batch	6
Soil	SVOC [a,b]	Low	8270C/L-61	2 residential 3 commercial	1	1 MS/MSD set per analytical batch [d]		0	0	0	0	1	1 PE per analytical batch	7

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EPA-NE QAPP Worksheet #9c - Rev. 10/99 (continued)

Field and Quality Control Sample Summary Table

Medium/ Matrix	Analytical Parameter	Conc. Level	Analytical Method/ SOP Reference[1]	No. of Sampling Locations[2]	No. of Field Dup Pairs	Organic		Inorganic		No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks[3]	No. of SRM or PE Samples[4]	Total No. of Samples to Lab[5]
						No. of MS	No. of MSD	No. of MS	No. of MSD					
Water	Dioxin/ Furan	Low	1613B/L-23	1	1	1	1	0	0	0	0	0	None available	4
Water	VOC[c]	Low	8260B/ L-60	33	2	2	2	0	0	2 to 4	0	2	None available	43 to 45[c]

[1] Complete SOP references in EPA-NE QAPP Worksheet #20.
[2] Number reported here represents the number of sampling locations – not the total number of samples that will be collected. Multiple samples will be collected at each sampling location; see EPA-NE QAPP Worksheets #9a and #12b.
[3] Rinsate blank only.
[4] SRM samples will not be collected in the field – instead these are fixed laboratory analytical QC samples supplied by a certified agency and prepared in the laboratory to demonstrate comparability. In cases where an SRM does not exist (i.e., SVOC phenols and phthalates in soil) or is not available for a specific analytical parameter/media – then a PE sample will be provided by NAE and shipped to the participating laboratory for analysis with the study samples. The only applicable PE samples for this study will be for SVOCs (Phenols, Phthalates) in soil. PE samples are not available for VOCs or dioxin/furan in water.
[5] Total number of samples to the lab only represents total numbers of samples **collected in the field and shipped to the participating lab**. This includes authentic (study) samples and field QC samples (*e.g.*, field duplicates, and extra water for preparation of MS/MSD). Total number of samples to the lab does **not** include fixed laboratory QC samples (*e.g.*, MS/MSD) for soil. In this case, aliquots of sample will be used from an authentic sample to prepare the fixed laboratory QC sample – separate and distinct samples will not be collected to satisfy the fixed laboratory QC sample requirements. Fixed laboratory QC sample (*e.g.*, MS/MSD) types and frequency are defined in EPA-NE QAPP Worksheet #11b or 24.
[a] Moisture content determined at participating laboratories in conjunction with each laboratory's specific analysis.
[b] SVOCs – phenols and phthalates.
[c] Collect 4 40-mL vials for each individual sample.
[d] Analytical batch contains 20 or fewer authentic samples.
[e] HCX analysis only conducted on commercial soils; not residential.

EPA-NE QAPP Worksheet #9d - Rev. 10/99

Analytical Services Table

Medium/ Matrix	Analytical Parameter	Concentration Level	Analytical Method/SOP[1]	Data Package Turnaround Time [2]	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)	Backup Laboratory/ Organization (Name and Address: Contact Person and Telephone Number)
Soil	Pesticide/ PCB Aroclors (a)	Low	NS&T/L-9	45 days	Deirdre Dahlen Battelle Duxbury 397 Washington Street Duxbury, MA 02332 (781-934-0571)	Backup GC/ECD systems available at Battelle Duxbury
Soil	SVOC (PAHs) (a)	Low	NS&T/L-10	45 days	Deirdre Dahlen Battelle Duxbury 397 Washington Street Duxbury, MA 02332 (781-934-0571)	Backup GC/MS systems available at Battelle Duxbury
Soil	Dioxin/ Furan/ HCX (a)	Low	1613B/L-23	60 days	Karen Tracy Battelle Columbus 505 King Avenue Columbus, OH 43201 (614) 424-4028	Backup GC/HRMS system available at Battelle Columbus
Ground-water	Dioxin/ Furan	Low	1613B/L-23	60 days	Karen Tracy Battelle Columbus 505 King Avenue Columbus, OH 43201 (614) 424-4028	Backup GC/HRMS system available at Battelle Columbus
Soil	Metals (a)	Low	L-41, L-42, L-L-44, L-45, L-111	45 days	Linda Bingler Battelle MSL 1529 Sequim Bay Rd. Sequim, WA 98382 (360) 681-3604	Backup ICP/MS, GFAA At MSL
Soil	MeHg (a)	Low	NA/L-40	45 days	Linda Bingler Battelle MSL 1529 Sequim Bay Rd. Sequim, WA 98382 (360) 681-3604	Backup CVAA System at MSL
Soil	Grain Size	Low	ASTM D422/ L-46	30 days	Ken Davis Applied Marine Sciences 502 North Highway 3 League City, TX 77573 (281) 554-7272	GeoPlan Associates Peter Rosen 30 Mann St. Hingham, MA 02043 (616) 740-1340
Soil	TOC	Low	9060/L-49	30 days	Ken Davis Applied Marine Sciences 502 North Highway 3 League City, TX 77573 (281) 554-7272	GeoPlan Associates Peter Rosen 30 Mann St. Hingham, MA 02043 (616) 740-1340

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EPA-NE QAPP Worksheet #9d - Rev. 10/99 (continued)

Analytical Services Table

Medium/ Matrix	Analytical Parameter	Concentration Level	Analytical Method/SOP[1]	Data Package Turnaround Time	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)	Backup Laboratory/ Organization (Name and Address: Contact Person and Telephone Number)
Soil	SVOCs (phenols, phthalates) (a)	Low	8270C/L-61	35 days	Sharon Bacha STL Pittsburgh 450 William Pitt Way Building 6 Pittsburgh, PA 15238 (412) 820-8380	STL North Canton 4101 Shuffel Drive NW North Canton, OH 44720
Water	VOC	Low	8260B/L-60	35 days	Keith Dudeck STL Pittsburgh 450 William Pitt Way Building 6 Pittsburgh, PA 15238 (412) 820-8380	STL North Canton 4101 Shuffel Drive NW North Canton, OH 44720

[1] Specify appropriate reference number/letter from the Field Analytical Method/SOP Reference Table (EPA-NE QAPP Worksheet #17) and from the Fixed Laboratory Method/SOP Reference Table (EPA-NE QAPP Worksheet #20).
[2] Data Package Turnaround Time may increase should large numbers of samples (e.g., >40) be received for analysis.
(a) Battelle (Duxbury, Columbus and Sequim) and STL will also determine moisture content in order to present soil data on a dry weight basis.

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EPA-NE QAPP Worksheet #10 - Rev. 10/99

Project Schedule Timeline Table

Activities	Dates (MM/DD/YY) [a]		Deliverable	Deliverable Due Date
	Anticipated Date(s) of Initiation	Anticipated Date of Completion		
QAPP Addendum Preparation				
Draft	June 3, 2002	July 26, 2002	QAPP	July 29, 2002
NAE and EPA Review	July 29, 2002	August 20, 2002		
Final	August 19, 2002	September 27, 2002		September 30, 2002
Field Sampling[1,2]				
Kick-off Meeting	October 21, 2002	October 21, 2002	N/A	N/A
Residential Soils	October 21, 2002	October 23, 2002		
Commercial Soils	October 30, 2002	October 30, 2002		
Groundwater	October 24, 2002	October 29, 2002		
Sample Analysis[2]				
Physical and Chemical Testing	October 31, 2002	December 31, 2002	Data Report	April 25, 2003
Third Party Validation (Tier II/III)	January 9, 2003	April 9, 2003		
Letter Data Report	April 10, 2003	April 24, 2003		

[1] Start date based on receiving Notice to Proceed by September 18, 2002
[2] Participating laboratories will be responsible for sample custody and data quality control through validation process.
[a] If due date falls on a weekend then the deliverable will be submitted on the following Monday.
N/A Not applicable.

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EPA-NE QAPP Worksheet #11a - Rev. 10/99

Project Quality Objectives/Decision Statements

Project Quality Objectives:
The project quality objectives for physical and chemical testing is to generate data of a quality to be used for the RI/FS. The data needed for the RI/FS must be definitive data of very high quality (tight measurement performance criteria. Sensitivity requirements for selected parameters (e.g., grain size) have not been defined.

Project quality objectives and measurement performance criteria for physical and chemical testing are defined below.

Measurement Performance Criteria:
Method performance criteria (MPC) chosen to ensure that the definitive data will be of high quality are defined by analysis parameter in EPA-NE QAPP Worksheet #11b.

Data quality may be defined in terms of accuracy, precision, representativeness, completeness, comparability, and sensitivity.

- *Accuracy* is the agreement between an observed value and an accepted value. Analytical accuracy is monitored for analytical chemistry measurements as specified in EPA Worksheet #11b.

  Applicable samples: LCS, MS, MSD, SRM, SIS (each sample).
  Applicable analyses:

  ⇒ Pesticide/PCB Aroclors (No SRM or MS/MSD for Aroclors)
  ⇒ SVOCs (no SRM for phenols and phthalates)
  ⇒ Dioxin/Furan/HCX (no SRM for HCX; no SRM for dioxin/furans in water)
  ⇒ Metals (SIS not applicable)
  ⇒ MeHg (SIS not applicable; no LCS)
  ⇒ TOC (SRM only)
  ⇒ VOCs (No SRM)

- *Precision* is defined as the degree of reproducibility among individual measurements of the same property, obtained under similar conditions. Measures of analytical precision will be determined in all phases of the program.

  Applicable samples: MS/MSD, DUP.
  Applicable analyses:

  ⇒ Pesticide/PCB Aroclors (No MS/MSD for Aroclors)
  ⇒ SVOCs
  ⇒ Dioxin/Furan/HCX
  ⇒ Metals, MeHg
  ⇒ Grain Size (DUP only)

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EPA-NE QAPP Worksheet #11a - Rev. 10/99 (continued)

Project Quality Objectives/Decision Statements

Precision (cont)

⇒ TOC (DUP only)
⇒ VOCs

- *Representativeness* is the degree to which data accurately and precisely represent a characteristic of a population. Representativeness is addressed primarily in the sample design, through the selection of sampling sites and procedures that reflect the project goals and environment being sampled. It is ensured by the proper handling, homogenizing, compositing, and storage of samples and analysis within the specified holding times so that the material analyzed reflects the material collected as accurately as possible.

  Applicable analyses: Moisture content, Pesticides/PCB Aroclors, SVOCs (PAHs, phenols, phthalates), Dioxins/Furans/HCX, Metals, MeHg, Grain size, TOC and VOCs.

- *Completeness* is defined as the amount of data collected as compared to the amount that is needed to make valid decisions. 100% completeness is targeted for all analyses. Study objectives will not be compromised if 95% of the analytes are reported.

  Applicable analyses: Moisture content, Pesticides/PCB Aroclors, SVOCs (PAHs, phenols, phthalates), Dioxins/Furans/HCX, Metals, MeHg, Grain size, TOC and VOCs.

- *Comparability* is the measure of the confidence with which one data set can be compared to another. Comparability can be measured using split samples, comparing data to historical, or as will be done for this project – by using established laboratory methods that are comparable to other low-level methods and by analyzing Standard Reference Material (SRM) samples, as available. Using SRMs from batch to batch of samples throughout this project shows how data compares at the concentration of the SRM.

  Applicable samples: SRM (*note – SRMs not available for water matrix; PEs will be used as available see EPA-NE QAPP Worksheet #22a*).
  Applicable analyses:

  ⇒ Pesticides
  ⇒ SVOCs (PAHs only)
  ⇒ Dioxin/Furan (no SRM for HCX; no SRM for dioxin/furan in water)
  ⇒ Metals
  ⇒ MeHg
  ⇒ TOC

EPA-NE QAPP Worksheet #11a - Rev. 10/99 (continued)

Project Quality Objectives/Decision Statements

- *Sensitivity* is the capability of methodology or instrumentation to discriminate among measurement responses for quantitative differences or a parameter of interest. Sensitivity expressed as the detection limits is presented in (EPA Worksheet #9b).
  Applicable analyses: Pesticides/PCB Aroclors, SVOCs (PAHs, phenols, phthalates), Dioxins/Furans/HCX, Metals, MeHg, TOC and VOCs.
- *Quantitation Limits*. Recommended project action goals are documented in EPA-NE QAPP Worksheet #9b. These are recommended detection limits, not **required** limits.

All deviations from protocols described in this QAPP will be documented and approved by the Project Manager and discussed in the final report. All data that do not meet the listed MPCs will be submitted to the Project Manager, or his designee, for review and assessment of the potential impact of the results.

Affected samples may be reanalyzed at the Project Manager's discretion. Data that are accepted outside these criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a, Data Verification and Validation Tasks), and the rationale for accepting the analysis will be thoroughly documented.

The calculation of quality control statistics is summarized in EPA-NE QAPP Worksheet #30.

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EPA-NE QAPP Worksheet #11b - Rev. 10/99

Measurement Performance Criteria Table

Medium/ Matrix	Soil
Analytical Parameter	Pesticide/PCBs and SVOCs (PAHs)
Concentration Level	Low

QC results are evaluated against the measurement performance criteria (MPC) and all data that do not meet the listed MPCs will be submitted to the Project Manager for review and assessment of the potential impact of the results. Affected samples may be reanalyzed. Data that are accepted outside these criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rational for accepting the analysis thoroughly documented in the QA/QC narrative.

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)[3]	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)
S-1	NS&T/L-9 (Pest/PCBs) & NS&T/L-10 (SVOCs – PAHs)	Accuracy	< sample-specific RL, or associated samples >5× blank values	Blank	A
			PD≤30% from a range of certified values (using surrogate corrected data; certified concentration in SRM must be >RL)	Standard Reference Material (*no SRM for Aroclor*)	A
			90% of analytes meet the following: 40-120% R (Concentration of spiked analytes in MS/MSD must be >5× background concentrations to be used for data quality assessment)	Laboratory Control Sample; Matrix Spike/Spike Duplicate	A
			40-125% R	Surrogates	A
		Precision	RPD≤50% for at least 90% of analytes (for analytes detected at level >RL)	Laboratory (Analytical) Sample Duplicates	A
			RPD≤30% for at least 90% of analytes (Using R data; Concentration of spiked analytes in MS/MSD must be >5× background concentrations to be used for data quality assessment)	MS/MSD	A
		Comparability	See SRM above	Intercomparison exercises (*e.g.*, SRM analyses), follow defined SOPs	A

RL = Reporting Limit; PD = Percent Difference; R = Recovery; RPD = Relative Percent Difference

[1]Reference SOP Number from EPA-NE QAPP Worksheet #13.
[2] Reference analytical method/SOP Number from EPA-NE QAPP Worksheet #20.
[3] Data Quality Indicators (a.k.a. PARCC parameters, *i.e.*, precision, accuracy/bias, sensitivity, data completeness, comparability).

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EPA-NE QAPP Worksheet #11b - Rev. 10/99

Measurement Performance Criteria Table

Medium/ Matrix	Soil/ Groundwater
Analytical Parameter	Dioxin/Furan/ HCX[a]
Concentration Level	Low

QC results are evaluated against the measurement performance criteria (MPC) and all data that do not meet the listed MPCs will be submitted to the Project Manager for review and assessment of the potential impact of the results. Affected samples may be reanalyzed. Data that are accepted outside these criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rational for accepting the analysis thoroughly documented in the QA/QC narrative.

Note – no second source of HCX is available; therefore, while LCS/MS/MSD QC samples will be fortified with HCX; there is no applicable MPC for HCX

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)[3]**	**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)**
S-1, S-2 S-6, S-7	1613B/ L-23	Accuracy	<5× MDL, or associated samples >5× blank values (>10× blank values for OCDD, OCDF and totals)	Blank	A
			PD≤30% from certified values (for certified values >5× MDL)	Standard Reference Material *(no applicable SRM for water or HCX)*	A
			Within Method 1613 Table 6 OPR requirements for LCS 50-120% R for MS/MSD (Analyte concentration in MS/MSD must be >5× background concentration to be used for data quality assessment)	Laboratory Control Sample; Matrix Spike/Spike Duplicate	A
			25-150% R	Internal Standards	A
		Precision	RPD≤50% (soil); ≤30% (water) (for analytes detected at level >10x MDL)	Laboratory (Analytical) Sample Duplicates	A
			RPD≤30% (Using R data; Concentration of spiked analytes in MS/MSD must be >5× background concentrations to be used for data quality assessment)	MS/MSD	A
		Comparability	See SRM above	Intercomparison exercises (*e.g.*, SRM analyses), follow defined SOPs	A

MDL = Method Detection Limit; PD = Percent Difference; R = Recovery; RPD = Relative Percent Difference

[a] MPC criteria (*i.e.*, SRM, LCS, MS/MSD, SIS) is not applicable to HCX analysis; HCX not applicable to groundwater.

[1] Reference SOP Number from EPA-NE QAPP Worksheet #13.

[2] Reference analytical method/SOP Number from EPA-NE QAPP Worksheet #20.

[3] Data Quality Indicators (a.k.a. PARCC parameters, *i.e.*, precision, accuracy/bias, sensitivity, data completeness, comparability)

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Measurement Performance Criteria Table

Medium/ Matrix	Soil
Analytical Parameter	Metals
Concentration Level	Low

QC results are evaluated against the measurement performance criteria (MPC) and all data that do not meet the listed MPCs will be submitted to the Project Manager for review and assessment of the potential impact of the results. Affected samples may be reanalyzed. Data that are accepted outside these criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rational for accepting the analysis thoroughly documented in the QA/QC narrative.

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)[3]	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)
S-1	Varies: 245.5/L-41 1640, 1638/ L-42 SW6010B, 200.7/L-44 200.9/L-45 SW846 7062, 7742/L-111	Accuracy	<5× MDL, or associated samples >5× blank values	Blank	A
			PD ≤ 25% from certified values (for certified values >5× MDL)	Standard Reference Material	A
			70-130 % R (Analyte concentration in MS/MSD must be >5× background concentration to be used for data quality assessment)	Laboratory Control Sample; Matrix Spike/Spike Duplicate	A
			Not applicable	Surrogates	A
		Precision	RPD ≤ 50% (for analytes detected at level > 10× MDL)	Laboratory (Analytical) Sample Duplicates	A
			RPD≤30% (Using R data; Concentration of spiked analytes in MS/MSD must be >5× background concentrations to be used for data quality assessment)	MS/MSD	A
		Comparability	See SRM above	Intercomparison exercises (*e.g.*, SRM analyses), follow defined SOPs	A

MDL = Method Detection Limit; PD = Percent Difference; R = Recovery; RPD = Relative Percent Difference.

[1]Reference SOP Number from EPA-NE QAPP Worksheet #13.
[2] Reference analytical method/SOP Number from EPA-NE QAPP Worksheet #20.
[3] Data Quality Indicators (a.k.a. PARCC parameters, *i.e.*, precision, accuracy/bias, sensitivity, data completeness, comparability).

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Measurement Performance Criteria Table

Medium/ Matrix	Soil
Analytical Parameter	MeHg
Concentration Level	Low

QC results are evaluated against the measurement performance criteria (MPC) and all data that do not meet the listed MPCs will be submitted to the Project Manager for review and assessment of the potential impact of the results. Affected samples may be reanalyzed. Data that are accepted outside these criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rational for accepting the analysis thoroughly documented in the QA/QC narrative.

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**[3]	**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)**
S-1	Bloom (1989)/L-40	Accuracy	<5× MDL, or associated samples >5× blank values	Blank	A
			PD ≤ 25% from certified values (for certified values >5× MDL)	Standard Reference Material	A
			70-130 % R (Analyte concentration in MS/MSD must be >5× background concentration to be used for data quality assessment)	Matrix Spike/Spike Duplicate *(no applicable LCS)*	A
			Not applicable	Surrogates	A
		Precision	RPD ≤ 50% (for analytes detected at level >10× MDL)	Laboratory (Analytical) Sample Duplicates	A
			RPD≤30% (Using R data; Concentration of spiked analytes in MS/MSD must be >5× background concentrations to be used for data quality assessment)	MS/MSD	A
		Comparability	See SRM above	Intercomparison exercises (*e.g.*, SRM analyses), follow defined SOPs	A

MDL = Method Detection Limit; PD = Percent Difference; R = Recovery; RPD = Relative Percent Difference.

[1]Reference SOP Number from EPA-NE QAPP Worksheet #13.
[2]Reference analytical method/SOP Number from EPA-NE QAPP Worksheet #20.
[3]Data Quality Indicators (a.k.a. PARCC parameters, *i.e.*, precision, accuracy/bias, sensitivity, data completeness, comparability).

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Measurement Performance Criteria Table

Medium/ Matrix	Soil
Analytical Parameter	Grain Size
Concentration Level	Low

QC results are evaluated against the measurement performance criteria (MPC) and all data that do not meet the listed MPCs will be submitted to the Project Manager for review and assessment of the potential impact of the results. Affected samples may be reanalyzed. Data that are accepted outside these criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rational for accepting the analysis thoroughly documented in the QA/QC narrative.

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)[3]	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)
S-1	ASTM D422/ L-46	Accuracy	Not applicable	Blank	A
			Not applicable – *No SRM for grain size in sediment/soil available*	Standard Reference Material	A
			Not applicable	Laboratory Control Sample; Matrix Spike/Spike Duplicate	A
			Not applicable	Surrogates	A
		Precision	RPD ≤ 50% (for analytes detected at level > 10× MDL)	Laboratory (Analytical) Sample Duplicates	A
			Not applicable	MS/MSD	A
		Comparability	See SRM above	Intercomparison exercises (*e.g.*, SRM analyses), follow defined SOPs	A

MDL = Method Detection Limit; RPD = Relative Percent Difference.
[1]Reference SOP Number from EPA-NE QAPP Worksheet #13.
[2]Reference analytical method/SOP Number from EPA-NE QAPP Worksheet #20.
[3]Data Quality Indicators (a.k.a. PARCC parameters, *i.e.*, precision, accuracy/bias, sensitivity, data completeness, comparability).

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Measurement Performance Criteria Table

Medium/ Matrix	Soil
Analytical Parameter	TOC
Concentration Level	Low

QC results are evaluated against the measurement performance criteria (MPC) and all data that do not meet the listed MPCs will be submitted to the Project Manager for review and assessment of the potential impact of the results. Affected samples may be reanalyzed. Data that are accepted outside these criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rational for accepting the analysis thoroughly documented in the QA/QC narrative.

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)[3]	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)
S-1	9060/ L-49	Accuracy	<10× MDL (with signal:noise >10:1)	Blank	A
			PD ≤ 5%	Standard Reference Material	A
			Not applicable	Laboratory Control Sample; Matrix Spike/Spike Duplicate	A
			Not applicable	Surrogates	A
		Precision	RPD ≤ 50% (for analytes detected at level >10× MDL)	Laboratory (Analytical) Sample Duplicates	A
			Not applicable	MS/MSD	A
		Comparability	See SRM above	Intercomparison exercises (*e.g.*, SRM analyses), follow defined SOPs	A

MDL = Method Detection Limit; RPD = Relative Percent Difference.
[1]Reference SOP Number from EPA-NE QAPP Worksheet #13.
[2]Reference analytical method/SOP Number from EPA-NE QAPP Worksheet #20.
[3]Data Quality Indicators (a.k.a. PARCC parameters, *i.e.*, precision, accuracy/bias, sensitivity, data completeness, comparability).

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Measurement Performance Criteria Table

Medium/ Matrix	Soil
Analytical Parameter	SVOC (phenols and phthalates)
Concentration Level	Low

QC results are evaluated against the measurement performance criteria (MPC) and all data that do not meet the listed MPCs will be submitted to the Project Manager for review and assessment of the potential impact of the results. Affected samples may be reanalyzed. Data that are accepted outside these criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rational for accepting the analysis thoroughly documented in the QA/QC narrative.

Note – All target analytes will be fortified into the LCS/MS/MSD and recovery results reported – but only "control analytes" will be evaluated against the MPC. Control analytes for this analysis are identified on EPA-NE QAPP Worksheet #24b.

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)[3]	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)
S-1	8270C/L-61	Accuracy	≤ RL, except bis-2-ethylhexylphthalate is ≤ 5× RL	Blank	A
			Not applicable – *No SRM for soil; PE sample prepared instead – see Worksheet #22a*	Standard Reference Material	A
			Varies – see EPA-NE QAPP Worksheet #24b	Laboratory Control Sample; Matrix Spike/Matrix Spike Duplicate	A
			Varies – see EPA-NE QAPP Worksheet #24b	Surrogates	A
		Precision	Varies – see EPA-NE QAPP Worksheet #24b	Laboratory (Analytical) Sample Duplicates	A
			Varies – see EPA-NE QAPP Worksheet #24b	MS/MSD	A
		Comparability	See SRM above	Intercomparison exercises (*e.g.*, SRM analyses), follow defined SOPs	A

RL = Reporting Limit ; R = Recovery.
[1] Sampling was the responsibility of EPA-NE and is not discussed in this QAPP.
[2] Reference analytical method/SOP Number from EPA-NE QAPP Worksheet #20 .
[3] Data Quality Indicators (a.k.a. PARCC parameters, *i.e.*, precision, accuracy/bias, sensitivity, data completeness, comparability).

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EPA-NE QAPP Worksheet #11b - Rev. 10/99

Measurement Performance Criteria Table

Medium/ Matrix	Water
Analytical Parameter	VOC
Concentration Level	Low

QC results are evaluated against the measurement performance criteria (MPC) and all data that do not meet the listed MPCs will be submitted to the Project Manager for review and assessment of the potential impact of the results. Affected samples may be reanalyzed. Data that are accepted outside these criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rational for accepting the analysis thoroughly documented in the QA/QC narrative.

Note – All target analytes will be fortified into the LCS/MS/MSD and recovery results reported – but only "control analytes" will be evaluated against the MPC. Control analytes for this analysis are identified on EPA-NE QAPP Worksheet #24b.

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)[3]	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)
S-6, S-7	8260B/L-60	Accuracy	<RL, except methylene chloride must be < 5x RL	Blank	A
			Not applicable – *No SRM or PE available*	Standard Reference Material	A
			Varies – see EPA-NE QAPP Worksheet #24b	Laboratory Control Sample; Matrix Spike/Matrix Spike Duplicate	A
			Varies – see EPA-NE QAPP Worksheet #24b	Surrogates	A
		Precision	Varies – see EPA-NE QAPP Worksheet #24b	Laboratory (Analytical) Sample Duplicates	A
			Varies – see EPA-NE QAPP Worksheet #24b	MS/MSD	A
		Comparability	See SRM above	Intercomparison exercises (*e.g.*, SRM analyses), follow defined SOPs	A

RL = Reporting Limit; R = Recovery.
[1] Sampling was the responsibility of EPA-NE and is not discussed in this QAPP.
[2] Reference analytical method/SOP Number from EPA-NE QAPP Worksheet #20.
[3] Data Quality Indicators (a.k.a. PARCC parameters, *i.e.*, precision, accuracy/bias, sensitivity, data completeness, comparability).

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EPA-NE QAPP Worksheet #12a - Rev. 10/99

Sampling Design and Rational

The Field Sampling Plan (FSP) has been prepared for these activities and is provided as a separate document (Battelle, 2002b) to this QAPP Addendum. The FSP and QAPP addendum comprise the Sampling and Analysis Plan (SAP) for the investigation.

The FSP is divided into two sections. Section 1.0 presents background information and states the objectives of the field activities. Section 2.0 describes the components of general site management and Section 3.0 presents the specifics of the field data collection activities. Other supporting information is provided in the appendices to the FSP.

The field sampling activities consist of the following subtasks:

- Mobilization/demobilization;
- Sample collection;
- Field investigation documentation;
- Field quality control (QC) samples;
- Chain-of-custody procedures;
- Decontamination procedures, and
- Characterization and disposal of Investigation Derived Waste (IDW) (if necessary).

Each of these tasks and the specific data collection activities are described in the FSP (Battelle, 2002b).

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EPA-NE QAP P Worksheet #12b - Rev. 10/99 (continued)

Sampling Locations, Sampling and Analysis Method/SOP Requirements Table

Sampling Location [1]	Location ID Number	Medium/ Matrix	Depth (Units)	Analytical Parameter	Conc Level	No. of Samples (Identify field duplicates and replicates)		Sampling SOP[2]	Analytical Method/ SOP[2]	Minimum Sample Volume [3]	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Centredale Manor Site	CMS-4101	Residential Soil	2 from each boring 5-7 (ft) 7-9 (ft)	Archival	N/A	2	N/A	S-1, S-2	N/A	½ full	125 mL pre-cleaned jar	Cold (<6°C)	N/A
	CMS-4102					2							
	CMS-4103					2							
	CMS-4106					2							
	CMS-4107					2							
	CMS-4108					2							
	CMS-4109					2							
	CMS-4110					2							
	CMS-4111					2							
Centredale Manor Site	CMS-4101	Residential Soil	1, 2 or 3 each from: 0-1 (ft) 1-3 (ft) 3-5 (ft)	Dioxin/Furan	Low	2	QC: 2 DU	S-1, S-2	L-23	½ full	125 mL pre-cleaned jar	Cold (<6°C)	1 year
	CMS-4102					3							
	CMS-4103					2							
	CMS-4104					1							
	CMS-4105					1							
	CMS-4106					3							
	CMS-4107					3							
	CMS-4108					3							
	CMS-4109					2							
	CMS-4110					3							
	CMS-4111					3							

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EPA-NE QAP P Worksheet #12b - Rev. 10/99 (continued)

Sampling Locations, Sampling and Analysis Method/SOP Requirements Table

Sampling Location [1]	Location ID Number	Medium/ Matrix	Depth (Units)	Analytical Parameter	Conc Level	No. of Samples (Identify field duplicates and replicates)		Sampling SOP[2]	Analytical Method/ SOP[2]	Minimum Sample Volume [3]	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Centredale Manor Site	CMS-4103	Residential Soil	Top 0 to 12 inches	Moisture, PCB Aroclor/Pest, SVOC (PAH)	Low	1	N/A	S-1	Moisture L-13; PCB Aroclor/ Pest L-9; SVOC (PAH) L-10	½ full	250 mL pre-cleaned glass jar	Cold (<6°C)	Organics: 1-year (EPA, 1992)
	CMS-4108					1							
Centredale Manor Site	CMS-4103	Residential Soil	Top 0 to 12 inches	Metals	Low	1	N/A	S-1	L-41, L-42, L-44, L-45, L-111	¾ full	125 mL spex jar	Cold (<6°C)	Metals: 6-mo Hg: 28-d
	CMS-4108					1							
Centredale Manor Site	CMS-4103	Residential Soil	Top 0 to 12 inches	MeHg	Low	1	N/A	S-1	L-40	½ full	125 mL spex jar	Cold (<6°C)	28-d
	CMS-4108					1							
Centredale Manor Site	CMS-4103	Residential Soil	Top 0 to 12 inches	Grain size, TOC	Low	1	N/A	S-1	Grain Size L-46; TOC L-49	½ full	500 mL pre-cleaned glass jar	Cold (<6°C)	28-d
	CMS-4108					1							
Centredale Manor Site	CMS-4103	Residential Soil	Top 0 to 12 inches	SVOCs (phenols/phthalates)	Low	1	N/A	S-1	L-61	¾ full	8 oz. pre-cleaned glass jar	Cold (<6°C)	14-d/40-d
	CMS-4108					1							
Lyman Mill Pond (= John E. Fogarty Center)	LPX-4112	Commercial Soil	Top 0 to 6 inches	Moisture, PCB Aroclor/Pest, SVOC (PAH)	Low	1	QC: 1 DU 1 RB	S-1	Moisture L-13; PCB Aroclor/ Pest L-9; SVOC (PAH) L-10	½ full	250 mL pre-cleaned glass jar	Cold (<6°C)	Organics: 1-year (EPA, 1992)
	LPX-4113					1							
	LPX-4114					1							
Lyman Mill Pond (= John E. Fogarty Center)	LPX-4112	Commercial Soil	Top 0 to 6 inches	Dioxin/Furan/HCX	Low	1	QC: 1 DU	S-1	L-23	½ full	125 mL precleaned jar	Cold (<6°C)	1-year
	LPX-4113					1							
	LPX-4114					1							

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EPA-NE QAP P Worksheet #12b - Rev. 10/99 (continued)

Sampling Locations, Sampling and Analysis Method/SOP Requirements Table

Sampling Location [1]	Location ID Number	Medium/ Matrix	Depth (Units)	Analytical Parameter	Conc Level	No. of Samples (Identify field duplicates and replicates)		Sampling SOP[2]	Analytical Method/ SOP[2]	Minimum Sample Volume [3]	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Lyman Mill Pond (= John E. Fogarty Center)	LPX-4112	Commercial Soil	Top 0 to 6 inches	Metals	Low	1	QC: 1 DU 1 RB	S-1	L-41, L-42, L-44, L-45, L-111	¾ full	125 mL spex jar	Cold (<6°C)	Metals: 6-mo Hg: 28-d
	LPX-4113					1							
	LPX-4114					1							
Lyman Mill Pond (= John E. Fogarty Center)	LPX-4112	Commercial Soil	Top 0 to 6 inches	MeHg	Low	1	QC: 1 DU	S-1	L-40	½ full	125 mL spex jar	Cold (<6°C)	28-d
	LPX-4113					1							
	LPX-4114					1							
Lyman Mill Pond (= John E. Fogarty Center)	LPX-4112	Commercial Soil	Top 0 to 6 inches	Grain Size; TOC	Low	1	QC: 1 DU	S-1	Grain Size L-46; TOC L-49	½ full	500 mL pre-cleaned glass jar	Cold (<6°C)	28-d
	LPX-4113					1							
	LPX-4114					1							
Lyman Mill Pond (= John E. Fogarty Center)	LPX-4112	Commercial Soil	Top 0 to 6 inches	SVOCs (phenols/phthalates)	Low	1	QC: 1 DU	S-1	L-61	¾ full	8 oz. pre-cleaned glass jar	Cold (<6°C)	14-d/40d
	LPX-4113					1							
	LPX-4114					1							
Centredale Manor	MW05S	Groundwater (c)	Varies	Dioxin/Furan	Low	1	QC: 1 DU 1 DUP (b)	S-6, S-7	L-23	Full w/ ½ inch headspace	2.5-L amber glass bottle	Cold (<6°C)	1-year

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EPA-NE QAP P Worksheet #12b Rev. 10/99 (continued)

Sampling Locations, Sampling and Analysis Method/SOP Requirements Table

Sampling Location [1]	Location ID Number	Medium/ Matrix	Depth (Units)	Analytical Parameter	Conc Level	No. of Samples (Identify field duplicates and replicates)		Sampling SOP[2]	Analytical Method/ SOP[2]	Minimum Sample Volume [3]	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Centredale Manor	GEC1	Groundwater (c)	Varies by well and time of year; See Field Sampling Plan	VOC	Low	1	QC: 2 DU 2 DUP 2 MS 2 MSD 2 RB 2-4 TB (1 TB/ cooler) (b)	S-6, S-7	L-60	Full (no headspace)	40-mL glass VOA vial 4 vials collected for each sample	Cold (<6°C), pH <2 with HCl	14-d
	GEC2					1							
	GEC3					1							
	GEC4					1							
	GEC5					1							
	GEC6					1							
	GEC7					1							
	MW01S					1							
	MW02S					1							
	MW02M					1							
	MW02D					1							
	MW03S					1							
	MW04S					1							
	MW04D					1							
	MW04B					1							
	MW05S					1							
	MW06S					1							
	MW07S					1							
	MW07D					1							
	MW08S					1							
	MW09S					1							
	MW10D					1							
	MW10B					1							
	MW11S					1							
	MW11M					1							
	MW11B					1							
	MW12D					1							
	MW12B					1							
	MW13S					1							
	MW13D					1							
	MW13B					1							
	MW14M					1							
	MW15D					1							

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EPA-NE QAP P Worksheet #12b Rev. 10/99 (continued)
Sampling Locations, Sampling and Analysis Method/SOP Requirements Table

DU = Field Duplicate; DUP = Laboratory (Analytical) Duplicate; MS = Matrix Spike; MSD = Matrix Spike Duplicate; RB = Rinsate Blank; PE = Performance Evaluation; TB = Trip Blank

[1] All field sampling locations are critical; see Field Sampling Plan for specific locations.

[2] See the Project Sampling SOP Reference Table (EPA-NE QAPP Worksheet #13), Field Analytical Method/SOP Reference Table (EPA-NE QAPP Worksheet #17), and Fixed Laboratory Method/SOP Reference Table (EPA-NE QAPP Worksheet #20).

[3] Sample volume listed for soil (all parameters) is sufficient to allow extra material for preparation of Fixed Laboratory quality control (QC) samples. For waters – additional samples will be collected in the field to satisfy Fixed Laboratory QC sample requirements, and in addition 1 field duplicate (DU) and 1 rinsate blank (RB) will be collected for all parameters, where indicated. For VOCs – one trip blank will also be collected. Supplemental QC samples identified above.

(a) PE samples, supplied by NAE/EPA, will be shipped directly to participating laboratories from EPA. These samples will not be shipped with study samples. See EPA-NE QAPP Worksheet #22a.

(b) Extra water is collected to satisfy laboratory QC sample requirements (e.g., DUP, MS and MSD)

(c) Naming convention for groundwater will be CMS-GW-xxxx (or xxxxx)-03; where xxxx is the Well ID defined in the Location ID Number column above. Naming convention also discussed in FSP.

EPA-NE QAPP Worksheet #13 - Rev. 10/99

Project Sampling SOP Reference Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Identification	Modified for Project Work Y or N	Comments[1]
S-1	How to Collect/Document Surface Soil Samples (Rev 01, 7/23/99)	Harding ESE (also referred to as MACTEC)	Stainless steel spoons, bowls; sample jars, sample labels, clear tape, permanent ink pen, field logbook	N	See FSP
S-2	How to Collect/Document Subsurface Soil Samples (Rev 01, 7/23/99)	As above	Stainless steel spoons, bowls; sample jars, sample labels, clear tape, permanent ink pen, field logbook	N	See FSP
S-3	How to Calculate Purge Volume (Rev 01, 7/23/99)	As above	Well keys, water level meter, logbook, permanent ink pen	N	See FSP
S-4	How to Purge a Well with Peristaltic, Submersible or Centrifugal Pumps (Rev 01, 7/23/99)	As above	Pump, power source, tubing, plastic sheeting, bucket, water level indicator, water quality indicator, groundwater sample data sheet	N	See FSP
S-5	How to Purge a Well with a Bailer (Rev 01, 7/23/99)	As above	Water level meter, well keys, plastic sheeting, bailer, water quality indicator, twine, bucket	N	See FSP
S-6	How to Collect/Document Water Samples with a Pump (Rev 01, 7/23/99)	As above	Pump, tubing, power source, plastic sheeting, sample containers	N	See FSP
S-7	How to Collect/Document Samples with a Bailer (Rev 01, 7/23/99)	As above	Water level meter, plastic sheeting, twine, bailer, sample containers	N	See FSP
S-8	How to Decontaminate Sampling Equipment (Rev 01, 7/23/99)	As above	Potable water, liquinox, DI water, other decon fluids, aluminum foil, field logbook	N	See FSP
S-9	How to Manage Investigation Derived Waste (Rev 01, 7/23/99)	As above	varies	N	See FSP
S-10	How to Monitor Operation of Drill Rigs (Rev 01, 7/23/99)	As above	Hardhat, safety glasses, steel-toed boots, logbook	N	See FSP
S-11	How to Complete Soil Boring Log (Rev 01, 7/23/99)	As above	Field data sheets, logbook	N	See FSP
S-12	GPS Measurements	As above	GPS unit	N	See FSP
S-13	How to Screen Sample Headspace for VOCs (Rev 01, 7/23/99)	As above	Sample jars, aluminum foil, PID	N	See FSP
S-14	How to Measure VOCs in Air with a PID or FID (Rev 01, 7/23/99)	As above	PID	N	See FSP

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EPA-NE QAPP Worksheet #13 - Rev. 10/99 (cont)

Project Sampling SOP Reference Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Identification	Modified for Project Work Y or N	Comments[1]
S-15	Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells (Rev 02, 7/30/96)	As above	Pump, poly tubing, bailer, twine, water quality indicator, water level indicator, sample jars, poly sheeting, plastic carboys, graduated cylinder	N	See FSP
S-16	Packaging and Shipment of Samples (Battelle SOP 5-210-03)	As above	Coolers	N	See FSP

[1] Sampling SOPs provided in Field Sampling Plan (Battelle, 2002b).

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EPA-NE QAPP Worksheet #14 - Rev. 10/99

Field Sampling Equipment Calibration Table

Equipment	Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference*
Bucket auger	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	S-1
Shovel	As above	As above	As above	As above	As above	S-1
Split spoon sampler	As above	As above	As above	As above	As above	S-2
Stainless steel bowl	As above	As above	As above	As above	As above	S-1
Hand trowel	As above	As above	As above	As above	As above	S-1
Peristaltic or bladder pump	As above	As above	As above	As above	As above	S-4, S-6
Bailer	As above	As above	As above	As above	As above	S-5, S-7

* Specify appropriate reference letter/number from the Project Sampling SOP Reference Table (EPA-NE QAPP Worksheet #13).

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EPA-NE QAPP Worksheet #15 - Rev. 10/99

Field Equipment Maintenance, Testing and Inspection Table

Sampling Equipment/ Instrument	Maintenance Activity	Testing Activity	Inspection Activity	Responsible Person	Frequency	Acceptance Criteria	Corrective Action	SOP Reference
Bucket auger	NA	Operation	Visual inspection	Mark Phaneuf (FOL)	Prior to use	auger is operable	Use replacement device	S-1
Shovel	NA	NA	Visual inspection	As above	Prior to use	Shovel is intact	Use replacement device	S-1
Split spoon sampler	NA	NA	Visual inspection	As above	Prior to use	Sampler is intact	Use replacement device	S-2
Stainless steel bowl	NA	NA	Visual inspection	As above	Prior to use	Sampler is intact	Use replacement device	S-1
Hand trowel	NA	NA	Visual inspection	As above	Prior to use	Sampler is intact	Use replacement device	S-1
Peristaltic or bladder pump	NA	NA	Visual/ operational inspection	As above	Prior to use	Pump is operable	Use replacement device	S-4, S-6
Bailer	NA	NA	Visual inspection	As above	Prior to use	Sampler is intact	Use replacement device	S-5, S-7

NA = Not applicable.
FOL = Field Operation Leader

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EPA-NE QAPP Worksheet #16 - Rev. 10/99

Sample Handling, Tracking and Custody Requirements

SAMPLE COLLECTION, PACKAGING AND SHIPMENT
Sample Collection: Andrew Sutton, Jason Naiden, Harding ESE – Soils (commercial, residential) and groundwater
Sample Packing: Andrew Sutton, Jason Naiden, Harding ESE – Soils (commercial, residential) and groundwater Sample Custody must refer to the project QAPP Addendum for QC resquirements; Only in the case of groundwater will extra bottles be collected for laboratory QC (e.g., MS/MSD). Otherwise, there is sufficient material from one bottle to satisfy both native sample and laboratory QC requirements.
Coordination of Shipment: Andrew Sutton, Jason Naiden, Harding ESE – Soils (commercial, residential) and groundwater
Type of Shipment (Courier): Overnight Courier
SAMPLE RECEIPT AND ANALYSIS
Responsible Organization: Battelle Duxbury (receive samples for moisture content, pesticide/PCB Aroclors, and SVOCs (PAHs) analyses) Battelle Columbus (receive samples for Dioxin/Furan/HCX analysis) Battelle MSL (receive samples for metals and MeHg analyses) Applied Marine Sciences (receive samples for TOC and Grain Size analyses) STL Pittsburgh (received soil samples for SVOC (phenols/phthalates) and groundwater samples for VOC analyses)
Sample Receipt: Jessica Fahey, Sample Custodian Battelle Duxbury Henry Pham, Sample Custodian Battelle Columbus Carolynn Suslick, Sample Custodian Battelle MSL Ken Davis, Sample Custodian Applied Marine Sciences, Inc Anthony Lee, Sample Custodian STL Pittsburgh
Sample Custody and Storage: Jessica Fahey, Sample Custodian Battelle Duxbury Henry Pham Sample Custodian Battelle Columbus Carolynn Suslick, Sample Custodian Battelle MSL Ken Davis, Sample Custodian Applied Marine Sciences, Inc Anthony Lee, Sample Custodian STL Pittsburgh
Sample Preparation: Roxanne Brackett, Moisture, SVOCs (PAHs) and Pesticide/PCB Aroclors at Battelle Duxbury Mark Misita, Henry Pham and Susan Winnard (assisted by Wesley Baxter), Dioxin/Furan/HCX at Battelle Columbus Chuck Apts and Jordana Wood, Metals at Battelle MSL Mary Ann Deuth, MeHg at Battelle MSL Ken Davis, TOC and Grain Size Applied Marine Sciences Larry Matko, SVOC (phenols/phthalate) at STL Pittsburgh Keith Dudeck, VOCs at STL Pittsburgh **Laboratory QC samples defined on EPA-NE QAPP Worksheet #24a must be prepared with the Study Samples. MS, MSD and laboratory duplicate samples must be prepared from Centredale project samples.**

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EPA-NE QAPP Worksheet #16 - Rev. 10/99 (continued)

Sample Handling, Tracking and Custody Requirements

Sample Determinative Analysis: Dan Bardon, SVOCs (PAHs) at Battelle Duxbury Jonathan Thorn, Chlorinated Pesticide /PCB Aroclors at Battelle Duxbury Joe Tabor (assisted by Mark Misita), Dioxin/Furan/HCX at Battelle Columbus Linda Bingler, Metals at Battelle MSL Mary Ann Deuth, MeHg at Battelle MSL Ken Davis, TOC and Grain Size Applied Marine Sciences Sharon Bacha, SVOC (phenols/phthalates) at STL Pittsburgh Keith Dudeck, VOC at STL Pittsburgh
SAMPLE ARCHIVAL
Field Sample Storage (No. of days from sample collection): Varies by parameter and matrix for chemical analyses – see Worksheet #9a (Table 2)
Sample Extract/Digestate Storage (No. of days from extraction/digestion): varies by parameter and matrix for chemical analysis– see Worksheet #9a (Table 2)
SAMPLE DISPOSAL
Responsible Organization: Each participating laboratory is responsible for disposal of samples received for required analyses
Responsible Personnel: Project Manager and Sample Custodian

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EPA-NE QAPP Worksheet #17 - Rev. 10/99

Field Analytical Method/SOP Reference Table

Reference Number	Title, Revision Date and/or Number	Definitive or Screening Data	Region I NESTS Method Code	Originating Organization	Analytical Parameter	Instrument	Organization Performing Field Analysis	Modified for Project Work Y or N
F-1	How to Screen Sample Headspace for VOCs Rev 01, 7/23/99	Screening		Harding ESE (also referred to as MACTEC)	VOCs	PID	Harding ESE	N
F-2	How to Measure VOCs in Air with a PID or FID Rev 01, 7/23/99	Screening		As above	VOCs	PID or FID	Harding ESE	N
F-3	Maintenance and Calibration of Measuring and Test Equipment	Screening		As above	pH, specific conductivity, temperature, redox potential, dissolved oxygen, turbidity, salinity	Horiba U-10 or U-22 Water Quality Meter	Harding ESE	N

Field SOPs included in Field Sampling Plan (Battelle, 2002b).

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EPA-NE QAPP Worksheet #18 - Rev. 10/99

Field Analytical Instrument Calibration Table

Instrument	Activity	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference
PID, FID	Screening of soil headspace samples	Daily, prior to sampling	Measure-ments within 10% of calibration standard	Instrument calibration with standard gas	Mark Phaneuf (FOL)	F-1
Water Level Indicator	Groundwater sampling	Daily, prior to sampling	Battery and audio alarm check OK	Repair/replace as necessary	As above	F-2
Horiba U-10 or U-22 Water Quality Meter	Screening of water quality parameters, including pH, dissolved oxygen, specific conductivity, oxidation/reduction potential, turbidity, and temperature	Daily, prior to sampling	Measure-ments within 10% of calibration standard	Instrument calibration with standard solution	As above	F-3
GPS	Determine coordinates of sampling locations	N/A	N/A	Replace instrument	As above	S-12

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EPA-NE QAPP Worksheet #19 - Rev. 10/99

Field Analytical Instrument/Equipment Maintenance, Testing and Inspection Table

Instrument	Maintenance Activity	Testing Activity	Inspection Activity	Responsible Person	Frequency	Acceptance Criteria	Corrective Action	Method/ SOP Reference
PID, FID	N/A	N/A	Visual inspection	Mark Phaneuf (FOL)	Daily	Equipment in working order	Replacement device obtained	F-1
Water level indicator	N/A	Battery/ opera-tional test	Visual inspection/ operational test	As above	Daily	Equipment in working order	Replacement device obtained	F-2
Horiba U-10 or U-22 Water Quality Meter	N/A	N/A	Visual inspection	As above	Daily	Equipment in working order	Replacement device obtained	F-3
GPS	N/A	N/A	Visual inspection	As above	Daily	Equipment in working order	Replacement device obtained	S-12

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EPA-NE QAPP Worksheet #20 - Rev. 10/99

Fixed Laboratory Analytical Method/SOP Reference Table

Ref Number	Fixed Laboratory Performing Analysis	Title, Revision Date and/or Number	Definitive[1] or Screening Data	Region I NESTS Method Code*	Analytical Parameter	Instrmt	Mod for Project Work Y or N
L-1	Battelle Duxbury	Use of the Cahn Model 25 and Cahn Model 28 Electrobalances (SOP 3-004)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-2	Battelle Duxbury	Operation and Maintenance of Hewlett-Packard 5970B, 5972A and 5973A Gas Chromatograph/Mass Selective Detector (GC/MSD) using Hewlett-Packard Software (SOP 3-092)	Definitive	NA	SVOC (PAHs)	GC/MS	N
L-3	Battelle Duxbury	Operation and Maintenance of Gas Chromatographs (SOP 3-116)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-4	Battelle Duxbury	Analytical Instrument Data Acquisition Using the Labsystems X-Chrome Data System (SOP 3-132)	Definitive	NA	Pest/PCB	GC/ECD	N
L-5	Battelle Duxbury	Use of Electronic Balances (SOP 3-160)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-6	Battelle Duxbury	Quality Assurance Facilities Inspections (SOP 4-009)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-7	Battelle Duxbury	Quality Assurance Audits of Reported Data (SOP 4-015)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-8	Battelle Duxbury	Non-Conformance and Corrective Action (SOP 4-035)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-9	Battelle Duxbury	Identification and Quantification of Polychlorinated Biphenyls (By Congener and Aroclor) and Chlorinated Pesticides by Gas Chromatography/Electron Capture Detection (SOP 5-128)	Definitive	NS&T Methods	Pest/PCB	GC/ECD	N
L-10	Battelle Duxbury	Identification and Quantification of Polynuclear Aromatic Hydrocarbons by Gas Chromatography/Mass Spectrometry (SOP 5-157)	Definitive	NS&T Methods	SVOCs (PAH)	GC/MS	N
L-11	Not assigned						
L-12	Battelle Duxbury	HPLC Cleanup of Samples for Semivolatile Organic Pollutants (SOP 5-191)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N

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Ref Number	Fixed Laboratory Performing Analysis	Title, Revision Date and/or Number	Definitive[1] or Screening Data	Region I NESTS Method Code*	Analytical Parameter	Instrmt	Mod for Project Work Y or N
L-13	Battelle Duxbury	Soil/Sediment Extraction for Trace Level Semi-Volatile Organic Contaminant Analysis (SOP 5-192)	Definitive	NA	SVOC (PAHs), Pest/PCB, Moisture	GC/MS and GC/ECD	N
L-14	Not assigned						
L-15	Battelle Duxbury	Cleaning of Organic Chemistry Labware (SOP 5-216)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-16	Battelle Duxbury	Chemistry Laboratory Sample Identification (SOP 6-007)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-17	Battelle Duxbury	Sample Receipt, Custody and Handling (SOP 6-010)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-18	Battelle Duxbury	Documentation Procedures in the Gas Chromatography/Mass Spectrometry (GC/MS) Facility (SOP 6-011)	Definitive	NA	SVOC (PAHs)	GC/MS	N
L-19	Battelle Duxbury	Data Recording (SOP 6-017)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-20	Battelle Duxbury	Laboratory Verification and Validation of Analytical Data (SOP 6-027)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-21	Battelle Duxbury	Preparation of Analytical Control Charts (SOP 7-028)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-22	Battelle Duxbury	Preparation, Analysis, and Reporting Quality Control Data in the Chemistry Laboratory (SOP 7-029)	Definitive	NA	SVOC (PAHs) and Pest/PCB	GC/MS and GC/ECD	N
L-23	Battelle Columbus	The Analysis of Polychlorinated Dibenzo-p-dioxin/Polychlorinated Dibenzofuran (PCDD/PCDF) Using High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS) Using Modified Method 8290 (ASAT.II-001-02)	Definitive	NA	Dioxin/ Furan/ HCX	GC/ HRMS	N
L-24	Battelle Columbus	Polychlorinated Dibenzo-p-dioxin/Polychlorinated Dibenzofuran (PCDD/PCDF) Sample Preparation Using Modified Methods 8290 (ASAT-II-002-02)	Definitive	NA	Dioxin/ Furan/ HCX	GC/ HRMS	Y (a)

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Ref Number	Fixed Laboratory Performing Analysis	Title, Revision Date and/or Number	Definitive[1] or Screening Data	Region I NESTS Method Code*	Analytical Parameter	Instrmt	Mod for Project Work Y or N
L-25	Battelle Columbus	Internal QA Inspection and Corrective Action Procedures for Polychlorinated Dibenzo-p-dioxin/Polychlorinated Dibenzofuran (PCDD/PCDF) and Related Compounds Analytical Programs (ASAT.II-003-00)	Definitive	NA	Dioxin/ Furan/ HCX	GC/ HRMS	N
L-26	Battelle Columbus	Polychlorinated Dibenzo-p-dioxin/Polychlorinated Dibenzofuran (PCDD/PCDF) Desiccating Agent And Adsorbent Preparation and Storage (ASAT.II-005-00)	Definitive	NA	Dioxin/ Furan/ HCX	GC/ HRMS	N
L-27	Battelle Columbus	Polychlorinated Dibenzo-p-dioxin/Polychlorinated Dibenzofuran (PCDD/PCDF) Standards and Reagents Preparation and Storage for Modified Method 8290 Analysis (ASAT.II-006-00)	Definitive	NA	Dioxin/ Furan/HCX	GC/ HRMS	N
L-28	Battelle Columbus	Chain of Custody for Dioxin/Furan Analysis (ASAT.II-007-00)	Definitive	NA	Dioxin/ Furan/HCX And PCBs	GC/ HRMS	N
L-29	Battelle Columbus	Standard Operating Procedure for Dioxin/Furan Technical Data Review (ASAT.II-010-00)	Definitive	NA	Dioxin/ Furan/HCX	GC/ HRMS	N
L-30	Battelle Columbus	Standard Operating Procedure for using Electronic and Mechanical Balances (ASAT.II-011-00)	Definitive	NA	Dioxin/ Furan/HCX And PCBs	GC/ HRMS	N
L-31	Battelle Columbus	Standard Operating Procedure (SOP) for the Use of Refrigerators and Freezers used for Dioxin-Related Projects (ASAT.II-012-00)	Definitive	NA	Dioxin/ Furan/HCX And PCBs	GC/ HRMS	N
L-32	Not assigned						
L-33	Battelle Columbus	Standard Operating Procedure (SOP) for the Use and Calibration of Digital and Glass Thermometers (ASAT.II-013-00)	Definitive	NA	Dioxin/ Furan/HCX and PCBs	GC/ HRMS	N
L-34	Battelle Marine Sciences Laboratory (MSL)	Sample Chain-of-Custody (MSL-A-002)	Definitive	NA	Metals	ICP/MS, FIAS, GFAA ICP/AES, CVAA, CVAF	N

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Ref Number	Fixed Laboratory Performing Analysis	Title, Revision Date and/or Number	Definitive[1] or Screening Data	Region I NESTS Method Code*	Analytical Parameter	Instrmt	Mod for Project Work Y or N
L-35	Battelle MSL	Percent Dry Weight and Homogenizing Dry Sediment, Soil, and Tissue (MSL-C-003)	Definitive	NA	Moisture Content	Analytical balance	N
L-36	Battelle MSL	Glassware and Equipment Cleaning Procedures (MSL-C-011)	Definitive	NA	Metals	ICP/MS, FIAS, GFAA ICP/AES, CVAA, CVAF	N
L-37	Battelle MSL	Sediment Evaporation Digestion (MSL-I-004)	Definitive	NA	Metals	ICP/MS, FIAS, GFAA ICP/AES, CVAA, CVAF	N
L-38	Battelle MSL	Mixed Acid Sediment Digestion (MSL-I-006)	Definitive	NA	Metals	ICP/MS, FIAS, GFAA ICP/AES, CVAA, CVAF	N
L-39	Not assigned						
L-40	Battelle MSL	MethylMercury in Tissues and Sediments by Cold Vapor Atomic Fluorescence (MSL-I-015)	Definitive	NA	MeHg	CVAF	N
L-41	Battelle MSL	Total Mercury in Tissues and Sediments by Cold Vapor Atomic Absorption (CVAA) (MSL-I-016)	Definitive	NA	Hg	CVAA	N
L-42	Battelle MSL	Determination of Elements in Aqueous and Digestate Samples by ICP/MS (MSL-I-022)	Definitive	NA	Metals	ICP/MS	N
L-43	Not assigned						
L-44	Battelle MSL	Determination of Metals in Aqueous and Digestate Samples by ICP/AES (MSL-I-027)	Definitive	NA	Metals	ICP/AES	N
L-45	Battelle MSL	Determination of Metals in Aqueous and Digestate Samples by GFAA (MSL-I-029)	Definitive	NA	Metals	GFAA	N

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Ref Number	Fixed Laboratory Performing Analysis	Title, Revision Date and/or Number	Definitive[1] or Screening Data	Region I NESTS Method Code*	Analytical Parameter	Instrmt	Mod for Project Work Y or N
L-46	Applied Marine Sciences, Inc. (AMS)	Wet Preparation of Soil Samples for the Quantitative Determination of Particle Size Analysis (Sieve and Hydrometer Method) (SOP 2103)	Definitive	NA	Grain Size	Analytical balance/ drying oven	N
L-47	AMS	Laboratory Determination of Moisture Content of Soils (SOP 2301)	Definitive	NA	Water Content	Analytical balance/ drying oven	N
L-48	AMS	No internal SOP – follow Method ASTM D2487	Definitive	NA	Classification	NA	N
L-49	AMS	Total Organic Carbon Content of Sediments by Coulometric Detection (SOP 2201)	Definitive	NA	TOC	Analytical balance/ CO_2 coulometer	N
L-50	STL Pittsburgh	Sample Receiving and Chain of Custody (PITT-QA-0051)	Definitive	NA	NA	NA	N
L-51	STL Pittsburgh	Glassware Clean-uping for Organic/Inorganic Procedures (PITT-QA-0003)	Definitive	NA	NA	NA	N
L-52	Not assigned						
L-53	STL Pittsburgh	Employee Orientation and Training (C-QA-0013)	Definitive	NA	NA	NA	N
L-54	STL Pittsburgh	Systems Audits (S-Q-002)	Definitive	NA	SVOC (phenols & phthalates), and VOC	NA	N
L-55	Not assigned						
L-56	STL Pittsburgh	Extraction and Cleanup of Organic Compounds From Waters and Soils, Based on SW-846 3500 Series, 3600 Series, 8151A and 600 Series Methods (C-OP-0001-PT)	Definitive	NA	SVOC (phenols & phthalates)	GC/MS	N
L-57	STL Pittsburgh	Gel-Permeation Cleanup Not Applicable	Definitive	NA	SVOC (phenols & phthalates)	GC/MS	N
L-58	Not assigned.						
L-59	Not assigned.						
L-60	STL Pittsburgh	Determination of Volatile Organics by GC/MS Based on Method 8260B, 624 and 524.2 (C-MS-0002-PT)	Definitive	NA	VOC	Purge and Trap, GC/MS	N

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Ref Number	Fixed Laboratory Performing Analysis	Title, Revision Date and/or Number	Definitive[1] or Screening Data	Region I NESTS Method Code*	Analytical Parameter	Instrmt	Mod for Project Work Y or N
L-61	STL Pittsburgh	GC/MS Analyses Based on Methods 8270C and 625 (C-MS-0001-PT)	Definitive	NA	SVOC (phenol & phthalate)	GC/MS	N
L-62	Not assigned						
L-63	Not assigned						
L-64	Battelle MSL	Quality Assurance Inspections of MSL System and Study Activities (MSL-Q-002)	Definitive	NA	Metals	NA	N
L-65	Battelle MSL	Quality Assurance Audits of Reports (MSL-Q-003)	Definitive	NA	Metals	NA	N
L-66	Not assigned						
L-67	Battelle MSL	Quality Assurance Data Audits (MSL-Q-005)	Definitive	NA	Metals	NA	N
L-68 through L-97	Not assigned						
L-98	Battelle Columbus	Polychlorinated Dibenzo-p-Dioxin/Polychlorinated Dibenzofuran (PCDD/PCDF) Sample Container Preparation and Shipment (ASAT.II-004-00)	Definitive	NA	Dioxin/Furan/ HCX	NA	N
L-99	AMS	Guidelines for Sample Receipt, Login, and Storage (SOP 1301)	Definitive	NA	Grain Size, TOC	NA	N
L-100 through L-110	Not assigned						
L-111	Battelle Sequim	Determination of Metals in Aqueous and Digestate Samples by HGAA-FIAS (MSL-I-030)	Definitive	NA	Metals	FIAS	N

All SOPs listed in shaded rows (above) are included with the QAPP Update; all other SOPs were provided with the May 23, 2001 QAPP

[1] SOPs listed here either directly or indirectly relate to the generation of definitive data.
(a) Planned modifications to SOP discussed in EPA-NE QAPP Worksheet #9a.

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EPA-NE QAPP Worksheet #21 - Rev. 10/99

Fixed Laboratory Instrument Maintenance and Calibration Table

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA[1]	Method/ SOP Ref*
Analytical balance	Moisture Content	Daily performance check (or with each use).	1×/daily using two Class "S" weights bracketing expected weight range	within 0.01 g of value	Calibration and service performed as needed or at regular intervals by professional metrology technician.	Roxanne Bracket (Sample Preparation Task Leader)	L-1
GC/ECD	Pest/PCB Analysis	Change injection port liner; check for leaks	IC: prior to analytical run; CC: every 12 hours	IC: RSD≤25% mean RSD≤15% CC: PD from initial ≤25%; mean PD≤15%	Remedial maintenance, new initial calibration, or reanalyze samples. Document and justify	Jonathan Thorn (GC/ECD Analyst)	L-9
GC/MS	SVOCs (PAHs) Analysis	Change injection port liner; tune MSD; check for leaks	IC: prior to analytical run; CC: every 12 hours	IC: RSD≤25% mean RSD≤15% CC: PD from initial ≤25%; mean PD≤15%	Remedial maintenance, new initial calibration, or reanalyze samples. Document and justify	Dan Bardon (GC/MS Analyst)	L-10
GC/HRMS	Dioxin/ Furan/ HCX Analysis	Column if needed; clip retention gap if needed; tune HRMS; check for leaks; analyze calibration point 3, window set, and column performance check	IC: minimum every 6 months; CC: every 12 hours	IC: RSD≤25% for native compounds and RSD≤35% for labeled compounds CC: Within limits of Method 1613B, Table 6 "VER" requirements	Remedial maintenance, new initial calibration, reanalyze samples or use of CC response factors in calculations. Document and justify	Joe Tabor (GC/HRMS Analyst) or Task Leader	L-23
Freeze Dryer	Freeze Drying	Performance check (seals, vacuum pump operation, temperature) with each use	NA	NA	Maintenance or repair as needed	Rebecca Wood Prep Lab Manager	L-35

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Fixed Laboratory Instrument Maintenance and Calibration Table

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA[1]	Method/ SOP Ref*
Analytical balance	Moisture Content	Daily performance check (or with each use).	1×/daily using two Class "S" weights bracketing expected weight range	within 0.001 g of value	Calibration and service performed as needed or at regular intervals by professional metrology technician.	Deborah Coffey QA Officer Rebecca Wood Prep Lab manager	L-35
ICP/MS	Metals Analysis	Daily sensitivity and stability checks	IC: prior to analytical run; CC: every 10 samples	IC: $r^2 \geq 0.995$ CC: PD from true value ≤ 25% Mean PD ≤ 15%	Remedial Maintenance new IC or reanalyze Document and justify	Chuck Apts Metals Analyst	L-42
CVAA	Hg Analysis	As above	As above	As above	As above	Mary Ann Deuth Hg Analyst	L-41
ICP/AES	As above	As above	As above	IC: r ≤ 0.99 CC: PD from true value ≤ 25% Mean PD ≤ 15%	As above	Jordana Wood Metals Analyst	L-44
GFAA	As above	As above	As above	As above	As above	Jordana Wood Metals Analyst	L-45
CVAF	Hg, MeHg Analysis	As above	As above	As above	As above	Mary Ann Deuth Hg Analyst	L-40
FIAS	As above	As above	As above	NA (2 point calibration)	As above	Jordana Wood Metals Analyst	L-111
Drying oven/analytical balance	Grain Size Determination	Temperature monitoring and calibrated, with annual maintenance	2x/daily (drying oven) daily (balance)	Within 0.001g of value (balance)	Re-weigh/re-calibrate/ service call	Ken Davis	L-46
As above	Water Content Determination	As above	As above	As above	As above	Ken Davis	L-47
CO_2 Coulometer and balance	TOC Analysis	Chem scrubbers changed daily	Weekly (3 level)	5% LB<10× DL	Replace ports/reagents	Ken Davis	L-49
GC/MS	SVOC (phenols & phthalates)	Tuning, IC	Prior to sample analyses; verified every 12 hours	%RSD for method defined CCCs are ≤ 30%, SPCCs meet minimum RRF criteria,	Re-calibrate Check Standard Solution Call maintenance as needed	Sharon Bacha	L-61
GC/MS	SVOC (phenols & phthalates)	Tuning, CC	Beginning of each sequence; initial calibration verified every 12 hours	Method defined CCCs are within 20% of initial calibration, SPCCs meet minimum RRF criteria	Re-calibrate Check Standard Solution Call maintenance as needed	Sharon Bacha	L-61

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Fixed Laboratory Instrument Maintenance and Calibration Table

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA[1]	Method/ SOP Ref*
GC/MS	VOC	Tuning, IC	Prior to sample analyses; verified every 12 hours	%RSD for method defined CCCs are ≤ 30%, SPCCs meet minimum RRF criteria,	Re-calibrate Check Standard Solution Call maintenance as needed	Keith Dudeck	L-60
GC/MS	VOC	Tuning, CC	Beginning of each sequence; initial calibration verified every 12 hours	Method defined CCCs are within 20% of initial calibration, SPCCs meet minimum RRF criteria	Re-calibrate Check Standard Solution Call maintenance as needed	Keith Dudeck	L-60
Purge & Trap Device	VOC	Reagent blanks run prior to samples	Beginning of each sequence	< RL except MeCl2 is < 5X RL	Bake-out and purge system	Keith Dudeck	L-60

IC = Initial Calibration; CC = Continuing Calibration; RSD = Relative Standard Deviation; PD = Percent Difference; LB = Lab Blank; DL = Detection Limit; RL = Reporting Limit; ICV = Initial Calibration Verification; CCV = Continuing Calibration Verification.

[1] If specified project personnel not available; alternate and equally trained staff will perform task/corrective action

* Specify appropriate reference letter/number from Fixed Laboratory Method/SOP Reference Table (EPA-NE QAPP Worksheet #20).

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EPA-NE QAPP Worksheet #22a - Rev. 10/99

Field Sampling QC Table

Sampling SOP	S-1
Medium/Matrix	Soil
Analytical Parameter	PCB Aroclor/Pest and SVOC (PAH)
Concentration Level	Low
Analytical Method/ SOP Reference	NS&T/L-9 (GC/ECD); L-10 (GC/MS)
Sampler's Name	Mark Phaneuf
Field Sampling Organization	Harding ESE
No. of Sample Locations	2 residential; 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (see EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – Unacceptable Field QC sample results are not a true measure of Fixed Laboratory accuracy and precision performance.

Field QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Equipment Blanks/ Rinsate Blanks	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	GC/ECD Analyst GC/MS Analyst	Accuracy	< sample-specific RL, or associated samples >5× blank values
Bottle Blanks	NA	NA	NA	NA	NA	NA
Trip Blanks	NA	NA	NA	NA	NA	NA
Cooler Temperature Blanks	1 per cooler (bottle with clean sand – not a sample)	NA	Inform Project Manager; Document in QA/QC Narrative	Laboratory Sample Custodian	NA	< 6 °C
Field Duplicate Pairs (Duplicate Subsamples)	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	GC/ECD Analyst GC/MS Analyst	Precision	Guidance Limits Only: RPD ≤50% for at least 90% of analytes (for analytes detected at level >RL)
Collocated Samples	NA	NA	NA	NA	NA	NA
Field Splits	NA	NA	NA	NA	NA	NA
PES sent to Laboratory	NA	NA	NA	NA	NA	NA
Other:	NA	NA	NA	NA	NA	NA

RL = Reporting Limit; RPD = Relative Percent Difference

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EPA-NE QAPP Worksheet #22a - Rev. 10/99

Field Sampling QC Table

Sampling SOP	S-1, S-2
Medium/Matrix	Soil
Analytical Parameter	Dioxin/Furan/ HCX
Concentration Level	Low
Analytical Method/ SOP Reference	1668B/L-23 1613A/L-32
Sampler's Name	Mark Phaneuf
Field Sampling Organization	Harding ESE
No. of Sample Locations	3 commercial 11 residential (a)

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (see EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – Unacceptable Field QC sample results are not a true measure of Fixed Laboratory accuracy and precision performance.

Field QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blanks/ Rinsate Blanks	NA	NA	NA	NA	NA	NA
Bottle Blanks	NA	NA	NA	NA	NA	NA
Trip Blanks	NA	NA	NA	NA	NA	NA
Cooler Temperature Blanks	1 per cooler (bottle with clean sand – not a sample)	NA	Inform Project Manager; Document in QA/QC Narrative	Laboratory Sample Custodian	NA	< 6 °C
Field Duplicate Pairs (Duplicate Subsamples)	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	GC/HRMS Analyst	Precision	Guidance Limits Only: RPD ≤50% (for D/F/HCX >10× MDL)
Collocated Samples	NA	NA	NA	NA	NA	NA
Field Splits	NA	NA	NA	NA	NA	NA
PES sent to Laboratory	NA	NA	NA	NA	NA	NA
Other:	NA	NA	NA	NA	NA	NA

RPD = Relative Percent Difference; MDL = Method Detection Limit
(a) residential soils will not be analyzed for HCX

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Field Sampling QC Table

Sampling SOP	S-1
Medium/Matrix	Soil
Analytical Parameter	Metals
Concentration Level	Low
Analytical Method/ SOP Reference	245.5/L-41; 1640, 1638/L-42; SW6010B, 200.7/L-44; and 200.9/ L-45 SW8467062, 7742/L-111
Sampler's Name	Mark Phaneuf
Field Sampling Organization	Harding ESE
No. of Sample Locations	2 residential; 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (see EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – Unacceptable Field QC sample results are not a true measure of Fixed Laboratory accuracy and precision performance.

Field QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Equipment Blanks/ Rinsate Blanks	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	Metals Analyst	Accuracy	< 5× MDL, or associated samples >5× blank values
Bottle Blanks	NA	NA	NA	NA	NA	NA
Trip Blanks	NA	NA	NA	NA	NA	NA
Cooler Temperature Blanks	1 per cooler (bottle with clean sand – not a sample)	NA	Inform Project Manager; Document in QA/QC Narrative	Laboratory Sample Custodian	NA	< 6 °C
Field Duplicate Pairs (Duplicate Subsamples)	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	Metals Analyst	Precision	Guidance Limits Only: RPD ≤ 50% (for analytes detected at level >10× MDL)
Collocated Samples	NA	NA	NA	NA	NA	NA
Field Splits	NA	NA	NA	NA	NA	NA
PES sent to Laboratory	NA	NA	NA	NA	NA	NA
Other:	NA	NA	NA	NA	NA	NA

RPD = Relative Percent Difference; MDL = Method Detection Limit

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Field Sampling QC Table

Sampling SOP	S-1
Medium/Matrix	Soil
Analytical Parameter	MeHg
Concentration Level	Low
Analytical Method/ SOP Reference	Bloom (1989)/L-40
Sampler's Name	Mark Phaneuf
Field Sampling Organization	Harding ESE
No. of Sample Locations	2 residential; 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (see EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – Unacceptable Field QC sample results are not a true measure of Fixed Laboratory accuracy and precision performance.

Field QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blanks/ Rinsate Blanks	NA	NA	NA	NA	NA	NA
Bottle Blanks	NA	NA	NA	NA	NA	NA
Trip Blanks	NA	NA	NA	NA	NA	NA
Cooler Temperature Blanks	1 per cooler (bottle with clean sand – not a sample)	NA	Inform Project Manager; Document in QA/QC Narrative	Laboratory Sample Custodian	NA	< 6 °C
Field Duplicate Pairs (Duplicate Subsamples)	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	Metals Analyst	Precision	Guidance Limits Only: RPD ≤ 50% (for analytes detected at level >10× MDL)
Collocated Samples	NA	NA	NA	NA	NA	NA
Field Splits	NA	NA	NA	NA	NA	NA
PES sent to Laboratory	NA	NA	NA	NA	NA	NA
Other:	NA	NA	NA	NA	NA	NA

RPD = Relative Percent Difference; MDL = Method Detection Limit

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Field Sampling QC Table

Sampling SOP	S-1
Medium/Matrix	Soil
Analytical Parameter	Grain Size and TOC
Concentration Level	Low
Analytical Method/ SOP Reference	ASTM D422/L-46 9060/L-49
Sampler's Name	Mark Phaneuf
Field Sampling Organization	Harding ESE
No. of Sample Locations	2 residential; 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (see EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – Unacceptable Field QC sample results are not a true measure of Fixed Laboratory accuracy and precision performance.

Field QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blanks/ Rinsate Blanks	NA	NA	NA	NA	NA	NA
Bottle Blanks	NA	NA	NA	NA	NA	NA
Trip Blanks	NA	NA	NA	NA	NA	NA
Cooler Temperature Blanks	1 per cooler (bottle with clean sand – not a sample)	NA	Inform Project Manager; Document in QA/QC Narrative	Laboratory Sample Custodian	NA	< 6 °C
Field Duplicate Pairs (Duplicate Subsamples)	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	Ken Davis	Precision	Guidance Limits Only: RPD ≤ 50% (for values >10× MDL)
Collocated Samples	NA	NA	NA	NA	NA	NA
Field Splits	NA	NA	NA	NA	NA	NA
PES sent to Laboratory	NA	NA	NA	NA	NA	NA
Other:	NA	NA	NA	NA	NA	NA

RPD = Relative Percent Difference; MDL = Method Detection Limit

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EPA-NE QAPP Worksheet #22a - Rev. 10/99

Field Sampling QC Table

Sampling SOP	S-1
Medium/Matrix	Soil
Analytical Parameter	SVOCs (phenols/ phthalates)
Concentration Level	Low
Analytical Method/ SOP Reference	8270C/L-61
Sampler's Name	Mark Phaneuf
Field Sampling Organization	Harding ESE
No. of Sample Locations	2 residential; 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (see EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – Unacceptable Field QC sample results are not a true measure of Fixed Laboratory accuracy and precision performance.

Field QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Equipment Blanks/ Rinsate Blanks	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	GC/MS Analyst	Accuracy	<RL, except bis-2-ethylhexylphthalate is ≤ 5× RL
Bottle Blanks	NA	NA	NA	NA	NA	NA
Trip Blanks	NA	NA	NA	NA	NA	NA
Cooler Temperature Blanks	1 per cooler (bottle with clean sand – not a sample)	NA	Inform Project Manager; Document in QA/QC Narrative	Laboratory Sample Custodian	NA	< 6 °C
Field Duplicate Pairs (Duplicate Subsamples)	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	GC/MS Analyst	Precision	Guidance Limits Only: RPD ≤ 50% (for analytes detected at level > 10× MDL)
Collocated Samples	NA	NA	NA	NA	NA	NA
Field Splits	NA	NA	NA	NA	NA	NA
PES sent to Laboratory*	1 per 20	NA	NA	GC/MS Analyst	Accuracy	Not applicable – Report values; EPA will evaluate
Other:	NA	NA	NA	NA	NA	NA

RPD = Relative Percent Difference; RL = Reporting Limit; MDL = Method Detection Limit
* USACE will formerly request PE samples from USEPA; USEPA will ship PE samples directly to participating laboratories in a timely manner such that the PE samples are processed in the laboratory along with the Centredale study samples. Storage conditions and holding times will be defined in the directions received with the PE samples.

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Field Sampling QC Table

Sampling SOP	S-6, S-7
Medium/Matrix	Groundwater
Analytical Parameter	Dioxin/Furan
Concentration Level	Low
Analytical Method/ SOP Reference	1668B/L-23 1613A/L-32
Sampler's Name	Mark Phaneuf
Field Sampling Organization	Harding ESE
No. of Sample Locations	1

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (see EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – Unacceptable Field QC sample results are not a true measure of Fixed Laboratory accuracy and precision performance.

Field QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blanks/ Rinsate Blanks	NA	NA	NA	NA	NA	NA
Bottle Blanks	NA	NA	NA	NA	NA	NA
Trip Blanks	NA	NA	NA	NA	NA	NA
Cooler Temperature Blanks	1 per cooler (bottle with lab water – not a sample)	NA	Inform Project Manager; Document in QA/QC Narrative	Laboratory Sample Custodian	NA	< 6 °C
Field Duplicate Pairs (Duplicate Subsamples)	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	GC/HRMS Analyst	Precision	Guidance Limits Only: RPD ≤ 50% (for D/F/HCX >10× MDL)
Collocated Samples	NA	NA	NA	NA	NA	NA
Field Splits	NA	NA	NA	NA	NA	NA
PES sent to Laboratory	NA	NA	NA	NA	NA	NA
Other:	NA	NA	NA	NA	NA	NA

RPD = Relative Percent Difference; QL = Quantitation Limit

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Field Sampling QC Table

Sampling SOP	S-6, S-7
Medium/Matrix	Water
Analytical Parameter	VOC
Concentration Level	Low
Analytical Method/ SOP Reference	8260B/L-60
Sampler's Name	Mark Phaneuf
Field Sampling Organization	Harding ESE
No. of Sample Locations	33

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (see EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – Unacceptable Field QC sample results are not a true measure of Fixed Laboratory accuracy and precision performance.

Field QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blanks/ Rinsate Blanks	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	GC/MS VOA Analyst	Accuracy	<RL, except methylene chloride must be < 5× RL
Bottle Blanks	NA	NA	NA	NA	NA	NA
Trip Blanks	1 per cooler	NA	Inform Project Manager	GC/MS VOA Analyst	Accuracy	<RL, or associated samples >10× blank values *(except common lab contaminants MeCl2 <5×RL)*
Cooler Temperature Blanks	1 per cooler (bottle with lab water – not a sample)	NA	Inform Project Manager; Document in QA/QC Narrative	Laboratory Sample Custodian	NA	< 6 °C
Field Duplicate Pairs (Duplicate Subsamples)	1 per 20	NA	Inform Project Manager; Document in QA/QC Narrative	GC/MS VOA Analyst	Precision	Guidance Limits Only: RPD ≤ 50% (for analytes detected at level >10× MDL)
Collocated Samples	NA	NA	NA	NA	NA	NA
Field Splits	NA	NA	NA	NA	NA	NA
PES sent to Laboratory	NA	NA	NA	NA	NA	NA
Other:	NA	NA	NA	NA	NA	NA

RPD = Relative Percent Difference; QL = Quantitation Limit; MDL = Method Detection Limit

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EPA-NE QAPP Worksheet #22b - Rev. 10/99

Field Sampling QC Table Cont.

Sampling SOP: S-1
Analytical Method/SOP: L-9 (Soil only); Pesticides/PCB Aroclors

Analyte	*Guidance QC Limits Only (a)*	
	Field Precision as Measured by: Duplicate Subsamples or Collocated Samples	**Field Accuracy/Bias (Contamination)**
4,4'-DDD	RPD≤ 50% for 90% of analytes, for values >RL	< sample-specific RL, or associated samples >5× blank values
4,4'-DDE	As above	As above
4,4'-DDT	As above	As above
Aldrin	As above	As above
alpha-BHC	As above	As above
alpha-Chlordane	As above	As above
beta-BHC	As above	As above
delta-BHC	As above	As above
Dieldrin	As above	As above
Endosulfan I	As above	As above
Endosulfan II	As above	As above
Endosulfan Sulfate	As above	As above
Endrin	As above	As above
Endrin Aldehyde	As above	As above
Endrin Ketone	As above	As above
gamma-BHC	As above	As above
gamma-Chlordane	As above	As above
Heptachlor	As above	As above
Heptachlor Epoxide	As above	As above
Methoxychlor	As above	As above
Technical chlordane	As above	As above
Toxaphene	As above	As above
Aroclor-1016	As above	As above
Aroclor-1221	As above	As above
Aroclor-1232	As above	As above
Aroclor-1242	As above	As above
Aroclor-1248	As above	As above
Aroclor-1254	As above	As above
Aroclor-1260	As above	As above
Aroclor-1268	As above	As above
Aroclor, Total (b)	As above	As above

RPD = Relative Percent Difference; RL = Reporting Limit

(a) QC limits provided are for guidance only. There is no applicable MPC for field duplicates. The only applicable corrective action that can be taken in cases where the RPD between field duplicates or concentrations of target compounds in the rinsate blank exceed the QC limits is to 1) Notify the Project Manager and 2) document exceedences in the QA/QC narrative. Exceedences from these QC limits are not a true measure of Fixed Laboratory data quality.

(b) Total Aroclor determined in database using final, validated data.

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EPA-NE QAPP Worksheet #22b - Rev. 10/99

Field Sampling QC Table Cont.

Sampling SOP: S-1
Analytical Method/SOP: L-10 (Soil only); SVOCs (PAHs)

Analyte (a)	*Guidance QC Limits Only (b)*	
	Field Precision as Measured by: Duplicate Subsamples or Collocated Samples	**Field Accuracy/Bias (Contamination)**
Biphenyl	RPD≤ 50% for 90% of analytes, for values >RL	< sample-specific RL, or associated samples >5× blank values
2-Methylnaphthalene	As above	As above
Acenaphthene	As above	As above
Acenaphthylene	As above	As above
Benzaldehyde	As above	As above
Anthracene	As above	As above
Benz[a]anthracene	As above	As above
Benzo[a]pyrene	As above	As above
Benzo[b]fluoranthene	As above	As above
Benzo[g,h,i]perylene	As above	As above
Benzo[k]fluoranthene	As above	As above
Chrysene	As above	As above
Dibenz[a,h]anthracene	As above	As above
Dibenzofuran	As above	As above
Fluoranthene	As above	As above
Fluorene	As above	As above
Indeno[1,2,3-cd]pyrene	As above	As above
Naphthalene	As above	As above
Phenanthrene	As above	As above
Pyrene	As above	As above
Total PAH (c)	As above	As above

RPD = Relative Percent Difference; RL = Reporting Limit
(a) **Bolded** PAHs = EPA priority pollutant PAH.
(b) QC limits provided are for guidance only. There is no applicable MPC for field duplicates. The only applicable corrective action that can be taken in cases where the RPD between field duplicates or concentrations of target compounds in the rinsate blank exceed the QC limits is to 1) Notify the Project Manager and 2) document exceedences in the QA/QC narrative. Exceedences from these QC limits are not a true measure of Fixed Laboratory data quality.
(c) Total PAH determined in database using final, validated data.

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Field Sampling QC Table Cont.

Sampling SOP: S-1, S-2 (soil); S-6, S-7 (groundwater)
Analytical Method/SOP: L-23 (Soil and Groundwater); Dioxins/Furans/HCX

Analyte (a)	*Guidance QC Limits Only (a)*	
	Field Precision as Measured by: Duplicate Subsamples or Collocated Samples	**Field Accuracy/Bias (Contamination)**
2,3,7,8-Tetrachlorodibenzo-p-dioxin	RPD≤ 50% for values >10× MDL	Not applicable (no rinsate blank will be collected or analyzed)
2,3,7,8-Tetrachlorodibenzofuran	As above	As above
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	As above	As above
1,2,3,7,8-Pentachlorodibenzofuran	As above	As above
2,3,4,7,8-Pentachlorodibenzofuran	As above	As above
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	As above	As above
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	As above	As above
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	As above	As above
1,2,3,4,7,8-Hexachlorodibenzofuran	As above	As above
1,2,3,6,7,8-Hexachlorodibenzofuran	As above	As above
1,2,3,7,8,9-Hexachlorodibenzofuran	As above	As above
2,3,4,6,7,8-Hexachlorodibenzofuran	As above	As above
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	As above	As above
1,2,3,4,6,7,8-Heptachlorodibenzofuran	As above	As above
1,2,3,4,7,8,9-Heptachlorodibenzofuran	As above	As above
Octachlorodibenzo-p-dioxin	As above	As above
Octachlorodibenzofuran	As above	As above
1,2,4,5,7,8-Hexachloro-9-Xanthene (HCX)	As above (soil only)	As above
Total HpCDD	As above (soil only)	As above
Total HpCDF	As above (soil only)	As above
Total HxCDD	As above (soil only)	As above
Total HxCDF	As above (soil only)	As above
Total PeCDD	As above (soil only)	As above
Total PeCDF	As above (soil only)	As above
Total TCDD	As above (soil only)	As above
Total TCDF	As above (soil only)	As above

RPD = Relative Percent Difference; MDL = Method Detection Limit

(a) QC limits provided are for guidance only. There is no applicable MPC for field duplicates. The only applicable corrective action that can be taken in cases where the RPD between field duplicates or concentrations of target compounds in the rinsate blank exceed the QC limits is to 1) Notify the Project Manager and 2) document exceedences in the QA/QC narrative. Exceedences from these QC limits are not a true measure of Fixed Laboratory data quality.

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Field Sampling QC Table Cont.

Sampling SOP: S-1
Analytical Method/SOP: L-41 (CVAA); L-42 (ICP/MS); L-44 (ICP/AES); L-45 (GFAA); L-111 (FIAS) (multiple analysis methods may be used to optimize detection limits and reduce interferences) (Soil only); Metals

Analyte	*Guidance QC Limits Only (a)*	
	Field Precision as Measured by: Duplicate Subsamples or Collocated Samples	**Field Accuracy/Bias (Contamination)**
Aluminum	RPD≤ 50% for values >10× MDL	< 5× MDL, or associated samples >5× blank values
Antimony	As above	As above
Arsenic	As above	As above
Barium	As above	As above
Beryllium	As above	As above
Cadmium	As above	As above
Chromium	As above	As above
Cobalt	As above	As above
Copper	As above	As above
Iron	As above	As above
Lead	As above	As above
Manganese	As above	As above
Mercury	As above	As above
Molybdenum	As above	As above
Nickel	As above	As above
Selenium	As above	As above
Silver	As above	As above
Thallium	As above	As above
Vanadium	As above	As above
Zinc	As above	As above

RPD = Relative Percent Difference; MDL = Method Detection Limit
(a) QC limits provided are for guidance only. There is no applicable MPC for field duplicates. The only applicable corrective action that can be taken in cases where the RPD between field duplicates or concentrations of target compounds in the rinsate blank exceed the QC limits is to 1) Notify the Project Manager and 2) document exceedences in the QA/QC narrative. Exceedences from these QC limits are not a true measure of Fixed Laboratory data quality.

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Field Sampling QC Table Cont.

Sampling SOP: S-1
Analytical Method/SOP: Bloom (1989)/L-40 (Soil only); MeHg

Analyte	*Guidance QC Limits Only (a)*	
	Field Precision as Measured by: Duplicate Subsamples or Collocated Samples	**Field Accuracy/Bias (Contamination)**
MeHg	RPD≤ 50% for values >10× MDL	Not applicable (no rinsate blank will be collected or analyzed)

RPD = Relative Percent Difference; MDL = Method Detection Limit

(a) QC limits provided are for guidance only. There is no applicable MPC for field duplicates. The only applicable corrective action that can be taken in cases where the RPD between field duplicates or concentrations of target compounds in the rinsate blank exceed the QC limits is to 1) Notify the Project Manager and 2) document exceedences in the QA/QC narrative. Exceedences from these QC limits are not a true measure of Fixed Laboratory data quality.

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Field Sampling QC Table Cont.

Sampling SOP: S-1
Analytical Method/SOP: L-46 (Soil only); Grain Size

Analyte	*Guidance QC Limits Only (a)*	
	Field Precision as Measured by: Duplicate Subsamples or Collocated Samples	**Field Accuracy/Bias (Contamination)**
% gravel	RPD≤ 50% for values >10× MDL	Not applicable (no rinsate blank will be collected or analyzed)
% coarse sand	As above	As above
% medium sand	As above	As above
% fine sand	As above	As above
% silt	As above	As above
% clay	As above	As above
Grain size distribution curve	As above	As above

RPD = Relative Percent Difference; MDL = Method Detection Limit
(a) QC limits provided are for guidance only. There is no applicable MPC for field duplicates. The only applicable corrective action that can be taken in cases where the RPD between field duplicates or concentrations of target compounds in the rinsate blank exceed the QC limits is to 1) Notify the Project Manager and 2) document exceedences in the QA/QC narrative. Exceedences from these QC limits are not a true measure of Fixed Laboratory data quality.

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Field Sampling QC Table Cont.

Sampling SOP: S-1
Analytical Method/SOP: L-49 (Soil only); TOC

Analyte	*Guidance QC Limits Only (a)*	
	Field Precision as Measured by: Duplicate Subsamples or Collocated Samples	**Field Accuracy/Bias (Contamination)**
TOC	RPD≤ 50% for values >10× MDL	Not applicable (no rinsate blank will be collected or analyzed)

RPD = Relative Percent Difference; MDL = Method Detection Limit

(a) QC limits provided are for guidance only. There is no applicable MPC for field duplicates. The only applicable corrective action that can be taken in cases where the RPD between field duplicates or concentrations of target compounds in the rinsate blank exceed the QC limits is to 1) Notify the Project Manager and 2) document exceedences in the QA/QC narrative. Exceedences from these QC limits are not a true measure of Fixed Laboratory data quality.

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Field Sampling QC Table Cont.

Sampling SOP: S-1
Analytical Method/SOP: L-61 (Soil only); SVOCs (Phenols and Phthalates)

Analyte	*Guidance QC Limits Only (a)*	
	Field Precision as Measured by: Duplicate Subsamples or Collocated Samples	**Field Accuracy/Bias (Contamination)**
2,4,5-Trichlorophenol	≤50% RPD	≤RL, except bis-2-ethylhexylphthalate is ≤5× RL
2,4-Dinitrophenol	≤50% RPD	As above
2-Nitrophenol	≤50% RPD	As above
4-Methylphenol	≤50% RPD	As above
4-Nitrophenol (control analyte)	**≤50% RPD**	As above
Bis(2-Ethylhexyl)phthalate	≤50% RPD	As above
Butylbenzylphtalate	≤50% RPD	As above
Carbazole	≤50% RPD	As above
Di-n-Butylphthalate	≤50% RPD	As above
Di-n-Octylphthalate	≤50% RPD	As above
Pentachlorophenol (control analyte)	**≤50% RPD**	As above
Phenol (control analyte)	**≤50% RPD**	**As above**

RPD = Relative Percent Difference; RL = Reporting Limit

(a) QC limits provided are for guidance only. There is no applicable MPC for field duplicates. The only applicable corrective action that can be taken in cases where the RPD between field duplicates or concentrations of target compounds in the rinsate blank exceed the QC limits is to 1) Notify the Project Manager and 2) document exceedences in the QA/QC narrative. Exceedences from these QC limits are not a true measure of Fixed Laboratory data quality.

Note – Only control analytes (identified above) can be evaluated against Guidance Limits for field duplicates

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Field Sampling QC Table Cont.

Sampling SOP: S-6, S-7
Analytical Method/SOP: L-60 (Groundwater only); VOC

Analyte	*Guidance QC Limits Only (a)*	
	Field Precision as Measured by: Duplicate Subsamples or Collocated Samples	**Field Accuracy/Bias (Contamination)**
1,1,1,2-Tertrachloroethane	RPD ≤ 50% for values >10× MDL	RL, except methylene chloride must be < 5× RL
1,1,1-Trichloroethane	As above	As above
1,1,2,2-Tertrachlloroethane	As above	As above
1,1,2-Trichloroethane	As above	As above
1,1-Dichloroethhane	As above	As above
1,1-Dichloroethene (control analyte)	As above	As above
1,1-Dichloropropene	As above	As above
1,2,3-Trichlorobenzene	As above	As above
1,2,3-Trichloropropane	As above	As above
1,2,4-Trichlorobenzene	As above	As above
1,2,4-Trimethylbenzene	As above	As above
1,2-Dibromo-3-chloropropane	As above	As above
1,2-Dibromoethane	As above	As above
1,2-Dichlorobenzene	As above	As above
1,2-Dichloroethane	As above	As above
1,2-Dichloropropane	As above	As above
1,3,5-Trimethylbenzene	As above	As above
1,3-Dichlorobenzene	As above	As above
1,3-Dichloropropane	As above	As above
1,4-Dichlorobenzene	As above	As above
2,2-Dichloropropane	As above	As above
2-Chlorotoluene	As above	As above
4-Clorotoluene	As above	As above
Benzene (control analyte)	As above	As above
Bromobenzene	As above	As above
Bromochloromethane	As above	As above
Bromodichloromethane	As above	As above
Bromoform	As above	As above
Bromomethane	As above	As above
Carbon Tetrachloride	As above	As above
Chlorobenzene (control analyte)	As above	As above
Chloroethane	As above	As above
Chloroform	As above	As above
Chloromethane	As above	As above

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Field Sampling QC Table Cont.

Sampling SOP: S-6, S-7
Analytical Method/SOP: L-60 (Groundwater only); VOC

Analyte	*Guidance QC Limits Only (a)*	
	Field Precision as Measured by: Duplicate Subsamples or Collocated Samples	**Field Accuracy/Bias (Contamination)**
cis-1,2-Dichloroethene	RPD≤ 50% for values >10× MDL	RL, except methylene chloride must be < 5× RL
cis-1,3-Dichloropropene	As above	As above
Dibromochloromethane	As above	As above
Dibromomethane	As above	As above
Dichlorodifluoromethane	As above	As above
Ethylbenzene	As above	As above
Hexachlorobutadiene	As above	As above
Isopropylbenzene	As above	As above
m&p-Xylene	As above	As above
Methylene Chloride	As above	As above
Naphthalene	As above	As above
n-Butylbenzene	As above	As above
n-Propylbenzene	As above	As above
o-Xylene	As above	As above
p-Isopropyltoluene	As above	As above
sec-Butylbenzene	As above	As above
Styrene	As above	As above
tert-Butylbenzene	As above	As above
Tetrachloroethene	As above	As above
Toluene (control analyte)	As above	As above
Total Volatile Organics (b)	Not applicable	As above
Total Xylenes (b)	As above	As above
trans-1,2-Dichloroethene	RPD ≤ 50% for values >10× MDL	As above
Trans-1,3-Dichloropropene	As above	As above
Trichloroethene (control analyte)	As above	As above
Trichlorofluoromethane	As above	As above
Vinyl Chloride	As above	As above

RPD = Relative Percent Difference; RL = Reporting Limit; MDL = Method Detection Limit
(a) QC limits provided are for guidance only. There is no applicable MPC for field duplicates. The only applicable corrective action that can be taken in cases where the RPD between field duplicates or concentrations of target compounds in the rinsate blank exceed the QC limits is to 1) Notify the Project Manager and 2) document exceedences in the QA/QC narrative. Exceedences from these QC limits are not a true measure of Fixed Laboratory data quality.
(b) Totals determined in database using final, validated data.

Note – Only control analytes (identified above) can be evaluated against Guidance Limits for field duplicates.

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EPA-NE QAPP Worksheet #24a - Rev. 10/99

Fixed Laboratory Analytical QC Sample Table

Medium/ Matrix	Soil
Sampling SOP	S-1
Analytical Parameter	Pest/PCBs
Concentration Level	Low
Analytical Method/ SOP Reference	NS&T/L-9 (GC/ECD)
Laboratory Name	Battelle Duxbury
No. of Sample Locations	2 residential 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – Two LCSs will be prepared with each set of samples. The first LCS will be fortified with PCB congeners; the second LCS will be fortified with Aroclor 1016 and Aroclor 1260. Aroclors will not be fortified into the MS/MSD.

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1/sample set	NA	Reextract, reanalyze, or justify	GC/ECD Analyst	Accuracy	< sample-specific RL, or associated samples >5× blank values
Reagent Blank	1/lot purchase	NA	Review findings with laboratory manager; check different lot	GC/ECD Analyst	Accuracy	Review findings with laboratory manager; check different lot
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA (as required)	NA	NA	NA	NA	NA
Laboratory Duplicate	1/ sample set	NA	Review with Project Manager; re-analyze or justify in project records	GC/ECD Analyst	Precision	RPD≤50% for at least 90% of analytes (for analytes detected at level >RL)
Laboratory Matrix Spike/Matrix Spike Duplicate	1/sample set	NA	Reextract, reanalyze or justification documented	GC/ECD Analyst	Accuracy/ Precision	90% of analytes meet the following: 40-120% R RPD≤30% for at least 90% of analytes (Concentration of spiked analytes in MS/MSD must be >5× background concentrations to be used for data quality assessment)

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EPA-NE QAPP Worksheet #24a (continued) - Rev. 10/99

Fixed Laboratory Analytical QC Sample Table

Medium/ Matrix	Soil
Sampling SOP	S-1
Analytical Parameter	Pest/PCBs
Concentration Level	Low
Analytical Method/ SOP Reference	NS&T/L-9 (GC/ECD)
Laboratory Name	Battelle Duxbury
No. of Sample Locations	2 residential 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives

Note – Two LCSs will be prepared with each set of samples. The first LCS will be fortified with PCB congeners; the second LCS will be fortified with Aroclor 1016 and Aroclor 1260. Aroclors will not be fortified into the MS/MSD.

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
LCS	2/sample set	NA	Review with Project Manager; re-analyze or justify in project records	GC/ECD Analyst	Accuracy	90% of analytes meet the following: 40-120% R
LFB	NA	NA	NA	NA	NA	NA
Surrogates	4 per sample (2 reported)	NA	Reextract, reanalyze or justification documented	GC/ECD Analyst	Accuracy	40-125% R
Internal Standards (ISs)	3 per sample (2 used for quant.)	NA	NA	NA	NA	NA
Other: SRM	1/sample set	NA	Reextract, reanalyze or justification documented	GC/ECD Analyst	Accuracy, Comparability	PD≤30% from a range of certified values [a] (using surrogate corrected data; certified concentration in SRM must be >RL)
ICS	1/ sample set	NA	Internal QC check only	GC/ECD Analyst	Precision	PD≤15% from true values

RL = Reporting Limit; PD = Percent Difference; R = Recovery; RPD = Relative Percent Difference; ICS = Independent Control Sample

[a] If detected value falls within the *range of certified values*, then the PD is reported as 0.0. However, if the detected value falls outside the range of certified values, then the PD is determined from either the upper or lower limit of the range. See Battelle SOP 7-029.

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EPA-NE QAPP Worksheet #24a - Rev. 10/99

Fixed Laboratory Analytical QC Sample Table

Medium/ Matrix	Soil
Sampling SOP	S-1
Analytical Parameter	SVOCs (PAHs)
Concentration Level	Low
Analytical Method/ SOP Reference	NS&T/L-10 (GC/MS)
Laboratory Name	Battelle Duxbury
No. of Sample Locations	2 residential 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	1/sample set	NA	Reextract, reanalyze, or justify	GC/MS Analyst	Accuracy	< sample-specific RL, or associated samples >5× blank values
Reagent Blank	1/lot purchase	NA	Review findings with laboratory manager; check different lot	GC/MS Analyst	Accuracy	Review findings with laboratory manager; check different lot
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA (as required)	NA	NA	NA	NA	NA
Laboratory Duplicate	1/ sample set	NA	Review with Project Manager; re-analyze or justify in project records	GC/MS Analyst	Precision	RPD≤50% for at least 90% of analytes (for analytes detected at level >RL)
Laboratory Matrix Spike/Matrix Spike Duplicate	1/sample set	NA	Reextract, reanalyze or justification documented	GC/MS Analyst	Accuracy/ Precision	90% of analytes meet the following: 40-120% R RPD≤30% for at least 90% of analytes (Concentration of spiked analytes in MS/MSD must be >5× background concentrations to be used for data quality assessment)

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EPA-NE QAPP Worksheet #24a (continued) - Rev. 10/99

Fixed Laboratory Analytical QC Sample Table

Medium/ Matrix	Soil
Sampling SOP	S-1
Analytical Parameter	SVOCs (PAHs)
Concentration Level	Low
Analytical Method/ SOP Reference	NS&T/L-10 (GC/MS)
Laboratory Name	Battelle Duxbury
No. of Sample Locations	2 residential 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
LCS	1/sample set	NA	Review with Project Manager; re-analyze or justify in project records	GC/MS Analyst	Accuracy	90% of analytes meet the following: 40-120% R
LFB	NA	NA	NA	NA	NA	NA
Surrogates	3 per sample	NA	Reextract, reanalyze or justification documented	GC/MS Analyst	Accuracy	40-125% R
Internal Standards (ISs)	3 per sample (1 used for quant.)	NA	NA	NA	NA	NA
Other: SRM	1/sample set	NA	Reextract, reanalyze or justification documented	GC/MS Analyst	Accuracy, Comparability	PD≤30% from a range of certified values [a] (using surrogate corrected data; certified concentration in SRM must be >RL)
ICS	1/ sample set	NA	Internal QC check only	GC/MS Analyst	Precision	PD≤15% from true values

RL = Reporting Limit; PD = Percent Difference; R = Recovery; RPD = Relative Percent Difference; ICS = Independent Control Sample

[a] If detected value falls within the *range of certified values*, then the PD is reported as 0.0. However, if the detected value falls outside the range of certified values, then the PD is determined from either the upper or lower limit of the range. See Battelle SOP 7-029.

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EPA-NE QAPP Worksheet #24a - Rev. 10/99

Fixed Laboratory Analytical QC Sample Table

Medium/ Matrix	Soil/ Groundwater
Sampling SOP	S-1, S-2, S-6, S-7
Analytical Parameter	Dioxin/ Furan/HCX[a]
Concentration Level	Low
Analytical Method/ SOP Reference	1613B/L-23
Laboratory Name	Battelle Columbus
No. of Sample Locations	11 res. soil 3 comm. soil 1 water

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – no second source of HCX; therefore, while LCS/MS/MSD QC samples will be fortified with HCX there is no applicable MPC criteria for HCX

[a] HCX only analyzed in residential soils; not groundwater or commercial soils

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1/sample set	NA	Reextract, reanalyze, or justify	GC/HRMS Analyst	Accuracy	<5× MDL, or associated samples >5× blank values (>10× blank values for OCDD, OCDF and totals)
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	1/ sample set	NA	Review with Laboratory Manager; re-analyze or justify in project records	Task Leader	Precision	RPD≤50% (soil) RPD≤30% (water) (for analytes detected at level >10× MDL)
Laboratory Matrix Spike/Matrix Spike Duplicate	1/sample set	NA	Review with Laboratory Manager; re-analyze or justify in project records	Task Leader	Accuracy/ Precision	50-120% R RPD≤30% (Analyte concentration in MS/MSD must be >5× background concentration to be used for data quality assessment)
LCS	1 /sample set	Method 1613B, Table 6, "OPR" requirements	Review with Laboratory Manager; re-analyze or justify in project records NA	Task Leader	Accuracy	Method 1613B, Table 6, "OPR" requirements
LFB	NA	NA	NA	NA	NA	NA
Surrogates	NA	NA	NA	NA	NA	NA
Internal Standards (ISs)	15 per sample	NA	Review with Laboratory Manager; re-analyze or justify in project records	GC/HRMS Analyst/ Preparation Analyst	Accuracy	25 – 150% R
Other: SRM	1/sample set *(not applicable for water or HCX)*	NA	Reextract, reanalyze or justification documented	Task Leader	Accuracy, Comparability	PD≤30% from certified values (for cert. Analytes >5× MDL)

MDL = Method Detection Limit; R = Recovery; RPD = Relative Percent Difference; OPR = Ongoing Precision and Recovery; PD = Percent Difference.

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Fixed Laboratory Analytical QC Sample Table

Medium/ Matrix	Soil
Sampling SOP	S-1
Analytical Parameter	Metals
Concentration Level	Low
Analytical Method/ SOP Reference	245.5/L-41; 1640, 1638/L-42; SW6010B, 200.7/L-44; 200.9/L-45; and SW846 7062, 7742/L-111
Laboratory Name	Battelle MSL
No. of Sample Locations	2 residential; 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1/sample set	NA	Reextract, reanalyze, and or blank subtract; document corrective action	Metals Analyst	Accuracy	<5× MDL, or associated samples >5× blank values
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA (as required)	NA	NA	NA	NA	NA
Laboratory Duplicate	1/sample set	NA	Review with Project Manager; re-analyze or justify in project records	Metals Analyst	Precision	RPD ≤ 50% (for analytes detected at level >10× MDL)
Laboratory Matrix Spike/Matrix Spike Duplicate	1 pair/sample set	NA	Reextract, reanalyze or justification documented	Metals Analyst	Accuracy/ Precision	70-130 % R RPD ≤ 30% (Analyte concentration in MS/MSD must be >5× background concentration to be used for data quality assessment)
LCS	1/sample set	NA	Review with Project Manager; re-analyze or justify in records	Metals Analyst	Accuracy	70-130% R
LFB	NA	NA	NA	NA	NA	NA
Surrogates	NA	NA	NA	NA	NA	NA
Internal Standards (ISs)	NA	NA	NA	NA	NA	NA
Other: SRM	1/sample set	NA	Reextract, reanalyze or justification documented	Metals Analyst	Accuracy Comparability	PD ≤ 25% from certified values (for certified values >5× MDL)

MDL = Method Detection Limit; R = Recovery; RPD = Relative Percent Difference; PD = Percent Difference.

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Fixed Laboratory Analytical QC Sample Table

Medium/ Matrix	Soil
Sampling SOP	S-1
Analytical Parameter	MeHg
Concentration Level	Low
Analytical Method/ SOP Reference	Bloom (1989)/L-40
Laboratory Name	Battelle MSL
No. of Sample Locations	2 residential 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1/sample set	NA	Reextract, reanalyze, and or blank subtract; document corrective action	Metals Analyst	Accuracy	<5× MDL, or associated samples >5× blank values
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA (as required)	NA	NA	NA	NA	NA
Laboratory Duplicate	1/sample set	NA	Review with Project Manager; re-analyze or justify in project records	Metals Analyst	Precision	RPD ≤ 50% (for analytes detected at level > 10× MDL)
Laboratory Matrix Spike/Matrix Spike Duplicate	1 pair/sample set	NA	Reextract, reanalyze or justification documented	Metals Analyst	Accuracy/ Precision	70-130 % R RPD ≤ 30% (Analyte concentration in MS/MSD must be >5× background concentration to be used for data quality assessment)
LCS	NA	NA	NA	NA	NA	NA
LFB	NA	NA	NA	NA	NA	NA
Surrogates	NA	NA	NA	NA	NA	NA
Internal Standards (ISs)	NA	NA	NA	NA	NA	NA
Other: SRM	1/sample set	NA	Reextract, reanalyze or justification documented	Metals Analyst	Accuracy Comparability	PD ≤ 25% from certified values (for certified values >5× MDL)

MDL = Method Detection Limit; R = Recovery; RPD = Relative Percent Difference; PD = Percent Difference.

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Fixed Laboratory Analytical QC Sample Table

Medium/ Matrix	Soil
Sampling SOP	S-1
Analytical Parameter	Grain Size
Concentration Level	Low
Analytical Method/ SOP Reference*	ASTM D422/L-46
Laboratory Name	Applied Marine Sciences, Inc.
No. of Sample Locations	2 residential 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	NA	NA	NA	NA	NA	NA
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	1 per sample set	NA	Review with Project Manager; re-analyze or justify in project records	Ken Davis	Precision	RPD ≤50% (for values >10×MDL)
Laboratory Matrix Spike/Matrix Spike Duplicate	NA	NA	NA	NA	NA	NA
LCS	NA	NA	NA	NA	NA	NA
LFB	NA	NA	NA	NA	NA	NA
Surrogates	NA	NA	NA	NA	NA	NA
Internal Standards (ISs)	NA	NA	NA	NA	NA	NA
Other: SRM	NA	NA	NA	NA	NA	Not applicable – *No SRM for grain size in sediment/soil available*

MDL = Method Detection Limit; RPD = Relative Percent Difference.

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Fixed Laboratory Analytical QC Sample Table

Medium/ Matrix	Soil
Sampling SOP	S-1
Analytical Parameter	TOC
Concentration Level	Low
Analytical Method/ SOP Reference*	9060/L-49
Laboratory Name	Applied Marine Sciences, Inc.
No. of Sample Locations	2 residential 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	NA	NA	NA	NA	NA	NA
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	1 per sample set	NA	Review with Project Manager; re-analyze or justify in project records	Ken Davis	Accuracy	<10× MDL with signal:noise > 10:1
Laboratory Duplicate	1/ sample set	NA	Review with Project Manager; re-analyze or justify in project records	Ken Davis	Precision	RPD≤50% (for values >10× MDL)
Laboratory Matrix Spike/Matrix Spike Duplicate	NA	NA	NA	NA	NA	NA
LCS	NA	NA	NA	NA	NA	NA
LFB	NA	NA	NA	NA	NA	NA
Surrogates	NA	NA	NA	NA	NA	NA
Internal Standards (ISs)	NA	NA	NA	NA	NA	NA
Other: SRM	1 per sample set	NA	Review with Project Manager; re-analyze or justify in project records	Ken Davis	Accuracy	PD ≤ 5%

MDL = Method Detection Limit; RPD = Relative Percent Difference;

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EPA-NE QAPP Worksheet #24a - Rev. 10/99

Fixed Laboratory Analytical QC Sample Table

Medium/ Matrix	Soil
Sampling SOP	S-1
Analytical Parameter	SVOC (phenols/ phthalates)
Concentration Level	Low
Analytical Method/ SOP Reference*	8270C/ L-61
Laboratory Name	STL Pittsburgh
No. of Sample Locations	2 residential 3 commercial

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – All target analytes will be fortified into the LCS/MS/MSD and recovery results reported – but only "control analytes" will be evaluated against the MPC. Control analytes for this analysis are identified on EPA-NE QAPP Worksheet #24b.

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	1 per batch of up to 20 samples	NA	Reanalyze, reprepare, or qualify data Document actions taken	SVOA Task Leader	Accuracy Precision	All target compounds must be < RL except bis-2-ethylhexylphthalate ≤ 5× RL
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	1 per batch of up to 20 samples	NA	Reanalyze, reprepare, or qualify data Document actions taken	SVOA Task Leader	Precision	Varies – see EPA-NE QAPP Worksheet #24b
Laboratory Matrix Spike/Matrix Spike Duplicate	1 per batch of up to 20 samples	NA	Evaluate LCS recoveries. Reanalyze, reprepare, or qualify data Document actions taken	SVOA Task Leader	Accuracy Precision	Varies – see EPA-NE QAPP Worksheet #24b
LCS	1 per batch of up to 20 samples	NA	Reanalyze, reprepare, or qualify data Document actions taken	SVOA Task Leader	Accuracy	Varies – see EPA-NE QAPP Worksheet #24b
LFB	NA	NA	NA	NA	NA	NA
Surrogates	6 per sample	NA	Evaluate recoveries in Method Blank and LCS. Reanalyze, reprepare, or qualify data Document actions taken	SVOA Task Leader	Accuracy	Varies – see EPA-NE QAPP Worksheet #24b
Internal Standards (ISs)	6 per sample	NA	NA	NA	NA	NA
Other: SRM	*PE sample analyzed – see Worksheet #22a*	NA	NA	NA	NA	Not applicable – *No SRM available for phenols/phthalates in soil*

RL = Reporting Limit.

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EPA-NE QAPP Worksheet #24a - Rev. 10/99

Fixed Laboratory Analytical QC Sample Table

Medium/ Matrix	Groundwater
Sampling SOP	S-6, S-7
Analytical Parameter	VOC
Concentration Level	Low
Analytical Method/ SOP Reference*	8260B/L-60
Laboratory Name	STL Pittsburgh
No. of Sample Locations	33

Data that are accepted outside the measurement performance criteria will be flagged with the appropriate data qualifier (EPA-NE QAPP Worksheet #9a) and the rationale for accepting the analysis will be thoroughly documented in the QA/QC narratives.

Note – All target analytes will be fortified into the LCS/MS/MSD and recovery results reported – but only "control analytes" will be evaluated against the MPC. Control analytes for this analysis are identified on EPA-NE QAPP Worksheet #24b.

Laboratory QC:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per batch of up to 20 samples (a)	NA	Reanalyze, reprepare, or qualify data Document actions taken	VOA Task Leader	Accuracy Precision	<RL, or associated samples >10× blank values *(except common lab contaminants (MeCl2 <5×RL)*
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA (as required)	NA	NA	NA	NA	NA
Laboratory Duplicate	1 per batch of up to 20 samples	NA	Reanalyze, reprepare, or qualify data Document actions taken	VOA Task Leader	Precision	Varies – see EPA-NE QAPP Worksheet #24b
Laboratory Matrix Spike/Matrix Spike Duplicate	1 per batch of up to 20 samples	NA	Evaluate LCS recoveries. Reanalyze, reprepare, or qualify data Document actions taken	VOA Task Leader	Accuracy Precision	Varies – see EPA-NE QAPP Worksheet #24b
LCS	1 per batch of up to 20 samples	NA	Reanalyze, reprepare, or qualify data Document actions taken	VOA Task Leader	Accuracy	Varies – see EPA-NE QAPP Worksheet #24b
LFB	NA	NA	NA	NA	NA	NA
Surrogates	4 per sample	NA	Evaluate recoveries in Method Blank and LCS. Reanalyze, reprepare, or qualify data; Document actions taken	VOA Task Leader	Accuracy	Varies – see EPA-NE QAPP Worksheet #24b
Internal Standards (ISs)	3 per sample	NA	NA	NA	NA	NA
Other: SRM	NA	NA	NA	NA	NA	NA

RL = Reporting Limit
(a) Analyzed prior to samples.

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EPA-NE QAPP Worksheet #24b - Rev. 10/99
Fixed Laboratory Analytical QC Sample Table cont.

Sampling SOP: S-1
Analytical Method/SOP: L-9 (Soil); Pesticides/PCB Aroclors

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (dry weight – ng/g)	Analytical Precision		Analytical Accuracy/Bias	
		Laboratory Replicate	MS/MSD	SRM	LCS/MS/MSD
4,4'-DDD	0.44	RPD≤ 50% (a)	RPD≤ 30% (c)	Not applicable	40-120% R (c)
4,4'-DDE	0.44	As above	As above	As above	As above
4,4'-DDT	0.44	As above	As above	PD ≤ 30% (b)	As above
Aldrin	0.44	As above	As above	Not applicable	As above
alpha-BHC	0.44	As above	As above	As above	As above
alpha-Chlordane	0.44	As above	As above	PD ≤ 30%	As above
beta-BHC	0.44	As above	As above	Not applicable	As above
delta-BHC	0.44	As above	As above	As above	As above
Dieldrin	0.44	As above	As above	As above	As above
Endosulfan I	0.44	As above	As above	As above	As above
Endosulfan II	0.44	As above	As above	As above	As above
Endosulfan Sulfate	0.44	As above	As above	As above	As above
Endrin	0.44	As above	As above	As above	As above
Endrin Aldehyde	0.44	As above	As above	As above	As above (d)
Endrin Ketone	0.44	As above	As above	As above	40-120% R (c)
gamma-BHC	0.44	As above	As above	As above	As above
gamma-Chlordane	0.44	As above	As above	As above	As above
Heptachlor	0.44	As above	As above	As above	As above
Heptachlor Epoxide	0.44	As above	As above	As above	As above
Methoxychlor	0.44	As above	As above	As above	As above
Technical chlordane	11.1	As above	As above	As above	Not applicable
Toxaphene	11.1	As above	As above	As above	As above
Aroclor-1016	11.1	As above	As above	As above	LCS only: 40-120% R
Aroclor-1221	11.1	As above	As above	As above	Not applicable
Aroclor-1232	11.1	As above	As above	As above	As above
Aroclor-1242	11.1	As above	As above	As above	As above
Aroclor-1248	11.1	As above	As above	As above	As above
Aroclor-1254	11.1	As above	As above	As above	As above
Aroclor-1260	11.1	As above	As above	As above	LCS only: 40-120% R
Aroclor-1268	11.1	As above	As above	As above	Not applicable
Aroclor, Total (e)	Not applicable	As above	As above	As above	As above
PCB Surrogates	As above	Not applicable	Not applicable	40 – 125% R	

RPD = Relative Percent Difference; PD = Percent Difference; LCS = Laboratory Control Sample; MS = Matrix Spike; MSD = Matrix Spike Duplicate; SRM = Standard Reference Material; R = Recovery; RL = Reporting Limit

(a) Replicates: for 90% of analytes, for values >RL
(b) SRM: Using surrogate corrected data, for values >RL
(c) For 90% of analytes; concentration of spiked analytes in MS/MSD must be >5× background concentration to be used for data quality assessment
(d) Problematic compound – inconsistent recovery from alumina column; low recoveries observed in the historical data.
(e) Total Aroclor determined in the database using final, validated data.

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EPA-NE QAPP Worksheet #24b - Rev. 10/99
Fixed Laboratory Analytical QC Sample Table cont.

Sampling SOP: S-1
Analytical Method/SOP: L-10 (Soil); SVOCs (PAHs)

Analyte[1]	Achievable Laboratory Sensitivity/ Quantitation Limits (dry weight – ng/g)	Analytical Precision		Analytical Accuracy/Bias	
		Laboratory Replicate	MS/MSD	SRM	LCS/MS/MSD
Biphenyl	1.11	RPD ≤ 50% (a)	RPD ≤ 30% (c)	Not applicable	40-120% R (c)
2-Methylnaphthalene	1.11	As above	As above	As above	As above
Acenaphthene	1.11	As above	As above	As above	As above
Acenaphthylene	1.11	As above	As above	As above	As above
Benzaldehyde	1.11	As above	As above	As above	Not applicable
Anthracene	1.11	As above	As above	PD ≤ 30% (b)	40-120% R (c)
Benz[a]anthracene	1.11	As above	As above	As above	As above
Benzo[a]pyrene	1.11	As above	As above	As above	As above
Benzo[b]fluoranthene	1.11	As above	As above	As above	As above
Benzo[g,h,i]perylene	1.11	As above	As above	As above	As above
Benzo[k]fluoranthene	1.11	As above	As above	As above	As above
Chrysene	1.11	As above	As above	As above	As above
Dibenz[a,h]anthracene	1.11	As above	As above	As above	As above
Dibenzofuran	1.11	As above	As above	Not applicable	Not applicable
Fluoranthene	1.11	As above	As above	PD ≤ 30%	40-120% R
Fluorene	1.11	As above	As above	Not applicable	As above
Indeno[1,2,3-cd]pyrene	1.11	As above	As above	PD ≤ 30%	As above
Naphthalene	1.11	As above	As above	As above	As above
Phenanthrene	1.11	As above	As above	As above	As above
Pyrene	1.11	As above	As above	As above	As above
Total PAH (d)	Not applicable	As above	As above	Not applicable	Not applicable
PAH Surrogates	As above	Not applicable	Not applicable	40 – 125% R	

RPD = Relative Percent Difference; PD = Percent Difference; LCS = Laboratory Control Sample; MS = Matrix Spike; MSD = Matrix Spike Duplicate; SRM = Standard Reference Material; R = Recovery; RL = Reporting Limit.

[1] **Bolded** compounds are priority pollutant PAHs

(a) Replicates: for 90% of analytes, for values >RL

(b) SRM: Using surrogate corrected data, for values >RL

(c) For 90% of analytes; concentration of spiked analytes in MS/MSD must be >5× background concentration to be used for data quality assessment

(d) Total PAH determined in database using final, validated data.

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EPA-NE QAPP Worksheet #24b - Rev. 10/99
Fixed Laboratory Analytical QC Sample Table cont.

Sampling SOP: S-1, S-2
Analytical Method/SOP: L-23 (Soil); Dioxin/Furan/HCX

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (pg/g Dry Weight)	Analytical Precision		Analytical Accuracy/Bias	
		Laboratory Replicate	MS/MSD	SRM	LCS/MS/MSD
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1	RPD ≤ 50% (a)	RPD ≤ 30% (c)	PD ≤ 30% (b)	LCS: Within Method 1613B Table 6 OPR MS/MSD: 50 – 120% (c)
2,3,7,8-Tetrachlorodibenzofuran	1	As above	As above	As above	As above
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	5	As above	As above	As above	As above
1,2,3,7,8-Pentachlorodibenzofuran	5	As above	As above	As above	As above
2,3,4,7,8-Pentachlorodibenzofuran	5	As above	As above	As above	As above
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	5	As above	As above	As above	As above
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	5	As above	As above	As above	As above
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	5	As above	As above	As above	As above
1,2,3,4,7,8-Hexachlorodibenzofuran	5	As above	As above	As above	As above
1,2,3,6,7,8-Hexachlorodibenzofuran	5	As above	As above	As above	As above
1,2,3,7,8,9-Hexachlorodibenzofuran	5	As above	As above	As above	As above
2,3,4,6,7,8-Hexachlorodibenzofuran	5	As above	As above	As above	As above
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	5	As above	As above	As above	As above
1,2,3,4,6,7,8-Heptachlorodibenzofuran	5	As above	As above	As above	As above
1,2,3,4,7,8,9-Heptachlorodibenzofuran	5	As above	As above	As above	As above
Octachlorodibenzo-p-dioxin	10	As above	As above	As above	As above
Octachlorodibenzofuran	10	As above	As above	As above	As above
1,2,4,5,7,8-Hexachloro-9-Xanthene (HCX)	100	As above	As above	Not applicable	Not applicable
Total HpCDD	Not applicable	Not applicable	Not applicable	As above	As above
Total HpCDF	As above	As above	As above	As above	As above
Total HxCDD	As above	As above	As above	As above	As above
Total HxCDF	As above	As above	As above	As above	As above
Total PeCDD	As above	As above	As above	As above	As above
Total PeCDF	As above	As above	As above	As above	As above
Total TCDD	As above	As above	As above	As above	As above
Total TCDF	As above	As above	As above	As above	As above
Dioxin/Furan Internal Standards	As above	Not applicable	Not applicable	25 – 150% R	

RPD = Relative Percent Difference; PD = Percent Difference; R = % Recovery; MS = Matrix Spike; MSD = Matrix Spike Duplicate; SRM = Standard Reference Material; MDL = Method Detection Limit;

(a) Replicates – for analytes detected at level >10× MDL

(b) SRM; For certified values >5× MDL

(c) Concentration of spiked analytes in MS/MSD must be >5× background concentration to be used for data quality assessment

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EPA-NE QAPP Worksheet #24b - Rev. 10/99
Fixed Laboratory Analytical QC Sample Table cont.

Sampling SOP: S-1
Analytical Method/SOP: L-41 (CVAA); L-42 (ICP/MS); L-44 (ICP/AES); L-45 (GFAA); L-111 (FIAS) (multiple analysis methods may be used to optimize detection limits and reduce interferences) (Soil); Metals

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (Dry Weight - µg/g)	Analytical Precision		Analytical Accuracy/Bias	
		Laboratory Replicate	MS/MSD	SRM	LCS/MS/MSD
Aluminum	4	RPD ≤ 50% (a)	RPD ≤ 30% (c)	Not applicable (e)	70-130% R (c) *[not applicable to MS, MSD (d)]*
Antimony	0.08	As above	As above	PD ≤ 25% (b)	70-130% R (c)
Arsenic	2	As above	As above	As above	As above
Barium	0.04	As above	As above	As above	As above
Beryllium	0.016	As above	As above	Not applicable	As above
Cadmium	0.71	As above	As above	PD ≤ 25% (b)	As above
Chromium	0.96	As above	As above	Not applicable (e)	As above
Cobalt	1.34	As above	As above	PD ≤ 25% (b)	As above
Copper	0.388	As above	As above	As above	As above
Iron	1.12	As above	As above	As above	70-130% R (c) *[not applicable to MS, MSD (d)]*
Lead	0.4	As above	As above	As above	70-130% R (c)
Manganese	0.064	As above	As above	As above	As above
Mercury	0.008	As above	As above	As above	As above
Molybdenum	1.6	As above	As above	As above	As above
Nickel	3.12	As above	As above	As above	As above
Selenium	1.06	As above	As above	As above	As above
Silver	0.356	As above	As above	As above	As above
Thallium	0.08	As above	As above	As above	As above
Vanadium	1.08	As above	As above	As above	As above
Zinc	0.384	As above	As above	As above	As above

RPD = Relative Percent Difference; PD = Percent Difference; R = % Recovery; MS = Matrix Spike; MSD = Matrix Spike Duplicate; SRM = Standard Reference Material; MDL = Method Detection Limit.

(a) Replicates – for analytes detected at level >10× MDL
(b) SRM; For certified values >5× MDL
(c) Concentration of spiked analytes in MS/MSD must be >5× background concentration to be used for data quality assessment
(d) Al and Fe will not be fortified into the MS and MSD samples given that the native concentration will mask the concentration spiked into the sample and the %recovery data would not be a good measure of data quality.
(e) Certified concentrations for Al and Cr are based on a strong digestion technique. Centredale methods use a weak leach-type digestion; which will result in under-recovery of Al and Cr compared to the certified concentrations. As a result, there are no applicable criteria for Al and Cr in the SRM.

EPA-NE QAPP Worksheet #24b - Rev. 10/99
Fixed Laboratory Analytical QC Sample Table cont.

Sampling SOP: S-1
Analytical Method/SOP: L-40 (CVAA) (Soil); MeHg

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (Wet Weight - µg/g)	Analytical Precision		Analytical Accuracy/Bias	
		Laboratory Replicate	MS/MSD	SRM	LCS/MS/MSD
MeHg	0.0002	RPD ≤ 50% (a)	RPD ≤ 30% (c)	PD ≤ 25% (b)	70-130% R (c) *(no applicable LCS)*

RPD = Relative Percent Difference; PD = Percent Difference; R = % Recovery; MS = Matrix Spike; MSD = Matrix Spike Duplicate; SRM = Standard Reference Material; MDL = Method Detection Limit.

(a) Replicates – for analytes detected at level >10× MDL

(b) SRM; For certified values >5× MDL

(c) Concentration of spiked analytes in MS/MSD must be >5× background concentration to be used for data quality assessment

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EPA-NE QAPP Worksheet #24b - Rev. 10/99
Fixed Laboratory Analytical QC Sample Table cont.

Sampling SOP: S-1
Analytical Method/SOP: L-46 (Soil); Grain Size

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (Dry Weight – %)	Analytical Precision	Analytical Accuracy/Bias	
		(Laboratory Replicates Only)	SRM	LCS/MS/MSD
% gravel	0.01	RPD ≤ 50% (for values >10× MDL)	Not applicable	Not applicable
% coarse sand	As above	As above	As above	As above
% medium sand	As above	As above	As above	As above
% fine sand	As above	As above	As above	As above
% silt	As above	As above	As above	As above
% clay	As above	As above	As above	As above
Grain size distribution curve	As above	Not applicable	As above	As above

RPD = Relative Percent Difference; MDL = Method Detection Limit; SRM = Standard Reference Material; LCS = Laboratory Control Sample; MS = Matrix Spike; MSD = Matrix Spike Duplicate

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EPA-NE QAPP Worksheet #24b - Rev. 10/99
Fixed Laboratory Analytical QC Sample Table cont.

Sampling SOP: S-1
Analytical Method/SOP: L-49 (Soil); TOC

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (Dry Weight – %)	Analytical Precision	Analytical Accuracy/Bias	
		(Laboratory Replicates Only)	SRM	LCS/MS/MSD
% TOC	0.01-0.001	RPD≤ 50% (for values >10× MDL)	PD ≤ 5%	Not applicable

RPD = Relative Percent Difference; MDL = Method Detection Limit; SRM = Standard Reference Material; LCS = Laboratory Control Sample; MS = Matrix Spike; MSD = Matrix Spike Duplicate

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EPA-NE QAPP Worksheet #24b - Rev. 10/99
Fixed Laboratory Analytical QC Sample Table cont.

Sampling SOP: S-1
Analytical Method/SOP: L-61 (Soil); SVOCs (Phenols and Phthalates)

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits Wet Weight - ng/g (Dry Weight – ng/g)[1]	Analytical Precision	Analytical Accuracy/Bias		
		Laboratory Replicate & MS/MSD (a,b)	SRM	LCS	MS/MSD (b)
2,4,5-Trichlorophenol	330 (660)	≤ 50% RPD	Not applicable	40-112% R	29-125% R
2,4-Dinitrophenol	1600 (3200)	≤ 53% RPD	As above	18-152% R	1-191% R
2-Nitrophenol	330 (660)	≤ 50% RPD	As above	39-111% R	29-182% R
4-Methylphenol	330 (660)	≤ 50% RPD	As above	30-110% R	33-118% R
4-Nitrophenol (control analyte)	1600 (3200)	**≤ 64% RPD**	As above	**22-128% R**	**10-148% R**
Bis(2-Ethylhexyl)phthalate	330 (660)	≤ 50% RPD	As above	8-158% R	8-158% R
Butylbenzylphtalate	330 (660)	≤ 50% RPD	As above	1-152% R	1-152% R
Carbazole	330 (660)	≤ 50% RPD	As above	1-175% R	1-175% R
Di-n-Butylphthalate	330 (660)	≤ 50% RPD	As above	1-118% R	1-118% R
Di-n-Octylphthalate	330 (660)	≤ 50% RPD	As above	4-146% R	4-146% R
Pentachlorophenol (control analyte)	1600 (3200)	**≤ 87% RPD**	As above	**10-123% R**	**10-144% R**
Phenol (control analyte)	330 (660)	**≤ 50 RPD**	As above	**35-110% R**	**10-148% R**
2-Fluorophenol (surrogate)	Not applicable	Not applicable	Not applicable	11-116% R	11-116% R
Phenol-d5 (surrogate)	As above	As above	As above	25-115% R	25-115% R
Nitrobenzene-d5 (surrogate)	As above	As above	As above	42-110% R	42-110% R
2-Fluorobiphenyl (surrogate)	As above	As above	As above	43-110% R	43-110% R
2,4,6-Tribromophenol (surrogate)	As above	As above	As above	35-116% R	35-116% R
Terphenyl-d14 (surrogate)	As above	As above	As above	37-137% R	37-137% R

RPD = Relative Percent Difference; R = % Recovery; MS = Matrix Spike; MSD = Matrix Spike Duplicate; SRM = Standard Reference Material; MDL = Method Detection Limit.

[1] Achieved laboratory detection limits presented on dry weight basis assuming 50% moisture.
(a) Replicates – for analytes detected at level >10×MDL; MS/MSD – see footnote (b)
(b) Concentration of spiked analytes in MS/MSD must be >5× background concentration to be used for data quality assessment

Note – All target analytes will be fortified into the LCS/MS/MSD and recovery results reported – but only "control analytes" will be evaluated against the MPC. Control analytes for this analysis are identified above. Corrective action only taken when a control analyte fails to meet the MPC.

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EPA-NE QAPP Worksheet #24b - Rev. 10/99
Fixed Laboratory Analytical QC Sample Table cont.

Sampling SOP: S-6, S-7
Analytical Method/SOP: L-23 (Groundwater); Dioxin/Furan

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (pg/L)	Analytical Precision	Analytical Accuracy/Bias	
		Laboratory Replicate & MS/MSD	SRM	LCS/MS/MSD
2,3,7,8-Tetrachlorodibenzo-p-dioxin	5	RPD ≤ 30% (a,c)	Not applicable	LCS: Within Method 1613B Table 6 OPR MS/MSD: 50 – 120% (c)
2,3,7,8-Tetrachlorodibenzofuran	5	As above	As above	As above
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	25	As above	As above	As above
1,2,3,7,8-Pentachlorodibenzofuran	25	As above	As above	As above
2,3,4,7,8-Pentachlorodibenzofuran	25	As above	As above	As above
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	25	As above	As above	As above
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	25	As above	As above	As above
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	25	As above	As above	As above
1,2,3,4,7,8-Hexachlorodibenzofuran	25	As above	As above	As above
1,2,3,6,7,8-Hexachlorodibenzofuran	25	As above	As above	As above
1,2,3,7,8,9-Hexachlorodibenzofuran	25	As above	As above	As above
2,3,4,6,7,8-Hexachlorodibenzofuran	25	As above	As above	As above
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	25	As above	As above	As above
1,2,3,4,6,7,8-Heptachlorodibenzofuran	25	As above	As above	As above
1,2,3,4,7,8,9-Heptachlorodibenzofuran	25	As above	As above	As above
Octachlorodibenzo-p-dioxin	50	As above	As above	As above
Octachlorodibenzofuran	50	As above	As above	As above
Dioxin/Furan Internal Standards	Not applicable	Not applicable	25 – 150% R	

RPD = Relative Percent Difference; PD = Percent Difference; R = % Recovery; MS = Matrix Spike; MSD = Matrix Spike Duplicate; SRM = Standard Reference Material; MDL = Method Detection Limit;

(d) Replicates – for analytes detected at level >10× MDL; MS/MSD – see footnote (c)

(e) SRM; For certified values >5× MDL

(f) Concentration of spiked analytes in MS/MSD must be >5× background concentration to be used for data quality assessment

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EPA-NE QAPP Worksheet #24b - Rev. 10/99
Fixed Laboratory Analytical QC Sample Table cont.

Sampling SOP: S-6, S-7
Analytical Method/SOP: L-60 (Water); VOC

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (µg/L)	Analytical Precision	Analytical Accuracy/Bias		
		Laboratory Replicate and MS/MSD (a)	SRM	LCS	MS/MSD
1,1,1,2-Tertrachloroethane	1	≤ 30% RPD	Not applicable	56-133% R	56-133% R
1,1,1-Trichloroethane	1	≤ 30% RPD	As above	70-130% R	70-130% R
1,1,2,2-Tertrachlloroethane	1	≤ 30% RPD	As above	50-140% R	50-140% R
1,1,2-Trichloroethane	1	≤ 30% RPD	As above	64-128% R	64-128% R
1,1-Dichloroethhane	1	≤ 30% RPD	As above	60-140% R	60-140% R
1,1-Dichloroethene (control analyte)	**1**	**≤ 30% RPD**	As above	**63-130% R**	**62-130% R**
1,1-Dichloropropene	1	≤ 30% RPD	As above	40-140% R	40-140% R
1,2,3-Trichlorobenzene	1	≤ 30% RPD	As above	40-140% R	40-140% R
1,2,3-Trichloropropane	1	≤ 30% RPD	As above	40-140% R	40-140% R
1,2,4-Trichlorobenzene	1	≤ 30% RPD	As above	40-140% R	40-140% R
1,2,4-Trimethylbenzene	1	≤ 30% RPD	As above	40-130% R	40-130% R
1,2-Dibromo-3-chloropropane	1	≤ 30% RPD	As above	70-130% R	70-130% R
1,2-Dibromoethane	1	≤ 30% RPD	As above	70-130% R	70-130% R
1,2-Dichlorobenzene	1	≤ 30% RPD	As above	40-140% R	40-140% R
1,2-Dichloroethane	1	≤ 30% RPD	As above	73-127% R	67-132% R
1,2-Dichloropropane	1	≤ 30% RPD	As above	61-136% R	61-136% R
1,3,5-Trimethylbenzene	1	≤ 30% RPD	As above	40-130% R	40-130% R
1,3-Dichlorobenzene	1	≤ 30% RPD	As above	40-140% R	40-140% R
1,3-Dichloropropane	1	≤ 30% RPD	As above	40-140% R	40-140% R
1,4-Dichlorobenzene	1	≤ 30% RPD	As above	40-140% R	40-140% R
2,2-Dichloropropane	1	≤ 30% RPD	As above	40-140% R	40-140% R
2-Chlorotoluene	1	≤ 30% RPD	As above	40-140% R	40-140% R
4-Clorotoluene	1	≤ 30% RPD	As above	40-140% R	40-140% R
Benzene (control analyte)	**1**	**≤ 30% RPD**	As above	**80-116% R**	**76-118% R**
Bromobenzene	1	≤ 30% RPD	As above	40-140% R	40-140% R
Bromochloromethane	1	≤ 30% RPD	As above	70-130% R	70-130% R
Bromodichloromethane	1	≤ 30% RPD	As above	63-134% R	63-134% R
Bromoform	1	≤ 30% RPD	As above	52-134% R	52-134% R
Bromomethane	2	≤ 30% RPD	As above	58-136% R	58-136% R
Carbon Tetrachloride	1	≤ 30% RPD	As above	72-133% R	61-143% R
Chlorobenzene (control analyte)	**1**	**≤ 30% RPD**	As above	**76-117% R**	**76-117% R**
Chloroethane	2	≤ 30% RPD	As above	54-130% R	54-130% R
Chloroform	1	≤ 30% RPD	As above	81-122% R	65-131% R
Chloromethane	2	≤ 30% RPD	As above	54-130% R	54-130% R
cis-1,2-Dichloroethene	1	≤ 30% RPD	As above	69-134% R	69-134% R
cis-1,3-Dichloropropene	1	≤ 30% RPD	As above	57-127% R	57-127% R
Dibromochloromethane	1	≤ 30% RPD	As above	58-130% R	58-130% R
Dibromomethane	1	≤ 30% RPD	As above	40-140% R	40-140% R

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Fixed Laboratory Analytical QC Sample Table cont.

Sampling SOP: S-6, S-7
Analytical Method/SOP: L-60 (Water); VOC

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits (µg/L)	Analytical Precision	Analytical Accuracy/Bias		
		Laboratory Replicate and MS/MSD (a)	SRM	LCS	MS/MSD
Dichlorodifluoromethane	2	≤ 30% RPD	As above	59-150% R	59-150% R
Ethylbenzene	1	≤ 30% RPD	Not applicable	56-121% R	56-121% R
Hexachlorobutadiene	1	≤ 30% RPD	As above	40-140% R	40-140% R
Isopropylbenzene	1	≤ 30% RPD	As above	40-130% R	40-130% R
m&p-Xylene	2	≤ 30% RPD	As above	59-124% R	59-124% R
Methylene Chloride	2	≤ 30% RPD	As above	70-132% R	70-132% R
Naphthalene	1	≤ 30% RPD	As above	57-136% R	57-136% R
n-Butylbenzene	1	≤ 30% RPD	As above	40-140% R	40-140% R
n-Propylbenzene	1	≤ 30% RPD	As above	40-140% R	40-140% R
o-Xylene	1	≤ 30% RPD	As above	61-130% R	61-130% R
p-Isopropyltoluene	1	≤ 30% RPD	As above	40-140% R	40-140% R
sec-Butylbenzene	1	≤ 30% RPD	As above	40-140% R	40-140% R
Styrene	1	≤ 30% RPD	As above	57-125% R	57-125% R
tert-Butylbenzene	1	≤ 30% RPD	As above	40-140% R	40-140% R
Tetrachloroethene	1	≤ 30% RPD	As above	78-131% R	70-130% R
Toluene (control analyte)	**1**	**≤ 30% RPD**	As above	**74-119% R**	**70-119% R**
Total Volatile Organics (b)	NA	Not applicable	As above	Not applicable	Not applicable
Total Xylenes (b)	3	≤ 30% RPD	As above	37-162% R	37-162% R
trans-1,2-Dichloroethene	1	≤ 30% RPD	As above	67-132% R	67-132% R
Trans-1,3-Dichloropropene	1	≤ 30% RPD	As above	58-121% R	58-121% R
Trichloroethene (control analyte)	**1**	**≤ 30% RPD**	As above	**75-122% R**	**62-130% R**
Trichlorofluoromethane	2	≤ 30% RPD	As above	55-144% R	55-144% R
Vinyl Chloride	2	≤ 30% RPD	As above	53-134% R	51-133% R
Dibromofluromethane (surrogate)	Not applicable	Not applicable	As above	73-122% R	73-122% R
1,2-Dichloroethane-d4 (surrogate)	As above	As above	As above	61-128% R	61-128% R
Toluene-d8 (surrogate)	As above	As above	As above	76-110% R	76-110% R
Bromofluorobenzene (surrogate)	As above	As above	As above	74-116% R	74-116% R

RPD = Relative Percent Difference; R = % Recovery; MS = Matrix Spike; MSD = Matrix Spike Duplicate; MDL = Method Detection Limit.

(a) Precision only applicable for values >10× MDL.
(b) Totals determined in database using final, validated data.

Note – All target analytes will be fortified into the LCS/MS/MSD and recovery results reported – but only "control analytes" will be evaluated against the MPC. Control analytes for this analysis are identified above. Corrective action only taken when a control analyte fails to meet the MPC.

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EPA-NE QAPP Worksheet #26 - Rev. 10/99

Project Documentation and Records Table

Sample Collection Records	Field Analysis Records	Fixed Laboratory Records	Data Assessment Records	Other
Field Logs	Well purging log (pH, T, conductivity, etc.)	Sample Receipt, Custody and Tracking Forms	Performance Audit Reports (sample preparation, chemical analysis)	
Custody Forms	Soil boring/sample description logs	Standard Preparation Logs (certificates of analysis, QC checks)	Lab-wide Systems Audit Reports	
Sample Labels		Equipment Calibration Logs	PE Sample Results	
Custody Seals		Sample Preparation Records	Corrective Action Forms	
Telephone Logs		GC/ECD, GC/MS and GC/HRMS Logbooks (acquisition, maintenance, tuning)	Control Charts	
Photograph log		Calibration Reports	Telephone Logs and/or electronic mail	
GPS log		Sample Quantification Reports		
		Sample Chromatograms		
		Laboratory Logbooks (acquisition, maintenance)		
		Final Report Tables (authentic samples and QC results)		
		Corrective Action Logs (miscellaneous documentation)		
		Study Records (*e.g.*, Data Package)		
		Sample Disposal Records		
		Telephone Logs and/or electronic mail		

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EPA-NE QAPP Worksheet #27a - Rev. 10/99

Assessment and Response Actions

Quality assurance encompasses all planned and systematic activities necessary to assure management that the products generated, and the services performed by Battelle meet the quality standards established in this QAPP. The primary mechanism for accomplishing this goal is audits. Audits refer to the formal assessment of conformance to the QA Program and its effectiveness. During an audit, the agreement with QA policy documents (*e.g.*, SOPs) is evaluated, deficiencies are identified, and corrective action is taken. Ideally, audits also serve to increase awareness and understanding of QA policies and procedures. Mr. Mark Guilmain will serve as Battelle Duxbury's QA Officer and is responsible for identifying areas for corrective action, coordinating the QA activities such as systems and data audits, and preparing reports to management for this project. QA Officers at participating laboratories will be responsible for coordinating and performing QA activities at participating laboratories. Identity and qualifications of auditors are presented in EPA-NE QAPP Worksheet #6. The following QA audits are planned for this project.

- A technical system (initiation) audit is conducted as part of the review of this QAPP to (1) ensure that the work assignment scope and all required elements are addressed adequately, (2) verify that all required SOPs are approved and current, and (3) to verify that all participants have the required qualifications and documented training to perform their assigned tasks.
- Performance audits are independent checks of routinely obtained data. One Certified or Standard Reference Material (CRM or SRM, respectively) will be incorporated into each batch of chemistry samples (as applicable) to assess the accuracy and precision with which target analytes of known concentration are recovered from a representative matrix. The acceptance criteria are discussed in EPA-NE QAPP Worksheet #11b.
- Systems audits at Battelle Duxbury are conducted at least quarterly by the Project QA Officer or his designee. The purpose of these audits is to evaluate facilities, equipment, and processes for conformance to Battelle standards. Battelle SOP 4-009 describes the procedures for conducting the audits. Specific laboratory activities (*e.g.*, sample custody, preparation of standard solutions, training records) may be targeted for review based on need and level of laboratory activity in addition to the general criteria specified in the inspection SOP. Quality Assurance data audits will be conducted for at least 10% of the reported data. These audits will reconstruct representative data from each sample based on sample processing records, instrument calibration factors (*e.g.*, response factors) and output (*e.g.*, area counts), and sample manipulations and spiking. Samples will be tracked from receipt and processing through analysis and reporting to ensure that the reported data are accurate, complete, and traceable. A QA Statement submitted to the Project Manager with each deliverable describes the audit and review activities conducted to assess the deliverable accuracy, and any outstanding issues that could impact data quality.

Data audits/reviews are also conducted as described in EPA-NA QAPP Worksheet #9a.

EPA-NE QAPP Worksheet #27b - Rev. 10/99

Project Assessment Table

Assessment Type	Frequency	Internal or External (1)	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 (CA), title and organizational affiliation	Person (s) responsible for monitoring effectiveness of CA, title and organizational affiliation
Fixed Laboratory Data Package Audit	10% of data packages (b)	Internal and External	Battelle Duxbury	Mark Guilmain QA Coordinator Battelle Duxbury	GC/MS Analyst GC/ECD Analyst Battelle Duxbury	Robert Beimer Laboratory Manager Battelle Duxbury	Mark Guilmain QA Coordinator Battelle Duxbury
Fixed Laboratory Data Package Audit	Each HRMS data package	Internal and External	Battelle Columbus	Zachary J. Willenberg QA Officer Battelle Columbus	Analysts (GC/HRMS, Sample Preparation) Battelle Columbus	Mary Schrock Laboratory Manager and/or Karen Tracy Task Leader Battelle Columbus	Zachary J. Willenberg QA Officer Battelle Columbus
Fixed Laboratory Data Package Audit	Each metals data package	Internal and External	Battelle MSL	Deborah Coffey QA Officer Battelle MSL	Analysts Battelle MSL	Linda Bingler Task Leader Battelle MSL	Deborah Coffey QA Officer Battelle MSL
Fixed Laboratory Data Package Audit	each grain size/TOC data package	Internal and External	Applied Marine Sciences, Inc. (AMS)	Jennifer Davis QC Manager AMS	Ken Davis Grain Size/TOC AMS	Ken Davis Task Leader AMS	Jennifer Davis QC Manager AMS
Fixed Laboratory Data Package Audit	5% of all Data Packages (c)	Internal and External	STL Pittsburgh	Patrick Conlon QA Manager STL Pittsburgh	GC/MS Analyst STL Pittsburgh	Keith Dudeck VOA Task Leader STL Pittsburgh And Sharon Bacha SVOA Task Leader STL Pittsburgh	Patrick Conlon QA Manager STL Pittsburgh

[1]*Note* – All data packages will receive internal validation and audits. In addition, all HRMS data packages will receive an external (E) Tier III validation by EPA-NE; whereas all non-HRMS data packages (excluding percent moisture) will receive an external (E) Tier II validation. Tier II validation will be conducted by Environmental Standards.

(a) Includes laboratory record books and standard data forms.

(b) All data packages receive a secondary review by the laboratory supervisor and project manager; 10% of all data packages receive QA review

(c) All data packages receive peer analyst/supervisor review; 5% of all data packages receive QA review

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EPA-NE QAPP Worksheet #27c - Rev. 10/99

Project Assessment Plan

QAPP Title:	Centredale QAPP
Assessed Organization:	Battelle Duxbury
Location of Assessment:	Battelle Duxbury, Duxbury, MA
Dates of Assessment:	Completion of analytical task
Assessment Team Members:	Rosanna Buhl, Mark Guilmain
Type of Assessment:	Data audit performed on at least 10% of the data
Assessment Scope:	Audit data package for completeness and accuracy in accordance with Battelle SOP 4-015
Documents to be Reviewed:	SVOC (PAHs) and chlorinated pesticides/PCB Aroclors data packages (custody, sample processing data, moisture data, GC/MS and GC/ECD data and calibrations, and final report tables)
Notification Date(s):	At completion of audit
Proposed Schedule:	Estimated December 31, 2002
Assessment No.:	
Contract No.:	

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EPA-NE QAPP Worksheet #27c - Rev. 10/99

Project Assessment Plan

QAPP Title:	Centredale Manor QAPP
Assessed Organization:	Battelle Columbus
Location of Assessment:	Battelle Columbus, Columbus, OH
Dates of Assessment:	Completion of analytical task
Assessment Team Members:	Zachary J. Willenberg
Type of Assessment:	Data audit
Assessment Scope:	Audit data package for completeness and accuracy
Documents to be Reviewed:	Dioxin/Furan/HCX data packages (custody, sample processing data, GC/HRMS data and calibrations, and final report tables)
Notification Date(s):	At completion of audit
Proposed Schedule:	Estimated December 31, 2002
Assessment No.:	
Contract No.:	

EPA-NE QAPP Worksheet #27c - Rev. 10/99

Project Assessment Plan

QAPP Title:	Centredale Manor QAPP
Assessed Organization:	Battelle Marine Sciences Laboratory (MSL)
Location of Assessment:	Battelle Marine Sciences Laboratory (MSL)
Dates of Assessment:	Completion of analytical task
Assessment Team Members:	Deborah Coffey
Type of Assessment:	Data audit
Assessment Scope:	Audit data package for completeness and accuracy
Documents to be Reviewed:	Metals and MeHg data package (custody, sample processing data, moisture data, instrument data and calibration records (if appropriate), final report tables
Notification Date(s):	At completion of audit
Proposed Schedule:	Estimated December 31, 2002
Assessment No.:	
Contract No.:	

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EPA-NE QAPP Worksheet #27c - Rev. 10/99

Project Assessment Plan

QAPP Title:	Centredale Manor QAPP
Assessed Organization:	Applied Marine Sciences, Inc.
Location of Assessment:	Applied Marine Sciences, Inc. League City, TX
Dates of Assessment:	Completion of analytical task
Assessment Team Members:	Jennifer Davis
Type of Assessment:	Data audit
Assessment Scope:	Audit data package for completeness and accuracy
Documents to be Reviewed:	Grain Size and TOC data package (custody, sample processing data, instrument data and calibration records (if appropriate), final report tables
Notification Date(s):	At completion of audit
Proposed Schedule:	Estimated December 2002
Assessment No.:	
Contract No.:	

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EPA-NE QAPP Worksheet #27c - Rev. 10/99

Project Assessment Plan

QAPP Title:	Centredale Manor QAPP
Assessed Organization:	Severn Trent Laboratory Pittsburgh
Location of Assessment:	Severn Trent Laboratory Pittsburgh
Dates of Assessment:	Completion of analytical task
Assessment Team Members:	Patrick Conlon
Type of Assessment:	Data audit performed on at least 5% of the data
Assessment Scope:	Audit data package for completeness and accuracy
Documents to be Reviewed:	VOC, SVOC (phenols/phthalates) data packages (custody, sample processing data, moisture data for SVOC only, instrument data and calibration, final report tables)
Notification Date(s):	At completion of audit
Proposed Schedule:	Estimated December 2002
Assessment No.:	
Contract No.:	

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EPA-NE QAPP Worksheet #28 - Rev. 10/99

QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation, Title and Organizational Affiliation	Report Recipients, Title and Organizational Affiliation
Data Audit	1/data package (Moisture)	At end of analytical task	Mark Guilmain QA Coordinator Battelle Duxbury	Sample Preparation Task Leader Laboratory Manager, and Project Manager Battelle Duxbury
Data Audit	1/data package (SVOC – PAHs and Chlorinated Pesticides/PCB Aroclors)	At end of analytical task	Mark Guilmain QA Coordinator Battelle Duxbury	GC/MS Analyst, GC/ECD Analyst, Laboratory Manager, and Project Manager Battelle Duxbury
Data Audit	1/data package (Dioxin/Furan/HCX, Moisture)	At end of analytical task	Zachary J. Willenberg QA Officer Battelle Columbus	Sample Preparation, HRGC/HRMS Analyst, Laboratory Manager, Task Leader Battelle Columbus
Data Audit	1/data package (Moisture, Metals, MeHg)	At end of analytical task	Deborah Coffey QA Officer Battelle MSL	Linda Bingler Task Leader Battelle MSL
Data Audit	1/data package (Grain Size, TOC)	At end of analytical task	Jennifer Davis QC Manager Applied Marine Sciences, Inc	Ken Davis Grain Size and TOC Task Leader Applied Marine Sciences
Data Audit	1/data package (VOC, SVOC – Phenols/Phthalates, Moisture)	At end of analytical task	Patrick Conlon QA Manager STL Pittsburgh	VOA Task Leader, SVOA Task Leader and Lab Manager STL Pittsburgh

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EPA-NE QAPP Worksheet #29a - Rev. 10/99

Data Verification Process

Verification Task	Description	I/E [1]	Responsible for Verification (Name, Organization)
QA Audit (Moisture)	Described in EPA-NE QAPP Worksheet #9a (Assessment/Audit Tasks) and EPA-NE QAPP Worksheet #27a, b	I	Roxanne Bracket (Sample Preparation) Deirdre Dahlen (Sample Analysis Task Manager) Mark Guilmain (QA Coordinator) Battelle Duxbury
QA Audit (SVOC – PAHs, Chlorinated Pesticides/PCB Aroclors)	As above	I	Roxanne Bracket (Sample Preparation) Dan Bardon (GC/MS Analyst) Jonathan Thorn (GC/ECD Analyst) Laboratory Supervisor (or designee) Deirdre Dahlen (Sample Analysis Task Manager) Mark Guilmain (QA Coordinator) Battelle Duxbury
QA Audit (Dioxin/Furan/HCX, Moisture)	As above	I	Mark Misita (Sample Preparation) Joe Tabor (HRMS Analyst) Karen Tracy (Task Leader) Mary Schrock (Laboratory Manager) Zachary J. Willenberg (QA Officer) Battelle Columbus
QA Audit (Moisture, Metals, MeHg)	As above	I	Linda Bingler Task Leader Deborah Coffey (QA Officer) Battelle MSL
QA Audit (Grain Size, TOC)	As above	I	Ken Davis (Task Leader) Jennifer Davis (QC Manager) Applied Marine Sciences, Inc.
QA Audit (VOC, SVOC – Phenols/Phthalates, Moisture)	As above	I	Patrick Conlon (QA Manager) STL Pittsburgh

[1] *Note* – All data packages will receive internal validation and audits. In addition, all HRMS data packages will receive an external (E) Tier III validation by EPA-NE; whereas all non-HRMS data packages (excluding percent moisture) will receive an external (E) Tier II validation. Tier II validation will be conducted by Environmental Standards.

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EPA-NE QAPP Worksheet #29b - Rev. 10/99

Data Validation Summary Table

Medium/ Matrix	Analytical Parameter	Conc Level	Validation Criteria[1] (a)	Validation Criteria Modified[2] (a)	Data Validation Tier Level (a)	Modified Tier Level Used[3]	Data Validator (Name, title and organizational affiliation)	Responsibility for Data Validations (Name, title and organizational affiliation)
Soil	Percent Moisture	Low	NA	NA	NA	NA	NA	NA
Soil	Pest/PCBs	Low	Data will receive third party validation following EPA Region I Validation guidelines	NA	Tier II	NA	David R. Blye Quality Assurance Specialist/Principal Environmental Standards, Inc.	Deirdre Dahlen Sample Analysis Task Leader Battelle Duxbury
Soil	SVOCs (PAHs)	Low	As above	NA	Tier II	NA	As above	As above
Soil/ Ground-water	Dioxin/ Furan/HCX	Low	As above	NA	Tier III	NA	Steve Stodola Dioxin Data Validation Coordinator (QA Chemist, OEME) USEPA Region I	Karen Tracy Dioxin/Furan/HCX Task Leader Battelle Columbus
Soil	Metals and MeHg	Low	As above	NA	Tier II	NA	David R. Blye Quality Assurance Specialist/Principal Environmental Standards, Inc.	Linda Bingler Metals Task Leader Battelle MSL
Soil	Grain Size and TOC	Low	As above	NA	Tier II	NA	As above	Ken Davis Grain Size/TOC Task Leader Applied Marine Sciences, Inc.
Soil	SVOC (phenols/ phthalates)	Low	As above	NA	Tier II	NA	As above	Patrick Conlon (QA Manager) STL Pittsburgh
Ground-water	VOC	Low	As above	NA	Tier II	NA	As above	Patrick Conlon (QA Manager) STL Pittsburgh

[1] If the most recent revision of the Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses will not be used to validate project data, then document this fact and, on EPA-NE QAPP Worksheet #29a, provide a detailed description of the alternate validation criteria and/or procedures that will be used.

[2] If the Region I validation criteria will be modified to meet project objectives, then document this fact and, on EPA-NE QAPP Worksheet #29a, provide a detailed description of the modified validation criteria that will be used.

[3] If a modified validation Tier will be used to validate project data, then document this fact and, on EPA-NE QAPP Worksheet #29a, provide a detailed description of the Tier modifications that will be used.

(a) Note – All data packages will also receive internal validation and audits, as described in EPA-NE QAPP Worksheets #9a (Assessment/Audit Tasks), #27a, #27b, #27c, #28 and #29a.

EPA-NE QAPP Worksheet #29c - Rev. 10/99

Data Validation Modifications

Participating laboratories (*i.e.,* Battelle Duxbury, Battelle Columbus, Battelle MSL, AMS, STL Pittsburgh) will be responsible for performing internal data validation and verification of the data package. Data validation and verification procedures will follow internal laboratory SOPs and are further described in EPA-NE QAPP Worksheet #9a. The appropriate Task Leader will document and justify modifications to data validation/verification procedures, followed up by notification to the Project Manager/QA Officer for approval.

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EPA-NE QAPP Worksheet #30 - Rev. 10/99

Data Usability Assessment

Data Usability Assessment

Data will be evaluated for usability as described in Figure 5 (EPA-NE QAPP Worksheet #30). All data will also received third party validation, which will include an assessment of data usability for the project.

Calculation of Quality Control Data

The calculation of quality control statistics is described in Battelle SOP 7-029 and routine methods used to assess precision and accuracy are described below.

Accuracy —Accuracy is the closeness of agreement between an observed value and an accepted value. Accuracy of analyses is assessed through analysis of laboratory control samples (LCS), standard reference materials (SRM), matrix spikes (MS/MSD), surrogate internal standards (SIS), and method or procedural blanks.

Accuracy is quantified through the use of the following equations:

- Percent Recovery (R) in authentic samples (*e.g.*, matrix spikes)

$$R = [(C_s - C_u) \div S] \times 100$$

Where,

C_s = concentration of spiked sample
C_u = concentration in unspiked sample and
S = expected concentration of spike in sample

- Percent Recovery based on known concentrations (*e.g.*, surrogates)

$$R = (C_s \div C_c) \times 100$$

Where,

C_c = certified or true concentration and
C_s = concentration of sample

- Percent Difference (PD) based on known concentrations (*e.g.*, SRM)

$$PD = (|C_c - C_s| \div C_c) \times 100$$

Where,

C_c = certified or true concentration and
C_s = concentration of sample

EPA-NE QAPP Worksheet #30 - Rev. 10/99 (continued)

Data Usability Assessment

Precision—Precision is defined as the degree of reproducibility among individual measurements of the same property, obtained under similar conditions. Measure of analytical precision may be determined by the analysis of laboratory replicate and matrix spike duplicates. Laboratory replicates are prepared by homogenizing and splitting samples in the laboratory, and carrying the subsamples through the entire analytical process.

Precision is quantified through the use of the following mathematical formulae:

- For two samples, Relative Percent Difference (RPD)

$$RPD = [\,|A - B|\, \div ((A + B)/2)] \times 100$$

Where,
A and B are the concentrations (or percent recoveries) detected in the two samples.

Coefficient of Variation (also referred to as percent relative standard deviation) is quantified through the use of the following mathematical formula:

- For three samples, Coefficient of Variation (CV)

$$CV = (SD/Mean) \times 100$$

Where,
SD is the standard deviation of the sample concentrations and
Mean is the mean of the sample concentrations

Data Evaluation Against Detection Limits

Chlorinated pesticide/PCB Aroclor and PAH—analysis results will be reported relative to the sample specific MDLs and RLs for that compound. MDLs are determined based on a seven replicate MDL study; RLs are equivalent to a final extract concentration that is the same as the low calibration standard concentration.

Sample specific RLs are calculated as:

$$RL = (Concentration\ in\ Low\ Std. \times final\ extract\ volume \times dilution\ factors) / Sample\ size$$

Non-detects, and concentrations of organic contaminants detected at concentrations less than the sample specific MDL will be reported as the sample specific MDL and U flagged. Concentrations of organic contaminants detected at levels above the sample specific MDL, but below the sample specific RL, will be reported and J flagged.

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EPA-NE QAPP Worksheet #30 - Rev. 10/99 (continued)

Data Usability Assessment

Dioxin/Furan—results will be reported relative to the sample specific estimated detection limit (EDL) for that compound. The sample specific EDL is defined as the concentration of a given analyte required to produce a signal with a peak height of at least 2.5 times the background signal level.

EDLs are calculated as:

$$EDL = (2.5 \times H_x \times Q_{is}) / (H_{is} \times W \times RF_n)$$

Where,

H_x = Sum of the height of the noise level for each quantitation ion for the unlabeled PCDDs/PCDFs.

H_{is} = Sum of the height of the noise level for each quantitation ion for the labeled internal standard.

W = Sample size, g wet weight

RF = Calculated mean relative response factor for each analyte

Q_{is} = Quantity, in pg, of the internal standard added to sample before extraction.

Dioxin/furan results detected at concentrations less than the EDL (<RL for HCX) will be J flagged. Non-detects will be reported as the EDL (RL for HCX) and U flagged. Data will not be censored, instead all detected values will be reported, even contaminants detected at levels less than the MDL.

Metals and MeHg—results will be reported relative to the achievable laboratory MDLs and QLs reported in EPA-NE QAPP Worksheet #9b. MDLs are determined based on a seven replicate MDL study; QLs are generally 3 to 4 times the MDLs.

Non-detects, and concentrations of metals detected at concentrations less than the MDL will be reported as the QL and U flagged. Concentrations of metals detected at levels above the MDL, but below the QL, will be reported and J flagged.

SVOC (phenols/phthalates) and VOC—results will be reported relative to the achievable laboratory MDLs and RLs reported in EPA-NE QAPP Worksheet #9b.

SVOC and VOC results detected at concentrations less than the MDL will be reported as the RL and U flagged. SVOC and VOCs detected at concentrations less than the RL but greater than or equal to the MDL will be reported and J flagged. Non-detects will be reported as the RL and U flagged.

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EPA-NE QAPP Worksheet #30 - Rev. 10/99 (continued)

Data Usability Assessment

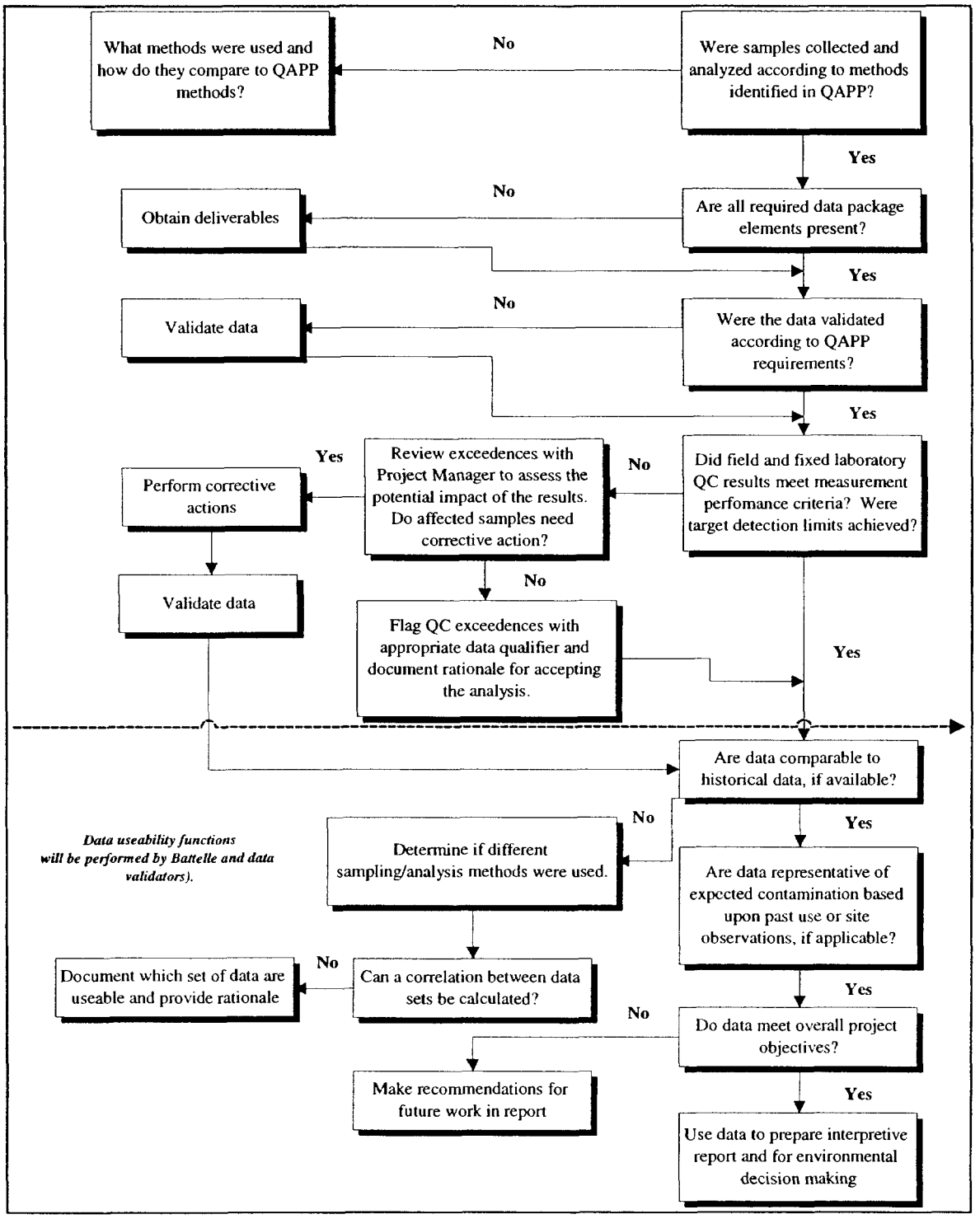

Figure 5. Preliminary Data Review Decision Tree.

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RI/FS TASK MANAGER

Patricia J. White **Battelle**

Senior Research Scientist
Geologist

Education:

B.S.	Geology, *Magna Cum Laude*, Kent State University, Kent, Ohio	1982
M.S.	Geology, University of Washington, Seattle, Washington	1986

Qualifications:

Ms. White has 18 years of experience as a geologist and has been focusing for the past 10 years on the assessment of contaminated sediment sites within the CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) framework. Ms. White is currently a project manager for multidisciplinary sediment studies that include site characterization, ecological and human health risk assessments, sediment dynamics studies and feasibility studies. Ms. White has also developed and managed analytical chemistry programs, characterized sediment for dredged material disposal studies, and conducted soil and groundwater studies. She has performed sediment-related work for the U.S. Navy, U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, U.S. Air Force and various port authorities. Ms. White returned to Battelle in 1999 after 3 years in Tasmania, Australia, where she managed programs involving contaminated site assessment, soil and groundwater remediation, and environmental auditing.

Relevant Experience:

- *Project Manager for the Navy Sediment Work Group.* Ms. White was the Project Manager for the offshore parcel at Hunters Point Shipyard (HPS) in San Francisco, California. The Sediment Work Group performed ecological and human health risk assessments and a sediment dynamics study at HPS. The ecological studies relied on three lines of evidence (sediment chemistry, toxicity and bioaccumulation) to evaluate risks to ecological receptors and included the collection of sediment grab samples, sediment cores, benthic invertebrates and forage fish and evaluation of data within a weight-of-evidence framework. The human health evaluation included the assessment of risk associated with consumption of shellfish and comparison of contaminant concentrations in sport fish collected at the site to concentrations in fish collected elsewhere in San Francisco Bay. Site-specific data were used to develop preliminary remediation goals and identify areas to be included in the feasibility study (FS) of remedial alternatives.

  Ms. White is also responsible for a sediment dynamics study designed to evaluate the fate and transport of sediment-bound contaminants, identify areas of net sediment deposition and erosion, estimate rates of sediment accumulation, and predict the likelihood of subsurface sediment remobilization. This study included time-series measurements of waves, currents, suspended sediment concentrations, temperature and salinity; determination of sediment flux; and numerical modeling to identify sediment transport patterns under typical and extreme conditions. As part of this study, Ms. White prepared detailed geologic descriptions of sediment cores and selected samples

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for the analysis of the radioisotopes lead-210 and cesium-137. Radioisotope profile data were used to estimate sediment accumulation rate and degree of vertical mixing.

Ms. White coordinated the evaluation of historical chemical and biological data for offshore sediments at the former Naval Air Station Alameda in San Francisco Bay as part of an Environmental Baseline Survey. She is also performing a sediment dynamics evaluation to support the characterization of a former skeet range, including the analysis of sediment cores and radioisotope profiles.

- *Feasibility Study Task Leader for the Navy Sediment Work Group.* Ms. White is responsible for the development and evaluation of remedial alternatives for sediment sites in San Francisco Bay. She coordinated and contributed to an evaluation of potential regional sediment management strategies, including the development of ten regional remedial alternatives for sediments from multiple Navy facilities.

- *Contributor to the Navy's "Implementation Guide for Assessing and Managing Contaminated Sediment at Navy Facilities."* Ms. White contributed to the section addressing remedial alternatives for sediment sites, which included collection of FS-related data, source identification and control, development of preliminary remediation goals and site-specific cleanup levels, and issues associated with various remedial options. This guide (currently in preparation) will be used by Navy Remedial Project Managers responsible for the assessment and remediaton of sediment sites.

- *Presenter for the Navy's Remediation Innovative Technology Seminar (RITS).* Ms. White presented a session on sediment policy, guidance and site characterization at a RITS seminar in June 2002. This session presented an overview of Navy policy and guidance pertaining to sediment investigations and discussed current methods for sediment site characterization.

- *Project Manager for the remedial investigation (RI) and feasibility study (FS) of pesticide-contaminated sediment at the United Heckathorn Superfund Site in Richmond, California.* The RI included a sediment coring program followed by chemical and biological testing of sediment samples. Ms. White used sediment data to delineate the horizontal and vertical extent of contamination, evaluate contaminant fate and transport, and estimate the volume of sediment requiring remediation. Suspended particulate- and dissolved-phase water samples derived from sediment were tested to assess the quality of effluent produced during confined disposal operations. Ms. White assisted in evaluation of remedial alternatives; including nearshore confined disposal, *in situ* containment, and landfill disposal.

- *Task Manager for analytical chemistry and data analysis tasks for the RI of the surface water operable unit at the McCormick & Baxter Superfund Site in Stockton, California.* Ms. White assisted in the development of a compositing scheme for analysis of sediment samples from a former wood treatment facility to reduce analytical costs and retain ability to identify hot spots. Ms. White used field and sediment chemistry data to map the horizontal and vertical extent of sediment contamination and supported the ecological risk assessment and development of sediment clean-up criteria for the site.

- *Project Manager for analytical services to support the ecological assessment of the Sulphur Bank Mercury Mine in Clear Lake, California.* Ms. White was responsible for the development of the analytical chemistry program; coordination of Principal Investigator, USEPA Project Manager, field team, and subcontract laboratories; review and validation of analytical data; and preparation of data reports.

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- *Project Geologist for numerous dredged material disposal studies conducted by Battelle for the U.S. Army Corps of Engineers and various ports.* Ms. White assisted with the collection of sediment cores, performed detailed geologic logging of sediment cores, served as analytical chemistry Task Manager and assisted in toxicology laboratory on an as-needed basis for dredged material evaluations for the U.S. Army Corps of Engineers San Francisco District, Port of Oakland and Port of Richmond.

- *Sub-Project Manager for the sitewide remedial investigation (RI) at Eielson Air Force Base, Alaska.* The sitewide RI included hydrogeologic characterization, collection and evaluation of background soil and groundwater quality data, annual groundwater monitoring, investigation of surface water and sediment contamination, and support of human health and ecological risk assessments. Ms. White assisted in the development of clean-up criteria and remedial alternatives for PCB-contaminated stream sediment and developed the sitewide Record of Decision.

- *Laboratory Analyst.* Ms. White was responsible for analysis of acid volatile sulfides and simultaneously extracted metals (AVS/SEM) in sediment samples, and iron species in water samples.

- *Project Manager for Australian National Railways Environmental Remediation Program.* Ms. White was responsible for management of Phase I (environmental audit), Phase II (comprehensive site characterization and risk assessment) and Phase III (remediation) investigations for 60 rail facilities in southern Tasmania. She assisted in the development of clean-up criteria through site-specific risk assessments, liaison and negotiation with regulatory agencies and affected parties, procurement and oversight of subcontractors, supervision of project staff, technical review of reports, and budget control. Remedial methods used or recommended included landfill disposal of hydrocarbon-contaminated soil, free-phase hydrocarbon product removal, and cement stabilization of metals-contaminated soil.

- *Lead Environmental Auditor for a major highway construction project.* Ms. White led an audit team that verified compliance of a construction contractor with environmental requirements of a highway construction contract. Primary issues included soil erosion and runoff into adjacent nearshore area and protection of a Fairy Penguin breeding colony. Other responsibilities included the formation and administration of community reference group to address environmental issues arising during road construction.

Professional Affiliations:

Society of Environmental Toxicology and Chemistry (SETAC)
Chairperson of the "Clean-Up Goals in Remediation" session at the Second SETAC World Congress in Vancouver, British Columbia, November 1995.

Additional Training:

40-hour OSHA Hazardous Waste Operations Training (1990)
8-hour OSHA Hazardous Waste Site Operations Supervisor Training (1995)
5-day Environmental Auditing Workshop, ISO 14000 Series (1997)
Groundwater Geochemistry Short Course (1991)

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Selected Publications and Presentations:

White, P.J., K. Israel and M. Pound. 2002 (*in press*). *Use of Sediment Transport Measurements to Evaluate Natural Recovery Potential.* 2002 Proceedings of the First International Conference on the Remediation of Contaminated Sediments, October 10-11, 2001, Venice, Italy.

White, P.J., K. Israel and M. Pound. 2001. *Modeling to Evaluate Fate and Transport of Sediment-Bound Contaminants at Hunters Point Shipyard, California.* U.S. Environmental Protection Agency Forum On Managing Contaminated Sediments at Hazardous Waste Sites, May 30 – June 1, 2001, Alexandria, Virginia.

Pound, M.J., J. Leather, P. White and L. Rose. 2001. *Using Rapid Sediment Characterization Technologies to Expedite the Marine Site Characterization Process.* Proceedings of the 2001 International Containment and Remediation Technology Conference and Exhibition, June 2001, Orlando, Florida. http://www.containment.fsu.edu/Proceedings.cfm

White, P.J., E. Pimentel and M. Pound. 2000. *Contaminated Sediment Management Options in San Francisco Bay, California.* Conference on Dredged Material Management: Options and Environmental Considerations. Sea Grant. December 3-6, 2000, Massachusetts Institute of Technology, Cambridge Massachusetts.

Thom, R.M., T.H. DeWitt, N.P. Kohn, L.D. Antrim, P.J. White, D.K. Shreffler, and J.Q. Word. 1997. *Ecological Risk Assessment of the Surface Water Operable Unit, McCormick and Baxter Superfund Site, Stockton, California.* PNNL-11466. Prepared for the U.S. Environmental Protection Agency, Region 9, San Francisco, California, by Battelle Marine Sciences Laboratory, Sequim, Washington; Pacific Northwest National Laboratory, Richland, Washington.

Kohn, N.P., W.W. Gardiner, and P.J. White. 1996. *Evaluation of 1995 Proposed Deepening Dredged Material from Oakland Harbor Berths 22, 23, 24, 25, and 26.* PNWD-2342. Prepared for the Port of Oakland by Battelle/Marine Sciences Laboratory, Sequim, Washington; Battelle, Pacific Northwest Laboratories, Richland, Washington.

White, P.J. and N.P. Kohn. 1996. *Remedial Investigation of the Surface Water Operable Unit, McCormick & Baxter Superfund Site.* Prepared for the U.S. Environmental Protection Agency by Battelle/Marine Sciences Laboratory, Sequim, Washington; published by Battelle Pacific Northwest Laboratories, Richland, Washington.

Dauble, D.D., C.A. Brandt, R.E. Lewis, P.J. White, and R.M. Smith. 1995. *Baseline Biological Risk Assessment for Aquatic Populations Occurring Near Eielson Air Force Base, Alaska.* Meeting Program, Society of Environmental Toxicology and Chemistry Second World Congress, Vancouver, British Columbia.

Kohn, N.P., W.W. Gardiner, M.R. Pinza, P.J. White. 1995. *Evaluation of 1995 Proposed Maintenance Dredged Material from Oakland Harbor Berths 22, 23, 24, 35, 67, and 68.* PNWD-2333. Prepared for the Port of Oakland by Battelle/Marine Sciences Laboratory, Sequim, Washington; Battelle, Pacific Northwest Laboratories, Richland, Washington.

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Lewis, R.E., M.T. Murphy, and P.J. White. 1995. *Evaluation of Metals in Soils and Groundwater at Eielson Air Force Base, Alaska.* Abstracts with Programs, Geological Society of America Cordilleran Section Meeting, Fairbanks, Alaska.

Pinza, M.R., H.L. Mayhew, L.M. Karle, N.P. Kohn, P.J. White, J.Q. Word, L. Michaels. 1995. *Ecological Evaluation of Proposed Dredged Material from Richmond Harbor Deepening Project.* PNL-10627. Prepared for the U.S. Army Corps of Engineers, San Francisco District, by Battelle/Marine Sciences Laboratory, Sequim, Washington. Published by Pacific Northwest Laboratory, Richland, Washington.

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White, P.J., P.D. Thorne, T.J. Gilmore, and C.A. Brandt. 1995. *Sitewide Remedial Investigation, Eielson Air Force Base, Alaska.* PNL-10742. Prepared for the United States Air Force by Battelle/Marine Sciences Laboratory, Sequim, Washington; published by Pacific Northwest Laboratory, Richland, Washington.

Dahlen, D.T., A.D. Uhler, and P.J. White. 1994. *Ultratrace Analysis of Organic Contaminants in Sediments, Water, and Tissues from a Marine Superfund Site.* Abstract Book, 15th Annual Meeting, Society of Environmental Toxicology and Chemistry, Pensacola, Florida.

Karle, L.M., M.R. Pinza, H.L. Mayhew, N.P. Kohn, P.J. White, J.Q. Word. 1994. *Ecological Evaluation of Proposed Dredged Material from Port of Richmond Terminal 1 Retest Project.* Prepared for the Port of Richmond, Richmond, California, under Contract #19476, by Battelle/Marine Sciences Laboratory, Sequim, Washington; Battelle, Pacific Northwest Laboratories, Richland, Washington.

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Kohn, N.P., W.W. Gardiner, R.K. Karls, P.J. White, J.A. Ward. 1994. *Evaluation of 1994 Proposed Maintenance Dredged Material from Oakland Harbor Berth 20, Berth 21, Berth 23, Berth 24, Berth 25, Berths 60-63, and Berths 67-68.* Prepared for the Port of Oakland under Contract 19471 by Battelle/Marine Sciences Laboratory, Sequim, Washington; Battelle, Pacific Northwest Laboratories, Richland, Washington.

Kohn, N.P., W.W. Gardiner, P.J. White. 1994. *Evaluation of 1994 Proposed Maintenance Dredged Material from Oakland Harbor Berths 26 and 30, and Oakland Outer Harbor Channel.* Draft report prepared for the Port of Oakland, Contract Number 19471, by Battelle/Marine Sciences Laboratory, Sequim, Washington; Battelle, Pacific Northwest Laboratories, Richland, Washington.

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Kohn, N.P., P.J. White, W.W. Gardiner, and J.Q. Word. 1994. *Ecological Evaluation of Proposed Dredged Material from Bulls Head Channel (Lower Suisun Bay).* PNL-9988. Prepared for the U.S. Army Corps of Engineers, San Francisco District, by Battelle/Marine Sciences Laboratory, Sequim, Washington. To be published by Pacific Northwest Laboratory, Richland, Washington.

Kohn, N.P., P.J. White, W.W. Gardiner, and J.Q. Word. 1994. *Ecological Evaluation of Proposed Dredged Material from Bulls Head Channel (Lower Suisun Bay).* PNL-9988. Prepared for the U.S. Army Corps of Engineers, San Francisco District, by Battelle/Marine Sciences Laboratory, Sequim, Washington; published by Pacific Northwest Laboratory, Richland, Washington.

Lincoff, A.H., G.P. Costan, M.S. Montgomery, and P.J. White. 1994. *Feasibility Study for the United Heckathorn Superfund Site, Richmond, California.* PNL-9991. Prepared for the U.S. Environmental Protection Agency by Battelle/Marine Sciences Laboratory, Sequim, Washington; published by Pacific Northwest Laboratory, Richland, Washington.

Mayhew, H.L., M.R. Pinza, L.M. Karle, N.P. Kohn, P.J. White, J.Q. Word. 1994. *Ecological Evaluation of Proposed Dredged Material from the Port of Richmond Maintenance and Deepening Program.* PNWD-2286. Prepared for the Port of Richmond, Richmond, California, under Contract 19476, by Battelle/Marine Sciences Laboratory, Sequim, Washington; Battelle, Pacific Northwest Laboratories, Richland, Washington.

White, P.J., N.P. Kohn, W.W. Gardiner, J.Q. Word. 1994. *The Remedial Investigation of Marine Sediment at the United Heckathorn Superfund Site.* PNL-9383. Prepared for the United States Environmental Protection Agency by Battelle/Marine Sciences Laboratory, Sequim, Washington; published by Pacific Northwest Laboratory, Richland, Washington.

White, P.J. and A.H. Lincoff. 1994. *Geologic Characterization of Marine Sediments at the United Heckathorn Superfund Site.* Abstracts with Programs, Geological Society of America 1994 Annual Meeting. 26:7, Geological Society of America, Boulder, Colorado.

Kohn, N.P., L.M. Karle, M.R. Pinza, H.L. Mayhew, P.J. White, B.D. Gruendell, J.Q. Word. 1993. *Ecological Evaluation of Proposed Dredged Material from the John F. Baldwin Ship Channel (Phase III--Biological Testing).* PNL-8828. Prepared for the U.S. Army Corps of Engineers, San Francisco District, by Battelle/Marine Sciences Laboratory, Sequim, Washington. Published by Pacific Northwest Laboratory, Richland, Washington.

White, P.J. 1993. *Background Groundwater Quality , Eielson Air Force Base, Alaska.* EMO-1103. Prepared for the U.S. Air Force under Contract DE-AC06-76RLO 1830, by Environmental Management Operations, Richland, Washington.

White, P.J. 1993. *Background Soil Quality , Eielson Air Force Base, Alaska.* EMO-1104. Prepared for the U.S. Air Force under Contract DE-AC06-76RLO 1830, by Environmental Management Operations, Richland, Washington.

White, P.J., and T.J. Gilmore. 1993. *Automatic Water Level Measurements, Eielson Air Force Base, Alaska.* EMO-1105. Prepared for the U.S. Air Force under Contract DE-AC06-76RLO 1830 by Environmental Management Operations, Richland, Washington.

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Sharon A. Bacha **Severn Trent Laboratories**

GROUP LEADER of GC/MS BNA

Qualifications Summary:

Ms. Bacha is the Group Leader of GC/MS BNA, responsible for coordinating the analysis of Base-Neutral and Acid (BNA) samples. She is responsible for performing analyses and data review within the group. Ms. Bacha is an experienced GC/MS analyst.

Professional Experience:

GC/MS BNA Group Leader
STL Pittsburgh – Pittsburgh, PA – January 2000 to Present*
Duties include:

- Responsible for coordination of department.
- Involved with the scheduling of projects in order to meet holding times and analytical due dates.
- Aids in troubleshooting and the maintenance of the instrumentation.
- Responsible for data review involving correct quality control and data entry.
- Operating at least one instrument. Reviewing and reporting data.

GC/MS BNA Group Leader
Quanterra Inc. — Pittsburgh, PA – July 1996 to Jan 2000
Duties include:

- Responsible for coordination of department.
- Involved with the scheduling of projects in order to meet holding times and analytical due dates.
- Aids in troubleshooting and the maintenance of the instrumentation.
- Responsible for data review involving correct quality control and data entry.
- Operating at least one instrument. Reviewing and reporting data.

GC/MS Chemist, BNA Group
Quanterra Inc. – Pittsburgh, PA – July 1994 to July 1996
Duties include:

- Operating at least one instrument. Reviewing and reporting data.
- Tracking sample holding times.
- Training personnel.
- Dealing with day to day problems, answering routine questions or problems.
- Communicating team problems and concerns to Team Leader.
- Analyzing Performance Evaluation (PE) samples.
- Carrying out quality control testing within the specifications of the methods and Quanterra Environmental Services Quality Assurance manual.

Team Leader, VOA and BNA Groups
IT Analytical Services – Pittsburgh, PA – 1991 to June 1994
Duties include:

- Operating at least one instrument.
- Administering work assignments as given by the Group Leader.

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- Tracking sample holding times.
- Training personnel.
- Dealing with day to day problems, answering routine questions or problems.
- Reporting to the Organics Section Manager.
- Communicating team problems and concerns to Organics Section Manager.
- Analyzing Performance Evaluation (PE) samples.
- Carrying out quality control testing within the specifications of the methods and IT Analytical Services Quality Assurance manual.

Team Leader, BNA Group
IT Analytical Services, Pittsburgh, PA – 1987 to 1991
Duties include:

- Operating at least one instrument.
- Administering work assignments as given by the Group Leader.
- Tracking sample holding times.
- Training personnel.
- Dealing with day to day problems, answering routine questions or problems.
- Reporting to the Organics Section Manager.
- Communicating team problems and concerns to Organics Section Manager.
- Analyzing of Performance Evaluation (PE) samples.
- Carrying out quality control testing within the specifications of the methods and IT Analytical Services Quality Assurance manual.

Education:

B.A. Chemistry Washington and Jefferson College – Washington, PA – 1985.
M.S. Forensic Sciences Virginia Commonwealth University – Richmond, Virginia – 1987.

* Severn Trent Laboratories acquired Quanterra Incorporated on January 31, 2000.

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LABORATORY MANAGER

Robert G. Beimer **Battelle**

Analytical Chemistry Laboratory Manager

Education:

Ph.D., Analytical Chemistry, University of Arizona, 1969
B.S., Chemistry, Iowa State University, 1965

Qualifications:

Dr. Beimer has managed contract analytical laboratories for 15 years, performing routine analytical services for the USEPA, DOD, DOE, and the ACE. During that time he has performed analyses on samples from a wide variety of sources using standard EPA methods as well as specialized methods for unique analytes and matrices including sediment, water, and tissue. He has also managed laboratories, which have specialized in the characterization of mixed waste including the analysis of radionuclides. All of these operations required strict adherence to EPA QA/QC guidance.

Dr. Beimer has managed two multi-year, $3M, methods development projects for the USEPA (EMSL-LV and EMSL-Ci). As a part of these projects, Dr. Beimer and his staff developed and/or validated 20 methods currently used in SW-846 and the Superfund Contract Laboratory Program (CLP). Some of the more significant methods included:

- The current CLP pesticide procedure.
- The high concentration organic protocol (CLP).
- The low detection limit organic protocol (CLP).
- Validation of method 8270 for Appendix IX analytes.
- Validation and training on the TCLP (Method 1311).

In addition to these methods, he also developed, validated, and implemented EPA Methods 1624 and 1625 for the USEPA Office of Water and used these methods to perform the organic analysis portion of the USEPA National Sewage Sludge Survey. Following the analytical portion of the task, he presented five workshops across the USA on the application of Methods 1624 and 1625 to sewage sludge analysis for the USEPA Office of Water. His efforts in these areas earned him a Certification of Appreciation Award from the USEPA.

Other projects which Dr. Beimer managed for the USEPA include (1) Characterization of Multi-Media Industrial Process Streams and Environmental Samples, (2) GC/MS Analysis Methods Development, and (3) The Development of Improved Environmental Assessment Protocols Relating to Health Effects and Decision Criteria.

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The government of Mexico invited Dr. Beimer and several representatives from the USEPA to participate in a (two-week, four cities) symposium on the Characterization of Hazardous Waste. The purpose of the symposium was to update the environmental professionals in Mexico on the new methods and instruments being employed in the USA for the analysis of hazardous waste. The total attendance at the symposia was over 2000.

Dr. Beimer is currently Project Manager for Battelle's analytical support to the USEPA National Fish Survey. The Battelle laboratory will be performing organic and metals analyses on hundreds of fish tissue samples in support of this important and high visibility project. In addition, Battelle will be cosponsoring the annual Conference on Analysis of Pollutants in the Environment for the USEPA-OST. This will be the third year of our participation as a cosponsor.

Dr. Beimer and his staff managed a series of QA projects for the USEPA. The first of these projects, for the USEPA-QAMS resulted in the development of QAMS 005/80, the first document to outline laboratory quality assurance requirements. The follow on projects were in support of the Superfund Innovative Technology Evaluation (SITE) program and involved the review of Quality Assurance Plans, final reports and engineering data generated by the technology developers.

Dr. Beimer was a part of the team of scientists, contracted by the USEPA, to validate the application of fused silica capillary column GC/MS technology to the analysis of priority pollutants. Following the validation, this same group applied the technique to the analysis of samples from the Love Canal. He also managed and served as principal investigator for an Army project to design and construct an ultra high sensitivity atmospheric pressure ionization mass spectrometer capable of detecting part-per-trillion levels of chemical agents in the atmosphere around nerve agent incinerator facilities.

Professional Positions:

Program Manager, Environmental Chemistry, Battelle Duxbury Operations, Duxbury, MA, 2000-Present.

General Manager, Barringer Laboratories, Inc., Golden, CO, 1997–2000.

Sr. Vice President and Laboratory Director, S-Cubed, San Diego, CA, 1985–1997.

Manager, Chemistry Department, TRW Energy Systems, Redondo Beach, CA, 1977-1985

Supervisor, Mass Spectrometry Application Laboratory, DuPont, Instrument Products Division, Wilmington DE, (1973-1977).

Research Chemist, Celanese Research Company, Mass Spectrometry Section, Summit NJ, 1969-1973.

Relevant Experience:

As General Manager at Barringer, Dr Beimer was responsible for all Environmental Laboratory operations, sales, and profit and loss. The laboratory had a staff of 60 people, who provided a full service capability including radiochemistry.

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As Laboratory Director at S-Cubed, He was in charge of 50 professionals who successfully completed $5M per year in contracted analytical services. He managed all aspects of the Environmental Chemistry Laboratory and did most of the marketing for the larger Federal Government programs. He was responsible for developing the mixed waste analysis capability at S-Cubed and won several mixed waste analytical projects with the Department of Energy.

Dr Beimer managed and served as principal investigator for an Army project to design and construct an ultra high sensitivity atmospheric pressure ionization mass spectrometer capable of detecting part-per-trillion levels of chemical agents in the atmosphere around nerve agent incinerator facilities.

During his eight years at TRW, he managed USEPA projects on (1) Characterization of Multi-Media Industrial Process Streams and Environmental Samples, (2) GC/MS Analysis Methods Development, and (3) The Development of Improved Environmental Assessment Protocols Relating to Health Effects and Decision Criteria. Perhaps his most sensitive responsibility was that of project manager for sampling and analysis in support of the Love Canal Contamination Study. Isotope dilution priority pollutant analysis of energy and mining wastes by GC/MS is one of the numerous analytical methods he helped the USEPA develop.

His principal responsibilities while at DuPont were trace level analysis of toxic substances using high sensitivity GC/MS, chemical ionization techniques, and capillary GC/MS. In addition to supervising the application laboratory, he assisted in the design, development, and application of a new GC/MS system.

At Celanese Research, he performed methods development and chemical analysis using GC/MS, TGA/MS, and HRMS. One of his projects was the determination of flammability mechanisms and flame retardant properties of polymers used in the manufacture of children's sleepware.

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Patrick A. Conlon **Severn Trent Laboratories**

TECHNICAL DIRECTOR AND MANAGER OF QUALITY ASSURANCE

Qualifications Summary:

Mr. Conlon, the Technical Director and Quality Assurance Manager, has over 18 years experience in the analytical services field. This experience includes all phases of analysis for both Organic and Inorganic analysis. His instrumentation experience includes: GS/MS, GC, AA, ICAP, IR, TOC, and auto-analyzers. Mr. Conlon's diversified experience has provided him with the opportunity to become familiar with regulatory protocols and methodologies. These include: USEPA CLP, NYS/ASP, DOD programs, RCRA/SW-846 and NPDES among others.

Professional Experience:

Technical Director & Manager, Quality Assurance
STL-Pittsburgh – Pittsburgh, PA – January 2000 to Present*
Duties include:

- Assessing and maintaining the Company Quality Assurance Management Plan and related policies.
- Acting as a member of the management team assuring and improving the quality of laboratory operations.
- Keeping up to date on new methods and new technologies.
- Supervising and/or providing training to the analytical staff, management staff and where appropriate the clients.
- Evaluating and assisting with regulatory compliance.
- Maintaining state and federal laboratory certification, accreditation programs.
- Recommending corrective actions to resolve quality deficiencies.
- Coordinating client and regulatory facility audits.
- Preparing monthly laboratory quality reports to management.

Technical Director & Manager, Quality Assurance
Quanterra Incorporated -- Pittsburgh, PA – February 1997 to January 2000
Duties include:

- Assessing and maintaining the Company Quality Assurance Management Plan and related policies.
- Acting as a member of the management team assuring and improving the quality of laboratory operations.
- Keeping up to date on new methods and new technologies.
- Supervising and/or providing training to the analytical staff, management staff and where appropriate the clients.
- Evaluating and assisting with regulatory compliance.
- Maintaining state and federal laboratory certification, accreditation programs.
- Recommending corrective actions to resolve quality deficiencies.
- Coordinating client and regulatory facility audits.
- Preparing monthly laboratory quality reports to management.

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Technical Director
Quanterra Incorporated -- Pittsburgh, PA – September 1995 to February 1997
Duties include:

- Remaining current with environmental analytical chemistry and regulatory requirements and its impact on management decision making.
- Writing, editing, and approving technical documentation.
- Supervising training documentation and training programs.
- Reviewing client data, interpreting technical issues and Quality Assurance Project Plans and other quality assurance-related documents, and managing production of Standard Operating Procedures.
- Serving as consultant on technical issues related to method selection, development of proposals or client work plans, and the evaluation of new business potential.
- Participating in the implementation and development of software and data processing systems.

Program Manager
Quanterra Incorporated -- Pittsburgh, PA -- June 1994 to September 1995
Duties included:

- Remained current with environmental analytical chemistry and regulatory requirements and its impact on management decision making.
- Wrote, edited, and approved technical documentation.
- Reviewed client data, interpreted technical issues and Quality Assurance Project Plans and other quality assurance-related documents, and managed production of Standard Operating Procedures.
- Served as consultant on technical issues related to method selection, development of proposals and client work plans.
- ·Participated in the implementation and development of software and data processing systems.
- Tracked and reviewed analytical work to ensure on-time delivery of reports and customer satisfaction.

Technical Director/Program Manager
IT Analytical Services -- Edison, NJ -- December 1991 to June 1994
Duties included:

- Remained current with environmental analytical chemistry and regulatory requirements and its impact on management decision making.
- Wrote, edited, and approved technical documentation.
- Reviewed client data, interpreted technical issues and Quality Assurance Project Plans and other quality assurance-related documents, and managed production of Standard Operating Procedures.
- Served as consultant on technical issues related to method selection, development of proposals or client work plans, and the identification of new business potential.
- Participated in the implementation and development of software and data processing systems.
- Tracked and reviewed analytical work to ensure on-time delivery of reports and customer satisfaction.

Organics Manager
IT Analytical Services -- Cerritos, CA -- August 1991 to December 1991
Duties included:

- Responsible for the production of three analytical groups including GC/MS, GC, and Organic Extractions.

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Quality Assurance Manager
OHM Corporation – Findlay, OH -- February 1991 to August 1991

Mass Spec Supervisor / HP RTA Systems Manager
OHM Corporation – Findlay, OH -- October 1990 to February 1991

Senior Mass Spectroscopist
OHM Corporation -- Findlay, OH -- May 1989 to October 1990

Laboratory Manager
Wastex Industries – Pottstown, PA – 1988 to 1989

Laboratory Director
Laboratory Resources, Incorporated -- Westwood, NJ -- 1985 to 1988

Laboratory Manager
Havens and Emerson Consulting Engineers -- Saddle Brook, NJ -- 1982 to 1985

GC Supervisor/Analytical Chemist
Havens and Emerson Consulting Engineers -- Saddle Brook, NJ -- 1980 to 1982

Education:

M.B.A. Rutgers University – Newark, NJ – 1989
B.S. Chemistry Stockton State College – Pomona, NJ – 1979
B.A. Education Rutgers College – New Brunswick, NJ – 1975

* Severn Trent Laboratories acquired Quanterra Incorporated on January 31, 2000.

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Keith W. Dudeck **Severn Trent Laboratories**

GROUP LEADER, GC/MS VOLATILES DEPARTMENT

Qualifications Summary:

Mr. Dudeck is the GC/MS Volatile Group Leader. He is an experienced organic chemist who is serving as the Gas Chromatograph/Mass Spectrometry (GC/MS) Volatiles Group Leader responsible for analysis, calculation, and reporting of GC/MS Volatiles data. He is familiar with soil and water analysis according to Environmental Protection Agency Contract Laboratory Program (EPA-CLP) protocol and has developed analytical techniques for the organic analysis of water and waste samples. He is responsible for day to day operations of the Volatile group.

Professional Experience:

GC/MS Volatiles Group Leader
STL-Pittsburgh – Pittsburgh, PA – January 2000 to Present*
Duties included:

- Responsible for day-to-day operations of the GC/MS Volatiles section of laboratory. He monitors laboratory capacity and accepts projects in the laboratory, effectively utilizing all laboratory personnel.
- Supervising the GC/MS section of the laboratory where work is performed according to Environmental Protection Agency Contractor Laboratory Program (EPA-CLP) protocols for the analysis of water, soil, wastewater, and hazardous wastes. Duties include:
- Organizing and supervising analytical testing in the GC/MS section.
- Implementing appropriate calculation and data review procedures regarding interpretation of spectra and reporting of data.
- Determining appropriate schedules/staffing levels within the group.
- Implementing improved automated and computerized systems within the group.
- Evaluating equipment selection and maintaining adequate supply of materials and chemicals.
- Performing or directing routine instrument maintenance as required.
- Assisting in the preparation and review of spectral data and preparation of analytical reports.

GC/MS Volatiles Group Leader
Quanterra Incorporated -- Pittsburgh, PA – July 1995 to January2000
Duties included:

- Responsible for day-to-day operations of the GC/MS Volatiles section of laboratory. He monitors laboratory capacity and accepts projects in the laboratory, effectively utilizing all laboratory personnel.
- Supervising the GC/MS section of the laboratory where work is performed according to Environmental Protection Agency Contractor Laboratory Program (EPA-CLP) protocols for the analysis of water, soil, wastewater, and hazardous wastes. Duties include:
- Organizing and supervising analytical testing in the GC/MS section.
- Implementing appropriate calculation and data review procedures regarding interpretation of spectra and reporting of data.
- Determining appropriate schedules/staffing levels within the group.

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- Implementing improved automated and computerized systems within the group.
- Evaluating equipment selection and maintaining adequate supply of materials and chemicals.
- Performing or directing routine instrument maintenance as required.
- Assisting in the preparation and review of spectral data and preparation of analytical reports.

Organics Group Leader
Quanterra Incorporated -- Pittsburgh, PA – July 1994 to September 1995

- Responsible for day-to-day operations of the organic section of laboratory, including Organic Extractions, GC and GCMS sections. He monitors laboratory capacity and accepts projects in the laboratory, effectively utilizing all laboratory personnel.

Operations Manager
IT Analytical Services -- Pittsburgh, PA -- 1991 to June 1994

- Responsible for day-to-day operations of the laboratory, including organic and inorganic sections. He monitors laboratory capacity and accepts projects in the laboratory, effectively utilizing all laboratory personnel.

Group Leader
IT Analytical Services – Pittsburgh, PA -- 1987 to 1991
Duties included:

- Supervising the GC/MS section of the laboratory where work is performed according to Environmental Protection Agency Contractor Laboratory Program (EPA-CLP) protocols for the analysis of water, soil, wastewater, and hazardous wastes. Duties include:
- Organizing and supervising analytical testing in the GC/MS section.
- Implementing appropriate calculation and data review procedures regarding interpretation of spectra and reporting of data.
- Determining appropriate schedules/staffing levels within the group.
- Implementing improved automated and computerized systems within the group.
- Evaluating equipment selection and maintaining adequate supply of materials and chemicals.
- Performing or directing routine instrument maintenance as required.
- Assisting in the preparation and review of spectral data and preparation of analytical reports.

Chemist I
IT Analytical Services -- Pittsburgh, PA -- 1986 to 1987
Duties include:

- Analyzing water, soils, and soil extracts using GC/MS.
- Calculating and interpreting GC/MS data.
- Preparing in-house analytical reports.
- Preparing and coordinating the preparation of CLP data and reports.
- Maintaining GC/MS equipment.
- Preparing standards for GC/MS analysis.

Associate Chemist
IT Analytical Services -- Pittsburgh, PA -- 1985 to 1987
Duties include:

- Analyzing waters, soils, and soil extracts using GC/MS.
- Calculating and interpreting GC/MS data.

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- Assisting in the review of GC/MS data and preparation of reports.
- Preparing of EPA-CLP data and reports.
- Maintaining GC/MS instruments.
- Preparing standards for GC/MS analysis.
- Total organic carbon (TOC) and total organic halogen (TOX) analysis.

Education:

B.S. Chemistry Grove City College – Grove City, PA – 1985

* Severn Trent Laboratories acquired Quanterra Incorporated on January 31, 2000.

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David A. Dunlap **Severn Trent Laboratories**

PROJECT MANAGER

Qualifications Summary:

Mr. Dunlap, Laboratory Project Manager, has experience in the area of soil chemistry, the preparing and subsequent analysis of soils and waters for metals, and volatile organics analysis of soils and waters. His familiarity with general laboratory data review and Environmental Protection Agency Contract Laboratory Protocols (EPA-CLP) has prompted this appointment of Project Manager.

Professional Experience:

Project Manager
STL-Pittsburgh -- Pittsburgh, PA – January 2000 to Present*
Duties include:

- Responsible for project management within the laboratory, including coordination with the operations manager, technical director, and general manager to facilitate the project programs. Duties include:
  - Preparing, reviewing and approving reports generated by the laboratory.
  - Coordinating with the Operations Manager in completing project work with project specific approved testing procedures.
  - Responding to client's questions before, during and after the sample analysis.
  - Prioritizing projects on a daily basis.

Project Manager
Quanterra Incorporated -- Pittsburgh, PA – July 1994 to January 2000
Duties include:

- Responsible for project management within the laboratory, including coordination with the operations manager, technical director, and general manager to facilitate the project programs. Duties include:
  - Preparing, reviewing and approving reports generated by the laboratory.
  - Coordinating with the Operations Manager in completing project work with project specific approved testing procedures.
  - Responding to client's questions before, during and after the sample analysis.
  - Prioritizing projects on a daily basis.

Analytical Project Coordinator
IT Analytical Services -- Pittsburgh, PA -- 1989 to June 1994
Responsible for project management within the laboratory, including coordination with the operations manager, technical director, and general manager to facilitate the project programs. Duties included:

- Preparing, reviewing and approving reports generated by the laboratory.
- Coordinating with the Operations Manager in completing project work with project specific approved testing procedures.
- Responding to client's questions before, during and after the sample analysis.
- Prioritizing projects on a daily basis.

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Group Leader, GC/MS Volatiles Department
IT Analytical Services -- Pittsburgh, PA -- 1987 to 1989
As Group Leader in the GC/MS department, Mr. Dunlap was responsible for data produced by the department. His duties included:

- Training GC/MS personnel in the different aspects of research and instrumentation.
- Maintaining laboratory equipment.
- Reviewing and updating all service contracts.
- Scheduling personnel for efficient instrumentation usage and timely transmittal of reports.
- Analyzing water, soil and soil extracts by GC/MS.
- Calculating and interpreting GC/MS data.
- Preparing in-house analytical reports.
- Preparing and coordinating CLP data and reports.

Chemist I (Group Leader)
IT Analytical Services -- Pittsburgh, PA -- 1986 to 1987
As Section Leader in the geochemical/soil preparation area, Mr. Dunlap was responsible for analyzing and preparing soils, solid and waste materials. He was also responsible for conducting and supervising proximate geochemical analyses, preparing reports, and reviewing analytical data. Other duties included:

- Training laboratory personnel in the performance of analytical testing.
- Organizing and scheduling testing in the group.
- Implementing appropriate calculation and data review procedures.
- Implementing improved automated and computerized systems and methodologies within the group.
- Evaluating equipment selection and maintaining an adequate supply of materials and chemicals.
- Performing or directing routine instrument maintenance as required.
- Assisting in the preparation and review of analytical reports.
- Performing analytical testing to insure required project turnaround time within the laboratory.
- Carrying out quality control testing within the specifications of the IT Analytical Services Quality Assurance Program.
- Supervising the analysis of performance evaluation samples for certification programs.

Associate Chemist
IT Analytical Services -- Pittsburgh, PA -- 1985 to 1986
Responsibilities included analysis of samples by flame, graphite furnace and cold vapor atomic absorption, spectrophotometry. Additional duties included:

- Preparing standards for Atomic Absorption analysis.
- Preparing liquid, soil, and waste samples for analyses; i.e., mercury digestions, total digestions, and dilutions.
- Analyzing samples by flame, graphite furnace and cold vapor Atomic Absorption Spectrophotometry.
- Calculating and reviewing AAS data.
- Assisting in preparation of Contract Laboratory Program (CLP) data and reports.

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Technician II
IT Analytical Services -- Pittsburgh, PA -- 1985
Duties as a technician in the Soils Preparation Section included:

- Preparing solid/waste samples for analysis; i.e., E.P. Toxicity, ASTM and CAM WET extractions.
- Hazardous Characterizations of samples; i.e., Corrosivity, Reactivity and Ignitability.
- Extracting soluble anions; i.e., chloride and sulfate.
- Analyzing sulfur by combustion-infrared analysis.
- Analyzing BTU using Bomb Calorimetry.

Education:

B.S. Chemistry University of Pittsburgh – Pittsburgh, PA – 1984.
Instructional I Certificate, Chemistry St. Vincent College – Latrobe, PA

* Severn Trent Laboratories acquired Quanterra Incorporated on January 31, 2000.

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Anthony Lee **Severn Trent Laboratories**

SAMPLE CUSTODIAN

Qualifications Summary:

Mr. Lee's duties include sample receiving, log-in, bottle preparation. He is responsible for verifying the identity, integrity and validity of all samples submitted to the laboratory for analysis. As Sample Custodian, he is responsible for the security and accountability of all samples and sample residue in the facility.

Professional Experience:

Team Leader, Sample Management
STL - Pittsburgh -- Pittsburgh, PA – November 1999 to Present*
Duties include:

- Recording all necessary information from the chain-of-custody and logging in samples into the computer system.
- Determining sample pH and storing samples in appropriate storage areas
- Supervising the disposal of samples.
- Supervising sample custodians.
- Supervising bottle preparation for field sampling.
- Maintaining samples by CLP and non-CLP protocol.
- Responsible for Level 2 reviews.

Sample Control
Recra Environmental, In.c/Keystone Environmental Resources, In. -- Pittsburgh, PA -- May 1987 to February 1998
Duties include:

- Recording all necessary information from the chain-of-custody and logging in samples into the computer system.
- Determining sample pH and storing samples in appropriate storage areas
- Supervising the disposal of samples.
- Supervising sample custodians.
- Supervising bottle preparation for field sampling.
- Maintaining samples by CLP and non-CLP protocol.
- Responsible for Level 2 reviews.

Sample Technician
Duties include:

- Recording all necessary information from the chain-of-custody and logging in samples into the computer system.
- Determining sample pH and storing samples in appropriate storage areas
- Supervising sample custodians.
- Supervising bottle preparation for field sampling.
- Maintaining samples by CLP and non-CLP protocol.

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Education:

Forbes Road Technical School – 1980
Transportation Skill Programs, Inc. Hazardous Waste Materials Course – 1982
Hazardous Materials Handling Certification for DOT 49 CFR Transportation Regulations – September 2000.

* Severn Trent Laboratories acquired Quanterra Incorporated on January 31, 2000.

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Lawrence W. Matko **Severn Trent Laboratories**

GROUP LEADER, GC/ORGANIC PREP

Qualifications Summary:

Mr. Matko is an experienced chemist in the area of pesticides/PCBs and herbicides analyses.

Professional Experience:

GC/Organic Prep Group Leader
STL - Pittsburgh– Pittsburgh, PA – January 2000 to Present*
Responsibilities include:

- Supervising the GC/HPLC, and Extraction departments to ensure the work is performed according to the EPA-CLP, SW-846, and state or site specific protocols for the analysis of water, soil, wastewater, and hazardous waste.
- Organizing the personnel and equipment to ensure that the analysis and project turnaround times are met.

GC/Organic Prep Group Leader
Quanterra Incorporated – Pittsburgh, PA – March 1996 to January 2000
Responsibilities include:

- Supervising the GC/HPLC, and Extraction departments to ensure the work is performed according to the EPA-CLP, SW-846, and state or site specific protocols for the analysis of water, soil, wastewater, and hazardous waste.
- Organizing the personnel and equipment to ensure that the analysis and project turnaround times are met.

GC Semivolatiles Team Leader
Quanterra Incorporated – Pittsburgh, PA – Sept. 1995 to March 1996
Duties include:

- Responsible for supervising the gas chromatography section of the laboratory where work is performed according to Environmental Protection Agency Contract Laboratory Program(EPA-CLP), SW-846, and state and site specific protocols for the analysis of water, soil, wastewater, and hazardous waste. Also responsible for organizing and performing testing in the gas chromatography section to insure that project turnaround times are met.

GC Chemist
Quanterra Incorporated -- Pittsburgh, PA – July 1994 to Sept. 1995
Duties include:

- Analyze samples by various methods such as Method 8080, CLP, Method 8150, and Methods 8020, 602, and 608. Analyze, calculate and process samples.
- Prepare standards.
- Perform extractions.
- Calculate data and data interpretation.

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GC Chemist
IT Analytical Services -- Pittsburgh, PA -- 1993 to June 1994
Duties include:

- Analyze samples by various methods such as Method 8080, CLP, Method 8150, and Methods 8020, 602, and 608.
- Prepare standards.
- Perform extractions.
- Calculate data and data interpretation.
- Train new analysts in the GC group.

GC Chemist
Chester Labnet -- Monroeville, PA -- 1991 to 1993
Duties included:

- Analyzed samples by various methods such as Method 8010, 8015, 8020, 8040, and 8150, 606, 611, and 612.
- Developed different methods including the new CLP protocol.
- Developed programs that concern set-up and ensured that they operated properly.
- Extracted and analyzed all performance evaluation samples associated with GC.

GC Chemist
Chemist, Gas Chromatography, IT Analytical Services, Pittsburgh, PA – 1989 to 1991
Duties in the GC group are as follows:

- Analyzed samples by various methods such as Method 8080, CLP, Method 8150, and Methods 8020, 602, and 608.
- Prepared standards.
- Performed extractions.
- Calculated data and data interpretation.
- Trained new analysts in the GC group.
- Maintaining and troubleshooting instrumentation.

Lab Technician
IT Analytical Services -- Pittsburgh, PA -- 1988 to 1989
Duties included:

- Extracted soil and water samples for semivolatiles, pesticides/PCBs, and herbicides.
- Worked in GC group in addition, where calculated runs and prepared standards.

Education:

B.A. Chemical Engineering Pennsylvania State University – State Park, Pennsylvania – 1985

* Severn Trent Laboratories acquired Quanterra Incorporated on January 31, 2000.

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Willard A. Murray, Ph.D., P.E.
Principal Engineer

Experience

Dr. Murray has more than 25 years of consulting, applied research, and academic experience in hydraulic engineering, groundwater hydrology, and surface-water hydrology. His experience also includes:

- Assessment of complex hydraulic systems;
- Evaluation and remediation of contaminated soil, sediment, surface water, and groundwater;
- Water quality studies;
- Surface water and groundwater modeling;
- Contaminant fate and transport;
- Hydraulics of sediment transport;
- Engineering feasibility studies;
- Remedial design;
- Successful implementation of innovative remedial technologies.
- Stormwater assessment;
- Environmental impact statements, and
- Litigation support and expert testimony.

Dr. Murray served as the Technical Director for Harding ESE's Comprehensive Long-term Environmental Action Navy (CLEAN) program, providing technical guidance and review to all aspects of the planning and execution of this $175 million environmental cleanup program.

Dr. Murray serves as a special in-house consultant for Harding ESE providing technical guidance for a wide variety of projects involving surface water and groundwater hydrology, remedial and hydraulic engineering design, field-engineering and bench scale bioremediation studies, and the application of innovative treatment technologies.

Dr. Murray conducted academic and applied research on sediment transport, including erosion and deposition mechanisms and modeling predictions for seven years at Lehigh University. He has also been very active for the past ten years in developing and teaching short courses through the University of Wisconsin Engineering Professional Development Department on the subjects of groundwater flow and transport in porous and fractured media (including modeling), and remedial design for cleanup at contaminated sites.

He is also active Harding ESE's Quality Assurance/Quality Control program. He previously served as the Corporate Director of Quality Management and Technology Development responsible for directing the implementation of the Corporate Quality Management Program and conducting Quality Assurance Audits. He was responsible for assuring that engineering and scientific principles were consistent throughout the company's operations. He currently assists in the development of technical and quality assurance procedures and assists in developing in-house training and education programs to support the professional development of our staff. His formal training includes Total Quality Management at the Philip Crosby Associates Quality College (1990-91) which included a four day Quality Improvement Process Management course and a four day course in the Philip Crosby Associates "Quality Education System" training for trainers.

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Registration and Certification

Professional Engineer - California, Florida, Georgia, Maine, Massachusetts, and Pennsylvania.

Education

Ph.D., Civil Engineering, Specialty in Hydraulic Engineering and Fluid Mechanics, University of Wisconsin, 1970
M.S., Civil Engineering, University of Wisconsin, 1966
B.S., Civil Engineering, University of Wisconsin, 1965

Awards

1978 Tau Beta Pi Outstanding Faculty Award, Lehigh University

Representative Projects

RI/FS and Remedial Design/Implementation at Navy Bases in the Southeastern United States. Served as Technical Director for site characterization and alternative assessment of several sites on Navy installations in Florida and Georgia. Remedial actions for chlorinated solvent contamination that were implemented included: Natural Attenuation (NAS Jacksonville and NAS Cecil Field), Air Sparging and Soil Vapor Extraction (NAS Jacksonville), Recirculation Well with In-Well Air Stripping (NTC Orlando), and Groundwater Extraction with Air Stripping and Carbon Sorption (NSB Kings Bay and NAS Jacksonville). Remedial actions included groundwater/river interaction studies involving stream gauging and numerical modeling of groundwater with the USGS (NAS Cecil Field) and excavation of PCB contaminated sediments from small streams and consolidating the material into a landfill before capping (NAS Jacksonville).

RI/FS and Remedial Design/Implementation for CPC International, Peterson Puritan Site, Cumberland, Rhode Island. Assisted in the design of the remedial investigation and served as Senior Technical Reviewer for the RI/FS and Remedial Design. The site was contaminated by 6000 gallons of tetrachloroethene (PCE) spilled from a tank car. The PCE migrated to a municipal wellfield and caused it to be shut down. Special modeling studies of the groundwater/river interaction were conducted to assess percentages of municipal well flow due to induced river recharge and from groundwater flow beneath the river. The remedial design included a pump and treat system combined with soil vapor extraction. Special areas downgradient were remediated using natural attenuation. Dr. Murray served as an expert witness in a case regarding insurance coverage for this spill. The trial decision was in favor of CPC for $12.5 million, and continued insurance coverage for entire cleanup.

Groundwater Extraction Optimization, USATHAMA, Anniston Army Depot, Anniston, Alabama. Project Engineer for Phase I of a remediation project to capture groundwater that was highly contaminated with solvents near former source areas and to limit downgradient migration. Phase I involved installation of extraction wells with testing in a "design-as-you-go" approach to optimize the capture zones of the pump and treat remedial measure. Control was achieved by providing capture for the predominant site contaminants, trichloroethene (TCE) and dichloroethene (DCE) to the 25 to 50 mg/l iso-concentration contour

Bioremediation of Chlorinated Solvents, Superfund Innovative Technology Evaluation (SITE) Program, U.S. EPA, Risk Reduction Laboratory, Cincinnati, Ohio. Project Director for a field pilot demonstration of Sequential Anaerobic/Aerobic Biodegradation of Chlorinated Solvents. This field demonstration was

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engineered to successfully destroy dissolved solvent contamination at levels of 20,000 µg/l. The engineered system included a recirculating groundwater treatment cell in which various amendments were added to stimulate natural bacterial action to destroy the solvent contamination. The field pilot was conducted at an MCP site in Watertown, Massachusetts in accordance with a RAM plan. Prior to conducting the pilot, a presentation was made at a DEP Pilot Innovative Technology Scoping (PITS) session.

Cleanup of Solvent-Contaminated Soil and Groundwater, Former Mechanical Engineering Lab, Allied Signal, Southfield, Michigan. Remediation of TCE in soil and groundwater was required prior to a property transfer at this site. Dr. Murray assisted in characterizing the 4-acre site and was a member of the design team that implemented the remedy. A slurry wall was installed surrounding the site for containment. A trench dewatering system that was later converted to an SVE system was used to complete the cleanup. Site cleanup to Michigan standards was accomplished in less than two years.

Stormwater Runoff and Sediment Transport, Confidential Client, Massachusetts MCP Site. Assessment of the applicability of NPDES Stormwater regulations was conducted for the repair of an eroded drainage channel. The project included assessment of the origin of sediment deposited on flood plain adjacent to site.

Litigation support for Whiteman Osterman & Hanna Re: State of New York v. Hodor Staller Kasper, et al. Dr. Murray provided expert opinion on hydrogeologic analysis related to the cause of fumes detected in basements and assessment of whether remedial methods were cost effective for a leaky underground storage tank gasoline spill. Multiple spills and changes in ownership over time were involved. The case was settled out of court.

Expert Witness for ITT Marlow Pump Facility, Midland Park, New Jersey. Chlorinated solvent contamination in a municipal wellfield was being blamed entirely on the ITT Marlow facility by the Village of Ridgewood Water Company. Through modeling and assessment of basin-wide hydrological conditions, including groundwater/river interaction, and other documented contamination in the valley, Dr. Murray was able to demonstrate that less than 5% of the contamination in the wellfield was due to the ITT Marlow facility.

Litigation support for Sulloway Hollis & Soden representing Canal Insurance Co. in their inquiry into the reasonableness of charges for cleanup of a tanker truck accident and resulting fuel oil spill onto a New Hampshire highway and adjacent wetlands. Based on assessment of cleanup hours claimed, time, weather, and the nature of on-site activities, Dr. Murray was able to demonstrate inconsistencies in charges. A settlement for significantly reduced costs was achieved out of court.

Haley & Aldrich, Portland, Maine, 1986-1987

Responsible for development of technical hydrogeological services as well as management and supervision of the hydrogeology staff. Also responsible for a wide range of groundwater and surface water hydrology projects. Typical projects include evaluation of industrial properties prior to conveyance, impact assessment of waste disposal methods, groundwater modeling to assess contaminant migration, groundwater supply development studies, and groundwater resources protection studies.

E.C. Jordan Co., Portland, Maine, (predecessor of Harding ESE, Inc.) 1983-1986

Responsible for directing programs involving subsurface characterization of geohydrology to determine the extent of contamination and direction/speed of its migration, computer simulation of groundwater

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flow and contaminant transport, and evaluation of alternatives for protection of water supply aquifers. Also responsible for design of hydrological aspects of environmental impact investigations, and determination of capacity of existing groundwater supply systems for future development. Responsible for line management of twelve members of the Earth Sciences Department.

RI/FS Studies at Superfund Sites in Illinois, Maine, Michigan and New York. Performed lead roles in many Superfund Site investigations. In addition to planning and executing remedial investigations, directed computer modeling studies to evaluate various remedial alternatives for contaminated groundwater in both unconsolidated formations and underlying fractured rock.

Installation Restoration Program, Martin Marietta Energy Systems for U. S. Air Force. Provided management and oversight and senior technical review for RI/FS projects at several Air Force Bases including Loring AFB, Plattsburgh AFB and Otis AFB (Massachusetts Military Reservation).

Assessment of Contamination in soils, groundwater, surface water and sediments from Former Coal Gasification Sites, New York State Electric and Gas. Site manager for a former coal gasification site and general technical reviewer for others on a multi-site contract with New York Electric and Gas Company. Responsibilities included oversight of all field activities, interfacing with the client and contract laboratories, scheduling, and monitoring the performance of project staff.

Dames & Moore, San Francisco, California, 1981-1983

Responsible for coordinating a waste management and hazardous substance program for the firm's western region, which offered services in regulatory compliance, environmental assessment, and remedial measures. Duties also included the design of groundwater monitoring networks; project management of a $4 million multi-disciplinary environmental impact assessment for a proposed surface mine including extensive surface water monitoring; and investigating sites for design and construction of waste-water treatment and storage ponds.

Characterization and Cleanup of Organic Solvent Spills, San Francisco Bay Area, California. Directed the investigation of contaminant migration and remediation of waste solvents from an underground storage tank. The remedial action included groundwater extraction and onsite treatment in a stripping tower with subsequent discharge to city sewer.

Litigation support for cases involving a leaking underground solvent storage tank which contaminated City of San Jose water supply wells, and flood damage resulting from the effects of an upstream dam.

Lawrence Livermore Laboratory, California, 1979-1981

Responsible for geohydrologic research related to deep geologic disposal of nuclear waste; in-situ studies of fracture hydrology in the Climax Stock granite at the Nevada Test Site; site characterization and contaminant mitigation investigation for underground coal gasification; and investigation of monitoring methodology and evaluation of regulations for underground injection of geothermal brine.

Lehigh University, 1972-1979

Assistant and Associate Professor of Civil Engineering. Taught undergraduate and graduate courses in fluid mechanics, hydraulic engineering, and groundwater hydrology. Also conducted and supervised research concerning heat transfer in groundwater flow, hydraulic modeling of scour problems around

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offshore structures, sedimentation in reservoirs, erosion of sand/clay soil mixtures, and fluidization applied to sediment transport.

Litigation support for Heleva Landfill in Ironton, Pennsylvania, involved conducting a 5-day pumping test followed by numerical modeling of groundwater flow in the fractured limestone formations of eastern Pennsylvania to determine the probable source of TCE contamination in a nearby community water well. Results (presented in court testimony) showed that although TCE had been illegally disposed in a nearby landfill, it was not the source of contamination in the community well.

Directed a special groundwater flow modeling study of the drawdown patterns in the fractured limestone bedrock formations in Saucon Valley, Eastern Pennsylvania, surrounding an underground mine at which groundwater was pumped for mine dewatering and discharged to a surface stream.

University of Wisconsin, 1972

Visiting Assistant Professor of Civil Engineering. Taught undergraduate and graduate courses in fluid mechanics and conducted research on unsaturated groundwater flow and the mixing of pollutants discharged in to lakes and streams.

University of Canterbury, New Zealand, 1971

Postdoctoral Fellow. Taught undergraduate and graduate courses in fluid mechanics and groundwater hydraulics; and conducted research on thermal pollution of groundwater supplies.

Memberships

American Society of Civil Engineers
American Geophysical Union
American Society for Engineering Education
National Ground Water Association
National Society of Professional Engineers
Sigma Xi
Chi Epsilon
Phi Kappa Phi

Publications and Presentations

2001. Mass Balance Calculations for Cost Allocation Strategies," 17th Annual Conference on Contaminated Soil, Sediments and Water, Amherst, Massachusetts, October 22-25, 2001.

2001. "Hydrofracturing of Granitic Rock Accelerates Site Closure", Fractured Rock 2001, March 26-28, Toronto, Canada (with R.A. Johnson, E.P. VanDoren, E.G. Nelson, J.D. Reid-Green and R. Trinks).

2001. "Enhanced Bioremediation of Chlorinated Solvents", Sixth International Symposium, In Situ and On-Site Bioremediation, June 4-7, San Diego, California (with M.A. Dooley and S.S. Koenigsberg).

2000 "HRC Enhanced Bioremediation of Chlorinated Solvents", *Proceedings* Second International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California, Sponsored by Battelle, May 22-25, Vol. C2-4, pp. 287-294, (with M. A. Dooley, and S. S. Koenigsberg).

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2000 "Hydrofracturing of Granitic Rock to Accelerate Contaminant Removal," Chapter 15, ASCE Special Publication on *Remediation in Rock Masses*, Edited by H. I. Inyang and C. J. Bruell, (with R. A. Johnson, E. P. VanDoren, E. G. Nelson, and R. Trinks).

2000 "Site 5 Air Sparging Pilot Test, Naval Air Station Cecil Field, Jacksonville, FL", *Journal of Hazardous Materials*, Volume 72 (2-3), pp. 121-145, (with J. Ullo and R. Lunardini).

1999 "Passively Enhanced In Situ Anaerobic Biodegradation of Chlorinated Solvents", The Fifth International Symposium on In Situ and On-Site Bioremediation, Sponsored by Battelle, April 19 – 22, San Diego, California (with M. Dooley, J. Johnson and A. Dogon).

1999. "Natural Attenuation of a Chlorinated Solvent Plume with Contingency Plans Just in Case", NDIA 25th Environmental Symposium, March 29 – April 2, Denver, Colorado (with P. Miller and D. Gaskins).

1999. "Natural Attenuation of Chlorinated Solvents: When Indicators are positive, Does This Mean Its Working?", *Journal of Soil Contamination*, Vol. 8, No. 1, pp. 23 – 27 (with M. Dooley and D. Smallbeck).

1998. "The Fast-Track Assessment and Remediation of a Chlorinated Solvent Plume Using Recirculation Well Technology", 14th Annual Conference on Contaminated Soils, Oct 19-22, U. Massachusetts – Amherst (with M. J. Salvetti and B. Nwokike).

1998. "Sequential Anaerobic/Aerobic Biodegradation of Chlorinated Solvents: Results from Pilot-Scale Operations", *Proceedings* First International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California, Sponsored by Battelle, May 18-21 (with R. F. Lewis, M. A. Dooley, and J. A. Johnson).

1997. "Bioremediation of a Chlorinated Solvent Plume Under an Operating Manufacturing Plant," *Proceedings*, 1997 Maine ASCE Technical Seminar, March 19, Lewiston, Maine (with M Dooley, D. Belcher, K. Odell, J. Johnson, A. Dogon, and J. Hardin).

1991. "Application of Simple Analytical Models for the Recovery of Contaminated Groundwater in River Environments," *Proceedings*, FOCUS Conference on Eastern Regional Ground Water Issues, NWWA, October 29-31, Portland, Maine (with Russell A. Johnson and Benjamin J. Rice).

1990. "The Modified Spittler Method for Fast, Accurate and Low Cost Determination of PCB Concentration in Soils and Sediments," PCB Forum - 1990, Houston Center, Houston, Texas, April 2 & 3 (with D. Twomey and S. Turner).

1988. "Fundamental Investigation of Gravity Currents with Varying Density," *Water Resources Bulletin*, Vol. 24, No. 5, pp 1041-1047 (with J. Warwick).

1988. "Mathematical Concepts of Flow in Fractured Rock," invited presentation at Geologic Society of America, Northeastern Section Meeting, Portland, Maine, March 10-12.

1986. "Groundwater Monitoring," presented at Solid Waste Management Short Course, October 20-22, Portland, Maine, sponsored by University of Maine and Maine Department of Environmental Protection.

1987. Discussion of "An Alternative Procedure for Analyzing Aquifer Tests Using the Theis Nonequilibrium Solution" by O.L. Franke, *Ground Water*, September-October.

1986. "Impact of Soil Chemistry on Contaminant Migration from Hazardous Waste Areas," Eighth Annual Symposium on Geotechnical and Geohydrological Aspects of Waste Management, February 5-7, Colorado State University, Fort Collins, Colorado (with J. Dragun and R. Lewis).

1985. "Monitoring Well Installation Procedures at Hazardous Waste Sites," ASCE Annual Convention and Exposition, October 21-25, Detroit, Michigan, with (E.G. Hill).

1985. "Variable Density Gravity Currents," Proceedings International Symposium on Refined Flow Modelling and Turbulence Measurements, the University of Iowa, Iowa City, Iowa, September 16-18, 1985 (with J.J. Warwick).

1985. "A Recent Assessment of the Hydrogeology and Groundwater Availability of the Northern New Jersey Coastal Plain Aquifers," Second Annual Eastern Regional Ground Water Conference - NWWA, July 16-18, Portland, Maine (with M. Miremadi).
1985. "Groundwater Modeling for Assessing Remedial Alternatives at a Superfund Site," *Proceedings*, 17 Mid-Atlantic Industrial Waste Conference, June 23-25 (with E.G. Hill and R.A. Lewis).
1985. "Sedimental Thoughts about Fritz Labs," presented at the 50th Anniversary Conference, Fritz Engineering Research Society, Lehigh University, Bethlehem, Pennsylvania, July 31-August 2.
1985. "Applications of Groundwater Modeling," presented at University of Maine Seminar on Groundwater, Augusta Civic Center, February 19.
1985. "Water Supply Contamination from Hazardous Waste," presented at Maine Utilities Association Annual Meeting, Groundwater Seminar sponsored by American Water Works Association, February 11.
1983. "Stratigraphic Influence on the Design and Implementation of Clean-up Methods: A Case History," presented at the 12th Annual Conference on Waste Technology, October, Memphis, TN (with J. Donovan).
1982. "Environmental Impacts of Underground Coal Gasification," Preprint No. 82-359, presented at the First International SME-AIME Fall Meeting, Honolulu, Hawaii, September 4-9.
1982. "Fossil-Fired Power Plants: Get Ready to Monitor Groundwater," POWER Magazine, June, pp. 81-83 (with A. Toepker).
1981. Contributions to "Geothermal Injection Monitoring Project," UCID-19066, Lawrence Livermore National Laboratory, April, by L. Younker.
1981. "Geohydrology of the Climax Stock Granite and the Surrounding Rock Formations, NTS," UCRL-53138, Lawrence Livermore National Laboratory, May.
1980. "Permeability Testing of Fractures in the Climax Stock Granite at the Nevada Test Site," Repository Sealing Field Testing Workshop, 1980, Santa Fe, New Mexico, September 18-19.
1980. "Mock Site Radionuclide Transport Assessment," NUREG/CR-1553, UCRL-52718, Lawrence Livermore National Laboratory, prepared for U.S. NRC, September (with T.R. Donich and J.O. O'Connell).
1980. "Three-Dimensional Modeling of Waste Migration from a Deep Geologic Repository," prepared for FIN AO277, WM-80-348, NRC Waste Management Program, Lawrence Livermore National Laboratory, Livermore, California, June 24.
1980. Contributions to several chapters in "The Bedded Salt Report: A Compendium of Technical Issues and Analyses Pertaining to Siting of a Nuclear Waste Repository in Bedded Salt." NUREG/CR-1525, UCRL-52737, Lawrence Livermore National Laboratory, Livermore, California, July 25 (prepared by F.R. Kovar and T.L. Steinborn).
1980. "Deep Geologic Isolation of Nuclear Waste: Numerical Modeling of Repository Scale Hydrology," FIN No. A-0277, WM-808-340-D, Lawrence Livermore Laboratory, April (with M.D. Dettinger and H.F. Lutz).
1980. "Sediment and Erosion Control Investigation - Pheasant Branch Creek, Middleton, Wisconsin," prepared for Water Resources Management Commission, City of Middleton, Wisconsin, February (with Spooner Engineering - Oshkosh, Wisconsin).
1979. "Hydrology," Chapter 3 in *Geoscience Data Base Handbook for Modeling a Nuclear Waste Repository*, by Dana Isherwood, NUREG/CR-0912, Vol. 1, Lawrence Livermore Laboratory, December.
1978. "Fluidization Applied to Sediment Transport - II," Fritz Engineering Laboratory Report, No. 710.2 (with A.G. Collins).
1978. "Sediment Deposition in Nonuniform Flow," presented at the 26th Annual Hydraulics Division Conference, ASCE, University of Maryland, College Park, Maryland, August 9-11.

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1977. "Erodibility of Coarse Sand/Clayey Silt Mixtures," *Proceedings*, Journal of the Hydraulics Division, ASCE, Vol. 103, No. HY10, October.
1977. "Modeling of Unconfined Groundwater Systems," with R.L. Johnson, *Groundwater Journal*, July-August.
1977. "Numerical Investigation of Variable Density Underflow Currents," Fritz Engineering Laboratory Report No. 410.2, Lehigh University, March (with J.J. Warwick).
1976. "Hydraulic Investigation of Taconite Tailings Launder," Fritz Engineering Laboratory Report, No. 200.76.3.1, December (with R.L. Johnson).
1976. "Turbidity Plume Flow in Uniform and Stratified Ocean Water and Implications for Sediment Disposal," Fritz Engineering Laboratory Report No. 410.1, Lehigh University, September (with C.R. Paola).
1976. "Erodibility of Coarse Sand/Clayey Silt Mixtures," Fritz Engineering Laboratory Report No. 411.2, Lehigh University, September.
1975. "Hydraulic Model Study of Erosion Control Structures," Fritz Engineering Laboratory Report No. 411.1, Lehigh University, June (with Andres Navia).
1974. "Thermal Pollution of Groundwater Supplies," Postdoctoral Research Report, Department of Civil Engineering, University of Canterbury, Christchurch, New Zealand.
1974. "Mathematical Model of Delta Formation in Reservoirs," Fritz Engineering Laboratory Report No. 384.3, (with O. Yucel, W.H. Graf, and M. Parsons).
1974. "Effects of Input Parameter Variation on Sedimentation in Reservoirs," Fritz Engineering Laboratory Report No. 384.2, (with M. Parsons).
1973. "The Dupuit-Forchheimer Equation - A Validity Criterion," *Proceedings*, ASCE, Vol. 99, No. 7, September (with P.L. Monkmeyer).
"Groundwater Resources of the Canterbury Plains - A Summary of Current Concepts," In-House Report, New Zealand Geological Survey, Christchurch, New Zealand (with D.D. Wilson).
1973. "Heat Transfer in Groundwater Flow," *Transactions*, AGU, Vol. 54, No. 4, April 1973 (abstract only), presented at 54th Annual Meeting, AGU, Washington, DC, April 16.
1972. "Delayed Yield and Unsaturated Flow Above a Falling Water Table," Technical Report, OWRR B-021-WIS, University of Wisconsin, Water Resources Center (with J.P. Grant, and P.L. Monkmeyer).
1972. "Unsteady Flow of Groundwater," Technical Completion Report, OWRR, Wisconsin Water Resources Center, University of Wisconsin (with P.L. Monkmeyer and J.A. Hoopes).
1972. "Definition of the Mixing Zone for Waste Effluents Discharged into Surface Waters," Completion Report, Department of Natural Resources, State of Wisconsin (with J.A. Hoopes and J.R. Villemonte).
1971. "Seepage Face Effects in Unsteady Groundwater Flow," ASCE Hydraulics Division Conference, Iowa (with P.L. Monkmeyer).
1968. "Unsteady Unconfined Groundwater Flow Toward a Well," ASCE Irrigation and Drainage Division Specialty Conference, Phoenix (with P.L. Monkmeyer).
1968. "Travel Time for Waves Moving Over a Sloping Bottom," *Proceedings*, ASCE, Vol. 94, No. WW3 (with P.L. Monkmeyer).
1967. Discussion of "Analyses of Parameters of an Unconfined Aquifer," by Kriz et al., *Proceedings*, ASCE, Vol. 93, No. HY4 (with P.L. Monkmeyer).

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Jason C. Naiden
Staff Scientist

Experience

Mr. Naiden is a trained Hydrologist with experience in many facets of environmental consulting. With 2 years of experience, he has conducted site investigations, provided oversight for remedial construction activities, developed project plans, and prepared project reports. He has also provided support for site characterization and design and implementation of remedial actions. He has participated in projects for commercial, industrial, local and Federal government agencies and is familiar with USEPA, MEDEP, RIDEM, NHDES and Massachusetts Contingency plan (MCP) regulations and requirements.

Specialized skill areas include: collection of sediment, soil, surface water, and groundwater samples (including low-flow methods), installation of soil borings and groundwater monitoring wells, Level C and D personal protective equipment and procedures, field documentation, preparation of required MCP documents, EPA Contract Lab protocol data base maintenance, and oversight of drillers and remedial construction contractors.

Training

OSHA 40-Hour HAZWOPER Safety Training, 2000
OSHA 8-Hour HAZWOPER Supervisory Training, 2001

Education

B.S. in Hydrology , University of New Hampshire, Durham , 2000

Representative Projects

MCP Phase I and II Site Assessment and RAO, US Army Corp of Engineers, Chicopee, Massachusetts Responsibilities included surveying, modeling, evaluation, and graphical representation of data to determine the nature and extent of residual jet fuel contamination. Activities included oversight of environmental drilling subcontractors, sample collection and documentation, and interpretation of GC/MS and ICP chromatographic analysis and fingerprinting data.

Site Investigation, US Army Corp of Engineers, Ayer, Massachusetts Responsibilities included IDW management, field implementation of a high profile and publicly sensitive drilling and sampling program, groundwater sampling, and preparation of the Health and Safety plan (HASP) and the Sampling and Analysis Plan (SAP).

Site Investigation and Remediation, Confidential Utility Clients, Arlington, Massachusetts. Site supervisor for a site investigation and associated soil remediation activities at a former manufactured gas plant (MGP) and former chrome plating disposal site. Activities included air monitoring, subsurface excavation, collection of subsurface soil and groundwater samples, and hydrogeologic testing. Over 60 soil borings were advances using using hollow stem auger, wash and drive, vibradrill, and direct push drilling and sampling methods. Constituents of concern included heavy metals, VOCs, PAHs, LNAPL and DNAPL. Other responsibilities included preparation of MCP required documents such as Utility related abatement measure (URAM), Immediate Response Action (IRA), Remedial Action Plan (RAP), and Phase II Comprehensive Site Assessment Reports.

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Remedial Construction Oversight, MassHighways, Provincetown and Newburyport, Massachusetts. Responsibilities included Release Abatement Measure (RAM) construction oversight, subcontractor oversight and direction, on-going soil sample management. Mr. Naiden also prepared the Method 1 Risk Assessment and associated MCP type A and B Response Action Outcome documents in support of regulatory site closure.

Site Investigation, Confidential Utility Client, Nashua, New Hampshire. Served as Field Operations Leader and task manager for a 3 month DNAPL assessment field program at a former Manufactured Gas Plant (MGP). Activities included determination of the nature and extent of contaminated media, preferential pathways, and contaminant fate and transport. Hx and Bx rock cores were collected using drive and wash drilling methods. Overburden soils were also sampled. Responsibilities included subcontractor oversight, sample collection, soil classification and logging, and daily coordination with State environmental regulators and corporate client Health and Safety auditors.

Site Investigation, Town of Arlington, Arlington, Massachusetts. Responsibilities included developing and purging groundwater monitoring wells, gauging the thickness of free product gauging, and hazardous materials sampling for a Phase I and II study. Included study of potentiometric surface gradients, groundwater flow rates, permeability, conductivity and transmissivity and calculations for migrational pathways to assess potential risk using various direct contact criteria.

Hydrological Study, MassHighways, Wellesley, Massachusetts In-depth calculations integrating in-situ groundwater VOC plume discharge to ephemeral stream entering MCP Tier I wellhead protection area. Statistical and regression driven calculation for risk characterization.

Confidential Commercial Client Wilmington, Massachusetts Conducted a Phase I initial site assessment, including field program coordination, groundwater flow characterization, geologic and hydrologic research, legal file review, and report preparation.

Confidential Industrial Client, Providence Rhode Island Construction, excavation and remediation oversight of publicly sensitive site. Liability limitation for PRP by perimenter air sampling during redevelopment effort. On-site real-time Field Chemical analysis, audit of construction site development plans, LNAPL IDW management, soils and groundwater sampling, SAP and HASP document construction, management of state stipulated regulatory compliance, Direct client and governmental oversight agency contact .

Projects prior to Employment at Harding ESE Inc.

Teaching Assistant University Of New Hampshire: Lab instructor and Tutor for climatological course.

NASA/ UNH: Stream gaging from Satellite Guidance. Included in-depth field work, advanced hydrologic methodology, statistical flow and regression/risk calculations for various structures, data base management, graphical and GIS utilization.

State of Maine Department of Health Engineering. Responsible for engineering feasibility study, regulatory analysis and enforcement of statewide source water and well head protection programs. Instituted and implemented these programs in conjunction with applicable local, state and Federal Laws, regulations, statutes, and enforcement codes.

MARK PHANEUF, Senior Staff Geologist

EXPERIENCE SUMMARY

Mr. Phaneuf is a geologist with over four years of experience overseeing subsurface explorations, monitoring well installations, landfill capping, and remedial construction. He has participated in numerous site investigations for state and federal government, and commercial clients, and has experience with geological and chemical data entry. Mr. Phaneuf has written various environmental documents including sampling and analysis plans, health and safety plans, access agreements, site investigation reports, and RAOs. Mr. Phaneuf is proficient in collection of soil and groundwater samples using multiple techniques.

TECHNICAL SKILL AREAS

- Investigation of MGP sites
- Phase I and II site assessments
- Remedial construction oversight
- Rock coring
- Monitoring well installation
- Groundwater sampling, including low flow procedures
- Soil and sediment sampling
- Bedrock fracture mapping
- SVE Pilot Testing

EXPERIENCE

Harding ESE, Inc. Wakefield, Massachusetts. April 1998 - Present.
Senior Staff Geologist

Federal Government Sites

U.S. Army Corps of Engineers, Fort Devens, MA, November 1998-Present

Mr. Phaneuf acted as Field Operations Leader during the installation of several deep bedrock wells that included the description of the core as part of the supplemental groundwater investigation for base closure activities. Site Investigations at this location assisted in determining the extent of a PCE plume and for future groundwater bio-remediation techniques. Mr. Phaneuf provided oversight during recent microwell installations which further defined the extent of the solvent plume. He also provided technical assistance with the HRC injection pilot study program.

U.S. Army Corps of Engineers, SSCOM, Natick, MA, July 1998
Mr. Phaneuf provided field support at this site. Responsibilities included low flow groundwater sampling using both bladder and Grundfos pumps to collect samples from monitoring wells. Mr. Phaneuf also assisted in field chemistry screening for groundwater analysis using multiple field test kits for metals and carbon dioxide.

U.S Army Corps of Engineers, New England Division, Former Westover Airforce Base, July 1998 – Present
Mr. Phaneuf has been involved in an ongoing subsurface field investigation at this site

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involving the redevelopment of a portion of the former airfield. Mr. Phaneuf has completed multiple rounds of groundwater sampling from a network of monitoring wells. He has also installed numerous GeoProbe borings to characterize soil and is working on a final field investigation phase involving the installation of microwells. Mr. Phaneuf has taken part in preparing an RAO report with AUL limitations along with the nature and extent sections.

U.S Army Corps of Engineers, New England Division, Providence Rhode Island, November 1999 – 2000
Mr. Phaneuf coordinated with subcontractors and completed all fieldwork involving this Brownfields site including the installation and development of several monitoring wells along with the documentation and description of subsurface soils. Soil and groundwater samples were collected for TPH DRO/GRO and VPH analysis. Mr. Phaneuf completed these field activities on time under a tight schedule and adverse field conditions. He also assisted in the writing of the Health and Safety Plan and Sampling and Analysis Plan.

United Sates Postal Service, Newton, MA, May 1998
Mr. Phaneuf assisted in two Phase I site assessments for a commercial client and for the USPS. Duties performed include site visit, client contact, and file reviews at MADEP and several local government offices for the completion of the report. Concerns at the site were chlorinated solvents in groundwater.

State Government Sites

Massachusetts Department of Environmental Protection (MADEP), Millville, MA, April 1998-Present
Mr. Phaneuf is involved in scheduled groundwater sampling of this site which has been impacted by chlorinated solvents affecting nearby private wells. Recently, the discovery of free DNAPL presence in a well prompted actions to begin construction of a treatment system. Mr. Phaneuf was also involved in the use of the Hermit Data Logger for permeability testing of the aquifer. Most recent events Mr. Phaneuf completed at this include the installation and test run for the SVE pilot test, which was successful and is now in the process of going full scale.

New York State Department of Environmental Conservation (NYSDEC), Watertown, NY, October 1998 – March 2000
Mr. Phaneuf acted as the Field Operations Leader for quarterly monitoring of groundwater impacted by chlorinated solvents from a former dry cleaning facility. Activities include low flow groundwater sampling, the completion of 15 GeoProbe borings with soil logging and analysis. Mr. Phaneuf also assisted an HLA geophysicist in a Ground Penetrating Radar (GPR) survey to locate a system of vaults beneath the former facility used in the dry cleaning process. Bedrock fracture mapping activities were completed as part of the field investigation.

Manufactured Gas Plant Sites

Confidential Utility Client, Exeter, New Hampshire, November 1998 - January 1999
Mr. Phaneuf served as Field Operations Leader during a multi-phase field investigation in which over 60 GeoProbes and several test pits were completed to assess subsurface soil and groundwater conditions. During the project, Mr. Phaneuf also oversaw the installation of seven monitoring wells on this property. This project required detailed recognition and classification of MGP residuals in soil, along with the identification of former MGP structures.

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Other Relevant Sites

Vacant Warehouse, Worcester, Massachusetts
Conducted a phase II site assessment of this Brownfields site, including ground-penetrating radar survey, subsurface soil and groundwater investigation to delineate impacted media, prepared the project health and safety plan and investigation reports.

ABB CE, Rochester, NY, July 2000 – September 2000
Mr. Phaneuf was involved in the remedial construction phase of the Former Taylor Instruments Site. He provided oversight for the installation of approximately 58 wells that were tied into the groundwater treatment system for the removal of chlorinated solvents from groundwater. Oversight included installation of overburden wells installed using both 4.25" HSAs and spun casing. Mr. Phaneuf also provided oversight for bedrock monitoring and extraction wells using air rotary and spun casing techniques. Other site activities included the sampling of mercury contaminated soils to characterize for disposal properties. Mr. Phaneuf conducted multiple pump tests on selected bedrock wells which ultimately determined optimum operation for the treatment system.

Confidential Manufacturing Client, Billerica, MA, May 2000 – Present
Mr. Phaneuf has been involved in the field investigations at this site including the installation of several water table and bedrock wells. Wells were strategically placed along several geophysical survey lines completed by an outside contractor. Wells were installed as couplets at low bedrock points indicated on the survey as a preferential flow path along bedrock surface. Contaminants of concern are VOCs from former manufacturing facilities that are potentially impacting nearby public well fields.

Confidential Manufacturing Client, Everett, MA, May 1998 – September 1998
Mr. Phaneuf has been involved in the operating and gauging of wells that are on-line with a product extraction system for the removal of no. 2 and 6 fuel oil and treatment of discharge water using activated carbon filtration.

Confidential Manufacturing Client, Everett, MA, May 1998 – September 1998
Mr. Phaneuf took part in the construction oversight phase of a landfill-capping project on a municipal landfill. Duties included monitoring the installation of geotextile fabrics and membranes. He also observed the filling of sand and erosion control procedures.

Gorham Mill Redevelopment, Providence, Rhode Island, August 1998- Present
Global Positioning System (GPS) mapping to define the boundaries of a former landfill for a future land use project. Also involved with test pit activities in which former subsurface structures were located and identified and executed several rounds of field chemistry sampling for soil disposal classifications.

EDUCATION

New Mexico Institute of Mining and Technology, Socorro, NM
B.S. Geology - December 1997

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ADDITIONAL TRAINING

OSHA 40-hour HAZWOPER training certification, 1998, 8 hr refresher current
HLA Soil Classification Course, 1999
Radiation Training and Awareness Certificate, 1999
AMTRAK Safety Training, 1999, 2001, 2002
First Aid/CPR, 1999, 2000

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Andrew W. Sutton
Staff Geologist

Mr. Sutton is a geologist with 2 years of experience in conducting remedial construction oversight and all aspects of environmental investigations. He has conducted several field investigations under the Massachusetts Contingency Plan and is familiar with EPA and CLP Sampling Protocols.

Specialized skill areas include: collection of sediment, soil, surface water, and groundwater samples (including low-flow methods), installation of soil borings and groundwater monitoring wells, Level C and D personal protective equipment and procedures, field documentation, preparation of project plans and MCP documents, EPA Contract Lab protocol data base maintenance, oversight of drillers and remedial construction contractors, and review of regulatory agency files.

Education
B.A., Geosciences and German, Williams College, Williamstown, Massachusetts, 2000

Project Experience

US Army Corps of Engineers, Centredale Manor Superfund Site, North Providence, Rhode Island – Prepared Health and Safety and Site Management Plans, and aided in the preparation of Field Sampling and Data Management Plans. Assisted in the collection of sediment and biota samples.

US Army Corps of Engineers, Former Watertown Arsenal, Watertown, Massachusetts – Researched and assembled Historical Site Assessment under MARSSIM guidance, and a Supplemental Phase II Comprehensive Site Assessment Report under the MCP. Conducted soil, surface water and sediment sampling, including storm-event surface water sampling.

Massachusetts Military Reservation, Sandwich, Massachusetts – Conducted environmental sampling at an Artillery and Testing Range to evaluate for the presence of residual explosives. Followed EPA Region 1 and CLP Protocols for sample collection and preparation. Assisted in radiological screening activities during a drum removal action. Conducted historical document review and analyzed and collected historical sampling data for presentation to client.

Utility Facility, Williamstown, Massachusetts – Supervised subsurface investigation for a Phase IV Remedy Implementation at a former Manufactured Gas Plant site under the Massachusetts Contingency Plan. The purpose of the project was to assess potential encroachment of Manufactured Gas Plant residuals towards a municipal wellfield. Activities included coordination and oversight of environmental drillers, soil boring and monitoring well installation (direct-push and hollow-stem auger drilling), field screening, low-flow groundwater sampling according to EPA protocols.

Utility Facility, Salem, Massachusetts – Conducted monthly free product gauging at a series of monitoring wells to evaluate the effectiveness of vacuum-enhanced product recovery events as part of an Massachusetts Contingency Plan Phase IV Remedy Implementation. Prepared a Class C RAO Report at close of Phase IV.

Former Utility Facility, Arlington, Massachusetts – Aided in the preparation of a Phase II Comprehensive Site Assessment report, including preparation of geologic cross sections and assembly of geologic and hydrogeologic background information for the Site.

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Manufacturing Facility, Concord, Massachusetts – Researched history of operations and prior remediation at a depleted uranium manufacturing site and presented information to client.

Former Manufacturing Facility, Providence, Rhode Island – Supervised microwell installation, andconducted perimeter air monitoring for dust and volatile constituents. Collected surface soil, soil, and sediment samples.

Manufacturing Facility, Windsor, Connecticut – Conducted low flow groundwater sampling, as well as surface water and sediment sampling in support of an ecological risk assessment. Also collected and processed biota samples, including fish and amphibian samples.

Former Landfill, Cranston, Rhode Island – Led field effort including installation of piezometers, and collection of surface water and sediment samples, as well as location and sampling of 'seeps' from the capped landfill.

Training
OSHA 40-Hour Hazwoper Safety Training, 2000
OSHA 8-Hour Hazwoper Safety Training Refresher, 2001, 2002
OSHA 8-Hour Hazwoper Supervisor Training, 2001

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Albert F. Vicinie III **Severn Trent Laboratories**

PITTSBURGH LABORATORY MANAGER

Professional Experience:

Laboratory Manager and Manager of Client Services, Commercial Programs
STL – Pittsburgh -- Pittsburgh, PA*

Duties for Laboratory Management (January 2000 to Present) include:

- Managing the Laboratory in all aspects from ensuring client deadlines are met to assuring that the quality of data is acceptable.
- Proposing the budgets for the laboratory facility.
- Directing the activities of sample control, customer service and project management groups in support of the laboratory's business plan and profit goals. A function that had formerly been performed by the Laboratory Systems Manager

Responsibilities for Manager, Client Services (January 2000 to Present) include:

- Preparing pricing for bid and proposals, contract negotiations.
- Managing incoming requests for qualifications, capabilities and pricing and the follow-up of such requests.
- Tracking the status of bids and proposals submitted, and gathering and evaluating market research.

Laboratory Manager and Manager of Client Services, Commercial Programs
Quanterra Incorporated – Pittsburgh, PA
Duties for Laboratory Management (October 1997 to January 2000) include:

- Managing the Laboratory in all aspects from ensuring client deadlines are met to assuring that the quality of data is acceptable.
- Proposing the budgets for the laboratory facility.
- Directing the activities of sample control, customer service and project management groups in support of the laboratory's business plan and profit goals. A function that had formerly been performed by the Laboratory Systems Manager

Responsibilities for Manager, Client Services (October 1997 to January 2000) include:

- Preparing pricing for bid and proposals, contract negotiations.
- Managing incoming requests for qualifications, capabilities and pricing and the follow-up of such requests.
- Tracking the status of bids and proposals submitted, and gathering and evaluating market research.

Laboratory Supervisor
At Labs – Formerly Corning Industrial Laboratories – Youngstown, Ohio – 1988 TO 1997

Responsible for all aspects of laboratory operations of a full service Environmental and Industrial Hygiene Laboratory. Coordinated development and validation of the more than 400 analytical methods that the laboratory currently offers. Work extensively with a national client base to develop sampling

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strategies that are complete and cost effective. Supervise and train a staff of 12 chemists and analysts. Work closely with sales force to provide technical assistance and presentations to clients. Successfully prepared proposals for numerous contracts including several national contracts in both the government and commercial sectors. Acquired and maintained laboratory accreditation by the OEPA, AIHA and CAP. Integral member of team that grew lab from less than 100K to 1.2M. Working knowledge of OSHA, RCRA, NPDES and CAA regulations and methodology. Provide Expert Witness testimony in municipal, state and federal court system.

Analytical Chemist
Western Pennsylvania Hospital –Pittsburgh, Pennsylvania –1986 TO 1988

Responsible for the development and performance of several analytical methods for the analysis of physiological fluids to aid in the diagnosis of inborn errors of metabolism utilizing HPLC and GC/MS. Research Chemist

Magee-Womens Hospital – Pittsburgh, Pennsylvania – 1983 To 1986

Established and managed a laboratory to conduct medical research of anesthetic and analgesic agents. Developed and performed numerous analytical methods for drugs and metabolites in physiological fluids. Prepared manuscripts for publication, budget and grant proposals. Presented research findings to the medical community.

Chemistry Teacher
Quigley High School – Baden, Pennsylvania – 1981-1982

Prepared lesson plans, presented lecture and laboratory aspects of chemistry to high school juniors and seniors. Additionally, substituted for math, computer science and physics. Coached Varsity Football and Track(field events).

Education:

B.S. Chemistry and Biology Gannon University – Erie, Pennsylvania – 1981
President, Pi Kappa Alpha Fraternity.
30 Credit hours in graduate level chemistry and pharmacology University of Pittsburgh – Pittsburgh, Pennsylvania – 1981-1986

Military
Chemical Corps – U.S. Army Reserve – 1981-1993

Various assignments included Platoon leader, Operations Officer, Company Commander, and Battalion Logistics Officer. During 4 years as Company Commander was responsible for the training, administration and readiness of 125 soldiers and the maintenance of approximately 50 vehicles. Unit consistently met or exceeded all standards.

Publications:

Published several articles and abstracts in addition to numerous presentations on a variety of topics.

* Severn Trent Laboratories acquired Quanterra Incorporated on January 31, 2000.

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BATTELLE COLUMBUS QA OFFICER

Zachary J. Willenberg **Battelle**

Quality Assurance Auditor
Atmospheric Science & Applied Technology

Education:

B.S., Fisheries and Wildlife, University of Missouri, 1996
M.S., Biology, Ball State University, 2000

Additional Training:

Good Laboratory Practices – ABC Laboratories – 1997
Good Laboratory Practices, Orientation and Documentation – Battelle – 2001
Respirator Training, Half and Full Face – Battelle – 2001, 2002
Blood Borne Pathogens – Battelle – 2001
Radiation Worker Training for Unsealed Sources – Battelle - 2002
National Association of Underwater Instructors (NAUI), Open Water II – Univ. of Missouri – 1994

Qualifications:

Mr. Willenberg has four years of experience contributing to a variety of environmental programs conducted for several regulatory agencies. He is currently conducting quality assurance audits for the Atmospheric Science & Applied Technology Department at Battelle. He is responsible for data review and system audits for adherence to all regulatory requirements of the U.S. Environmental Protection Agency (EPA), as well as state agencies.

Relevant Experience:

New Jersey Sediments for Dioxin/Furan, Pesticide and PCB analysis. Performed Quality Assurance audits of data quality for laboratory notebooks, High Resolution Mass Spectrometry (HRMS) data packets, and final reports used for analysis of various dioxin/furan, pesticides and PCB congeners.

Centredale Sediments for Dioxin/Furan and PCB analysis, US Army Corps of Engineers (USACE) New England District. Performed Quality Assurance audits of data quality for laboratory notebooks, HRMS data packets and final reports used for analysis of various dioxins/furans and PCB congeners.

Centredale Tissues for Dioxin/Furan and PCB analysis, USACE New England District. Performed Quality Assurance audits of data quality for laboratory notebooks, HRMS data packets and final reports used for analysis of various dioxins/furans and PCB congeners.

Verification of Ambient Fine Particle Monitors. **Performed Quality Assurance audits of data quality**

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for data packets and final reports for use in verification of particle monitors under EPA's Environmental Technology Verification (ETV) project.

Verification of Portable Arsenic Test Kits. Performed Quality Assurance technical system audits of laboratory work and audits of data quality for data packets and final reports for use in verification of portable arsenic test kits under EPA's ETV project.

National Dioxin Air Monitoring Network (NDAMN). Performed Quality Assurance technical site audits of fieldwork under EPA's NDAMN Project.

Prior Professional Experience:

Ball State University. As a Research Biologist with Ball State University, was responsible for the collection and identification of various fish species, and the analysis of yellow perch bony structures for age and growth. This study combined fieldwork, laboratory analysis, and statistical tests to answer questions about the past effects of commercial harvest and the recent introduction of various exotic species on the age and growth, and reproductive success of yellow perch in the Indiana waters of the Lake Michigan.

ABC Laboratories, Inc. As a technical scientist with ABC Laboratories, Inc., was responsible for testing radiolabeled and non-radiolabeled compounds for biodegradation and environmental fate of agricultural chemicals for product registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). This work dealt with advanced analytical instrumentation operating under EPA Good Laboratory Practices (40 CFR 160). Projects focused primarily on soil and water metabolism,

Professional Recognition and Affiliations:

Member, American Fisheries Society.

Presentations:

Willenberg, Z.; Lauer, T., 2000. "Growth of Channel Catfish, *Ictalurus punctatus*, in the Lower 200 Miles of the Wabash River", Indiana Chapter of the American Fisheries Society Spring Meeting, held on March 2-3, 2000, Nashville, Indiana.

Willenberg, Z.; Lauer, T., 2000. "Growth of Channel Catfish, *Ictalurus punctatus*, and Flathead Catfish, *Pylodictis olivaris,* in the Lower 200 Miles of the Wabash River", Indiana Academy of Science, held on November 2-3, Richmond, Indiana.

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Electronic Data Deliverable (EDD) Specifications

EDD FIELD #	FIELD NAME	REQUIRED	DATA TYPE	FIELD WIDTH	DATA FIELD DESCRIPTION
1	NSAMPLE	Y	C	30	Field sample ID as listed on the Chain-of-Custody. The sample number indicated in this field should never be truncated. The only exception for this field not matching the chain-of-custody is for reanalyses and matrix spike results in which a RE or MS suffix will be added to the sample number respectively. For Lab QC use a unique Lab ID
2	CLASS	Y	C	15	Dioxins = 'DIOX', Metals = 'M', Volatiles = 'OV', Semivolatiles/BNAs = 'OS', Pesticides/PCBs = 'PESTP', Herbicides = 'HERB', Explosives = 'EXP', Any petroleum hydrocarbon or fuel = 'TPH', Wet Chemistry = 'WET', Radionuclide = 'RAD', Miscellaneous = 'MISC', Total Organic Carbon = 'TOC', Grain Size = 'GS'. For TCLP analyses, add "T" suffix, e.g. TCLP Metals = 'MT'.
3	PARAMETER	Y	C	45	Chemical or analyte name exactly as reported on laboratory hardcopy data package.
4	EPASAMNO	Y	C	15	If EPA Sample Number is not applicable use sample ID from NSAMPLE field.
5	CASNO		C	50	Chemical Abstract Service number for the parameter listed. The CAS number should be reported exactly as it is listed in publications such as the Merck Index. This field should be left blank for those parameters not having CAS numbers (e.g. Total PAH).
6	LAB_RESULT	Y	N	20(6)	Reported value in units specified in the UNITS field containing the proper number of significant digits. The % Recovery shall be placed in this field for matrix spike and laboratory control sample results.
7	QUAL		C	5	The laboratory qualifier as reported on the laboratory hardcopy data package. For example, a 'U' qualifier should be used for all nondetected results.
8	UNITS	Y	C	10	The units of measure as reported on the laboratory hardcopy data package.
9	CASE		C	5	In CLP Program, identifies samples sent to a laboratory over a specific period of time.
10	SDG	Y	C	15	Sample delivery group or Batch number identifier assigned by the laboratory. This number should exactly match the SDG designated on the hardcopy data package.
11	LABORATORY	Y	C	25	Laboratory name.
12	LAB_ID	Y	C	15	Laboratory ID for the given sample.
13	REC_DATE		D	8	Date sample was received by the Laboratory.
14	EXTR_DATE		D	8	Date sample was extracted or prepared by the laboratory.
15	ANAL_DATE	Y	D	8	Date sample was analyzed by the laboratory.
16	METHOD	Y	C	50	Analytical method used to quantitate parameter concentrations as listed in the laboratory technical specification (e.g. '8270A' for SW-846 Method 8270A.
17	MDL	[1]	N	15(6)	Method Detection Limit (MDL) in units specified in the UNITS field and method specified in the METHOD field.
18	IDL	[1]	N	15(6)	Instrument Detection Limit (IDL) in units specified in the UNITS field.
19	CRDL_CRQL	[1]	N	15(6)	Contract Required Detection/Quantitation Limit (CRDL/CRQL) in the units specified in the UNITS field. RDL for non-CLP parameters.
20	DIL_FACTOR		N	6(1)	Dilution factor
21	PCT_MOIST		N	5(1)	Percent moisture for soil samples; 100 for water samples.
22	COMMENTS		C	20	Analytical result qualifier or comment other than that listed in the LAB_QUAL field. Example: 'Reanalysis'.
23	DVTIER	Y	C	2	Level of data Validation. Valid values are 0 (not validated), 1 (cursory), 2 (moderately rigorous, 3 (rigorous).
24	LAB_QC_TYPE	Y	C	6	Normal Environmental Sample = "N", Laboratory Duplicate = "DUP", Matrix Spike = "MS", Matrix Spike Duplicate = "MSD", Laboratory Control Sample = "LCS", Laboratory Control Sample Duplicate = "LCSD", Method Blank = "MB", Preparation Blank = "PB", Field Replicate = "REP", Standard Reference Material = "SRM", Blank Spike = "BS".

[1] Either an IDL, MDL or CRDL_CRQL (fields 17 through 19) needs to be provided for each sample - if applicable
Y – Yes; C – Character; N – Numeric; D – Date; ( ) - number of decimal places

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Example EDD (page 1 of 2)

NSAMPLE	EPASAMNO	LAB_ID	LABORATORY	LAB_QC_TYPE	SAMP_DATE	EXTR_DATE	ANAL_DATE	CASE	SDG	PARAMETER
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Biphenyl
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	2-Methylnaphthalene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Acenaphthene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Acenaphthylene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Anthracene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Benzaldehyde
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Benzo[a]anthracene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Benzo[a]pyrene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Benzo[b]fluoranthene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Benzo[g,h,i]perylene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Benzo[k]fluoranthene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Chrysene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Dibenz[a,h]anthracene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Dibenzofuran
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Fluoranthene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Fluorene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Indeno[1,2,3-c,d]pyrene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Naphthalene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Phenanthrene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Pyrene
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Naphthalene-d8
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Phenanthrene-d10
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	Chrysene-d12
RWR-FP-5002-0000-01	RWR-FP-5002-0000-01	W5530-1	BATD	N	16-07-01	24-09-01	10-10-01		01-499	

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Example EDD (cont; page 2 of 2)

CAS_NO	CLASS	METHOD	LAB_RESULT	UNITS	QUAL	IDL	MDL	CRDL_CRQL	DIL_FACTOR	PCT_MOIST	COMMENTS	FRACTION
92-52-4	OS	BATD5-157	58.57	NG/G_DRYWT			1.73			48.08		T
91-57-6	OS	BATD5-157	170.22	NG/G_DRYWT			1.73			48.08		T
83-32-9	OS	BATD5-157	563.84	NG/G_DRYWT			1.73			48.08		T
208-96-8	OS	BATD5-157	210.65	NG/G_DRYWT			1.73			48.08		T
120-12-7	OS	BATD5-157	982.95	NG/G_DRYWT	D		34.69		33.34	48.08		T
100-52-7	OS	BATD5-157	112.08	NG/G_DRYWT			1.73			48.08		T
56-55-3	OS	BATD5-157	3311.39	NG/G_DRYWT	D		34.69		33.34	48.08		T
50-32-8	OS	BATD5-157	3204.84	NG/G_DRYWT	D		34.69		33.34	48.08		T
205-99-2	OS	BATD5-157	3263.74	NG/G_DRYWT	D		34.69		33.34	48.08		T
191-24-2	OS	BATD5-157	2183.89	NG/G_DRYWT	D		173.46		33.34	48.08		T
207-08-9	OS	BATD5-157	3098.90	NG/G_DRYWT	D		34.69		33.34	48.08		T
218-01-9	OS	BATD5-157	3844.25	NG/G_DRYWT	D		34.69		33.34	48.08		T
53-70-3	OS	BATD5-157	590.75	NG/G_DRYWT	D		34.69		33.34	48.08		T
132-64-9	OS	BATD5-157	399.25	NG/G_DRYWT			1.73			48.08		T
206-44-0	OS	BATD5-157	7686.74	NG/G_DRYWT	D		34.69		33.34	48.08		T
86-73-7	OS	BATD5-157	658.99	NG/G_DRYWT			1.73			48.08		T
193-39-5	OS	BATD5-157	2384.11	NG/G_DRYWT	D		34.69		33.34	48.08		T
91-20-3	OS	BATD5-157	302.18	NG/G_DRYWT			1.73			48.08		T
85-01-8	OS	BATD5-157	5301.36	NG/G_DRYWT	D		34.69		33.34	48.08		T
129-00-0	OS	BATD5-157	6210.02	NG/G_DRYWT	D		34.69		33.34	48.08		T
NA	OS	BATD5-157	62	PCT_REC						48.08		T
NA	OS	BATD5-157	80	PCT_REC						48.08		T
NA	OS	BATD5-157	93	PCT_REC						48.08		T

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Raw Data Elements – Battelle Duxbury

Data Package Elements	PCB Aroclor/Pesticide	SVOCs (PAHs)
Inventory Sheet	✓	✓
QA/QC Narratives	✓	✓
Sample Custody/Receipt Data		
Airbills	✓	✓
Custody forms	✓	✓
Sample tags (if available)	Will provide if not adhered to sample bottles	
Sample receipt/log-in sheets	✓	✓
Miscellaneous shipping/receiving records	✓	✓
Internal lab sample transfer/tracking records	✓	✓
Sample Data		
Final data tables (summary data; field and QC)	✓	✓
Tentatively identified compounds summary form		
Total ion chromatograms		✓
Raw spectra of target compound and background subtracted spectrum of target compound for each sample		
Mass spectra of all reported TICs/three best library matches for each sample		
Chromatograms (both columns, if applicable)	✓	
GC integration reports	✓	✓
Pesticide identification summary form [1]	✓	
For Pest/PCBs confirmed by GC/MS, copies of raw spectra	Not applicable	
GPC sample chromatograms	✓	✓
Manual worksheets	✓	✓
Sample preparation records ***(includes moisture content results)***	✓	✓
Sample acquisition logsheets [2]	✓	✓
ICP/MS raw data		
Furnace AA raw data		
Mercury raw data		
Cyanide raw data		
Other analytical raw data		
Standards Data		
MDL study final tables	✓	✓
Initial calibration reports	✓	✓
Continuing calibration reports (including pesticide degradation checks)	✓	✓
Chromatograms and quant reports for all GC/MS standards		✓
Pesticide analyte resolution summary form	Not applicable (*)	
Pesticide calibration verification summary form [3]	✓	
Pesticide analytical sequence summary form [4]	✓	
GC chromatograms and data system print outs for all GC standards	✓	
For pesticides/Aroclors confirmed by GC/MS	Not applicable	
GPC standard chromatograms	✓	✓
Florisil cartridge check summary form		
Instrument detection limits summary data		
ICP Interelement correction factors summary form		
ICP linear ranges summary form		
CRDL standards for AA and ICP summary form		
Standards preparation forms	✓	✓

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Raw Data Elements – Battelle Duxbury (continued)

Data Package Elements	PCB Aroclor/Pesticide	SVOCs (PAHs)
QC Data		
Tune reports		✓
SIS recovery data	✓	✓
MS/MSD recovery data	✓	✓
Method blank data	✓	✓
Internal standard areas/RTs (quant reports, above)	✓	✓
QC raw data (RICs, chromatograms, quant reports)	✓	✓
ICP interference check sample summary form		
Spike sample recovery summary form	✓	✓
Post digest spike sample recovery data		
Sample duplicate precision data	✓	✓
LCS recovery data	✓	✓
Standard addition results		
ICP serial dilutions summary form		
QC raw data – ICP, Furnace, mercury		
QC sample preparation records	✓	✓
Miscellaneous Data		
Copies of preparation/analysis logbooks	✓	✓
Screening records		
All instrument output from screening activities		
Preparation logs raw data	✓	✓
Percent solids data	✓	✓
Other records (QAPP, project memorandums)	✓	✓

[1] Battelle assumes this is a summary data table of target pesticides detected in project samples.
[2] Battelle assumes that acquisition logsheets are records of GC oven conditions under which samples are analyzed.
[3] Battelle assumes that the pesticide calibration verification summary form is the continuing calibration check report.
[4] Battelle assumes that the analytical sequence summary form is the hardcopy listing of samples acquired in the analytical sequence.
* Battelle SOP 5-128 does not require analyte resolution check.

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Raw Data Elements – Battelle Columbus

Data Package Elements	Dioxin/Furan/HCX
Inventory Sheet	✓
QA/QC Narratives	✓
Sample Custody/Receipt Data	
Airbills	✓
Custody forms	✓
Sample tags (if available)	Will provide if not adhered to sample bottles
Sample receipt/log-in sheets	✓
Miscellaneous shipping/receiving records	✓
Internal lab sample transfer/tracking records	✓
Sample Data	
Final data tables (summary data; field and QC)	✓
Tentatively identified compounds summary form	
Total ion chromatograms	✓
Raw spectra of target compound and background subtracted spectrum of target compound for each sample	
Mass spectra of all reported TICs/three best library matches for each sample	
Chromatograms (both columns, if applicable)	✓
GC integration reports	✓
Pesticide identification summary form	
For Pest/PCBs confirmed by GC/MS, copies of raw spectra	
GPC sample chromatograms	
Manual worksheets	✓
Sample preparation records	✓
Sample acquisition logsheets [1]	✓
ICP/MS raw data	
Furnace AA raw data	
Mercury raw data	
Cyanide raw data	
Other analytical raw data	
Standards Data	
MDL study final tables	✓
Initial calibration reports	✓
Continuing calibration reports (including pesticide degradation checks)	✓
Chromatograms and quant reports for all GC/MS standards	✓
Pesticide analyte resolution summary form	
Pesticide calibration verification summary form	
Pesticide analytical sequence summary form	
GC chromatograms and data system print outs for all GC standards	
For pesticides/Aroclors confirmed by GC/MS	
GPC standard chromatograms	
Florisil cartridge check summary form	
Instrument detection limits summary data	
ICP Interelement correction factors summary form	
ICP linear ranges summary form	
CRDL standards for AA and ICP summary form	
Standards preparation forms	✓

Raw Data Elements – Battelle Columbus (continued)

Data Package Elements	Dioxin/Furan/HCX
QC Data	
Tune reports	✓
SIS recovery data	✓
MS/MSD recovery data	✓
Method blank data	✓
Internal standard areas/RTs (quant reports, above)	✓
QC raw data (RICs, chromatograms, quant reports)	✓
ICP interference check sample summary form	
Spike sample recovery summary form [2]	✓
Post digest spike sample recovery data	
Sample duplicate precision data	✓
LCS recovery data	✓
Standard addition results	
ICP serial dilutions summary form	
QC raw data – ICP, Furnace, mercury	
QC sample preparation records	✓
Miscellaneous Data	
Copies of preparation/analysis logbooks	✓
Screening records	
All instrument output from screening activities	
Preparation logs raw data	✓
Percent solids data	✓
Other records (QAPP, project memorandums)	✓

[1] Battelle assumes that acquisition logsheets are records of GC oven conditions under which samples are analyzed.
[2] Battelle assumes that Spike Sample Recovery Summary Forms are summary report tables with recovery results

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Raw Data Elements – Battelle MSL Chemistry

Data Package Elements	Metals / MeHg
Inventory Sheet	✓
QA/QC Narratives	✓
Sample Custody/Receipt Data	
Airbills	✓
Custody forms	✓
Sample tags (if available)	Will provide if not adhered to sample bottles
Sample receipt/log-in sheets	✓
Miscellaneous shipping/receiving records	✓
Internal lab sample transfer/tracking records	✓
Sample Data	
Final data tables (summary data; field and QC)	✓
Tentatively identified compounds summary form	
Total ion chromatograms	
Raw spectra of target compound and background subtracted spectrum of target compound for each sample	
Mass spectra of all reported TICs/three best library matches for each sample	
Chromatograms (both columns, if applicable)	
GC integration reports	
Pesticide identification summary form	
For Pest/PCBs confirmed by GC/MS, copies of raw spectra	
GPC sample chromatograms	
Manual worksheets	✓
Sample preparation records	✓
Sample acquisition logsheets	
ICP/MS raw data	✓
Furnace AA raw data	✓
Mercury raw data	✓
Cyanide raw data	
Other analytical raw data	
Standards Data	
MDL study final tables	
Initial calibration reports	✓
Continuing calibration reports (including pesticide degradation checks)	✓
Chromatograms and quant reports for all GC/MS standards	
Pesticide analyte resolution summary form	
Pesticide calibration verification summary form	
Pesticide analytical sequence summary form	
GC chromatograms and data system print outs for all GC standards	
For pesticides/Aroclors confirmed by GC/MS	
GPC standard chromatograms	
Florisil cartridge check summary form	
Instrument detection limits summary data	✓
ICP Interelement correction factors summary form	
ICP linear ranges summary form	
CRDL standards for AA and ICP summary form	
Standards preparation forms	✓

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Raw Data Elements – Battelle MSL Chemistry (continued)

Data Package Elements	Metals / MeHg
QC Data	
Tune reports	
SIS recovery data	
MS/MSD recovery data	✓
Method blank data	✓
Internal standard areas/RTs (quant reports, above)	
QC raw data (RICs, chromatograms, quant reports)	✓
ICP interference check sample summary form	✓
Spike sample recovery summary form [1]	✓
Post digest spike sample recovery data	
Sample duplicate precision data	✓
LCS recovery data	✓
Standard addition results	
ICP serial dilutions summary form	
QC raw data – ICP, Furnace, mercury	✓
QC sample preparation records	✓
Miscellaneous Data	
Copies of preparation/analysis logbooks	✓
Screening records	
All instrument output from screening activities	
Preparation logs raw data	✓
Percent solids data	✓
Other records (QAPP, project memorandums)	✓

[1] Battelle assumes that Spike Sample Recovery Summary Forms are summary report tables with recovery results

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Raw Data Elements – Applied Marine Sciences

Data Package Elements	Grain Size	TOC
Inventory Sheet	✓	✓
QA/QC Narratives	✓	✓
Sample Custody/Receipt Data		
Airbills	✓	✓
Custody forms	✓	✓
Sample tags (if available)	Will provide if not adhered to sample bottles	
Sample receipt/log-in sheets	✓	✓
Miscellaneous shipping/receiving records	✓	✓
Internal lab sample transfer/tracking records	✓	✓
Sample Data		
Final data tables (summary data; field and QC)	✓	✓
Tentatively identified compounds summary form		
Total ion chromatograms		
Raw spectra of target compound and background subtracted spectrum of target compound for each sample		
Mass spectra of all reported TICs/three best library matches for each sample		
Chromatograms (both columns, if applicable)		
GC integration reports		
Pesticide identification summary form		
For Pest/PCBs confirmed by GC/MS, copies of raw spectra		
GPC sample chromatograms		
Manual worksheets	✓	✓
Sample preparation records	✓	✓
Sample acquisition logsheets		
ICP/MS raw data		
Furnace AA raw data		
Mercury raw data		
Cyanide raw data		
Other analytical raw data		
Standards Data		
MDL study final tables		✓
Initial calibration reports		✓
Continuing calibration reports (including pesticide degradation checks)		✓
Chromatograms and quant reports for all GC/MS standards		
Pesticide analyte resolution summary form		
Pesticide calibration verification summary form		
Pesticide analytical sequence summary form		
GC chromatograms and data system print outs for all GC standards		
For pesticides/Aroclors confirmed by GC/MS		
GPC standard chromatograms		
Florisil cartridge check summary form		
Instrument detection limits summary data		
ICP Interelement correction factors summary form		
ICP linear ranges summary form		
CRDL standards for AA and ICP summary form		
Standards preparation forms		

Raw Data Elements – Applied Marine Sciences (continued)

Data Package Elements	Grain Size	TOC
QC Data		
Tune reports		
SIS recovery data		
MS/MSD recovery data		
Method blank data		✓
Internal standard areas/RTs (quant reports, above)		
QC raw data (RICs, chromatograms, quant reports)	✓	✓
ICP interference check sample summary form		
Spike sample recovery summary form		
Post digest spike sample recovery data		
Sample duplicate precision data	✓	✓
LCS recovery data		
Standard addition results		
ICP serial dilutions summary form		
QC raw data – ICP, Furnace, mercury		
QC sample preparation records	✓	✓
Miscellaneous Data		
Copies of preparation/analysis logbooks	✓	✓
Screening records		
All instrument output from screening activities		
Preparation logs raw data	✓	✓
Percent solids data		
Other records (QAPP, project memorandums)	✓	✓

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Raw Data Elements – STL Pittsburgh

Data Package Elements	VOC and SVOC (phenol/phthalates)
Inventory Sheet	✓
QA/QC Narratives	✓
Sample Custody/Receipt Data	
Airbills	✓
Custody forms	✓
Sample tags (if available)	Will provide if not adhered to sample bottles
Sample receipt/log-in sheets	✓
Miscellaneous shipping/receiving records	✓
Internal lab sample transfer/tracking records	
Sample Data	
Final data tables (summary data; field and QC)	✓
Tentatively identified compounds summary form	
Total ion chromatograms	✓
Raw spectra of target compound and background subtracted spectrum of target compound for each sample	✓
Mass spectra of all reported TICs/three best library matches for each sample	
Chromatograms (both columns, if applicable)	✓
GC integration reports	✓
Pesticide identification summary form	
For Pest/PCBs confirmed by GC/MS, copies of raw spectra	
GPC sample chromatograms	
Manual worksheets	✓
Sample preparation records	✓
Sample acquisition logsheets [1]	✓
ICP/MS raw data	
Furnace AA raw data	
Mercury raw data	
Cyanide raw data	
Other analytical raw data	
Standards Data	
MDL study final tables	
Initial calibration reports	✓
Continuing calibration reports (including pesticide degradation checks)	✓
Chromatograms and quant reports for all GC/MS standards	✓
Pesticide analyte resolution summary form	
Pesticide calibration verification summary form	
Pesticide analytical sequence summary form	
GC chromatograms and data system print outs for all GC standards	
For pesticides/Aroclors confirmed by GC/MS	
GPC standard chromatograms	
Florisil cartridge check summary form	
Instrument detection limits summary data	
ICP Interelement correction factors summary form	
ICP linear ranges summary form	
CRDL standards for AA and ICP summary form	
Standards preparation forms	

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Raw Data Elements – STL Pittsburgh (continued)

Data Package Elements	VOC and SVOC (phenol/phthalates)
QC Data	
Tune reports	✓
SIS recovery data	✓
MS/MSD recovery data	✓
Method blank data	✓
Internal standard areas/RTs (quant reports, above)	✓
QC raw data (RICs, chromatograms, quant reports)	✓
ICP interference check sample summary form	
Spike sample recovery summary form [2]	✓
Post digest spike sample recovery data	
Sample duplicate precision data	✓
LCS recovery data	✓
Standard addition results	
ICP serial dilutions summary form	
QC raw data – ICP, Furnace, mercury	
QC sample preparation records	✓
Miscellaneous Data	
Copies of preparation/analysis logbooks	✓
Screening records	
All instrument output from screening activities	
Preparation logs raw data	✓
Percent solids data	✓
Other records (QAPP, project memorandums)	✓

[1] Assume that acquisition logsheets are records of GC oven conditions under which samples are analyzed.
[2] Assume that Spike Sample Recovery Summary Forms are summary report tables with recovery results.

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