Department of Energy

Portsmouth/Paducah Project Office
1017 Majestic Drive, Suite 200
Lexington, Kentucky 40513
(859) 219-4000

MAR 07 2016

Mr. Brian Begley
Federal Facility Agreement Manager
Division of Waste Management
Kentucky Department for Environmental Protection
200 Fair Oaks Lane, 2nd Floor
Frankfort, Kentucky 40601

PPPO-02-3326400-16B

Ms. Julie Corkran
Federal Facility Agreement Manager
U.S. Environmental Protection Agency, Region 4
61 Forsyth Street
Atlanta, Georgia 30303

Dear Mr. Begley and Ms. Corkran:

TRANSMITTAL OF THE 2016 UPDATE OF THE PADUCAH GASEOUS DIFFUSION PLANT PROGRAMMATIC QUALITY ASSURANCE PROJECT PLAN, DOE/LX/07-2402&D1

Please find enclosed the 2016 update of the *Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan,* DOE/LX/07-2402&D1 (P-QAPP). This P-QAPP has been updated in accordance with the approach discussed in a conference call on October 26, 2015.

The P-QAPP was written to address elements of data collection that do not change from project to project and to collect these elements into a template to be used to prepare project-specific QAPPs.

If you have any questions or require additional information, please contact me at (270) 441-6820.

Sincerely,

Jennifer Woodard

Jennifer Woodard
Paducah Site Lead
Portsmouth/Paducah Project Office

Enclosure:
PGDP Programmatic Quality Assurance Project Plan, DOE/LX/07-2402&D1

e-copy w/enclosure:
april.webb@ky.gov, KDEP/Frankfort
brian.begley@ky.gov, KDEP/Frankfort
corkran.julie@epa.gov, EPA/Atlanta
craig.jones@ffspaducah.com, FFS/Kevil
ffscorrespondence@ffspaducah.com, FFS/Kevil
gaye.brewer@ky.gov, KDEP/PAD
jana.white@ffspaducah.com, FFS/Kevil
jennifer.woodard@lex.doe.gov, PPPO/PAD
joseph.towarnicky@ffspaducah.com, FFS/Kevil
leo.williamson@ky.gov, KDEP/Frankfort
lisa.crabtree@ffspaducah.com, FFS/Kevil
mark.duff@ffspaducah.com, FFS/Kevil
michael.gerle@ffspaducah.com, FFS/Kevil
mike.guffey@ky.gov, KDEP/Frankfort
myrna.redfield@ffspaducah.com, FFS/Kevil
nathan.garner@ky.gov, KYRHB/Frankfort
pad.rmc@swiftstaley.com, SSI/Kevil
reinhard.knerr@lex.doe.gov, PPPO/PAD
rich.bonczek@lex.doe.gov, PPPO/LEX
richards.jon@epamail.epa.gov, EPA/Atlanta
stephaniec.brock@ky.gov, KYRHB/Frankfort

DOE/LX/07-2402&D1
Secondary Document

Paducah Gaseous Diffusion Plant
Programmatic Quality Assurance
Project Plan

CLEARED FOR PUBLIC RELEASE

DOE/LX/07-2402&D1
Secondary Document

Paducah Gaseous Diffusion Plant
Programmatic Quality Assurance
Project Plan

Date Issued—February 2016

U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
FLUOR FEDERAL SERVICES, INC.,
managing the
Deactivation Project at the
Paducah Gaseous Diffusion Plant
under Task Order DE-DT0007774

CLEARED FOR PUBLIC RELEASE

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENTS

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF QAPP WORKSHEETS

ACRONYMS

BGOU	Burial Grounds Operable Unit
CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
COPC	chemical (or radionuclide) of potential concern
CSM	conceptual site model
CVAA	cold vapor atomic absorption
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOECAP	DOE Consolidated Audit Program
DQI	Data Quality Indicator
DQO	data quality objective
ECD	electron capture detector
EDD	Electronic Data Deliverable
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
FID	flame ionization detector
FIDLER	field instrument for detection of low energy
FPDP	Fluor Federal Services, Inc., Paducah Deactivation Project
FSP	field sampling plan
GC	gas chromatograph
GC-MS	gas chromatograph/mass spectrometer
GPS	Global Positioning System
ICP-AES	inductively coupled plasma atomic emission spectroscopy
ICP-MS	inductively coupled plasma mass spectrometry
IDQTF	Intergovernmental Data Quality Task Force
KDEP	Kentucky Department for Environmental Protection
LATA Kentucky	LATA Environmental Services of Kentucky, LLC
LSRS	LATA-Sharp Remediation Services, LLC
MCL	maximum contaminant level
MDA	minimum detectable activity
MDL	method detection limit
MPC	measurement performance criteria
MS	matrix spike
NAL	no action level
NDIRD	non-dispersive infrared detector
OREIS	Oak Ridge Environmental Information System
PAH	polycyclic aromatic hydrocarbon
PAL	project action limit
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
PCB	polychlorinated biphenyl
PEGASIS	Portsmouth/Paducah Project Office Environmental Geographic Analytical Spatial Information System
PGDP	Paducah Gaseous Diffusion Plant
P-QAPP	Programmatic Quality Assurance Project Plan
PQL	practical quantitation limit
PQO	project quality objective

PT	proficiency testing
QA	quality assurance
QC	quality control
RAD	radionuclide
RADCON	radiation control
RCT	radiological control technician
RGA	Regional Gravel Aquifer
RI	remedial investigation
RPD	relative percent difference
SAP	sampling and analysis plan
SOP	standard operating procedure
SPP	systematic planning process
SVOA	semivolatile organic analyte
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TOC	total organic carbon
UCRS	Upper Continental Recharge System
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
VOA	volatile organic analyte
VOC	volatile organic compound
WAG	waste area group
XRF	X-ray fluorescence

1. INTRODUCTION

This update to the Programmatic Quality Assurance Project Plan (P-QAPP) has been prepared by Fluor Federal Services, Inc., Paducah Deactivation Project (FPDP) based on the most recent programmatic QAPP, *Programmatic Quality Assurance Project Plan* (DOE 2015), which was developed in alignment with the *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP Manual) guidelines for QAPPs (IDQTF 2005), as updated by the *Optimized UFP-QAPP Worksheets* guidance (IDQTF 2012). (NOTE: As in the optimized guidance, the original worksheet numbers are retained but combined per the guidance.) Table 1 in Worksheet #1 provides a crosswalk between the UFP-QAPP and the *U.S. Environmental Protection Agency Guidance on Quality Assurance Project Plans*, CIO 2106-G-05-QAPP (EPA 2012).

The UFP-QAPP is a consensus quality systems document prepared by a working group made up of representatives from the U.S. Environmental Protection Agency (EPA), the U.S. Department of Defense (DoD), and the U.S. Department of Energy (DOE). Originally issued in 2005, the UFP-QAPP was developed to provide procedures and guidance for consistently implementing the national consensus standard: American National Standards Institute/American Society of Quality E-4, *Quality Systems for Environmental Data and Technology Programs*, for the collection and use of environmental data at federal facilities.

This updated P-QAPP provides a template for development of future project-specific QAPPs. In migrating to the optimized worksheet format, additional information has been added to some of the worksheets to streamline the use of this P-QAPP in the preparation of project-specific QAPPs. As noted in the guidance (IDQTF 2012), this QAPP continues to capture some of the elements that would comprise related project-planning documents, such as a sampling and analysis plan (SAP), work plan, and field sampling plan (FSP). The example worksheets provided in the P-QAPP were developed from previously developed project-specific QAPPs.

The Paducah Gaseous Diffusion Plant (PGDP) site employs a range of sampling activities. The goal of this P-QAPP is to streamline the systematic planning process and provide uniformity of data collection and laboratory services by using this P-QAPP as a template in the development of project-specific QAPPs.

This P-QAPP captures elements of data collection that do not materially change from project to project [e.g., the requirement to use current standard operating procedures (SOPs), the cleanup criteria, the analytical methods, the use of data validation]. In addition, it presents examples that allow the P-QAPP to be used as a template to develop a project-specific QAPP to include project-specific information [e.g., data quality objectives (DQOs), schedules, number, and type of samples].

To provide uniformity, this P-QAPP does the following:

- Refers to the SOPs already developed for the site and in place;
- Establishes routinely available analytical limits; in part, to support an evaluation of the suitability of these limits to meet DQOs as part of the development of the project-specific QAPP;

- Incorporates the *Data and Documents Management and Quality Assurance Plan for Paducah Environmental Management and Enrichment Facilities*, DOE/OR/07-1595&D2 (DOE 1998); and

- Standardizes data validation processes by linking the process to SOPs (see Worksheet #21).

Additional information is provided in the P-QAPP's three appendices: Appendix A, Comparison of the Method Detection Limits to the Project Action Limits Developed Using 2015 Child Resident No Further Action, Background and Maximum Contaminant Level Concentrations (for Water Samples); Appendix B, The Role of Independent Third Party Data Validation in Meeting Data Quality Objectives at Paducah Gaseous Diffusion Plant; and Appendix C, Discussion of the Quality Assurance Criteria to be Applied to Field Analytical Methods.

This document is not a substitute for the development of project-specific QAPPs, FSPs, the decisions on DQOs, type of analyses, number of samples, type of samples, project schedule, etc., and should not be used to support performance of individual projects. The systematic planning decisions for a given project are included in the project-specific FSPs and QAPPs.

This P-QAPP focuses on providing worksheets describing fixed laboratory methods. However, selected field methods [e.g., X-ray fluorescence (XRF), colorimetric methods for polychlorinated biphenyls (PCBs), radionuclide surveys] that may be contemplated for specific projects are included. Information provided in this P-QAPP shall be reviewed and confirmed as appropriate as part of the development of the project-specific QAPP.

It is emphasized that the final, approved, project-specific QAPP is designed to be a stand-alone document containing the specifications and procedures necessary for project personnel to carry out their assigned responsibilities. For example, the field team should be able to rely on the project-specific QAPP for complete sampling instructions, including how to sample, where to sample, how many samples to collect, the types of bottles, preservatives, related quality control (QC), etc. If the approved project-specific QAPP provides insufficient procedures to carry out tasks, then SOPs that provide this information must be made available. If required elements are contained in other documents, those documents may be referenced; however, the documents must be available to personnel responsible for reviewing and implementing the project-specific QAPP.

2. GUIDE TO PREPARING A PROJECT-SPECIFIC QAPP

This P-QAPP shall be used as a template to prepare a project-specific QAPP. Although used as a template in preparing the project-specific QAPP, the information presented as examples in the P-QAPP shall be reviewed and confirmed during the preparation of the project-specific QAPP. In alignment with the optimized UFP-QAPP worksheet guidance, each worksheet of the P-QAPP includes text (presented in green) that provides instruction on how to fill out each worksheet. Typically, the green text will be deleted in the project-specific QAPP. Black text is used for the worksheet template and examples. Because this P-QAPP is to be used as a template, the worksheets generally are presented as they will be filled out for a project-specific QAPP.

This document is presented with names of the current position holders. If the person filling that position changes, the next project-specific QAPP document will incorporate the names of the new position holders. The changes applied to the project-specific QAPP will be tracked and incorporated into the P-QAPP at its annual review.

THIS PAGE INTENTIONALLY LEFT BLANK

QAPP Worksheets #1 and #2. Title and Approval Page
(UFP-QAPP Manual Section 2.1)
(EPA 2106-G-05 Section 2.2.1)

This worksheet identifies the principal points of contact for organizations having decision authority in the project and documents their commitment to implement the QAPP. Signatories usually include the lead organization's project manager, quality assurance (QA) manager, and individuals with approval or oversight authority from each regulatory agency. Signatures indicate that officials have reviewed the QAPP and concur with its implementation as written. If separate concurrence letters are issued (as is typical at PGDP), the original correspondence should be maintained with the final, approved QAPP in the project file. It is the lead organization's responsibility to make sure signatures are in place before work begins.

QAPP Worksheets #1 and #2. Title and Approval Page
(UFP-QAPP Manual Section 2.1)
(EPA 2106-G-05 Section 2.2.1)

QAPP Worksheets #1 and #2. Title and Approval Page

Site Name/Project Name: Paducah Gaseous Diffusion Plant (PGDP)/*Project Name (to be added)*
Site Location: Paducah, Kentucky
Site Number/Code: KY8890008982
Contractor Name: Fluor Federal Services, Inc., Paducah Deactivation Project (FPDP)
Contractor Number: Task Order DE-DT0007774
Contract Title: Paducah Gaseous Diffusion Plant Paducah Deactivation Project
Work Assignment Number: *(to be added)*

Document Title: *Quality Assurance Project Plan for (project name)*

Lead Organization: U.S. Department of Energy (DOE)

Preparer's Name and Organizational Affiliation: Joseph Towarnicky, Ph.D., FPDP

Preparer's Address, Telephone Number, and E-mail Address: 5511 Hobbs Road, Kevil, KY, 42053, Phone (270) 441-5134, joseph.towarnicky@ffspaducah.com

Preparation Date (Month/Year): 2/2016

Document Control Number: DOE/LX/07-2402/D1

FPDP Environmental Management Director — Signature for Mark J. Duff — Date: 3/7/16

FPDP Regulatory Affairs Manager — Signature Myrna Espinosa Redfield — Date: 3/7/16

FPDP Environmental Monitoring Project Manager — Signature Lisa Crabtree — Date: 3/7/16

QAPP Worksheets #1 and #2. Title and Approval Page (Continued)

List guidance, plans, and reports from previous investigations relevant to this project.

1. Identify guidance used to prepare QAPP:

   - Intergovernmental Data Quality Task Force, March 2005. The *Uniform Federal Policy for Implementing Environmental Quality Systems*, Version 2.0, 126 pages.
   - Intergovernmental Data Quality Task Force, March 2005. The *Uniform Federal Policy for Quality Assurance Project Plans: Part 1 UFP QAPP Manual*, Version 1.0, 177 pages (DTIC ADA 427785 or EPA-505-B-04-900A).
   - Intergovernmental Data Quality Task Force, March 2005. The *Uniform Federal Policy for Quality Assurance Project Plans: Part 2A UFP QAPP Worksheets*, Version 1.0, 44 pages.
   - Intergovernmental Data Quality Task Force, March 2005. The *Uniform Federal Policy for Quality Assurance Project Plans: Part 2B Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities*, Version 1.0, 76 pages.
   - Intergovernmental Data Quality Task Force, March 2012. *Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP QAPP Worksheets*, 42 pages.

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant*, DOE/OR/07-1707 (FFA)

3. Identify approval entities: DOE, U.S. Environmental Protection Agency (EPA) Region 4, and Kentucky Department for Environmental Protection (KDEP)

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

5. List dates of scoping sessions that were held: Initial scoping sessions held December 2010 and January 2011

Guidance, plans, and reports from previous investigations relevant to an individual project to be added under the appropriate headers above.

QAPP Worksheets #1 and #2. Title and Approval Page (Continued)

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

Title:	**Approval Date:**
Data and Documents Management and Quality Assurance Plan for Paducah Environmental Management and Enrichment Facilities, DOE/OR/07-1595&D2 (DOE 1998)	10/5/1998
Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan, DOE/LX/07-1269&D2/R1	5/14/2013 5/20/2013
Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan, Paducah, Kentucky, DOE/LX/07-1269&D21R2 (P–QAPP)	5/8/2015

7. List organizational partners (stakeholders) and connection with lead organization:
EPA Region 4, KDEP

8. List data users: DOE, FPDP, subcontractors, EPA Region 4, KDEP

9. Table 1 provides a crosswalk of required QAPP elements. No elements are omitted intentionally from this QAPP.

   If any of the elements and information are not applicable to the project, then indicate the omitted QAPP elements/information on Table 1.

   This QAPP includes all 28 worksheets that are required based on UFP-QAPP guidance, as updated with the optimized worksheet guidance. Each of these worksheets has been reviewed to ensure the accuracy of the information presented in this QAPP.

Table 1. Crosswalk: UFP-QAPP Workbook to 2106-G-05-QAPP

Optimized UFP-QAPP Worksheets		**CIO 2106-G-05 QAPP Guidance Section**	
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7, & 8	Personnel Qualifications and Sign-off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certification
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
10	Conceptual Site Model	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP ELEMENTS FOR EVALUATING EXISTING DATA
14 & 16	Project Tasks and Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection/Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field QC	2.3.5	Quality Control Requirements
21	Field SOPs	2.3.2	Sampling Procedures and Requirements
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Require
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical Quality Control and Corrective Action	2.3.5	Quality Control Requirements
29	Project Documents and Records	2.2.8	Documentation and Records Requirements
31, 32, & 33	Assessments and Corrective Action	2.4	ASSESSMENTS AND DATA REVIEW (CHECK)
		2.5.5	Reports to Management
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

QAPP Worksheet #3 and #5. Project Organization and QAPP Distribution
(UFP-QAPP Manual Section 2.3 and 2.4)
(EPA 2106-G-05 Section 2.2.3 and 2.2.4)

This worksheet identifies key project personnel, as well as lines of authority and lines of communication among the lead agency, prime contractor, subcontractors, and regulatory agencies. An example is provided below. For the purpose of the draft QAPP, it is permissible to show "TBD" (to be determined) in cases where roles have not been assigned; however, key personnel must be identified in the final, approved QAPP.

For the purpose of document control, this worksheet also is used to document recipients of controlled copies of the QAPP (See Minimum Distribution List below). The draft QAPP, final QAPP, and any changes/revisions must be provided to QAPP recipients shown on that chart. Contractors and subcontractors shown on these charts and lists are responsible for document control within their organizations.

QAPP Worksheets #3 and #5. Project Organization and QAPP Distribution
(UFP-QAPP Manual Section 2.3 and 2.4)
(EPA 2106-G-05 Section 2.2.3 and 2.2.4)

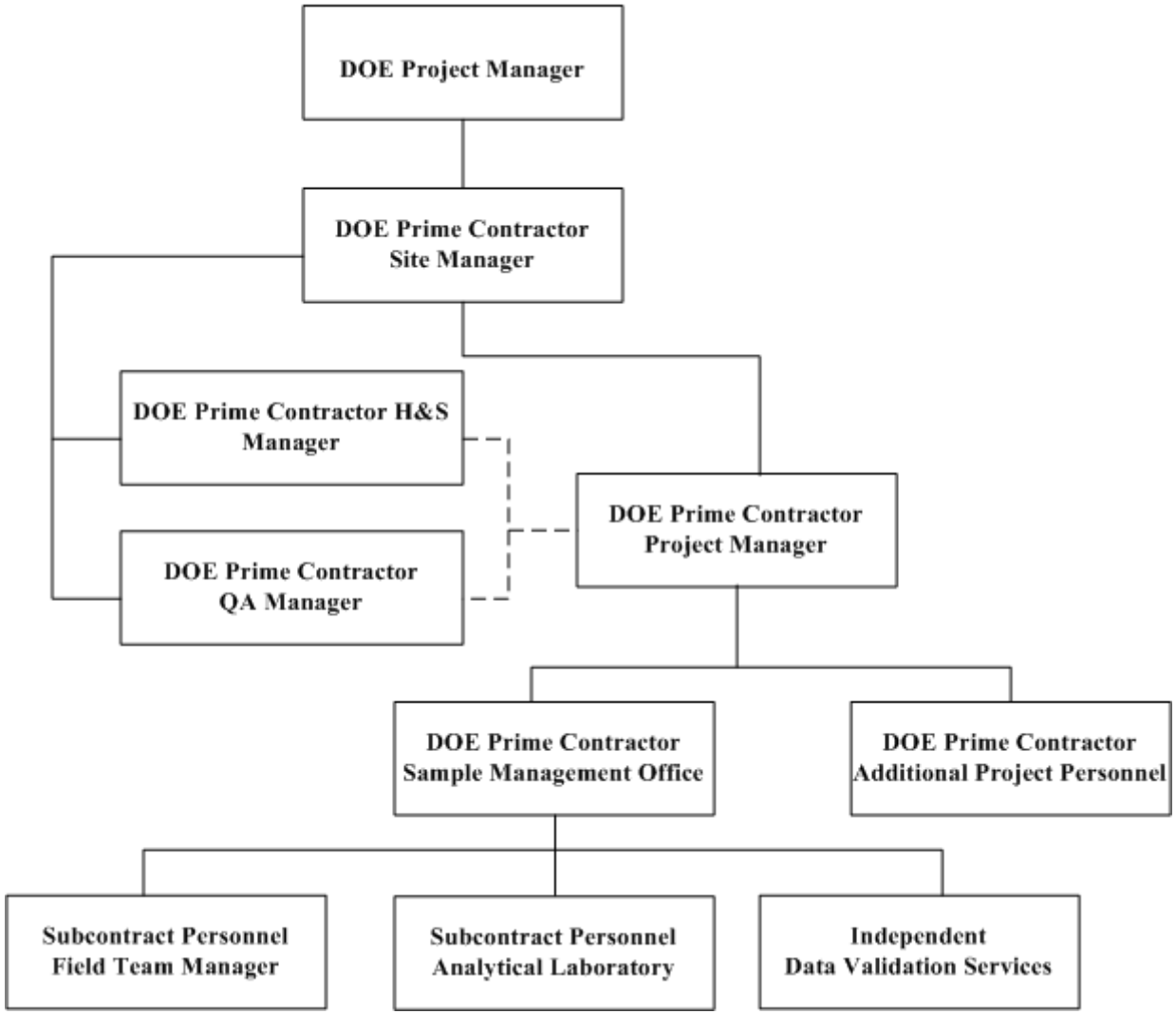
QAPP Worksheet #3. Minimum Distribution List

Distribution is based on the position title. A change in the individual within an organization will not trigger a resubmittal of the QAPP. DOE may choose to update the sheet and submit changes to the document holders. This change will not require a review by FFA stakeholders because it is not a substantive change. Managers are responsible for distribution to their staff.

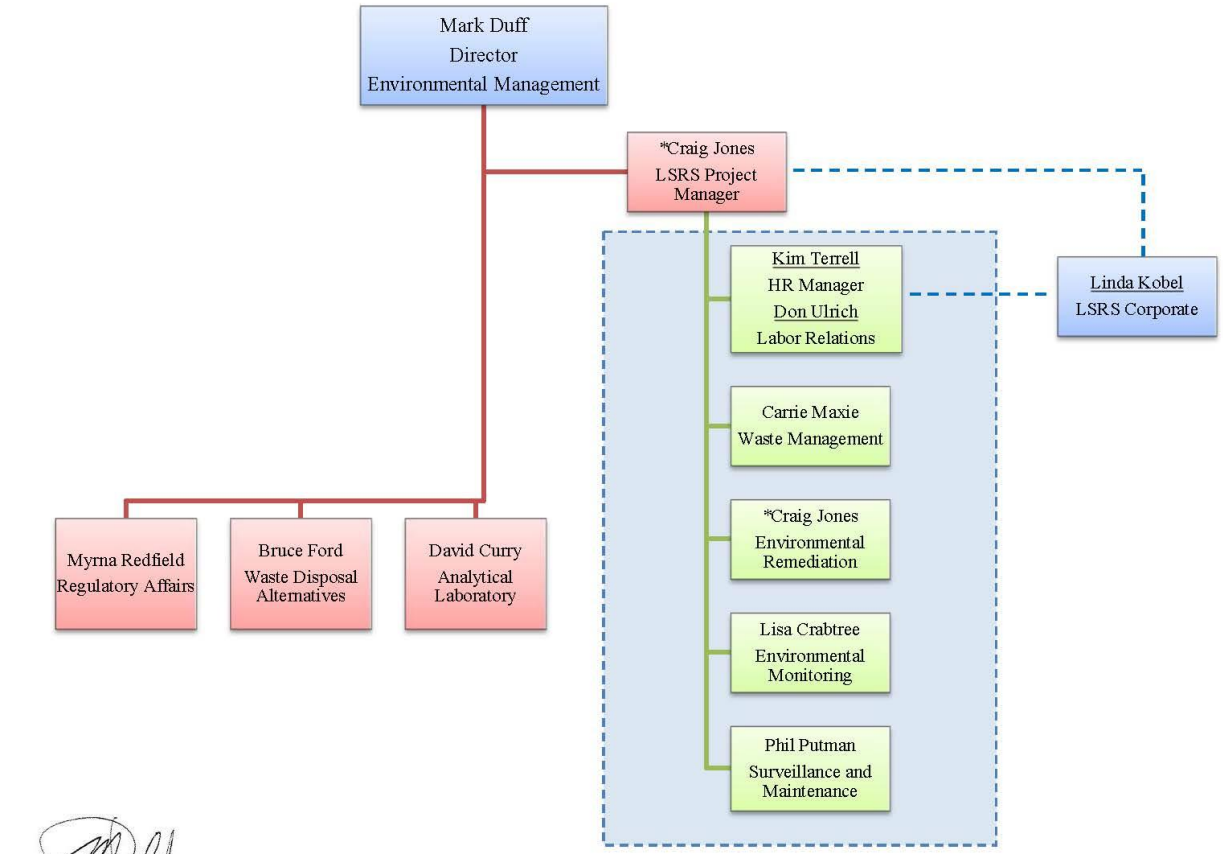
Controlled copies of the (project-specific QAPP derived from this programmatic) QAPP will be distributed according to the distribution list below. This list will be updated, as needed, and kept by the FPDP Records Management Department. Each person receiving a controlled copy also will receive any updates/revisions. If uncontrolled copies are distributed, it will be the responsibility of the person distributing the uncontrolled copy to provide updates/revisions.

Position Title	Organization	QAPP Recipients	Current Telephone Number	Current E-mail Address	Document Control Number
Paducah Site Lead	DOE	Jennifer Woodard	(270) 441-6820	jennifer.woodard@lex.doe.gov	1
FFA Manager	DOE	Tracey Duncan	(270) 441-6862	tracey.duncan@lex.doe.gov	2
Project Manager	DOE	David Dollins	(270) 441-6819	dave.dollins@lex.doe.gov	3
Director of Environmental Management	FPDP	Mark Duff	(270) 441-5030	mark.duff@ffspaducah.com	4
Regulatory Affairs Manager	FPDP	Myrna Redfield	(270) 441-5113	myrna.redfield@ffspaducah.com	5
LSRS Project Manager	FPDP	Craig Jones	(270) 441-5114	craig.jones@ffspaducah.com	6
FFA Manager	KDEP	Brian Begley	(502) 564-6716	brian.begley@ky.gov	7
Kentucky Division of Waste Management	KDEP	Gaye Brewer	(270) 898-8468	gaye.brewer@ky.gov	8
FFA Manager	EPA	Julie Corkran	(404) 562-8547	corkran.julie@epa.gov	9
Remedial Project Manager	EPA	Jon Richards	(404) 562-8648	richards.jon@epa.gov	10
Environmental Radiation Protection and Risk Assessment Manager	FPDP	LeAnne Garner	(270) 441-5136	leanne.garner@ffspaducah.	11
FFA Manager	FPDP	Jana White	(270) 441-5185	jana.white@ffspaducah.com	12
Quality Manager	FPDP	Jim Quinnette	(270) 441-5226	jim.quinnette@ffspaducah.com	13
Environmental Monitoring and Reporting Project Manager	FPDP	Lisa Crabtree	(270) 441-5135	lisa.crabtree@ffspaducah.com	14
Health and Safety Manager	FPDP	Steve Wentzel	(270) 441-6239	steve.wentzel@ffspaducah.com	15
Regulatory Compliance Manager	FPDP	Michael Gerle	(270) 441-6680	michael.gerle@ffspaducah.com	16
Sample/Data Management	FPDP	Jaime Morrow	(270) 441-5508	jaime.morrow@ffspaducah.com	17

QAPP Worksheet #5-A. Project Level Organizational Chart



QAPP Worksheet #5-B. Project Contractor Environmental Management Organizational Chart



Name: _____

Date: 09/15/15

***Dual Role**

QAPP Worksheets #4, #7, and #8. Personnel Qualifications and Sign-off Sheet
(UFP-QAPP Manual Sections 2.3.2–2.3.4)
(EPA 2106-G-05 Section 2.2.1 and 2.2.7)

This worksheet is used to identify key project personnel for each organization performing tasks defined in this QAPP. In this example, organizations include the prime contractor and laboratory. Add spaces for additional organizations and personnel as needed. This worksheet lists individual's project titles or roles; qualifications; and any specialized/nonroutine training, certifications, or clearances required by the project (e.g., explosives and ordnance disposal technician, professional engineer, certified professional geologist).

QAPP Worksheets #4, #7, and #8, Personnel Qualifications and Sign-off Sheet
(UFP-QAPP Manual Sections 2.3.2–2.3.4)
(EPA 2106-G-05 Section 2.2.1 and 2.2.7)

QAPP Worksheet #4. Project Personnel Sign-Off Sheet: Sample Collection, Data Analysis, Data Validation

Personnel actively engaged in sample collection, data analysis, and data validation for this project are required to read applicable sections of this QAPP and sign a Personnel Sign-off Sheet. The master list of signatures will be kept with the project work control documentation.

Project Position Title	Organization	Specialized Training/ Certification, if any	Signature*	Date
Sampler	FPDP	N/A		
Sample Management Office	FPDP	N/A		
Independent Third-Party Data Validator	Los Alamos Technical Associates (LATA), Ohio	N/A		
Environmental Radiation Protection and Risk Assessment Manager	FPDP	N/A		

*Signatures indicate personnel have read and agree to implement this QAPP as written.

QAPP Worksheet #7. Personnel Responsibility and Qualifications Table

ORGANIZATION: FPDP

Name	Position Title Responsible	Organization Affiliation	Responsibilities	Education and Experience Qualifications[1]
Craig Jones	Project Manager	FPDP	Overall project responsibility	> 4 years relevant work experience
E. Fraser Johnstone	Environmental Engineer/Scientist	FPDP	Project sampling and analysis plan	Bachelor degree plus > 1 year relevant work experience
Myrna Redfield	Regulatory Affairs Manager	FPDP	Project environmental compliance responsibility	Bachelor degree plus > 4 years work experience
Jana White	FFA Manager	FPDP	Project compliance with the FFA	> 4 years work relevant experience
Lisa Crabtree	Environmental Monitoring Project Manager	FPDP	Support project on sampling and reporting activities	> 4 years relevant work experience
Jaime Morrow	Sample Management Office	FPDP	Project sample and data management	> 2 years relevant work experience
Steve Wentzel	Health and Safety Manager	FPDP	Project health and safety responsibility	Bachelor degree plus > 1 year relevant experience
Bill Chase	Waste Coordinator	FPDP	Overall project waste management responsibility	> 4 years relevant experience
James Moore	Data Validator	LATA, Westerville, Ohio	Performing data validation according to specified procedures	Bachelor degree plus relevant experience
To be Added	Analytical Laboratory Project Manager	GEL Laboratories	Sample analysis and data reporting	Bachelor degree plus relevant experience

[1] Candidates who do not have a certificate or required degree but demonstrate additional "equivalent relevant work experience" can be considered when evaluating qualifications. This assessment will be conducted by the project manager as he/she assembles the appropriate team for the project.

QAPP Worksheet #8. Special Personnel Training Requirements Table

Personnel are trained in the safe and appropriate performance of their assigned duties in accordance with requirements of work to be performed. For this project, there are no special training requirements other than what normally is required for work at the PGDP site.

QAPP development uses a graded approach. A work control package will be generated prior to implementation of the project; the package will list any specific project-level training requirements.

Project Function	Specialized Training—Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Project Tasks	There has been no specialized training required for this program other than what normally is required for site work at PGDP. The contractor will evaluate specific tasks and personnel will be assigned training as necessary to perform those tasks. Training may address health and safety aspects of specific tasks as well as contractor-specific, site-specific, and task-specific requirements. Specialized training may address health and safety aspects of specific tasks as well as contractor-specific, site-specific, and task-specific requirements.	TBD	TBD	TBD	FPDP staff, subcontractors	Training files are maintained by the FPDP training organization. A training database is used to manage and track training.

If training records and/or certificates do not exist or are not available, this should be noted.
TBD = to be determined

QAPP Worksheet #6. Communication Pathways
(UFP-QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4)

This worksheet should be used to document specific issues (communication drivers) that will trigger the need to communicate with other project personnel or stakeholders. Its purpose is to ensure that there are procedures in place for providing the appropriate notifications and generating the appropriate documentation when handling important communications, including those involving regulatory interfaces, unexpected events, emergencies, nonconformances, and stop work orders. Examples are provided below; additional drivers may be added as needed.

QAPP Worksheet #6. Communication Pathways
(UFP-QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4)

QAPP Worksheet #6. Communication Pathways

NOTE: Formal communication across company or regulatory boundaries occurs via letter. Other forms of communication, such as e-mail, meetings, etc., will occur throughout the project.

Communication Drivers	Organizational Affiliation	Position Title Responsible	Procedure
Federal Facility Agreement, DOE/OR/07-1707	DOE Paducah Site Lead	Paducah Site Lead	Formal communication among DOE, EPA, and KDEP.
Federal Facility Agreement, DOE/OR/07-1707	DOE Paducah	DOE Project Manager	Formal communication between DOE and contractor for Environmental Remediation Projects.
Project requirements	FPDP	Director of Environmental Management	Formal communication among the project, the Site Lead, and the DOE Project Manager.
Project requirements	FPDP	Project Manager	Communication between the project and the FPDP Environmental Remediation Project Manager.
Project QA requirements	FPDP	Quality Manager	Project quality-related communication between the QA department and FPDP project personnel.
FFA Compliance	FPDP	Regulatory Affairs Manager	Internal communication regarding FFA compliance with the FPDP Project Manager.

NOTE: If there are additional communication requirements at the project-specific level, they will be addressed in a project-specific FSP/QAPP.

QAPP Worksheet #6. Communication Pathways (Continued)

Communication Drivers	Organizational Affiliation	Position Title Responsible	Organizational Department Manager	Procedure
Sampling Requirements	FPDP	Sample Team Lead	Environmental Monitoring	Internal communication regarding field sampling with the FPDP Project Manager.
Analytical Laboratory Interface	FPDP	Scientist	Sample Management Office	Communication between FPDP and analytical laboratory.
Waste Management Requirements	FPDP	Waste Coordinator	Project Integration and Operations Manager	Internal communication regarding project waste management with FPDP Project Manager.
Environmental Compliance Requirements	FPDP	Regulatory Compliance Manager	Regulatory Affairs Manager	Internal correspondence regarding environmental requirements and compliance with the FPDP Project Manager.
Subcontractor Requirements (if applicable)	FPDP	Subcontract Administrator	Business Manager	Correspondence among the project and subcontractors, if applicable.
Health and Safety Requirements	FPDP	Health and Safety Manager	Health and Safety Manager	Internal communication regarding safety and health requirements with the FPDP Project Manager.

NOTE: This QAPP is position based with names of the current positions. In the event the contractor changes, DOE will notify EPA and KDEP of the change.

QAPP Worksheet #9. Project Planning Session Summary
(UFP-QAPP Manual Section 2.5.1 and Figures 9-12)
(EPA 2106-G-05 Section 2.2.5)

Project Scoping Session Participant Sheet

A copy of this worksheet should be completed for each project planning session, whether sessions are internal (project teams only) or external (includes regulators and/or stakeholders). It is used to provide a concise record of participants, key decisions or agreements reached, and action items. Depending on the stage of planning, project-planning sessions should involve key technical personnel, as needed. Scoping sessions can be by phone, Web conferencing, and/or face-to-face meeting, depending upon logistical considerations. Previous meeting minutes can be included as attachments, if necessary, and referenced. Users may find it helpful to have copies of worksheets on hand for planning sessions, in whatever state of completion they may be; however, Worksheets 10, 11, 15, and 17 should be prioritized in the early stages of project planning. The following template may be modified to suit both the project and the specific planning session.

Project-specific QAPPs developed in association with FSPs will follow the same systematic planning process. The type and frequency of scoping sessions and the type and number of persons who participate in scoping sessions are related to the size and complexity of the project, technical components of the project, and the number of organizations involved. For example, small projects may use project teams that consist of only two or three people who convene via teleconference. A typical scoping component is a kick-off meeting to establish and define the roles and responsibilities of each team member, set out performance requirements for response times and project execution, and build a project team. QAPP Worksheet #9 will be completed for project-specific QAPPs. Example Worksheet #9 entries are provided below from the Solid Waste Management Unit (SWMU) 4 sampling.

QAPP Worksheet #9. Project Planning Session Summary
(UFP-QAPP Manual Section 2.5.1 and Figures 9-12)
(EPA 2106-G-05 Section 2.2.5)

QAPP Worksheet #9. Project Scoping Session Participant Sheet

Project scoping is the key to the success of any project and is part of the systematic planning process. The preparation of this QAPP included review of past documents produced and planning meetings to establish the objectives of the project. This QAPP has been prepared to be consistent with the Data Management Plan (DOE 1998) developed for the FFA. The worksheet below was completed as part of the scoping of the project.

Two scoping meetings were held concerning the SWMU 4 Sampling Project prior to developing the SAP and QAPP. The following tables include details about these meetings. A properly-prepared Worksheet #9 should include key decisions or agreements reached and action items. Scoping also may address potential relevant-to-the-project issues (e.g., geology, climate, population distributions, endangered species, etc.).

Name of Project: SWMU 4 Sampling
Date of Session: December 9, 2010
Scoping Session Purpose: DOE contractor internal scoping held to identify physical, hazard, and security constraints at SWMU 4 that might impact data collection.

Position Title	Affiliation	Name	Phone #	E-mail Address	Project Role
Project Manager	LATA Kentucky	John Samples	270-441-5080	john.samples@lataky.com	PM
BGOU Manager	LATA Kentucky	Jim Erickson	270-441-5083	jim.erickson@lataky.com	Program management
Engineering Manager	LATA Kentucky	Randy Scott	270-441-5162	randy.scott@lataky.com	Engineering support
Sample/Data Management Manager	LATA Kentucky	Lisa Crabtree	270-441-5315	lisa.crabtree@lataky.com	Laboratory requirements
Risk Manager	LATA Kentucky	Joe Towarnicky	270-441-5134	joe.towarnicky@lataky.com	Technical support
QA specialist	LATA Kentucky	Ryan Nall	270-331-0852	ryan.nall@lataky.com	QA
Waste Engineer	LATA Kentucky	Robert Owens	270-441-5356	robert.owens@lataky.com	Waste disposition
RADCON Supervisor	LATA Kentucky	Matt Morin	270-441-5330	matt.morin@lataky.com	Rad control
RADCON Tech	LATA Kentucky	Jim Mullins	240-441-5395	jim.mullins@lataky.com	Rad control
Security	SST Security	Chuck Moreland	270-441-5078	chuck.moreland@swiftstaley.com	Physical security
Engineer	GEO Consultants	Chris Marshall	270-462-3882	chris.marshall@lataky.com	Estimator

QAPP Worksheet #9. Project Scoping Session Participant Sheet (Continued)

Name of Project: SWMU 4 Sampling
Date of Session: December 9, 2010
Scoping Session Purpose: Kickoff meeting

Position Title	Affiliation	Name	Phone #	E-mail Address	Project Role
Health and Safety	LATA Kentucky	Mark Mitchell	270-519-2292	mark.mitchell@lataky.com	Safety rep
Industrial Hygiene	LATA Kentucky	J. Scott McIntyre	270-441-5789	scott.mcintyre@lataky.com	IH
Security	SST Security	Charlie Cobb	270-441-5248	charlie.cobb@swiftstaley.com	Physical security
Facility Manager	LATA Kentucky	Eddie Windhorst	270-441-5170	edward.windhorst@lataky.com	Facility manager
Nuclear Safety	LATA Kentucky	John Justice	270-441-5207	john.justice@lataky.com	Nuclear safety

Notes/comments:

Consensus decisions made:

Action items:

QAPP Worksheet #9. Project Scoping Session Participant Sheet (Continued)

Name of Project: SWMU 4 Sampling
Date of Session: January 18–19, 2011
Scoping Session Purpose: Reach agreement on the objectives of data collection with FFA managers

Name	Organization	Phone	E-mail
Ballard, Turpin	EPA	404-562-8553	ballard.turpin@epa.gov
Bonczek, Richard	DOE	859-219-4051	rich.bonczek@lex.doe.gov
Brewer, Gaye	KDWM	270-898-8468	gaye.brewer@ky.gov
Brock, Stephanie	KY RHB	502-564-8390	stephaniec.brock@ky.gov
Burright, Jeff	Sapere Consulting	541-368-5390	jburright@sapereconsulting.com
Dawson, Jana	TechLaw	703-818-3254	jdawson@techlawinc.com
Duncan, Tracey	PRC	270-441-6803	tracey.duncan@lex.doe.gov
Erickson, Jim	LATA Kentucky	270-441-5083	jim.erickson@lataky.com
Garner, Nathan	KY RHB	502-564-8390	nathan.garner@ky.gov
Gibson, Jeff	KDWM	502-564-6716	jeffrey.gibson@ky.gov
Macdonald, Emily	Sapere Consulting	509-524-2344	emacdonald@sapereconsulting.com
Richards, Walt	PRC	270-444-6839	walt.richards@lex.doe.gov
Samples, John	LATA Kentucky	270-441-5080	john.samples@lataky.com
Struttmann, Todd	LATA Kentucky	270-816-8852	todd.struttmann@lataky.com
Towarnicky, Joe	LATA Kentucky	270-217-6789	joseph.towarnicky@lataky.com
Winner, Edward	KDWM	502-564-6716	edward.winner@ky.gov
Woodard, Jennifer	DOE	270-441-6820	jennifer.woodard@lex.doe.gov

Notes/comments:

Consensus decisions made:

Action items:

QAPP Worksheet #10. Conceptual Site Model
(UFP-QAPP Manual Section 2.5.2)
(EPA 2106-G-05 Section 2.2.5)

This worksheet is used to present the project's conceptual site model (CSM). The CSM is a tool to assist in the development of DQOs. The CSM primarily uses text and/or figures, but also may include tables to convey succinctly what currently is known about the site, and it should be updated as new data are collected. As with the QAPP in general, the level of detail in the CSM should be based on the graded approach. If an investigation includes multiple sites with unique characteristics or problems to be addressed, then a separate CSM should be prepared for each site.

The CSM should include the following information:

- Background information (i.e., site history, unless this information is presented in an Executive Summary);
- Sources of known or suspected hazardous waste;
- Known or suspected contaminants or classes of contaminants;
- Primary release mechanism;
- Secondary contaminant migration;
- Fate and transport considerations;
- Potential receptors and exposure pathways;
- Land use considerations;
- Key physical aspects of the site (e.g., site geology, hydrology, topography, climate); and
- Current interpretation of nature and extent of contamination to the extent that it will influence project-specific decision-making.

Data gaps and uncertainties associated with the CSM need to be clearly identified.

QAPP Worksheet #10 may be used as an outline for the problem discussion in the QAPP. The project team developing the project-specific FSP and associated QAPP may choose to include this information in the body of the report rather than populating this worksheet. An example Worksheet #10 follows.

QAPP Worksheet #10. Conceptual Site Model
(UFP-QAPP Manual Section 2.5.2)
(EPA 2106-G-05 Section 2.2.5)

QAPP Worksheet #10. Problem Definition (Example Taken from SWMU 4 Project)

The problem to be addressed by the project: The following data gaps have been identified:

1. There is insufficient data at SWMU 4 to determine whether trichloroethene (TCE) is present in each of the burial cells, as well as the extent and mass of TCE contamination with sufficient accuracy to effectively and efficiently complete a remedial design for a TCE remedy in the burial cells.
2. There is insufficient data at SWMU 4 to determine the extent and mass of TCE contamination with sufficient accuracy to effectively and efficiently complete a remedial design of TCE in the Upper Continental Recharge System (UCRS) (i.e., soils from ground surface to the top of the Regional Gravel Aquifer (RGA) not identified as burial cells).
3. There is insufficient data at SWMU 4 to determine the extent and mass of TCE source term with sufficient accuracy to effectively and efficiently complete a remedial design for source term in the RGA.

The environmental questions being asked: What is the volume of TCE present in the disposal cells, UCRS, and RGA at SWMU 4? What other potential COCs are present?

Observations from any site reconnaissance reports: Waste Area Group (WAG) 3 sampling indicated TCE contamination along with metals, PCBs, and radiological contaminants; however, the samples from WAG 3 were not taken from within the primary disposal cells. WAG 3 and other existing SWMU 4 data are summarized in the Burial Grounds Operable Unit (BGOU) Remedial Investigation (RI) Report.

A synopsis of secondary data or information from site reports: Section 3 of the work plan describes the secondary data used to develop DQOs.

The possible classes of contaminants and the affected matrices: The primary contaminant of concern is TCE. Other potential contaminants include technetium-99 (Tc-99), uranium, vinyl chloride, *cis*-1,2-dichloroethene (DCE), and PCBs. Affected matrices are expected to be as follows (if present).

1. Soil
2. Water

The rationale for inclusion of chemical and nonchemical analyses: Worksheet #11 presents rationale for inclusion of chemical and nonchemical analyses

Information concerning various environmental indicators: Groundwater investigations have indicated SWMU 4 as contributor to the TCE contamination plume. Buried waste cells were identified based on the geophysical investigation of the SWMU. Worksheet 13 includes a list of investigation reports associated with SWMU 4.

Project decision conditions ("If..., then..." statements): If there is an insufficient sample volume of soil or water for any particular sample point to conduct planned analysis, then the following priority shall be given to filling sample containers: first, volatile organic compounds (VOCs); second, radionuclides (RADs); third, metals; fourth, PCBs; fifth, semivolatile organic compounds (SVOCs); and sixth, geotechnical and other remedial design parameters listed in Worksheet #17B.

Additional contingency investigations and decision rules are listed in Section 5.1 of this document.

NOTE: This sheet is a summary of the project and will be described in the project-specific FSP problem definition information. The project manager will ensure these components are part of the FSP. Completion of a separate Worksheet #10 to identify where these components are located in the FSP is at the discretion of the project manager.

QAPP Worksheet #11. Project/Data Quality Objectives
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

Project Quality Objectives/Systematic Planning Process Statements

This worksheet is used to develop and document project quality objectives (PQOs) or DQOs using a systematic planning process (SPP). Examples of SPP include (1) the DQO process[2] and (2) the U.S. Army Corps of Engineers' Technical Planning Process.[3] This statement (along with all other statements in this P-QAPP) must be confirmed in the preparation of the project-specific QAPP or modified, as needed. The type of SPP used will vary based on the graded approach. This worksheet mainly is populated as text, although some diagrams that capture decision processes are recommended. Regardless of the SPP applied, the QAPP must document the environmental decisions that need to be made and the level of data quality needed to ensure that those decisions are based on sound scientific data. The following guidelines are based on EPA's seven-step DQO process.

1. State the Problem. The problem statement should be consistent with information contained in the CSM (Worksheet #10).

2. Identify the Goals of the Study. Identify specific study questions and define alternative outcomes. The goals for either decision or estimation problems should explain how the data will be used to answer questions and choose among the stated alternatives. Characterizing the "nature and extent of contamination" is a commonly stated but inappropriate study goal because it is vague and not focused on potential outcomes.

3. Identify Information Inputs. Specify the types of data that are required to fill gaps in the CSM. Explain in specific terms how data will be used. In addition to analytical data, this could include published information on geology, climate, population distributions, endangered species, etc. Information inputs should be consistent with decisions made during project scoping, as documented on Worksheet #9.

4. Define the Boundaries of the Study. Specify the target population and characteristics of interest, define spatial/temporal limits, and the scale of inference (i.e., which populations will be represented by which data). Developing the list of target analytes presents one of the greatest opportunities for streamlining a project, as it can help avoid unnecessary costs associated with sampling, analysis, data review, reporting, and management. Target analytes should be focused on specific constituents reasonably known or suspected to be present. The list of target analytes should be based on data gaps in the CSM. Focusing the list of analytes also provides better opportunities for optimizing method performance to best suit those analytes.

[2] Guidance on Systematic Planning Using the Data Quality Objectives Process, U.S. EPA, EPA QA/G-4, February 2006.
[3] Technical Project Planning Process, U.S. Army Corps of Engineers, EM 200-1-2, August 1998.

QAPP Worksheet #11. Project/Data Quality Objectives (Continued)
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

Project Quality Objectives/Systematic Planning Process Statements

5. Develop the Analytic Approach. Define the parameter(s) of interest; specify the type of inference (e.g., "samples from groundwater monitoring wells x, y, and z will represent potable water at the site); and develop the logic for drawing conclusions from findings (i.e., which sample results will be used to support which decisions.) For decision problems, these are expressed as "if---then" statements, or decision rules, that link potential results with conclusions or future actions. For estimation problems, specify the estimator and the estimation procedure.

6. Specify Performance or Acceptance Criteria. For projects that involve hypothesis testing (e.g., presence or absence of contamination exceeding some threshold value) for decision-making, this will involve specifying probability limits for decision errors. For estimations and other analytic approaches (e.g., estimating the volume of groundwater or soil potentially requiring remediation), this will involve the development of performance criteria (for new data being collected) or acceptance criteria (for existing data being considered for use).

7. Develop the Detailed Plan for Obtaining Data. Worksheet #11 generally will briefly explain the basis for the sampling design and then refer to Worksheet #17, Sample Design and Rationale, for further details. Worksheets #19, 20, 24–28, and 30 will specify analysis design requirements.

QAPP Worksheet #11. Project/Data Quality Objectives (Continued)
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

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

This worksheet details the standards for field and analytical data quality. Analytical data will be generated by DOE Consolidated Audit Program (DOECAP) laboratories utilizing approved laboratory test methods. The overall PQOs are to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will meet the DQOs of this project.

Who will use the data? DOE, FPDP, KDEP, and EPA.

What will the data be used for? To eliminate the data gaps identified in Worksheet #10.

What type of data is needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques): **From SWMU 4 Investigation:** Soil gas data, concentrating on VOCs, from passive soil gas investigation monitors analyzed by fixed-base analytical laboratory techniques. Field screening samples from XRF analysis of soil samples and PCB test kits also will be used to determine subsequent sample locations (see Section 5 of the work plan and FSP). VOCs and Tc-99 data from both soil and water samples using fixed-base analytical laboratory techniques. Selected samples (see Worksheet #18) will be analyzed for the full radiological, VOC, SVOC, and PCB suites and for Resource Conservation and Recovery Act (RCRA) metals plus contaminant of concern (COC) metals from the BGOU RI. Geotechnical and other related samples that may be needed for remedy selection and implementation will be collected (see Worksheet #17-B).

How "good" do the data need to be in order to support the environmental decision? Data needs to meet the measurement quality objective and data quality indicators established by the systematic planning process consistent with procedure CP3-ES-5003, *Quality Assured Data;* CP2-ES-0063, *Environmental Monitoring Data Management Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky;* and CP3-EM-1003, *Developing, Implementing, and Maintaining Data Management Implementation Plans*.

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

Who will collect and generate the data? FPDP. Additionally, meteorological data may be acquired from other sources, as needed.

How will the data be reported? Field data will be recorded on chain-of-custody forms, in field logbooks, and field data sheets. The fixed-base laboratory will provide data in an Electronic Data Deliverable (EDD). Project data following verification assessment and validation will be placed into and reported from the Paducah Oak Ridge Environmental Information System (OREIS). Data loaded into Paducah OREIS will be made available to the public stakeholders via the Portsmouth/Paducah Project Office Environmental Geographic Analytical Spatial Information System (PEGASIS).

How will the data be archived? Electronic data will be archived in OREIS in accordance with Section 8.5 (Data and Records Archival) of the *Data and Documents Management and Quality Assurance Plan* (DOE 1998).

NOTE: The worksheet is completed partially with items that will be consistent across project-specific FSPs. The project-specific FSPs will need to populate the balance of this worksheet.

QAPP Worksheet #12. Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

This worksheet documents the quantitative measurement performance criteria (MPC) in terms of precision, bias, and sensitivity for both field and laboratory measurements and is used to guide the selection of appropriate measurement techniques and analytical methods. MPC are developed to ensure collected data will satisfy the PQOs or DQOs documented on Worksheet #11. A separate worksheet should be completed for each type of field or laboratory measurement. For analytical methods, MPC should be determined for each matrix, analyte, and concentration level. [Qualitative MPC (representativeness and comparability) should be addressed in the sample design, which is documented on Worksheet #17.] If MPC are analyte-specific, include this detail in a separate table or modify this worksheet as necessary. Example QAPP Worksheet #12 information is provided below representing the currently used analytical methods. The listed methods have been reviewed to ensure that the criteria summarized below are aligned with those presented in the method. In the preparation of the project-specific QAPP, this information shall be confirmed. Changes in the method or laboratory can result in changes to these criteria.

QAPP Worksheet #12. Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Sampling will follow the referenced standard operating procedures. The following tables provide the measurement performance criteria.

QAPP Worksheet #12-A. Measurement Performance Criteria

Matrix	Soil/Sediment
Analytical Group[1]	Volatile Organic Compounds
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SW-846-8260	Precision–Lab	RPD–≤ 25%	Laboratory Duplicates	A
		Precision	RPD–≤ 35%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Trip Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

PQL = practical quantitation limit; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-B. Measurement Performance Criteria

Matrix	Soil/Sediment
Analytical Group[1]	Metals (aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, selenium, silver, thallium, uranium, vanadium, and zinc)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	200.8/ SW-846-6010/6020	Precision–Lab	RPD–≤ 20%	Laboratory Duplicates	A
		Precision	RPD–≤ 35%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias-Contamination	No target compounds > PQL	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

PQL = practical quantitation limit; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-C. Measurement Performance Criteria

Matrix	Soil/Sediment
Analytical Group[1]	Metals (Mercury)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SW-846-7471	Precision–Lab	RPD–≤ 20%	Laboratory Duplicates	A
		Precision	RPD–≤ 35%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias-Contamination	No target compounds > PQL	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

PQL = practical quantitation limit; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-D. Measurement Performance Criteria

Matrix	Soil/Sediment
Analytical Group[1]	PCBs
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SW-846-8082	Precision–Lab	RPD–≤ 25%	Laboratory Duplicates	A
		Precision	RPD–≤ 35%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias-Contamination	No target compounds > PQL	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

PQL = practical quantitation limit; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-E. Measurement Performance Criteria

Matrix	Soil/Sediment
Analytical Group[1]	Radionuclides (uranium-234, uranium-235, uranium-238)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	Alpha spectroscopy	Precision–Lab	RPD–≤ 25%	Laboratory Duplicates	A
		Precision	RPD–≤ 50%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > MDA	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

MDA = minimum detectable activity; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-F. Measurement Performance Criteria

Matrix	Soil/Sediment
Analytical Group[1]	Radionuclides (americium-241, neptunium-237, plutonium-238, plutonium-239/240, thorium-230)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	Alpha spectroscopy	Precision–Lab	RPD–≤ 25%	Laboratory Duplicates	A
		Precision	RPD–≤ 50%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > MDA	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

MDA = minimum detectable activity; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-G. Measurement Performance Criteria

Matrix	Soil/Sediment
Analytical Group[1]	Radionuclides (cesium-137)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	Gamma spectroscopy	Precision–Lab	RPD–≤ 25%	Laboratory Duplicates	A
		Precision	RPD–≤ 50%	Field Duplicates	S
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

MDA = minimum detectable activity; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
Note: Cobalt-60 was deleted from the P-QAPP because it is not a site-related constituent of potential concern. Should an individual project investigate cobalt-60, it should be added back to the project-specific QAPP.

QAPP Worksheet #12-H. Measurement Performance Criteria

Matrix	Soil/Sediment
Analytical Group[1]	Radionuclides (technetium-99)
Concentration Level	Low

Sampling Procedure[2]	**Analytical Method/SOP**[3, 4]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
	Liquid scintillation	Precision–Lab	RPD–≤ 25%	Laboratory Duplicates	A
		Precision	RPD–≤ 50%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > MDA	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

MDA = minimum detectable activity; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-I. Measurement Performance Criteria

Matrix	Soil/Sediment
Analytical Group[1]	Semivolatile Organic Compounds
Concentration Level	Low

Sampling Procedure[2]	**Analytical Method/SOP**[3, 4]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
	SW-846-8270	Precision–Lab	RPD–< 25%	Laboratory Duplicates	A
		Precision	RPD–< 35%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Trip Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

PQL = practical quantitation limit; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-J. Measurement Performance Criteria

Matrix	Water
Analytical Group[1]	Semivolatile Organic Compounds
Concentration Level	Low

Sampling Procedure[2]	**Analytical Method/SOP**[3, 4]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
	SW-846-8270	Precision–Lab	RPD–< 25%	Laboratory Duplicates	A
		Precision	RPD–< 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Trip Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

PQL = practical quantitation limit; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-K. Measurement Performance Criteria

Matrix	Water/Groundwater
Analytical Group[1]	Volatile Organic Compounds
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SW-846-8260	Precision–Lab	RPD–≤ 25%	Laboratory Duplicates	A
		Precision	RPD–≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Trip Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

PQL = practical quantitation limit; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-L. Measurement Performance Criteria

Matrix	Water/Groundwater
Analytical Group[1]	Metals (aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, selenium, silver, thallium, uranium, vanadium, and zinc)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	200.8/ SW-846-6010/6020	Precision–Lab	RPD–≤ 20%	Laboratory Duplicates	A
		Precision	RPD–≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias-Contamination	No target compounds > PQL	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

PQL = practical quantitation limit; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-M. Measurement Performance Criteria

Matrix	Water/groundwater
Analytical Group[1]	Metals (Mercury)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SW-846-7470	Precision–Lab	RPD–≤ 20%	Laboratory Duplicates	A
		Precision	RPD–≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias-Contamination	No target compounds > PQL	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

PQL = practical quantitation limit; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-N. Measurement Performance Criteria

Matrix	Water/groundwater
Analytical Group[1]	PCBs
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SW-846-8082	Precision–Lab	RPD–≤ 25%	Laboratory Duplicates	A
		Precision	RPD–≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias-Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias-Contamination	No target compounds > PQL	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

PQL = practical quantitation limit; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-O. Measurement Performance Criteria

Matrix	Water/groundwater
Analytical Group[1]	Radionuclides (americium-241, neptunium-237, plutonium-238, plutonium-239/240, thorium-230, uranium-234, uranium-235, uranium-238)
Concentration Level	Low

Sampling Procedure[2]	**Analytical Method/SOP**[3, 4]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
	Alpha spectroscopy	Precision–Lab	RPD–≤ 25%	Laboratory Duplicates	A
		Precision	RPD–≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > MDA	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

MDA = minimum detectable activity; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-P. Measurement Performance Criteria

Matrix	Water/groundwater
Analytical Group[1]	Radionuclides (cesium-137)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	Gamma spectroscopy	Precision–Lab	RPD–≤ 25%	Laboratory Duplicates	A
		Precision	RPD–≤ 25%	Field Duplicates	S
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

MDA = minimum detectable activity; RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.

QAPP Worksheet #12-Q. Measurement Performance Criteria

Matrix	Water/groundwater
Analytical Group[1]	Radionuclides (technetium-99)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	Liquid scintillation	Precision–Lab	RPD–≤ 25%	Laboratory Duplicates	A
		Precision	RPD–≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[6]	Laboratory Sample Spikes	A
		Accuracy/Bias-Contamination	No target compounds > MDA	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseates	S
		Completeness[5]	90%	Data Completeness Check	S&A

MDA = minimum detectable activity
RPD = relative percent difference.
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #23.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.
[6] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

QAPP Worksheet #12-R. Measurement Performance Criteria

Matrix	Soil
Analytical Group[1]	Metals (uranium)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3, 4]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SW-846-6200 (XRF)	Precision	RPD–35%	Field Duplicates	S
		Accuracy/Bias-Contamination	No target compounds > QL	Method Blanks/Instrument Blanks	A
		Completeness[5]	90%	Data Completeness Check	S&A

QL = quantitation limit
RPD= relative percent difference
XRF = X-ray fluorescence
[1] If information varies within an analytical group, separate by individual analyte.
[2] Reference number from QAPP Worksheet #21.
[3] Reference number from QAPP Worksheet #21.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.

QAPP Worksheet #12-S. Measurement Performance Criteria

Matrix	Soil/sediment
Analytical Group[1]	Total PCBs (Aroclor 1016, 1232, 1242, 1248, 1254, 1260)
Concentration Level	Moderate

Sampling Procedure[2]	**Analytical Method/SOP**[3, 4]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Per manufacturer's instructions	SW-846-4200 (immunoassay test kit)	Precision	N/A	Compare results against laboratory values	S
		Accuracy/Bias-Contamination	N/A	Compare results against laboratory values	A
		Completeness[5]	N/A	Compare results against laboratory values	S&A

N/A = not applicable
QL = quantitation limit
PCB = polychlorinated biphenyl

[1] If information varies within an analytical group, separate by individual analyte.
[2] No procedure specific to method; use manufacturer's instructions.
[3] SW-846 Method; No SOP specific to Method; use manufacturer's instructions.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.

QAPP Worksheet #12-T. Measurement Performance Criteria

Matrix	Soil/sediment
Analytical Group[1]	PAHs (3-, 4-, 5-ring compounds including phenanthrene, anthracene, fluorine, benzo(a)anthracene, chrysene, fluoranthene, pyrene)
Concentration Level	Moderate

Sampling Procedure[2]	**Analytical Method/SOP**[3, 4]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Per manufacturer's instructions	SW-846-4035 (PAH test kit)	Precision	N/A	Compare results against laboratory values Field Duplicates	S
		Accuracy/Bias-Contamination	N/A	Compare results against laboratory values Method Blanks/Instrument Blanks	A
		Completeness[5]	N/A	Compare results against laboratory values Data Completeness Check	S&A

N/A = not applicable
QL = quantitation limit
PAH = polycyclic aromatic hydrocarbon

[1] If information varies within an analytical group, separate by individual analyte.
[2] No procedure specific to method; use manufacturer's instructions.
[3] SW-846 Method; No SOP specific to Method; use manufacturer's instructions.
[4] The most current version of the method will be used.
[5] Completeness is calculated as the number of samples planned to be collected divided by the number of sample results that were rejected.

QAPP Worksheet #12-U. Measurement Performance Criteria

Matrix	Air
Analytical Group[1]	C-400 volatile organic compounds (VOCs), including trichloroethene; 1, 2-dichloroethene; vinyl chloride; 1,1-dichloroethene
Concentration Level	Very Low

Sampling Procedure[2]	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
CP4-ER-1035, Vapor Sampling	EPA-TO-15, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air: Determination of Volatile Organic Compounds (VOCs) in Air Collected In Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)	Precision-Lab	N/A	Evaluate lab data packages	A

N/A = not applicable

[1] If information varies within an analytical group, separate by individual analyte.
[2] The most current version of the method will be used.

QAPP Worksheet #13. Secondary Data Uses and Limitations
(UFP-QAPP Manual Section 2.7)
(EPA 2106-G-05 Chapter 3: QAPP Elements for Evaluating Existing Data)

This worksheet should be used to identify sources of secondary data (i.e., data generated for purposes other than this specific project or data pertinent to this project generated under a separate QAPP) and summarize information relevant to their uses for the current project. This worksheet should be supplemented by text describing specifically how secondary data will be used. The project team needs to carefully evaluate the quality of secondary data (in terms of precision, bias, representativeness, comparability, and completeness) to ensure they are of the type and quality necessary to support their intended uses. Secondary data can include the following: sampling and testing data collected during previous investigations, historical data, background information, interviews, modeling data, photographs, aerial photographs, topographic maps, and published literature. When evaluating the reliability of secondary data and determining limitations on their uses, consider the source of the data, the time period during which they were collected, methods by which data were collected, potential sources of uncertainty, the type of supporting documentation available, and the comparability of data collection methods to the currently proposed methods. Examples are provided below.

QAPP Worksheet #13. Secondary Data Uses and Limitations
(UFP-QAPP Manual Section 2.7)
(EPA 2106-G-05 Chapter 3: QAPP Elements for Evaluating Existing Data)

QAPP Worksheet #13. Secondary Data Criteria and Limitations Table (from SWMU 4)

Secondary Data Type	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Factors Affecting Reliability and Limitations on Data Use
OREIS Database	Various	Various	Data will be used to determine the nature and extent of soil, sediment, surface water, and groundwater contamination. The data in the OREIS database will be used in conjunction with newly acquired data to fill data gaps, as described in Worksheet #10 (e.g., COC data in the OREIS database will be used in conjunction with newly acquired data, using professional judgment considering the uncertainties of the historic data, to determine whether COCs are present in the burial cells, as well as the extent and mass of TCE contamination with sufficient accuracy to complete a remedial design for a remedy in the burial cells).	Data have been verified, assessed, and validated (if validation is required). Rejected data will not be used. The changes that may have taken place in the *in situ* environmental media because collecting older data must be considered.

QAPP Worksheet #13. Secondary Data Uses and Limitations (Continued)
(UFP-QAPP Manual Section 2.7)
(EPA 2106-G-05 Chapter 3: QAPP Elements for Evaluating Existing Data)

QAPP Worksheet #13. Secondary Data Criteria and Limitations Table (from SWMU 4) (Continued)

Historical Documentation	CH2M Hill 1992. *Results of the Site Investigation, Phase II, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, KY/Sub/13B-97777C P03/1991/1. Clausen, J. L., K. R. Davis, J. W. Douthitt, and B. E. Phillips 1992. *Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III*, KY/E-150, Paducah, KY. DOE 2000a. *Remedial Investigation Report for Waste Area Grouping 3 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1895/V1-V4&D1, U.S. Department of Energy, Paducah, KY, September. DOE 2000b. *Data Report for the Sitewide Remedial Evaluation for Source Areas Contributing to Off-site Groundwater Contamination at the Paducah Gaseous Diffusion Plant, Paducah Kentucky*, DOE/OR/07-1845&D1). DOE 2007. *Site Investigation Report for the Southwest Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2180&D2/R1. DOE 2010. *Remedial Investigation Report for the Burial Grounds Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0030&D2/R1. DOE 2011a. *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2010 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PAD/ENR/0130.	DOE contractors, soil and water, 1998–2008 Various	Information will be used in conjunction with newly collected data to determine whether COCs are present in the burial cells, as well as the extent and mass of TCE contamination with sufficient accuracy to complete a remedial design for a remedy in the burial cells. Information will be used as guidance on related project work.	Data have been verified, assessed, and validated (if validation required). Rejected data will not be used. Information from historical documents will be limited to the available documentation as it relates to a specific project. Use of historical data may be limited based on how long ago the data were collected and whether site conditions have changed since data collection.

NOTE; OREIS is the repository for PGDP environmental and waste characterization analytical results. OREIS is a limited access database. Most of the results in OREIS are downloaded to PEGASIS periodically (usually on a quarterly basis). The general public can access data in PEGASIS.

QAPP Worksheets #14/16. Project Tasks & Schedule
(UFP-QAPP Manual Section 2.8.2)
(EPA 2106-G-05 Section 2.2.4)

Summary of Project Tasks

The QAPP should include a project schedule showing specific tasks, the person or group responsible for their execution, and planned start and end dates. Options for presenting this information include the following template or a Gantt chart that can be attached and referenced. Examples of activities that should be listed include key on-site and off-site activities. Any critical steps and dates should be highlighted.

The table will not need to be included as a worksheet as long as a schedule is included with the site-specific FSP. If the schedule is provided in the FSP, the QAPP should include a statement such as the following: The project-specific FSP includes a project-specific schedule with the minimum of the information included in Worksheet #16.

An example Worksheet #16 from the SWMU 4 QAPP follows.

QAPP Worksheets #14/16. Project Tasks & Schedule
(UFP-QAPP Manual Section 2.8.2)
(EPA 2106-G-05 Section 2.2.4)

QAPP Worksheet #14. Summary of Project Tasks*

Sampling Tasks: Collect samples, prepare blanks, preserve samples, document field notes, complete chain-of-custody, label samples, package/ship samples per standard operating procedures Worksheet #21.

Analysis Tasks: Receive samples, complete chain-of-custody, extract samples, analyze extract, review data, report data per standard methods in Worksheet #21.

Quality Control Tasks: QC will be per QAPP worksheets as follows:

- QC samples—Worksheets #20 and #28
- Equipment calibration—Worksheets #22 and #24
- Data review/validation—Worksheets #34, #35, #36, and #37

Secondary Data: See Worksheet #13.

Data Management Tasks: Data management will be per procedure CP4-ES-5007, *Data Management Coordination*; CP3-ES-1003, *Developing, Implementing, and Maintaining Data Management Implementation Plan; and* CP2-ES-0063, *Environmental Monitoring Data Management Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*.

Documentation and Records: Documentation and records will be per procedure CP3-RD-0010, *Records Management Process.*

Assessment/Audit Tasks: Assessments and audits will be per procedure CP3-QA-1003, *Management and Self Assessments.*

Prior to mobilization to perform fieldwork, an independent assessment (Internal Field Readiness Review) will be conducted to determine if the project is prepared to proceed (e.g., scope has been defined and is understood by workforce, scope has regulatory approval, scope properly contracts, personnel properly training to complete).

One management assessment will be performed during each phase (Phase I, II, III, IV) of field implementation to verify work is being performed consistent with the SAP. See project schedule on Worksheet #16.

Data Review Tasks: Data review tasks will be per procedure CP3-ES-5003, *Quality Assured Data;* and CP2-ES-0063, *Environmental Monitoring Data Management Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky.*

*It is understood that SOPs are contractor specific.

QAPP Worksheet #16. Project Schedule/Timeline Table

This schedule for this project is provided below. This schedule was taken from the SWMU 4 project.

Activities	Organization	Dates*		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
SWMU 4 Sampling	BGOU	05-Apr-12	31-Aug-13	N/A	N/A
Procurement/Work Package Development and Management Readiness Review	BGOU	05-Apr-12	13-Jan-15	N/A	N/A
Phase I					
Collection of Soil & Gas Samples****	BGOU	27-Aug-12	01-Nov-12	Samples	01-Nov-12
Sample Analysis	BGOU	04-Sep-12	31-Nov-12	Data	31-Nov-12
Determine 20-ft boring locations based on soil gas analysis**	BGOU	01-Dec-12	04-Jan-13	Locations of 20 ft borings	04-Jan-13
Phase II					
Collection of Samples****	BGOU	15-Dec-12	18-Jan-13	Samples	18-Jan-13
Sample Analysis	BGOU	20-Dec-12	18-Feb-13	Data	18-Feb-13
Determine locations for 60-ft borings**	BGOU	26-Jan-13	18-Feb-13	Locations for 60 ft borings	18-Feb-13
Phase III (initial 11 borings)					
Collection of Samples****	BGOU	22-Jan-13	16-June-13	Samples	16-June-13
Sample Analysis	BGOU	25-Feb-13	20-Sept-13	Data	20-Sept-13
Determine locations for 16 additional borings	BGOU	21-Sept-13	21-March-14	Acceptance Letter	21-March-14
QAPP revision and approval	BGOU	22-March-14	23-Oct-14	Approval Letter	23-Oct-14
Phase III (final 16 borings)					
Collection of Samples****	BGOU	7-Nov-14	09-Dec-14	Samples	16-Dec-14
Sample Analysis	BGOU	8-Nov-14	02-March-15	Data	02-March-15
Determine RGA boring locations**	BGOU	27-Sept-13	07-Apr-15	RGA boring locations	07-Apr-15
Phase IV					
Collection of Samples****	BGOU	15-May-15	06-Jul-15	Samples	15-Jul-15
Sample Analysis	BGOU	15-May-15	06-Aug-15	Data	06-Aug-15
Determine RGA MW locations**	BGOU	07-Aug-15	11-Sept-15	RGA MW locations	11-Sept-15
Phase V					
Install/Develop Monitoring Wells**	BGOU	21-Sept-15	6-Nov-15	Wells	6-Nov-15
Water Sample and Analysis	BGOU	09-Nov-15	09-Dec-15	Inclusion in RI Report	Established in SMP

Worksheet #16. Project Schedule/Timeline Table (Continued)

Activities	Organization	Dates*		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Slug test	BGOU	09-Nov-15	09-Dec-15	Inclusion in the RI Report	Established in SMP
Phase II					
Test Pits***	BGOU	09-Nov-15	18-Nov-15	Inclusion in the RI Report	Established in SMP

*These dates are for project planning purposes only, not enforceable milestones. Enforceable milestones are found in the Site Management Plan.
**This activity includes a "hold point" at which consultation with the FFA parties will occur prior to executing the subsequent Phase or for final selection of testing and sampling locations.
***Consult regulators prior to returning waste or waste like materials to the pit. Though test pits are considered part of Phase II for logistics reasons, they will be excavated after Phase V.
****A management assessment will occur as part of this activity.

QAPP Worksheet #15. Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

This worksheet should be completed for each matrix, analyte, analytical method, and concentration level (if applicable). Its purpose is to ensure the selected analytical laboratory and method can provide accurate data (i.e., quantitative results with known precision and bias) at the project action limit (PAL). During the systematic planning process, identify target analytes, PALs, and the reference limits (e.g., regulatory limits or risk-based limits) on which action limits are based. (If more than one set of reference limits is applicable, add additional columns.) Target analytes that are critical to project-specific decision-making should be highlighted. Next, determine the matrix-specific quantitation limit goal. The quantitation limit goal should be lower than the PAL by an amount determined by the DQOs/PQOs. This information, along with the MPC documented on Worksheet #12, should be used to select analytical methods and laboratories. Once the methods and laboratories have been selected, the remaining columns should be completed with laboratory-specific information. Project teams need to keep in mind that the laboratory-specific quantitation limit usually is determined in reagent water; therefore, the project quantitation limit goal (matrix-specific quantitation limit) will be higher. Explanations should be provided in cases where the quantitation limit is greater than either the project quantitation limit goal or the PAL. The laboratory must provide documentation that demonstrates precision and bias at the laboratory-specific quantitation limit. The laboratory-specific quantitation limit cannot be lower than the lowest calibration standard for any given method and analyte.

For the initially developed project-specific QAPP, the laboratory-specific columns should be filled out with target values to be used in laboratory solicitation and to support identification of the potential need to seek lower detection limits. The final laboratory-specific values will be populated and the project-specific QAPP updated once the laboratory has been contracted.

As part of the preparation of a project-specific QAPP, the PAL values should be updated with the most recent values or with project-specific values, as appropriate. As these values are updated, the P-QAPP will need to be updated accordingly.

QAPP Worksheet #15. Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

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

Matrix: Water
Analytical Group: VOCs

VOCs	CAS Number	Project Action Limit/NAL (µg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (µg/L)	MDLs[e] (µg/L)
Acrylonitrile	107-13-1	0.052/0.0523	Tapwater[d]/NAL	Yes	5	1.5
Benzene	71-43-2	5.0/0.453	MCL/NAL	Yes	1	0.3
Carbon tetrachloride	56-23-5	5.0/0.452	MCL/NAL	Yes	1	0.3
Chloroform	67-66-3	80/0.221	MCL/NAL	Yes	1	0.3
1,1-Dichloroethene	75-35-4	7.0/0.171	MCL/NAL	Yes	1	0.3
cis-1,2-Dichloroethene	156-59-2	70/3.56	MCL/NAL	Yes	1	0.3
trans-1,2-Dichloroethene	156-60-5	100/9.26	MCL/NAL	Yes	1	0.3
Ethylbenzene	100-41-4	700/1.49	MCL/NAL	Yes	1	0.3
Tetrachloroethene	127-18-4	5.0/3.95	MCL/NAL	Yes	1	0.3
Trichloroethene	79-01-6	5.0/0.281	MCL/NAL	Yes	1	0.3
Vinyl Chloride	75-01-4	2.0/0.0187	MCL/NAL	Yes	1	0.3

QAPP Worksheet #15-A. Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (Continued)

VOCs	CAS Number	Project Action Limit/NAL (µg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (µg/L)	MDLs (µg/L)
Total Xylenes	1330-20-7	10,000/19.2	MCL/NAL	Yes	3	0.3
o-Xylene	95-47-6	19/19.2	Tapwater/NAL	Yes	1	0.3
m-Xylene	108-38-3	19/19.3	Tapwater/NAL	Yes	2	0.3
p-Xylene	106-42-3	19/19.3	Tapwater/NAL	Yes	2	0.3

NOTE: Worksheet #15 will be prepared with preliminary target laboratory specific PQLs and MDLs to be used to procure the laboratory.

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MCL = maximum contaminant level
MDL = method detection limit
NAL = no action level for child resident scenario from the Risk Methods Document (DOE 2015)
PQL = practical quantitation limit
VOC = volatile organic compound

[a] This QAPP references the NALs established by the Risk Methods Document for the child resident scenario (DOE 2015) to support project planning and identify whether lower reporting limits may be needed for some constituents. In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process.
[b] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2015) and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments performed at PGDP between 1990 and 2008.
[c] The analytical laboratory may not be able to meet the child resident scenario NALs established by the Risk Methods Document (DOE 2015). For cases where the PQL is above the PAL/NAL, FPDP will have the laboratory report to the method detection limit, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] Tapwater—Source: EPA regional screening levels, Tapwater Supporting Table (Target Risk = 1E-6, Hazard Quotient = 0.1) November 2015.
[e] MDLs and PQLs for the selected laboratory will be provided in an updated QAPP once the laboratory has been contracted.

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

Matrix: Water
Analytical Group: Metals

Metals	CAS Number	Project Action Limit/NAL (mg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (mg/L)	MDLs[e] (mg/L)
Aluminum	7429-90-5	2.0/1.99	Tapwater[d]/NAL	Yes	0.05	0.015
Antimony	7440-36-0	0.0060/0.000772	MCL/NAL	Yes	0.003	0.001
Arsenic	7440-38-2	0.010/0.0000516	MCL/NAL	Yes	0.005	0.0017
Barium	7440-39-3	2.0/0.370	MCL/NAL	Yes	0.002	0.0006
Beryllium	7440-41-7	0.0040/0.00219	MCL/NAL	Yes	0.0005	0.0002
Boron	7440-42-8	0.40/0.399	Tapwater/NAL	Yes	0.015	0.004
Cadmium	7440-43-9	0.0050/0.000898	MCL/NAL	Yes	0.001	0.00011
Chromium (total)	7440-47-3	0.10/2.08	MCL/NAL	Yes	0.01	0.002
Chromium VI	18540-29-9	0.000035/0.0000341	Tapwater/NAL	Yes	0.01	0.0033
Cobalt	7440-48-4	0.0006/0.000600	Tapwater/NAL	Yes	0.001	0.0001
Copper	7440-50-8	1.3/0.0798	MCL/NAL	Yes	0.001	0.00035
Iron	7439-89-6	1.4/1.40	Tapwater/NAL	Yes	0.1	0.033
Lead	7439-92-1	0.015/0.0150	MCL[f]/NAL	Yes	0.002	0.0005
Manganese	7439-96-5	0.043/0.0420	Tapwater/NAL	Yes	0.005	0.001

QAPP Worksheet #15-B. Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (Continued)

Matrix: Water
Analytical Group: Metals

Metals	CAS Number	Project Action Limit/ NAL (mg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (mg/L)	MDLs[e] (mg/L)
Mercury	7439-97-6	0.0020/0.000556	MCL/NAL	Yes	0.0002	0.000067
Molybdenum	7439-98-7	0.010/0.00997	Tapwater[d]/NAL	Yes	0.0005	0.000165
Nickel	7440-02-0	0.039/0.0390	Tapwater[d]/NAL	Yes	0.002	0.0005
Selenium	7782-49-2	0.050/0.00997	MCL/NAL	Yes	0.005	0.0015
Silver	7440-22-4	0.0094/0.00922	Tapwater[d]/NAL	Yes	0.001	0.0002
Thallium	7440-28-0	0.0020/0.0000199	MCL/NAL	Yes	0.002	0.00045
Uranium	7440-61-1	0.030/0.00598	MCL/NAL	Yes	0.0002	0.000067
Vanadium	7440-62-2	0.0086/0.00826	Tapwater[d]/NAL	Yes	0.01	0.003
Zinc	7440-66-6	0.60/0.600	Tapwater[d]/NAL	Yes	0.01	0.0035

NOTE: Worksheet #15 will be prepared with preliminary target laboratory specific PQLs and MDLs to be used to procure the laboratory.

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MCL = maximum contaminant level
MDL = method detection limit
NAL = no action level for child resident scenario from the Risk Methods Document (DOE 2015)
PQL = practical quantitation limit

[a] This QAPP references the MCLs (or EPA screening level for tapwater if no MCL) to support project planning and identify whether lower reporting limits may be needed for some constituents. The worksheet also lists the NALs established by the Risk Methods Document for the child resident scenario (DOE 2015). In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process.
[b] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2015) and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments performed at PGDP between 1990 and 2008.
[c] The analytical laboratory may not be able to meet the child resident scenario NALs established by the Risk Methods Document (DOE 2015). For cases where the PQL is above the PAL/NAL, FPDP will have the laboratory report to the MDL, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] Tapwater—Source: EPA regional screening levels, Tapwater Supporting Table (Target Risk = 1E-6, Hazard Quotient = 0.1) November 2015
[e] MDLs and PQLs for the selected laboratory will be provided in an updated QAPP once the laboratory has been contracted.
[f] The MCL established by the EPA for lead is based on a treatment technique action level of 0.015 mg/L.

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

Matrix: Water
Analytical Group: PCBs

PCBs	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (µg/L)	MDLs[d] (µg/L)
Aroclor-1016	12674-11-2	0.140	NAL	Yes	0.1	0.0333
Aroclor-1221	11104-28-2	0.00457	NAL	Yes	0.1	0.0333
Aroclor-1232	11141-16-5	0.00457	NAL	Yes	0.1	0.0333
Aroclor-1242	53469-21-9	0.0390	NAL	Yes	0.1	0.0333
Aroclor-1248	12672-29-6	0.0390	NAL	Yes	0.1	0.0333
Aroclor-1254	11097-69-1	0.0390	NAL	Yes	0.1	0.0333
Aroclor-1260	11096-82-5	0.0390	NAL	Yes	0.1	0.0333

NOTE: Worksheet #15 will be prepared with preliminary target laboratory specific PQLs and MDLs to be used to procure the laboratory.

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDL = method detection limit
NAL = no action level for child resident scenario from the Risk Methods Document (DOE 2015)
PCBs= polychlorinated biphenyls
PQL = practical quantitation limit

[a] This QAPP references the MCLs (or EPA screening level for tapwater if no MCL) to support project planning and identify whether lower reporting limits may be needed for some constituents. The worksheet also lists the NALs established by the Risk Methods Document for the child resident scenario (DOE 2015). In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process.
[b] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2015) and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments performed at PGDP between 1990 and 2008.
[c] The analytical laboratory may not be able to meet the child resident scenario NALs established by the Risk Methods Document (DOE 2015). For cases where the PQL is above the PAL/NAL, FPDP will have the laboratory report to the MDL, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] MDLs and PQLs for the selected laboratory will be provided in an updated QAPP once the laboratory has been contracted.

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

Matrix: Water
Analytical Group: Radionuclides

Radionuclides	CAS Number	Project Action Limit (pCi/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c] MDAs[d] (pCi//L)
Americium-241	14596-10-2	0.504	NAL	Yes	1
Cesium-137	10045-97-3	1.71	NAL	Yes	10
Neptunium-237	13994-20-2	0.763	NAL	Yes	1
Plutonium-238	13981-16-3	0.398	NAL	Yes	1
Plutonium-239/240	15117-48-3/14119-33-6	0.387	NAL	Yes	1
Technetium-99	14133-76-7	4 mrem/year-dose[e] (19.0 pCi/L)	MCL (NAL)	Yes	25
Thorium-230	14269-63-7	0.572	NAL	Yes	1
Uranium-234	13966-29-5	0.739	NAL	Yes	1
Uranium-235	15117-96-1	0.728	NAL	Yes	1
Uranium-238	24678-82-8	0.601	NAL	Yes	1

NOTE: Worksheet #15 will be prepared with preliminary target laboratory specific PQLs and MDLs to be used to procure the laboratory.

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDA = minimum detectable activity
NAL = no action level for child resident scenario from the Risk Methods Document (DOE 2015)

[a] This QAPP references the MCLs (or EPA screening level for tapwater if no MCL) to support project planning and identify whether lower reporting limits may be needed for some constituents. The worksheet also lists the NALs established by the Risk Methods Document for the child resident scenario (DOE 2015). In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process.
[b] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2014) and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments performed at PGDP between 1990 and 2008.
[c] The analytical laboratory may not be able to meet the child resident scenario NALs established by the Risk Methods Document (DOE 2015). For cases where the PQL is above the PAL/NAL, FPDP will have the laboratory report to the method detection limit, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] MDAs for the selected laboratory will be provided in an updated QAPP once the laboratory has been contracted.
[e] The value derived by the EPA from the 4 mrem/yr MCL for Tc-99 is 900 pCi/L (see http://www.epa.gov/reg-flex/radionuclides-drinking-water-small-entity-compliance-guide-february-2002). An alternate value derived by the EPA from the 4 mrem/yr MCL is 3,790 pCi/L and was proposed in the July 18, 1991, *Federal Register*, http://nepis.epa.gov/Adobe/PDF/10003I8N.PDF.

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

Matrix: Soil/Sediment
Analytical Group: Metals

Metals	CAS Number	Project Action Limit (mg/kg)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (mg/kg)	MDLs[d] (mg/kg)
Aluminum	7429-90-5	7,740	NAL	Yes	10	3
Antimony	7440-36-0	3.13	NAL	Yes	1	0.33
Arsenic	7440-38-2	0.267	NAL	Yes	1	0.2
Barium	7440-39-3	1,530	NAL	Yes	0.4	0.1
Beryllium	7440-41-7	15.6	NAL	Yes	0.1	0.02
Boron	7440-42-8	1,560	NAL	Yes	3	0.8
Cadmium	7440-43-9	5.07	NAL	Yes	0.2	0.02
Chromium (total)	7440-47-3	16.4	NAL	Yes	0.6	0.2
Chromium VI	18540-29-9	0.301	NAL	Yes	0.4	0.12
Cobalt	7440-48-4	2.34	NAL	Yes	0.2	0.06
Copper	7440-50-8	313	NAL	Yes	0.2	0.066
Iron	7439-89-6	5,480	NAL	Yes	20	6.6
Lead	7439-92-1	400	NAL	Yes	0.4	0.1

QAPP Worksheet #15-E. Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (Continued)

Matrix: Soil/Sediment
Analytical Group: Metals

Metals	CAS Number	Project Action Limit (mg/kg)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (mg/kg)	MDLs[d](mg/kg)
Manganese	7439-96-5	183	NAL	Yes	1	0.2
Mercury	7439-97-6	2.35	NAL	Yes	0.01	0.004
Molybdenum	7439-98-7	39.1	NAL	Yes	0.2	0.06
Nickel	7440-02-0	155	NAL	Yes	0.4	0.1
Selenium	7782-49-2	39.1	NAL	Yes	1	0.33
Silver	7440-22-4	39.1	NAL	Yes	0.5	0.1
Thallium	7440-28-0	0.0782	NAL	Yes	0.4	0.06
Uranium	7440-61-1	23.4	NAL	Yes	0.04	0.013
Vanadium	7440-62-2	39.3	NAL	Yes	0.5	0.1
Zinc	7440-66-6	2,350	NAL	Yes	2	0.4

NOTE: Worksheet #15 will be prepared with preliminary target laboratory-specific PQLs and MDLs to be used to procure the laboratory.

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDL = method detection limit
NAL = no action level for child resident scenario from the Risk Methods Document (DOE 2015)
PCB = polychlorinated biphenyl
PQL = practical quantitation limit
TBD = to be determined

[a] This QAPP references the NALs established by the Risk Methods Document for the child resident scenario (DOE 2015) to support project planning and identify whether lower reporting limits may be needed for some constituents. In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process.
[b] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2015) and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments performed at PGDP between 1990 and 2008.
[c] The analytical laboratory may not be able to meet the child resident scenario NALs established by the Risk Methods Document (DOE 2015). For cases where the PQL is above the PAL/NAL, FPDP will have the laboratory report to the method detection limit, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] MDLs and PQLs for the selected laboratory will be provided in an updated QAPP once the laboratory has been contracted.

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

Matrix: Soil/Sediment
Analytical Group: PCBs

PCBs	CAS Number	Project Action Limit (mg/kg)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (mg/kg)	MDLs[d] (mg/kg)
Aroclor-1016	12674-11-2	0.190	NAL	Yes	0.0033	0.001099
Aroclor-1221	11104-28-2	0.0659	NAL	Yes	0.0033	0.001099
Aroclor-1232	11141-16-5	0.0659	NAL	Yes	0.0033	0.001099
Aroclor-1242	53469-21-9	0.0782	NAL	Yes	0.0033	0.001099
Aroclor-1248	12672-29-6	0.0782	NAL	Yes	0.0033	0.001099
Aroclor-1254	11097-69-1	0.0543	NAL	Yes	0.0033	0.001099
Aroclor-1260	11096-82-5	0.0782	NAL	Yes	0.0033	0.001099

NOTE: Worksheet #15 will be prepared with preliminary target laboratory specific PQLs and MDLs to be used to procure the laboratory.

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDL = method detection limit
NAL = no action level for child resident scenario from the Risk Methods Document (DOE 2015)
PQL = practical quantitation limit
PCBs = polychlorinated biphenyls

[a] This QAPP references the NALs established by the Risk Methods Document for the child resident scenario (DOE 2015) to support project planning and identify whether lower reporting limits may be needed for some constituents. In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process.
[b] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2015) and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments performed at PGDP between 1990 and 2008.
[c] The analytical laboratory may not be able to meet the child resident scenario NALs established by the Risk Methods Document (DOE 2015). For cases where the PQL is above the PAL/NAL, FPDP will have the laboratory report to the method detection limit, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] MDLs and PQLs for the selected laboratory will be provided in an updated QAPP once the laboratory has been contracted.

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

Matrix: Soil/Sediment
Analytical Group: Radionuclides

Radionuclides	CAS Number	Project Action Limit (pCi/g)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c] MDAs[d] (pCi/g)
Americium-241	14596-10-2	3.03	NAL	Yes	1
Cesium-137	10045-97-3	0.116	NAL	Yes	0.1
Neptunium-237	13994-20-2	0.239	NAL	Yes	1
Plutonium-238	13981-16-3	4.42	NAL	Yes	1
Plutonium-239/240	15117-48-3/ 14119-33-6	3.87	NAL	Yes	1
Technetium-99	14133-76-7	117	NAL	Yes	5
Thorium-230	14269-63-7	5.22	NAL	Yes	1
Uranium-234	13966-29-5	5.93	NAL	Yes	1
Uranium-235	15117-96-1	0.347	NAL	Yes	1
Uranium-238	24678-82-8	1.28	NAL	Yes	1

NOTE: For consistency at a programmatic level, these worksheets will be reviewed and updated for project-specific QAPPs. Worksheet #15 of each project-specific QAPP will have a Project QL column that will be related to action levels deemed appropriate for the specific analytes as a result of three-party project scoping.

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDA = minimum detectable activity
NAL = no action level for child resident scenario from the Risk Methods Document (DOE 2015)
[a] This programmatic QAPP references the NALs established by the Risk Methods Document for the child resident scenario (DOE 2015) to support project planning and identify whether lower reporting limits may be needed for some constituents. In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process within the project-specific QAPP.
[b] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2015) and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COC in risk assessments performed at PGDP between 1990 and 2008.
[c] The analytical laboratory may not be able to meet the child resident scenario NALs established by the Risk Methods Document (DOE 2015). For cases where the MDA is above the PAL/NAL, FPDP will have the laboratory report to the method detection limit, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] MDAs for the selected laboratory will be provided in an updated QAPP once the laboratory has been contracted.

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

Matrix: Soil/Sediment
Analytical Group: VOCs

VOCs	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (µg/kg)	MDLs[d] (µg/kg)
1,1-Dichloroethene	75-35-4	22,700	NAL	Yes	1	0.33
cis-1,2-Dichloroethene	156-59-2	15,600	NAL	Yes	1	0.33
trans-1,2-Dichloroethene	156-60-5	14,300	NAL	Yes	1	0.33
Acrylonitrile	107-13-1	255	NAL	Yes	5	1.7
Benzene	71-43-2	1,160	NAL	Yes	1	0.33
Carbon Tetrachloride	56-23-5	653	NAL	Yes	1	0.33
Chloroform	67-66-3	316	NAL	Yes	1	0.33
Ethylbenzene	100-41-4	5,780	NAL	Yes	1	0.33
Tetrachloroethene	127-18-4	8,100	NAL	Yes	1	0.33
Trichloroethene	79-01-6	412	NAL	Yes	1	0.33
Vinyl chloride	75-01-4	59.2	NAL	Yes	1	0.33
Total Xylenes	1330-20-7	58,400	NAL	Yes	3	1
p-xylene	106-42-3	56,100	NAL	Yes	2	0.67
m-xylene	108-38-3	55,100	NAL	Yes	2	0.67
o-xylene	95-47-6	64,500	NAL	Yes	1	0.33

NOTE: Worksheet #15 will be prepared with preliminary target laboratory specific PQLs and MDLs to be used to procure the laboratory. Once selected, the PQL/MDL information will be updated.

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDL = method detection limit
NAL = no action level for child resident scenario from the Risk Methods Document (DOE 2015)
PQL = practical quantitation limit

QAPP Worksheet #15-H. Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (Continued)

[a] This QAPP references the NALs established by the Risk Methods Document for the child resident scenario (DOE 2015) to support project planning and identify whether lower reporting limits may be needed for some constituents. In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process within the project-specific QAPP.
[b] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2015) and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments performed at PGDP between 1990 and 2008.
[c] The analytical laboratory may not be able to meet the child resident scenario NALs established by the Risk Methods Document (DOE 2015). For cases where the PQL is above the PAL/NAL, FPDP will have the laboratory report to the method detection limit, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] MDLs will be provided in project-specific QAPPs once the laboratory has been contracted.

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

Matrix: Soil/Sediment
Analytical Group: SVOCs

SVOCs	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs[d] (µg/kg)	MDLs[d] (µg/kg)
Acenaphthene	83-32-9	171,000	NAL	Yes	33.3	10
Acenaphthylene	208-96-8	171,000[d]	NAL	Yes	33.3	10
Anthracene	210-12-7	854,000	NAL	Yes	33.3	10
Carbazole	86-74-8	10,000	NAL	Yes	33.3	10
Dieldrin[1]	60-57-1	12.6	NAL	Yes	1.34	0.33
Fluoranthene	206-44-0	114,000	NAL	Yes	33.3	10
Hexachlorobenzene	118-74-1	126	NAL	Yes	333	100
Naphthalene	91-20-3	3,830	NAL	Yes	33.3	10
2-Nitroaniline	88-74-4	33200	NAL	Yes	333	110
N-nitroso-di-n-propylamine	621-64-7	28.7	NAL	Yes	333	100
Phenanthrene	85-01-8	171,000[e]	NAL	Yes	33.3	10
Pyrene	129-00-0	85,400	NAL	Yes	33.3	10
Total PAHs (carcinogenic)	50-32-8	6.19	NAL	Yes	N/A	N/A

NOTE: Worksheet #15 will be prepared with preliminary target laboratory specific PQLs and MDLs to be used to procure the laboratory.

[1] SW-846 Method 8081
CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDL = method detection limit
NAL = no action level for child resident scenario from the Risk Methods Document (DOE 2015)
PAH = polycyclic aromatic hydrocarbon
PQL = practical quantitation limit
SVOC = semivolatile organic compound

QAPP Worksheet #15-I. Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (Continued)

[a] This QAPP references the NALs established by the Risk Methods Document for the child resident scenario (DOE 2015) to support project planning and identify whether lower reporting limits may be needed for some constituents. In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process.
[b] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2015) and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments performed at PGDP between 1990 and 2008.
[c] The analytical laboratory may not be able to meet the child resident scenario NALs established by the Risk Methods Document (DOE 2015). For cases where the PQL is above the PAL/NAL, FPDP will have the laboratory report to the method detection limit, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] MDLs and PQLs for the selected laboratory will be provided in an updated QAPP once the laboratory has been contracted.
[e] Acenaphthylene and phenanthrene use values for acenaphthene as a surrogate.

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

Matrix: Water
Analytical Group: SVOCs

SVOCs	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (µg/L)	MDLs[e] (µg/L)
Acenaphthene	83-32-9	53/49.2	Tapwater[d]/NAL	Yes	1	0.3
Acenaphthylene[f]	208-96-8	49.2	NAL	Yes	1	0.3
Anthracene	210-12-7	180/160	Tapwater[c]/NAL	Yes	1	0.3
Carbazole	86-74-8	1.96	NAL	Yes	1	0.3
Dieldrin[1]	60-57-1	0.0018/0.00168	Tapwater[c]/NAL	Yes	0.04	0.0125
Fluoranthene	206-44-0	80/80.2	Tapwater[c]/NAL	Yes	1	0.3
Hexachlorobenzene	118-74-1	1/0.0487	MCL/NAL	Yes	10	3
Naphthalene	91-20-3	0.17/0.165	Tapwater[c]/NAL	Yes	1	0.3
2-nitroaniline	88-74-4	19/18.8	Tapwater[c]/NAL	Yes	10	3
N-nitroso-di-n-propylamine	621-64-7	0.011/0.0108	Tapwater[c]/NAL	Yes	10	3
Phenanthrene[f]	85-01-8	49.4	NAL	Yes	1	0.3
Pyrene	129-00-0	12/10.8	Tapwater[c]/NAL	Yes	1	0.3
Total PAHs (carcinogenic)[g]	50-32-8	0.20/0.00343	MCL/NAL	Yes	N/A	N/A

NOTE: Worksheet #15 will be prepared with preliminary target laboratory-specific PQLs and MDLs to be used to procure the laboratory.

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MCL = maximum contaminant level
MDL = method detection limit
NAL = no action level for child resident scenario from the Risk Methods Document (DOE 2015)
PAH = polycyclic aromatic hydrocarbon
PQL = practical quantitation limit
SVOC = semivolatile organic compound
TBD = to be determined

QAPP Worksheet #15-J. Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (Continued)

[1] SW-846 Method 8081
[a] This QAPP references the MCLs (or EPA screening level for tapwater if no MCL) to support project planning and identify whether lower reporting limits may be needed for some constituents. The worksheet also lists the NALs established by the Risk Methods Document for the child resident scenario (DOE 2015). In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process.
[b] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2015) and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments performed at PGDP between 1990 and 2008.
[c] The analytical laboratory may not be able to meet the child resident scenario NALs established by the Risk Methods Document (DOE 2015). For cases where the PQL is above the PAL/NAL, FPDP will have the laboratory report to the method detection limit, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] Tapwater—Source: EPA regional screening levels, Tapwater Supporting Table (Target Risk = 1E-6, Hazard Quotient = 0.1) November 2015.
[e] MDLs and PQLs for the selected laboratory will be provided in an updated QAPP once the laboratory has been contracted.
[f] Acenaphthylene and phenanthrene use NALs for acenaphthene as a surrogate.
[g] Total PAHs uses MCL for benzo(a)pyrene.

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

Matrix: Soil/Sediment
Analytical Group: Metals (uranium by XRF)

Metals	CAS Number	Project Action Limit (mg/kg)	Project Action Limit Reference	Site COPC?[a]	Laboratory-Specific	
					PQLs (mg/kg)	MDLs (mg/kg)
Uranium	7440-61-1	10[b]	Project scoping	Yes	N/A	10

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDL = method detection limit
N/A = not applicable
PQL = practical quantitation limit
[a] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2015).
[b] The PAL for uranium was set to ensure the DQOs, agreed to by the FFA parties, were met using the XRF analytical method. The PAL approaches the PGDP surface soil background concentration of 4.9 mg/kg for uranium, and is below the risk-based NAL of 58.6 mg/kg for the child recreational user (DOE 2015). Finally, an acknowledged XRF subject matter expert confirmed detection at the PAL could be achieved reliably with an XRF calibrated to detect uranium.

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

Matrix: Water
Analytical Group: VOCs

VOCs	CAS Number	Project Action Limit (µg/m^3)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (µg/m^3)	MDLs[e] (µg/m^3)
1,1-Dichloroethene	75-35-4	880	Vapor Intrusion Screening Level (VISL, Commercial)	Yes	2.0	0.59
cis-1,2-Dichloroethene	156-59-2	N/A	No VISL	Yes	2.0	0.59
trans-1,2-Dichloroethene	156-60-5	N/A	No VISL	Yes	2.0	0.59
Trichloroethene	79-01-6	3.0	VISL, Commercial	Yes	2.7	0.81
Vinyl Chloride	75-01-4	2.8	VISL, Commercial	Yes	1.28	0.38

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDL = method detection limit
PQL = practical quantitation limit
VOC = volatile organic compound

[a] VISL = Vapor Intrusion Screening Level (Commercial, Carcinogen Target Risk = 1.0E-6, Target Hazard Quotient = 1.0)
[b] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2015) and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments performed at PGDP between 1990 and 2008.
[c] Laboratory has PQL of 0.5 ppbv and MDL of 0.15 ppbv. Values were converted to µg/m^3 at 25°C.

QAPP Worksheet #17. Sampling Design and Rationale
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

Sampling Design and Rationale

This worksheet should be used to describe the sampling design and the basis for its selection. This worksheet mainly will consist of text. It documents the last step of the systematic planning process. If a site consists of multiple areas to be sampled, a separate worksheet should be used for each.

There are two general types of sampling designs: (1) probability-based designs, which should be used when statistical conclusions are required; and (2) judgmental designs, which are more applicable to help refine CSMs when further study is planned or to confirm previous findings, but that usually do not provide sufficient basis on their own to support statistical conclusions. Advice on selecting appropriate sample designs may be found in Chapter 2 of *Guidance for Choosing a Sampling Design for Environmental Data Collection*, EPA QA/G-5s (EPA 2002). *Regardless of the type of design selected, this worksheet should explain the basis for its selection.* It also should describe the following:

1. The physical boundaries for the area under study (include maps or diagrams);

2. The time period being represented by the collected data;

3. The descriptions and basis for dividing the site into sampling areas (e.g., decision units, exposure units) that support the decision statements documented on Worksheet #11;

4. The basis for the number and placement of samples within sampling areas;

5. If sample locations are specified in the QAPP, descriptions of how actual sample positions will be located once in the field (include maps or diagrams);

6. If a sample cannot be collected where planned, the decision process for changing the location;

7. If sample locations will be determined in the field, the decision process for doing so; and

8. Contingencies in the event field conditions are different than expected and could have an effect on the sample design.

QAPP Worksheet #17. Sampling Design and Rationale (Continued)

Site-specific sampling process design and rationale may be outlined in a companion FSP developed for projects. Either the FSP or Worksheet #17 will provide the sampling and analysis requirements for each project, sampling locations, frequencies, rationale for selection, and analytical parameters for each location.

QAPP Worksheet #17. Sampling Design and Rationale
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

QAPP Worksheet #17-A. Sampling Design and Rationale

Worksheet #17 provides the sampling and analysis requirements for the project, including sampling locations, frequencies, rationale for selection, and analytical parameters for each location. The exact sample locations and the total number of samples might change from those described, depending on field conditions encountered. The purpose of the sampling process design is to describe relevant components of the investigation design; define the key parameters to be investigated; indicate the number and type of samples to be collected; and describe where, when, and how the samples are to be collected. The example information provided below is for a SWMU 4 investigation project.

This sheet is a summary of the project and will be described in the project-specific FSP sampling design and rationale information. The project manager will ensure these components are part of the FSP. Completion of a separate Worksheet #17 to identify where these components are located in the FSP is at the discretion of the project manager.

QAPP Worksheet #17-A. Sampling Design and Rationale (Continued)

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach): Describe in the project-specific FSP or describe in this worksheet for simple projects.

Describe the sampling design and rationale in terms of which matrices will be sampled: A description of the analyses, methods, and the method detection limits should be provided. The choice of methods and method detection limits should be justified, especially regarding screening levels that will not be attained.

- **What analyses will be performed and at what analytical limits?** See Worksheets #12 and #15.
- **Where are the sampling locations (including QC, critical, and background samples)?** See FSP.
- **How many samples to be taken?** See FSP.

What is the sampling frequency (including seasonal considerations)? (May refer to map or Worksheet #18 for details.)

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, judgmental statistical approach): The investigation will be implemented in five phases. A general description of the planned work for each phase is described below. Contingencies and decision rules for the planned work are found in Section 5 of the SAP/work plan. The FFA parties have agreed that the additional investigative sampling at SWMU 4 as contained within the Field Sampling Plan will conclude sampling for the SWMU 4 project such that EPA and/or KDEP will not request or require any additional sampling other than confirmatory sampling for the remainder of the SWMU 4 project.

Phase I will utilize passive soil gas technology to identify areas within the SWMU that feature elevated VOC soil vapor readings. The rationale for this phase is to provide screening level data to determine the best location of subsequent data collection efforts. These are employed because they are fast, easy, inexpensive, and provide data adequate for this screening-level phase of the project. Though the sphere, or radius, of effectiveness is influenced by many factors (e.g., depth and concentration of the source, soil porosity) and is difficult to determine, the method will detect VOCs over a larger area than a conventional soil sample. The first phase also will consist of collecting surface soil samples to determine contaminant distribution and concentration in surface soils. This will be accomplished using five-point composite sampling that will be analyzed using field techniques (i.e., PCB test kits and metals analysis by XRF) and sending 10% of the total to a fixed-base laboratory. The rationale for this is to get the maximum coverage of the area while minimizing analytical costs.

QAPP Worksheet #17-A. Sampling Design and Rationale (Continued)

Phase II will collect shallow (< 20 ft bgs) samples. These samples will be used to identify VOC concentrations, along with other COCs, in the disposal cells and adjacent shallow soils. The results from the passive soil gas sampling and historical soil and water sample results will be used to select locations that are the most likely to contain elevated COCs. Test pits also will be excavated to gather subsurface information between 0 and 20 ft bgs. (Note: Though test pits are considered part of Phase II, for logistical reasons, they will be excavated after Phase V.) Additionally, Phase II will include installation of seven shallow (20 ft bgs) UCRS monitoring wells; water elevations and samples will be collected from these wells. Phase III will include a maximum of 27 Direct Push Technology borings to 60 ft bgs at the locations agreed to by the FFA parties. The rationale for this phase is to determine the depth and the lateral extent of contamination.

Phase IV will install 10 borings to the top of the McNairy Formation, approximately 105 ft. The rationale for these borings is to determine the extent and mass of TCE source term with sufficient accuracy to effectively and efficiently complete a remedial design for source term in the RGA.

Phase V will include installation of five additional RGA monitoring wells. The rationale for this sampling is to define the nature and extent of VOC source term so that a remedial design for VOCs can be completed. Samples will be collected from soil and water (where encountered) at UCRS (Hydrogeologic Unit 4)/RGA interface to identify where VOC source term may have penetrated to the RGA. Additional samples will be collected from soil at the RGA interface with the McNairy to complete a remedial design for a VOC remedy in the RGA, if a free-phase TCE source is found at the base of the RGA. A second objective of Phase V is to collect sufficient quality and quantity of data to determine the RGA groundwater velocity and flow direction.

Describe the sampling design and rationale in terms of which matrices will be sampled: Passive soil gas sampling will be used to determine the locations of soil boring based on the highest VOC concentrations. Soil and water samples will be collected from the borings to a depth of 105 ft. Samples will be analyzed for VOCs, SVOCs, PCBs, metals, and radionuclides (refer to QAPP Worksheet 18 for the number samples and analytical methods by depth). Twenty-two soil borings will be sampled down to 20 ft bgs. Data from the 20 ft borings will be used in part to select locations for 27 borings that will be extended to 60 ft bgs. Ten additional borings will be advanced 105 ft (approximate bottom of the RGA/top of the McNairy Formation). Contingency sampling, as described in Section 5 of the SAP/Work Plan, may occur.

What analyses will be performed and at what analytical limits? See Worksheets #12 and #15.

Standard Environmental Sampling: Total volatile organic analyte (VOA) analysis by SW-846, 8260; PCB extraction by SW-846-3150C for water, PCB extraction for soil by SW-846-3540C or SW-846-3546, analysis by 8082, metal analysis by SW-846, 200.8/6010B/6020; radiological analysis by alpha spec, gamma spec, and liquid scintillation; semivolatile organic analyte (SVOA) analysis by SW-846, 8270. See Worksheet #15 for method detection limit.

Engineering and Design Sampling: Chemical oxygen demand by EPA 410.4; total and dissolved organic carbon by SW-846-9060 EPA 415.1, slug test by ASTM D7242-06. See worksheet 17-B for complete list and additional details.

Where are the sampling locations (including QC, critical, and background samples)? See Worksheet #18.

How many samples to be taken? 161 soil samples, up to 132 water samples (dependent on water yield). See Worksheet #18.

What is the sampling frequency (including seasonal considerations)? This is a one-time sampling event except for the 20 ft wells installed under the scope of Phase II, which will be measured monthly for 12 months in order to determine the effects of various seasonal conditions on groundwater level. Installed wells will be sampled once upon completion; subsequent sampling will be based on the Environmental Monitoring Plan for the PGDP (FPDP 2016), which is updated annually. Thus seasonal conditions at the time of sampling are unknown. Passive soil gas sampling is the only other sampling that may be affected by seasonal conditions; it is assumed that unsaturated soil conditions are optimal for this data gathering; the manufacturer will be consulted and the deployment schedule may be altered to avoid seasonal saturation.

QAPP Worksheet #17-B. Sampling Design and Rationale (Engineering and Design Sampling)

Analysis	Media Type	# of Samples	Test/Analytical Method	Project Reference Value	PQL
Standard Penetration Test	Soil	4 UCRS, 3 RGA	ASTM D1586-11	NA	NA
Grain Size Data	Soil	4 UCRS, 3 RGA	ASTM D422-63(2007)	NA	NA
Air Permeability	Soil	1	ASTM D6539-13	NA	NA
Percolation Test	Soil	4 UCRS	ASTM D338509	NA	NA
Fraction Organic Carbon	Soil	1	SW-846-9060 as modified for soil samples	NA	NA
Electron Donor Parameters					
Chemical Oxygen Demand	Water	2	EPA 410.4	NA	27 mg/L
Total Organic Carbon	Water	2	EPA 415.1/ SW-846-9060	20 mg/L	1 mg/L
Dissolved Organic Carbon	Water	2	EPA 415.1/ SW-846-9060	20 mg/L	1 mg/L
Field Parameters					
DO	Water	All Water	Hach Quanta Hydrolab	0.5 mg/L	0.2 mg/L
pH	Water	All Water	Hach Quanta Hydrolab	5 to 9 Std Units	02. Std Units
Redox	Water	All Water	Hach Quanta Hydrolab	50 mV against Ag/AgCl	20 mV
Temperature	Water	All Water	Hach Quanta Hydrolab	20°C	+/- 0.1°C
Specific Conductance		All Water	Hach Quanta Hydrolab	NA	0.001 mS/cm
Alkalinity	Water	4 UCRS, 3 RGA	Hach® Alkalinity Test Kit, Model AL-DT	NA	0.1–10 mg/L
Slug test	Water	5	ASTM D7242-06	NA	NA
Microbial Parameters					
Microbial Community	Water	2	Laboratory SOP	NA	NA
Water Quality Parameters					
Sulfate	Water	1	EPA 300.0/SW-846-9056	NA	2 mg/L
Chloride	Water	1	EPA 300.0/SW-846-9056	NA	2 mg/L
Calcium	Water	1	SW-846-6010B	NA	1 mg/L
Nitrate	Water	1	EPA 300.0/SW-846-9056	NA	4 mg/L
Ferrous Iron	Water	1	SM 3500-Fe B	NA	0.2 mg/L

QAPP Worksheet #18. Sampling Locations and Methods
(UFP-QAPP Manual Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.1 and 2.3.2)

QAPP Worksheet #18. Sampling Locations and Methods/Standard Operating Procedure Requirements Table for Screening Samples

The primary value of this worksheet is as a completeness check for field personnel and auditors/assessors. It facilitates checks to make sure all planned samples have been collected and appropriate methods have been used. Ideally, this worksheet should list each individual sample that is planned to be collected, including field QC samples. Samples with common entries may be grouped, but field QC samples and samples that are unique must be listed separately. If a sample is being collected in increments, use only one line to identify the sample as it will be analyzed; there is no need to list the increments separately. (If the increments are placed in separate containers to be combined in the laboratory, then each container must be labeled.) If a project involves the collection of a large number of samples, however, it may be acceptable to list groups of similar samples on a single row. Detailed sampling SOPs must be available to field personnel and should be included as an appendix to the QAPP and referenced in this worksheet. The comments field can be used as a reminder to note any special sample handling required in the field and/or Global Positioning System (GPS) coordinates. A map with locations marked should be included. Use additional worksheets as necessary.

QAPP Worksheet #18. Sampling Locations and Methods (Continued)
(UFP-QAPP Manual Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.1 and 2.3.2)

QAPP Worksheet #18. Sampling Locations and Methods/Standard Operating Procedure Requirements Table for Screening Samples

Worksheet #18 provides information pertaining to sampling planned for this project.

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group[a]	Concentration Level[b]	Number of Samples (Identify Field Duplicate %)[c]	Sampling SOP Reference[d]	Rationale for Sampling Location
TBD	Soil	Surface/ subsurface	Metals 6200 by XRF	Unknown	TBD (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Soil	Surface/ subsurface	PCB by Hach Pocket Colorimeter™ II Test Kit (or equivalent)	Unknown	TBD (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Soil	Surface/ subsurface	Gamma radiation by sodium iodide detector (or equivalent)	Unknown	N/A	N/A	See Worksheet #17
TBD	Soil	Surface/ subsurface	Metals	Unknown	TBD (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Soil	Surface/ subsurface	PCBs	Unknown	TBD (minimum of 5%)	See Worksheet #21	See Worksheet #17

QAPP Worksheet #18. Sampling Locations and Methods/SOP Requirements Table for Screening Samples (Continued)

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group[a]	Concentration Level[b]	Number of Samples (Identify Field Duplicate %)[c]	Sampling SOP Reference[d]	Rationale for Sampling Location
TBD	Soil	0–20 ft (5 ft intervals)	VOC, SVOCs, PCBs, Radiological, Metals[c]	Low	94 (4 samples from each of 22, 20 ft-borings, and 1 sample from each of 6 test pits) (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Soil	20–60 ft (10 ft intervals)	VOCs (all intervals); Metals,[d] Radiological, and PCBs in the Top and Bottom Intervals	Low	108 (4 samples from each of 27, 60 ft borings) (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Water	0–20 ft	VOC, SVOCs, PCBs, Radiological, Metals[c]	Low	35 (1 sample from each of 22, 20 ft borings, 1 from each of 7 newly installed UCRS MWs, and 1 from each of 6 test pits) (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Water	20–60 ft	VOCs	Low	27 (1 sample from each of 27, 60 ft borings) (minimum of 5%)	See Worksheet #21	See Worksheet #17

QAPP Worksheet #18. Sampling Locations and Methods/SOP Requirements Table for Screening Samples (Continued)

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group[a]	Concentration Level[b]	Number of Samples (Identify Field Duplicate %)[c]	Sampling SOP Reference[d]	Rationale for Sampling Location
TBD	Soil	0–1 ft	PCBs test kits, XRF Metals analysis (performed in field lab); PCBs, Metals SVOCs, radiological (performed in fixed-base lab)	Low	154 (1 sample from each of 154 five-point composite grids) will be sent to a field lab, of these 16 will be sent to a fixed-base lab for verification (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Soil	60–105	VOCs, Tc-99	Low	20 (2 intervals from each of 10 105 ft borings) (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Water	60–105	VOCs, Tc-99	Low	95 (9 intervals from each of 10 105 ft borings and 1 from each of 5 newly installed RGA MWs) (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Soil	0–105	Geotechnical	Low	8 samples taken for grain size and air permeability (no duplicates)	See Worksheet #21	See Worksheet #17
TBD	Soil gas	0–1 ft	VOCs	Low	48	See Worksheet #21	See Worksheet #17

[a] See Analytical SOP References Table (Worksheet #23).
[b] If historical data provide information on anticipated concentration, that information will be populated on this sheet.
[c] Contingency locations not included.
[d] See Field SOP References Table (Worksheet #21).

N/A = not applicable
PCB = polychlorinated biphenyl
SOP = standard operating procedure
TBD = to be determined
XRF = X-ray fluorescence

QAPP Worksheet #19 and 30. Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

The purpose of this worksheet is to serve as a reference guide for field personnel. It is also an aid to completing the chain-of-custody form and shipping documents. Complete this table for each laboratory used. If laboratory accreditation/certification is required for this project, the project team must verify that the laboratory maintains current accreditation/certification status for each analyte/matrix/method combination, as applicable, throughout its involvement with the project. If the accreditation expiration dates are the same for entries then a global expiration date can be added at the top of the table, as appropriate.

Laboratory: (Name, sample receipt address, point of contact, e-mail, and phone numbers)

List any required accreditations/certifications:

Back-up Laboratory: N/A

Sample Delivery Method:

QAPP Worksheet #19 and 30. Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

QAPP Worksheet #19. Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[a]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Water	VOC	Low	See Worksheet #12	120 mL	3 x 40 mL Glass VOA vial	HCl; cool to < 4°C	14 days for preserved
Water	PCBs[b]	Low	See Worksheet #12	1 L	1L Amber Glass	Cool to < 4°C	NA
Water	RADs	Low	See Worksheet #12	3 L	Plastic	HNO_3; Cool to < 4°C	6 months
Water	Metals	Low	See Worksheet #12	1 L	Plastic	HNO_3 pH < 2 Cool to < 4°C	6 months (28 days for mercury)
Water	SVOCs	Low	See Worksheet #12	1 L	1L Amber Glass	Cool to < 4°C	7 days to extraction; 40 days to analysis
Soil/sediment	Metals	Low	See Worksheet #12	100 g	4 oz. Glass	Cool to < 4°C	6 months (28 for mercury)
Soil/sediment	PCBs[b]	Low	See Worksheet #12	250 g	9 oz. Glass	Cool to < 4°C	NA
Soil/sediment	RADs	Low	See Worksheet #12	250 g	9 oz. Glass	Cool to < 4°C	6 months
Soil/sediment	VOCs	Low	See Worksheet #12	250 g	9 oz. Glass/EnCore	Cool to < 4°C	14 days
Soil/sediment	SVOCs	Low	See Worksheet #12	250 g	9 oz. Amber Glass	Cool to < 4°C	14 days to extraction; 40 days to analysis
Soil/sediment	PAHs	Moderate	See Worksheet #12	Per test kit instructions			
Soil/sediment	PCBs	Moderate	See Worksheet #12	Per test kit instructions			
Soil gas	VOCs	Low	See Worksheet #12	Per manufacturer's instructions			
Air	VOCs	Very Low	See Worksheet #12	SUMMA canister with 8-hour orifice			

NOTE: Sample volume and container requirements will be specified by the laboratory.
[a] See Analytical SOP References table (Worksheet #23).
[b] A 45-day holding time is an expectation of the laboratory; however, because SW-846 does not indicate a holding time for PCBs, any data that exceeds the 45 days will be identified, but not qualified.
HCl = hydrochloric acid
HNO_3 = nitric acid
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
RAD = radionuclide
SVOC = semivolatile organic compound
VOA = volatile organic analysis
VOC = volatile organic compound

QAPP Worksheet #30. Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP[a]	Data Package Turnaround Time	Laboratory/Organization[b] (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization[b] (Name and Address, Contact Person and Telephone Number)
Soil/ Sediment	PCBs	Low	See Worksheet #18 For ID Numbers, see Worksheet #27	See Worksheet #23	28-day	GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407 PM: Valerie Davis (843) 556-8171	MO00054 TestAmerica Laboratories, Inc. 13715 Rider Trail North Earth City, MO 63045 PM: Jayna Awalt (314) 298-8566
Soil/ Sediment	Metals	Low		See Worksheet #23	28-day		
Soil/ Sediment	Radionuclides	Low		See Worksheet #23	28-day		
Soil/ Sediment	VOCs	Low		See Worksheet #23	28-day		
Soil/ Sediment	SVOCs	Low		See Worksheet #23	28-day		
Water	PCBs	Low		See Worksheet #23	28-day		
Water	Metals	Low		See Worksheet #23	28-day		
Water	Radionuclides	Low		See Worksheet #23	28-day		
Water	VOCs	Low		See Worksheet #23	28-day		
Water	SVOCs	Low		See Worksheet #23	28-day		

[a] Analytical method SOPs for radiochemistry parameters are laboratory specific.
[b] The laboratory information will be confirmed in the project-specific QAPP once the laboratory has been contracted.

PCBs = polychlorinated biphenyls
SOPs = Standard Operating Procedures
SVOCs = semivolatile organic compound
VOA = volatile organic analysis
VOCs = volatile organic compounds

QAPP Worksheet #20. Field QC Summary
(UFP-QAPP Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.5)

Field Quality Control Sample Summary Table

This worksheet provides a summary of the types of samples to be collected and analyzed for the project. Its purpose is to show the relationship between the number of field samples and associated QC samples for each combination of analyte/analytical group and matrix. This worksheet also is useful for informing the laboratory of the number of samples to expect and for preparing analytical cost estimates. The number and types of QC samples should be based on project-specific DQOs, and this worksheet should be adapted as necessary to accommodate project-specific requirements. Not all types of QC samples shown in the example below will be necessary for all projects. However, some projects may require additional QC samples (e.g., proficiency testing samples), which can be listed in the "other" column.

Samples that are collected at different depths at the same location, and analyzed separately, should be counted as separate field samples. Even if they are taken from the same container as the parent field sample, matrix spikes (MSs) and MS duplicates are counted separately, because they are analyzed separately. If composite samples or incremental samples are being collected, include only the sample that will be analyzed, subsamples and increments should not be listed separately; however, containers making up the sample (as received by the laboratory) must be labeled.

QAPP Worksheet #20. Field QC Summary
(UFP-QAPP Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.5)

Field Quality Control Sample Summary Table

QAPP Worksheet #20. Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference*	No. of Sampling Locations	No. of Field Duplicate Pairs	Inorganic No. of MS	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Soil/Sediments	VOCs	Low	See Worksheet #12	See Worksheets #17/#18	5%	5%	5%	5%	A	See Worksheets #17/#18
Soil/Sediments	PCBs	Low	See Worksheet #12	See Worksheets #17/#18	5%	5%	5%	5%	A	See Worksheets #17/#18
Soil/Sediment	Metals	Low	See Worksheet #12	See Worksheets #17/#18	5%	5%	5%	5%	A	See Worksheets #17/#18
Soil/Sediment	Radionuclides	Low	See Worksheet #12	See Worksheets #17/#18	5%	5%	5%	5%	A	See Worksheets #17/#18
Soil/Sediments	SVOCs[1]	Low	See Worksheet #12	See Worksheets #17/#18	5%	5%	5%	5%	A	See Worksheets #17/#18
Water	VOCs	Low	See Worksheet #12	See Worksheets #17/#18	5%	5%	5%	5%	A	See Worksheets #17/#18
Water	Metals	Low	See Worksheet #12	See Worksheets #17/#18	5%	5%	5%	5%	A	See Worksheets #17/#18
Water	PCBs	Low	See Worksheet #12	See Worksheets #17/#18	5%	5%	5%	5%	A	See Worksheets #17/#18
Water	Radionuclides	Low	See Worksheet #12	See Worksheets #17/#18	5%	5%	5%	5%	A	See Worksheets #17/#18
Water	SVOCs[1]	Low	See Worksheet #12	See Worksheets #17/#18	5%	5%	5%	5%	A	See Worksheets #17/#18

Note: Work package documents will identify the sampling locations, matrices, number of samples, and sample identification numbers for samples to be submitted to DOECAP-audited laboratory. This is not applicable for samples analyzed by field methods.
A = PT sample only will be collected when required by a specific project.
[1] Only samples from Phase I and Phase II will be analyzed for SVOCs.
*Analytical method SOPs for radiochemistry parameters are laboratory specific.

Conc. = Concentration
ID = identification
MS = matrix spike
PT = proficiency testing
PCB = polychlorinated biphenyl
TBD = to be determined
SVOC = semivolatile organic compound
VOC = volatile organic compound

QAPP Worksheet #21. Field SOPs
(UFP-QAPP Manual Section 3.1.2)
(EPA 2106-G-05 Section 2.3.2)

Project Sampling SOP References Table

This worksheet is intended for use to document the specific field procedures being implemented, which is important for measurement traceability. The QAPP must contain detailed descriptions of procedures for field activities, including sample collection; sample preservation; equipment cleaning and decontamination; equipment testing, maintenance, and inspection; and sample handling and custody. If these procedures are included in existing SOPs, then the SOPs should be reviewed to make sure they either are (1) sufficiently prescriptive to be implemented as written or (2) modified as necessary for this project. If an SOP provides more than one procedure or option (for example, one SOP covers the use of several different types of field equipment for the same procedure) this worksheet must note the specific option or equipment being used. Basic information about the SOPs should be provided in this table, and the SOPs themselves should be included in an appendix to the QAPP. Field SOPs must be readily available to field personnel responsible for their implementation. The QAPP must explain any planned modifications to field SOPs. Modifications should be noted clearly on the SOPs. The specific type(s) of SOP modifications/deviations must be summarized in the comments column or a reference provided.

QAPP Worksheet #21. Field SOPs
(UFP-QAPP Manual Section 3.1.2)
(EPA 2106-G-05 Section 2.3.2)

QAPP Worksheet #21. Project Sampling SOP References Table

SOPs to be used on this project are summarized below.

Reference Number	Title and Number[a]	Originating Organization[b]	Equipment Type	Modified for Project Work? (Y/N)	Comments
1	CP4-ES-0043, *Temperature Control for Sample Storage*	Contractor	Sampling	N	N/A
2	CP2-ES-0025, *Paducah Environmental Monitoring Waste Management Plan*	Contractor	N/A	N	N/A
3	CP2-ES-0026, *Wet Chemistry and Miscellaneous Analyses Data Verification and Validation*	Contractor	N/A	N	N/A
4	CP2-ES-0811, *Pesticide and PCB Data Verification and Validation*	Contractor	N/A	N	N/A
5	CP4-ES-1001, *Transmitting Data to the Paducah Oak Ridge Environmental Information System (OREIS)*	Contractor	N/A	N	N/A
6	CP2-ES-0063, *Environmental Monitoring Data Management Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*	Contractor	N/A	N	N/A
7	CP4-ES-2100, *Groundwater Level Measurement*	Contractor	Sampling	N	N/A
8	CP4-ES-2101, *Groundwater Sampling*	Contractor	Sampling	N	N/A
9	CP4-ES-2203, *Surface Water Sampling*	Contractor	Sampling	N	N/A
10	CP4-ES-2302, *Collection of Sediment Samples Associated with Surface Water*	Contractor	Sampling	N	N/A
11	CP4-ES-0074, *Monitoring Well Inspection and Maintenance*	Contractor	Sampling	N	N/A
12	CP4-ES-2700, *Logbooks and Data Forms*	Contractor	N/A	N	N/A
13	CP4-ES-2702, *Decontamination of Sampling Equipment and Devices*	Contractor	Sampling	N	N/A
14	CP4-ES-2704, *Trip, Equipment, and Field Blank Preparation*	Contractor	N/A	N	N/A
15	CP4-ES-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*	Contractor	N/A	N	N/A

QAPP Worksheet #21. Project Sampling SOP References Table (Continued)

Reference Number	Title and Number[a]	Originating Organization[b]	Equipment Type	Modified for Project Work? (Y/N)	Comments
16	CP3-ES-5003, *Quality Assured Data*	Contractor	N/A	N	N/A
17	CP3-ES-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance*	Contractor	N/A	N	N/A
18	CP4-ES-5007, *Data Management Coordination*	Contractor	N/A	N	N/A
19	CP2-ES-5102, *Radiochemical Data Verification and Validation*	Contractor	N/A	N	N/A
20	CP4-ES-5103, *Polychlorinated Dibenzodioxins-Polychlorinated Dibenzofurans Verification and Validation*	Contractor	N/A	N	N/A
21	CP2-ES-5105, *Volatile and Semivolatile Data Verification and Validation*	Contractor	N/A	N	N/A
22	CP2-ES-5107, *Inorganic Data Validation and Verification*	Contractor	N/A	N	N/A
23	CP2-ES-0026, *Wet Chemistry and Miscellaneous Analyses Data Verification and Validation*	Contractor	N/A	N	N/A
24	CP3-ES-1003, *Developing, Implementing, and Maintaining Data Management Implementation Plans*	Contractor	N/A	N	N/A
25	CP4-ES-1002, *Submitting, Reviewing, and Dispositioning Changes to the Environmental Databases OREIS and PEMS*	Contractor	N/A	N	N/A
26	CP4-ER-1035, *Vapor Sampling*	Contractor	N/A	N	N/A

[a] SOPs are posted to the FPDP intranet Web site. External FFA parties can access this site using remote access with privileges upon approval. It is understood that SOPs are contractor specific.
[b] The work will be conducted by FPDP staff or a subcontractor. In either case, SOPs listed will be followed.
N/A = not applicable

QAPP Worksheet #22. Field Equipment Calibration, Maintenance, Testing, and Inspection
(UFP-QAPP Manual Section 3.1.2.4)
(EPA 2106-G-05 Section 2.3.6)
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

This worksheet should document procedures for calibrating, maintaining, testing, and/or inspecting field equipment (e.g., tools, pumps, gauges, magnetometers, pH meters, water-level measurement devices). If these activities are documented in an SOP or manufacturer's instructions, and the relevant SOP or instruction is attached, then the frequency, acceptance criteria, and corrective action columns may be left blank. Note that the information summarized in this worksheet should be recorded in the field notes/logs.

QAPP Worksheet #22. Field Equipment Calibration, Maintenance, Testing, and Inspection
(UFP-QAPP Manual Section 3.1.2.4)
(EPA 2106-G-05 Section 2.3.6)

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

The following is the field equipment to be used on the project.

Field Equipment*	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
MiniRAE Photoionization Detector (PID) Toxic Gas Monitor with 10.5 eV Lamp or Similar Meter	Calibrate at the beginning of the day; check at the end of the day	As needed in the field; semiannually by the supplier	Measure known concentration of isobutylene 100 ppm (calibration gas)	Upon receipt, successful operation	Calibrate a.m., check p.m.	± 10% of the calibrated value	Manually zero meter or service as necessary and recalibrate	Field Team Leader	Manufacturers specifications
Water Quality Meter	Calibrate at the beginning of the day	Performed monthly and as needed	Measure solutions with known values (National Institute for Standards and Technology traceable buffers and conductivity calibration solutions)	Upon receipt, successful operation	Daily before each use	pH: ± 0.1 s.u. Specific Conductivity: ± 3% ORP: ± 10 mV DO: ± 0.3 mg/L Temp.: ± 0.3ºC	Recalibrate or service as necessary	Field Team Leader	Manufacturers specifications

QAPP Worksheet #22. Field Equipment Calibration, Maintenance, Testing, and Inspection Table (Continued)

Field Equipment*	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Turbidity Meter (Nephthelometer)	Calibrate daily before each use	As needed	Measure solutions with known turbidity standards	Upon receipt, successful operation	Daily before each use	N/A (instrument zeroed)	Manually zero meter or service as necessary and recalibrate	Field Team Leader	Manufacturer's specifications
Ferrous Iron Colorimeter	Accuracy check at the beginning of each day	Return to instrument rental for replacement	Measure with standard solution	Upon receipt, successful operation	Check daily before each use	Pass/Fail	Return to rental company for replacement	Field Team Leader	Manufacturer's specifications
PCB Colorimeter	Accuracy check at the beginning of each day	As needed	Measure with standards	Upon receipt, successful operation	Check daily before each use	Within range of manufacturer's standard	Service by manufacturer	Field Team Leader	Manufacturer's specifications
Titrator (for total residual chlorine)	Calibrate to manufacturer's solution weekly	As needed	Measure with standard solution	Upon receipt, successful operation	Weekly	With range of manufacturer's standard	Service by manufacturer	Field Team Leader	Manufacturer's specifications
Global flow meter	Calibrate when replace battery	As needed	Spin prop to verify instrument reading	Upon receipt, successful operation	Check daily before each use	Pass/Fail	Service by manufacturer	Field Team Leader	Manufacturer's specifications
Electron Water Level Meter	N/A	None	Check daily before each use	Upon receipt, successful operation	Check daily before each use	Pass/Fail	Return to rental company for replacement	Field Team Leader	Manufacturer's specifications
Hach flow meter	Calibrate to readings on flume	Quarterly or as needed	Measure against flume	Upon receipt, successful operation	Weekly as needed	Pass/Fail	Service by manufacturer	Field Team Leader	Manufacturer's specifications

QAPP Worksheet #22. Field Equipment Calibration, Maintenance, Testing, and Inspection Table (Continued)

Field Equipment*	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Alpha Scintillator	Annually or as specified by manufacturer	Annually or as needed	Daily prior to use	Upon receipt, successful operation	Daily prior to use	Pass/Fail	Return to rental company for replacement	RCT Supervisor	Manufacturer's specifications
Geiger Mueller	Annually or as specified by manufacturer	Annually or as needed	Daily prior to use	Upon receipt, successful operation	Daily prior to use	Pass/Fail	Return to rental company for replacement	RCT Supervisor	Manufacturer's specifications
Gamma Scintillator or FIDLER	Annually or as specified by manufacturer	Annually or as needed	Daily prior to use	Upon receipt, successful operation	Daily prior to use	Pass/Fail	Service by manufacturer	RCT Supervisor	Manufacturer's specifications
Field Equipment GPS	Daily check of known point beginning and end of each field day	Per manufacturers specifications	Measure known control points and compare values	Upon receipt, successful operation	Beginning and end of each field day	Pass/Fail	Service by manufacturer	Field Team Leader	Manufacturer's specifications
GPS Gamma Ray Survey Instrumentation	Annually or as specified by manufacturer	Annually or as needed	Daily prior to use	Upon receipt, successful operation	Annually or as needed	Pass/Fail	Return to rental company for replacement	RCT Supervisor	Manufacturer's specifications

*Additional equipment may be needed; additional equipment will follow manufacturer's specifications for calibration, maintenance, inspection, and testing. Calibration data will be documented in logbooks consistent with CP4-ES-2700, *Logbooks and Data Forms*.
FIDLER = field instrument for detection of low energy
GPS = Global Positioning System
N/A = not applicable
PCB = polychlorinated biphenyl
RCT = radiological control technician

QAPP Worksheet #23. Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

Analytical SOP References Table

This worksheet documents information about the specific sample preparation and analytical procedures to be used, which is important for measurement traceability. Screening data are used for interim investigations and/or will not be used for final risk assessment or site assessment decisions unless they have been confirmed with definitive procedures. SOPs for sample preparation and analytical procedures must be current and referenced whether these activities are performed in the field or in an off-site laboratory. If this information is not known at the time the QAPP is being prepared (i.e., laboratory selection has not occurred), it is acceptable to enter "TBD" for the required information. This worksheet must be completed, however, before the QAPP is approved. If required by the project, copies of the SOPs should be included as a hard copy or electronic appendix. The project team should review SOPs to make sure they are either (1) sufficiently prescriptive to be implemented as written or (2) modified, as necessary, for this project. If an SOP provides more than one procedure or option [e.g., extraction procedures for analytes of different concentration levels (SW5035), sulfur cleanup options (SW3660), or derivatization techniques (SW8151)], the specific option being implemented must be noted. This worksheet must summarize planned modifications to existing SOPs, and modifications should be noted clearly on the copies of the SOPs themselves. Personnel responsible for implementing sample preparation and analytical SOPs must have access to the specific SOPs they are using.

QAPP Worksheet #23. Analytical SOP's
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

QAPP Worksheet #23. Analytical SOP References Table

Reference Number*	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis**	Modified for Project Work?(Y/N)
8260	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	Definitive	VOAs	GC/MS	GEL or TestAmerica	No
8082	Polychlorinated Biphenyls (PCBs) by Gas Chromatography	Definitive	PCBs	GC	GEL or TestAmerica	No
6010	Inductively Coupled Plasma-Atomic Emission Spectrometry	Definitive	Metals	ICP	GEL or TestAmerica	No
6020	Inductively Coupled Plasma-Mass Spectrometry	Definitive	Metals	ICP-MS	GEL or TestAmerica	No
8270[1]	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	Definitive	SVOAs	GC/MS	GEL or TestAmerica	No
7470/7471	Cold vapor Atomic Absorption	Definitive	Mercury	AA	GEL or TestAmerica	No
4035	Soil Screening for Polynuclear Aromatic Hydrocarbons by Immunoassay	Screening	PAHs	Field Test Kit	Fluor	No
4020	Screening for Polychlorinated Biphenyls by Immunoassay	Screening	PAHs	Field Test Kit	Fluor	No
9060	Total Organic Carbon	Definitive	Wet Chemistry	TOC Analyzer (NDIRD)	GEL or TestAmerica	No
9040	pH Electrometric Measurement	Definitive	Physical	pH Meter	GEL or TestAmerica	No
TO-15	Determination Of VOCs In Air Collected In Specially-Prepared Canisters And Analyzed by GC/MS	Definitive	VOCs	GC/MS		No

QAPP Worksheet #23. Analytical SOP References Table (Continued)

Reference Number*	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis**	Modified for Project Work? (Y/N)
Gas Flow Proportional***	Gas Flow Proportional	Definitive	Rads	Gas flow proportional counter	GEL or TestAmerica	No
Alpha Spec***	Alpha Spectrometry	Definitive	Rads	Alpha Spectrometry	GEL or TestAmerica	No
Gamma Spec***	Gamma Spectrometry	Definitive	Rads	Gamma Spectrometry	GEL or TestAmerica	No
Liquid Scintillation***	Tc-99 by Liquid Scintillation	Definitive	Rads	Liquid Scintillation	GEL or TestAmerica	No

*Information will be based on laboratory used. Analysis will be by the most recent revision.
**GEL Laboratories information is applicable to Phase I, II, and the initial 11 borings on Phase III.
***Analytical methods for radiochemistry parameters are laboratory specific.
TBD = to be determined
[1] Only samples from Phase I and Phase II will be analyzed for SVOCs.

QAPP Worksheet #24. Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

This worksheet should be completed for analytical instruments, whether used in the field or the laboratory. As appropriate to the instrument, calibration procedures should include tuning, initial calibration, calibration blank, initial calibration verification (second source), continuing calibration verification, linear dynamic range (ICP and ICP/MS only), and verification of detection and quantification limits (however defined.) See also Worksheet 15. If information for a specific procedure is provided in an SOP, and the SOP is attached, then this worksheet can reference the SOP and identify the responsible person.

QAPP Worksheet #24. Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

QAPP Worksheet #24. Analytical Instrument Calibration

Laboratory equipment and instruments used for quantitative measurements are calibrated in accordance with the laboratory's formal calibration program as summarized in the SOPs. Whenever possible, the laboratory uses recognized procedures for calibration such as those published by EPA or American Society for Testing and Materials. If established procedures are not available, the laboratory develops a calibration procedure based on the type of equipment, stability, characteristics of the equipment, required accuracy, and the effect of operation error on the quantities measured. Whenever possible, physical reference standards associated with periodic calibrations such as weights or certified thermometers with known relationships to nationally recognized standards are used. Where national reference standards are not available, the basis for the reference standard is documented. Equipment or instruments that fail calibration or become inoperable during use are tagged to indicate they are out of calibration. Such instruments or equipment are repaired and successfully recalibrated prior to reuse. High resolution mass spectrometer instruments undergo extensive tuning and calibration prior to running each sample set. The calibrations and ongoing instrument performance parameters are recorded and reported as part of the analytical data package.

Instrument*	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference

* The laboratory is responsible for maintaining instrument calibration information per their QA Plan including control charts established for instrumentation. This information is audited annually by DOECAP. Laboratory(s) contracted will be DOECAP audited. Additional certifications may be needed based on project-specific requirements (e.g., National Environmental Laboratory Accreditation Program, KDEP Drinking Water Laboratory Program). Field survey/sampling instrumentation will be calibrated according to manufacturer's instructions.

QAPP Worksheet #25. Analytical Instrument and Equipment Maintenance, Testing, and Inspection (UFP-QAPP Manual Section 3.2.3) (EPA 2106-G-05 Section 2.3.6)

Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

The project team should determine whether it is necessary to complete fields in this table. For example, if the selected laboratory is operating under a quality system that conforms to ISO 17025:2005, then the activities documented in this table will be documented in the laboratory's quality manual (however named). In this case, it may be acceptable to simply reference the quality manual (including revision number and date.) If the project has specific requirements that are different from those contained in the laboratory's quality manual, this table should be completed for those items.

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference*
GC-MS	Replace/clean ion source; clean injector, replace injector liner, replace/clip capillary column, flush/replace tubing on purge and trap; replace trap	QC standards	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Section Manager	See Worksheet #23
GC	ECD/FID maintenance; replace/clip capillary column	QC standards	ECD, FID, injector, injector liner, column, column flow	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Section Manager	See Worksheet #23
ICP-AES	Clean plasma torch; clean filters; clean spray and nebulizer chambers; replace pump tubing	Metals	Torch, filters, nebulizer chamber, pump, pump tubing	As needed	Initial and/or continuing calibration criteria must be met	Repeat maintenance activity or remove from service	Laboratory Area Supervisor	See Worksheet #23
ICP-MS	Clean plasma torch; clean filters; clean spray and nebulizer chambers; replace pump tubing	Metals	Torch, filters, nebulizer chamber, pump, pump tubing	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Area Supervisor	See Worksheet #23

QAPP Worksheet #25. Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference*
pH meter	Clean probe	QC standards	Probe	As needed	The value for each of the certified buffer solutions must be within ± 0.05 pH units of the expected value	Repeat maintenance activity or remove from service	Laboratory Manager	See Worksheet #23
Spectro-photometer	Flush/replace tubing	QC standards	Tubing	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Manager	
TOC Analyzer (NDIRD)	Replace sample tubing, clean sample boat, replace syringe	QC standards	Tubing, sample boat, syringe	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Manager	See Worksheet #23
CVAA	Replace tubing, check instrument lines and connections, check windows in cell, ensure lamp operational	Metals	Instrument lines and connections, windows and lamp	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Area Supervisor	See Worksheet #23

CVAA = cold vapor atomic absorption
FID = flame ionization detector
GC-MS = gas chromatography-mass spectrometry
GC = gas chromatography
ICP-AES = inductively coupled plasma atomic emission spectroscopy
ICP-MS = inductively coupled plasma mass spectroscopy
NDIRD = nondispersive infrared detector
QC = quality control
TOC = total organic carbon

*The laboratory is responsible for maintaining instrument and equipment maintenance, testing, and inspection information per their QA Plan. This information is audited annually by DOECAP. Laboratory(s) contracted will be DOECAP audited. Field survey/sampling instrumentation will be maintained, tested, and inspected according to manufacturer's instructions.

QAPP Worksheet #26 and 27. Sample Handling, Custody, and Disposal
(UFP-QAPP Manual Section 3.3)
(EPA 2106-G-05 Section 2.3.3)

This worksheet is used to document responsibilities for maintaining custody of samples from sample collection through disposal. Examples of forms, sample labels, and chain-of-custody documentation should be included as an attachment to the QAPP. The information in this worksheet table can be referenced to the appropriate SOPs if they are attached to the QAPP.

Activity:

Organization and title or position of person responsible for the activity:

SOP reference:

Sample labeling:

Chain-of-custody form completion:

Packaging:

Shipping coordination:

Sample receipt, inspection, and log-in:

Sample custody and storage:

Sample disposal:

QAPP Worksheet #26 and 27. Sample Handling, Custody, and Disposal
(UFP-QAPP Manual Section 3.3)
(EPA 2106-G-05 Section 2.3.3)

QAPP Worksheet #26. Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT	
Sample Collection (Personnel/Organization):	Sampling Teams/DOE Prime Contractor and Subcontractors
Sample Packaging (Personnel/Organization):	Sampling Teams/DOE Prime Contractor and Subcontractors
Coordination of Shipment (Personnel/Organization):	Lab Coordinator/DOE Prime Contractor
Type of Shipment/Carrier:	Direct Delivery or Overnight/Federal Express in accordance with the on-site transportation plan or U.S. Department of Transportation requirements
SAMPLE RECEIPT AND ANALYSIS	
Sample Receipt (Personnel/Organization):	Sample Management/Contracted Laboratory
Sample Custody and Storage (Personnel/Organization):	Sample Management/Contracted Laboratory
Sample Preparation (Personnel/Organization):	Analysts/Contracted Laboratory
Sample Determinative Analysis (Personnel/Organization):	Analysts/Contracted Laboratory
SAMPLE ARCHIVING	
Field Sample Storage (No. of days from sample collection):	The field laboratory is required to analyze samples within 48 hours of collection and those samples are archived until results are screened (same day as analysis). The fixed-base laboratory will archive samples for 4 months or less depending on project-specific requirements.
Sample Extract/Digestate Storage (No. of days from extraction/digestion):	120 Days
Biological Sample Storage (No. of days from sample collection):	Not applicable.
SAMPLE DISPOSAL	
Personnel/Organization:	Waste Disposition/Sample Management Office/DOE Prime Contractor and Subcontractors
Number of Days from Analysis	6 months

QAPP Worksheet #27. Sample Custody Requirements*

Chain-of-custody procedures are comprised of maintaining sample custody and documentation of samples for evidence. To document chain-of-custody, an accurate record of samples must be maintained in order to trace the possession of each sample from the time of collection to its introduction to the laboratory.

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Field sample custody requirements will be per DOE Prime Contractor procedures, CP4ES-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*; and CP3-ES-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance.*

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

Are per the DOECAP-audited laboratory's standard procedures. When the samples are delivered to the laboratory, signatures of the laboratory personnel receiving them and the courier personnel relinquishing them will be completed in the appropriate spaces on the chain-of-custody record, unless the courier is a commercial carrier. This will complete the sample transfer. It will be every laboratory's responsibility to maintain internal logbooks and records that provide custody throughout sample preparation and analysis process.

Sample Identification Procedures:

Sample identification requirements will be specified in work package documents.

Chain-of-custody Procedures:

Chain-of-custody requirements will be per DOE Prime Contractor procedures, CP4-ES-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*; and CP3-ES-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance.*

*It is understood that SOPs are contractor specific.

QAPP Worksheet #28. Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

The purpose of this worksheet is to ensure that the selected analytical methods are capable of meeting project-specific MPC, which are based on PQOs/DQOs. Complete a separate worksheet for each sampling technique, analytical method/SOP, matrix, and analytical group. If method/SOP QC acceptance criteria do not meet the project-specific MPC, the data obtained may be unusable for making reliable project decisions. In this case, the project team should consider selecting an alternate method or modifying the method. The list of QC samples in this example is incomplete. See Section 2.2 of Part 2B of the UFP-QAPP QA/QC Compendium, the QA Matrix in Section 3.4, and Tables 4, 5, and 6 for further information and guidance on QC samples.

QAPP Worksheet #28. Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

QAPP Worksheet #28-A. QC Samples Table

Matrix: Aqueous Samples
Analytical Group/Concentration Level: VOC, Metals, PCBs, Rads, SVOCs[1]
Sampling SOP: See Worksheet #21
Analytical Method/SOP Reference: 8260, 200.8/6010/6020,8082, Alpha Spec, Gamma Spec, Liquid Scint, 8270
Sampler's Name/Field Sampling Organization: FPDP
Analytical Organization: GEL
No. of Sample Locations: 157

QC Sample	Frequency/Number*	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field blank	Minimum 5%	≤ CRQL**	Verify results; reanalyze	Laboratory should alert project	Contamination—Accuracy/bias	See procedure CP3-ES-5003, *Quality Assured Data*
Trip blank	1 per cooler containing VOC samples	≤ CRQL**	Verify results; reanalyze		Contamination—Accuracy/bias	See procedure CP3-ES-5003, *Quality Assured Data*
Equipment blank	Minimum 5%	≤ CRQL**	Verify results; reanalyze		Contamination—Accuracy/bias	See procedure CP3-ES-5003, *Quality Assured Data*
Spiked field samples	1 per analytical batch	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples		Accuracy/Precision	See procedure CP3-ES-5003, *Quality Assured Data*
Laboratory spiked blanks	1 per analytical batch	See data validation plans 5105, -5107	Check calculations and instrument; reanalyze affected samples		Contamination-Accuracy/Bias	See procedure CP3-ES-5003, *Quality Assured Data*

Worksheet #28-A. QC Samples Table (Continued)

QC Sample	Frequency/Number*	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per analytical batch	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples	Laboratory should alert project	Accuracy	See procedure CP3-ES-5003, *Quality Assured Data*
Surrogate Standards	All sample blanks and QA samples	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples		Accuracy	See procedure CP3-ES-5003, *Quality Assured Data*
Internal standards	All samples and standards	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples		Accuracy	See procedure CP3-ES-5003, *Quality Assured Data*
Field duplicate	Minimum 5%	None	Data reviewer will place qualifiers on samples affected	Project	Homogeneity/ Precision	RPD ≤ 50% soils, RPD < 25% aqueous
Laboratory duplicate	Per laboratory procedure	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Verify results re-prepare and reanalyze	Laboratory analyst	Precision	See procedure CP3-ES-5003, *Quality Assured Data*

Worksheet #28-A. QC Samples Table (Continued)

QC Sample	Frequency/Number*	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Tracers/Carriers	Each sample tested by a radiochemical separations method	See data validation plan CP2-ES- 5102	Check calculations and instrument; reanalyze affected samples	Laboratory analyst	Accuracy	See procedure CP3-ES-5003, *Quality Assured Data*

*The number of QC samples is listed on Worksheet #20.
**Unless dictated by project-specific parameters, ≤ contract-required quantitation limit (CRQL).
[1] Only samples from Phase I and Phase II will be analyzed for SVOCs.

QAPP Worksheet #28-B. QC Samples Table

Matrix: Soils/Sediments
Analytical Group/Concentration Level: VOC, Metals, PCBs, Radionuclides, SVOCs[1]
Sampling SOP: See Worksheet #21
Analytical Method/SOP Reference: 8260, 200.8/6010/6020,8082, Alpha Spec, Gamma Spec, Liquid Scint, 8270
Sampler's Name/Field Sampling Organization: FPDP
Analytical Organization: GEL Laboratories
No. of Sample Locations: 384

QC Sample	Frequency/Number*	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field blank	Minimum 5%	≤ CRQL**	Verify results; reanalyze	Laboratory should alert project	Contamination—Accuracy/bias	See procedure CP3-ES-5003, *Quality Assured Data*
Trip blank	1 per cooler containing VOC samples	≤ CRQL**	Verify results; reanalyze		Contamination—Accuracy/bias	See procedure CP3-ES-5003, *Quality Assured Data*
Equipment blank	Minimum 5%	≤ CRQL**	Verify results; reanalyze		Contamination—Accuracy/bias	See procedure CP3-ES-5003, *Quality Assured Data*
Spiked field samples	1 per analytical batch	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples		Accuracy/Precision	See procedure CP3-ES-5003, *Quality Assured Data*
Laboratory spiked blanks	1 per analytical batch	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples		Contamination-Accuracy/Bias	See procedure CP3-ES-5003, *Quality Assured Data*

QAPP Worksheet #28-B. QC Samples Table (Continued)

QC Sample	Frequency/Number*	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per analytical batch	See data validation plans CP2-ES-0026, -0811, 5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples	Laboratory should alert project	Accuracy	See procedure CP3-ES-5003, *Quality Assured Data*
Surrogate Standards	All sample blanks and QA samples	See data validation plans CP2-ES-0026, -0811, 5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples		Accuracy	See procedure CP3-ES-5003, *Quality Assured Data*
Internal standards	All sample blanks and QA samples	See data validation plans CP2-ES-0026, -0811, 5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples		Accuracy	See procedure CP3-ES-5003, *Quality Assured Data*
Field duplicate	Minimum 5%	None	Data reviewer will place qualifiers on samples affected	Project	Homogeneity/ Precision	RPD ≤ 50% soils, RPD < 25% aqueous, Specific RPD defined for each group in Worksheet #12
Laboratory duplicate	Per laboratory procedure	See data validation plans CP2-ES-0026, -0811, 5102, -5105, -5107	Verify results re-prepare and reanalyze	Laboratory analyst	Precision	See procedure CP3-ES-5003, *Quality Assured Data*
Tracers/Carriers	Each sample tested by a radiochemical separations method	See data validation plan CP2-ES-5102	Check calculations and instrument; reanalyze affected samples	Laboratory analyst	Accuracy	See procedure CP3-ES-5003, *Quality Assured Data*

*The number of QC samples is listed on Worksheet #20.
**Unless dictated by project-specific parameters, ≤ CRQL.
[1] Only samples from Phase I and Phase II will be analyzed for SVOCs.

QAPP Worksheet #29. Project Documents and Records
(UFP-QAPP Manual Section 3.5.1)
(EPA 2106-G-05 Section 2.2.8)

This worksheet should be used to record information for documents and records that will be generated for the project. It describes how information will be collected, verified, and stored. Its purpose is to support data completeness, data integrity, and ease of retrieval.

QAPP Worksheet #29. Project Documents and Records
(UFP-QAPP Manual Section 3.5.1)
(EPA 2106-G-05 Section 2.2.8)

QAPP Worksheet #29. Project Documents and Records Table

All project data and information must be documented in a format that is usable by project personnel. The QAPP describes how project data and information shall be documented, tracked, and managed from generation in the field to final use and storage in a manner that ensures data integrity, defensibility, and retrieval.

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records*	Other
Data logbooks and associated completed sampling forms; sample chains-of-custody	Laboratory data packages, OREIS database, and associated data packages	OREIS database and associated data packages	CP3-ES-5003, Att. G, Data Assessment Review Checklist and Comment Form	CP3-OP-0009-F01, Observation Checklist Form

*It is understood that SOPs are contractor specific.
OREIS = Oak Ridge Environmental Information System

QAPP Worksheets #31, 32, and 33. Assessments and Corrective Action
(UFP-QAPP Manual Sections 4.1.1 and 4.1.2)
(EPA 2106-G-05 Section 2.4 and 2.5.5)

Planned Project Assessments Table

This worksheet is used to document responsibilities for conducting project assessments, responding to assessment findings and implementing corrective action. Appropriately scheduled assessments (e.g., field sampling technical systems audits at the beginning of sampling) allow management to implement corrective action in a timely manner, thereby correcting nonconformances and minimizing their impact on DQOs/PQOs. Assessment checklists should be included in the QAPP or referenced.

QAPP Worksheets #31, 32, and 33. Assessments and Corrective Action (UFP-QAPP Manual Sections 4.1.1 and 4.1.2) (EPA 2106-G-05 Section 2.4 and 2.5.5)

QAPP Worksheet #31. Planned Project Assessments Table

FPDP will ensure that protocol outlined in the QAPP is implemented adequately. Assessment activities help to ensure that the resultant data quality is adequate for its intended use and that appropriate responses are in place to address nonconformances and deviations from the QAPP. Below is a list of assessments project teams may use.

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Independent Assessment/ Surveillance	A	Internal	QA Manager or designee	QA Specialists	Project Manager	Project Manager	QA Manager
Laboratory Audit	Annual	External	DOE Consolidated Audit Program (DOECAP)	Laboratory Assessor	Laboratory	Laboratory	DOECAP
Management Assessments	Annual	Internal	Project Manager or designee	Project Manager or Designee		Project Manager	QA Manager
Performance Observation	B	Internal	Project Manager or designee	Project Manager	Project Manager	Project Manager	Project Manager
Performance Observation Follow-up surveillances	Quarterly	Internal	Project Manager or designee	Project Manager or designee	Project Manager	Project Manager	Project Manager

A = Assessment frequency determined by QA Manager and conducted per CP3-QA-1003, *Management and Self Assessments*.
B = Assessment frequency determined by project manager.
*Reference: CP3-OP-0009, *Performance Observations Desk Instructions*

QAPP Worksheet #32. Assessment Findings and Corrective Action Responses

Provisions shall be taken in the field and laboratory to ensure that any problems that may develop shall be dealt with as quickly as possible to ensure the continuity of the project/sampling events. Field modifications to procedures in the QAPP must be approved before the modifications are implemented and then documented. The process controlling procedure modification is CP3-OP-0002, *Development, Approval, and Change Control for FPDP Performance Documents*. Field modifications are documented through the work control process per CP3-SM-1003. Corrective action in the field may be necessary when the sampling design is changed. For example, a change in the field may include increasing the number or type of samples or analyses, changing sampling locations, and/or modifying sampling protocol. When this occurs, the project team shall identify any suspected technical or QA deficiencies and note them in the field logbook. Listed in Worksheet #32 is how project teams will address assessment findings.

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Time frame of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Time Frame for Response
Management, Independent, and Surveillances	Form CP3-QA-1003-F02, Management/Self-Assessment Report, Form CP3-QA-1003-F03, Management/Self-Assessment Checklist, and Form CP3-QA-3001-F02, Issue Identification Form	Project management, issue owner, contractor	Upon issuance of Forms CP3-QA-1003-F02, Management/Self-Assessment Report and CP3-QA-1003-F03, Management/Self-Assessment Checklist, form CP3-QA-3001-F02, Issue Identification Form, will be completed and attached to the assessment report	CP3-QA-3001, Issue Identification Form, documents the issue response and/or corrective actions	Action owner as designated by issue owner, contractor	Fifteen days for initial issue response, corrective action schedule determined by issue owner, per CP3-QA-3001*

*It is understood that SOPs are contractor specific.

QAPP Worksheet #33. QA Management Reports Table

Reports to management include project status reports, field and/or laboratory audits, and data quality assessments. These reports will be directed to the QA Manager and Project Manager who have ultimate responsibility for assuring that any corrective action response is completed, verified, and documented.

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 Recipient(s) (Title and Organizational Affiliation)
Field Change Requests	As needed	Ongoing	Field staff	QAPP recipients
QAPP Addenda	As needed	Not Applicable	Project Manager	QAPP recipients
Field Audit Report	TBD as determined by QA Manager	30 days after completion of audit	QA Manager	FPDP Project Manager QA Manager
Corrective Action Plan	As needed	Within 3 weeks of request	Project Manager	QA Manager

TBD = to be determined
QA = quality assurance

QAPP Worksheet #34. Data Verification and Validation Inputs
(UFP-QAPP Manual Section 5.2.1 and Table 9)
(EPA 2106-G-05 Section 2.5.1)

This worksheet is used to list the inputs that will be used during data verification and validation. Inputs include planning documents, field records, and laboratory records. Data verification is a check that specified activities involved in collecting and analyzing samples have been completed and documented and that the necessary records (objective evidence) are available to proceed to data validation. Data validation is the evaluation of conformance to stated requirements, including those in the contract, methods, SOPs, and the QAPP. Examples of records subject to verification and validation are listed below. The actual inputs required should be based on the graded approach, as defined during project planning.

QAPP Worksheet #34. Verification (Step I) Process Table

This section of the QAPP provides a description of the QA activities that will occur after the data collection phase of the project is completed. Implementation of this section will determine whether the data conforms to the specified criteria satisfying the project objectives.

Verification Input	Description*	Internal/ External	Responsible for Verification (Name, Organization)
Field Logbooks	Field logbooks are verified per DOE Prime Contractor (FPDP) procedure CP4-ES-2700, *Logbooks and Data Forms*, and CP3-ES-5003, *Quality Assured Data*.	Internal	Project Management or designee, Contractor
Chains-of-custody	Chains-of-custody are controlled by DOE Prime Contractor procedure CP3-ES-5004, *Sample Tracking, Lab Coordination and Sample Handling Guidance*; and CP4-ES-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals.* Chains-of-custody will be included in data assessment packages for review as part of data verification and data assessment.	Internal	Sample Management Office Personnel and Project Management, Contractor
Field and Laboratory Data	Field and analytical data are verified and assessed per DOE Prime Contractor procedure CP3-ES-5003, *Quality Assured Data*. Data assessment packages will be created per this procedure. The data assessment packages will include field and analytical data, chains-of-custody, data verification and assessment queries, and other project-specific information needed for personnel to review the package adequately. Data assessment packages will be reviewed to document any issues pertaining to the data and to indicate if data met the data quality objectives of the project.	Internal	Sample Management Office Personnel and Project Management, Contractor
Sampling Procedures	Evaluate whether sampling procedures were followed with respect to equipment and proper sampling support using audit and sampling reports, field change requests and field logbooks.	Internal	Sample Management Office Personnel, Project Management, and QA Personnel**, Contractor
Laboratory Data	Laboratory data will be verified by the laboratory performing the analysis for completeness and technical accuracy prior to submittal to FPDP. Subsequently, FPDP will evaluate the data packages for completeness and compliance.	External/ Internal	Laboratory Manager, FPDP Sample Management Office Personnel
Electronic Data Deliverables (EDDs)	Determine whether required fields and format were provided.	Internal	Sample Management Office Personnel
QAPP	Planning documents will be available to reviewers to allow reconciliation with planned activities and objectives.	Internal	All data users

*It is understood that SOPs are contractor specific.
**QA specialist performs general QA review.

QAPP Worksheet #35. Data Verification Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

This worksheet documents procedures that will be used to verify project data. It applies to both field and laboratory records. Data verification is a completeness check to confirm that required activities were conducted, specified records are present, and the contents of the records are complete. As illustrated in the following example, verification often is performed at more than one step by more than one person.

QAPP Worksheet #35. Assessment, Verification, and Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description[a]	Responsible for Validation (Name, Organization)
IIa	Data Deliverables, Analytes, and Holding Times	The documentation from the contractual screening will be included in the data assessment packages, per DOE Prime Contractor procedure CP3-ES-5003, *Quality Assured Data*.	Sample Management Office Personnel, Contractor
IIa	Chain-of-Custody, Sample Handling, Sampling Methods and Procedures, and Field Transcription	These items will be validated during the data assessment process as required by DOE Prime Contractor procedure CP3-ES-5003, *Quality Assured Data,* and CP3-ES-1003, *Developing, Implementing, and Maintaining Data Management Implementation Plans.* The documentation of this validation will be included in the data assessment packages.	Sample Management Office Personnel, Contractor
IIa	Analytical Methods and Procedures, Laboratory Data Qualifiers, and Standards	These items will be reviewed during the data validation process as required by DOE Prime Contractor data validation procedures. Data validation will be performed in parallel with data assessment. The data validation report and data validation qualifiers will be considered when the data assessment process is being finalized.	Data Validation Subcontractor, and Sample Management Office Personnel, Project, Contractor
IIa	Audits	The audit reports and accreditation and certification records for the laboratory supporting the projects will be considered in the bidding process.	QA Personnel
IIb	Deviations and qualifiers from Step IIa	Any deviations and qualifiers resulting from Step IIa process will be documented in the data assessment packages.	Sample Management Office Personnel, Project, and QA Personnel, Contractor
IIb	Sampling Plan, Sampling Procedures, Co-located Field Duplicates, Project Quantitation Limits, Confirmatory Analyses, Performance Criteria	These items will be evaluated as part of the data verification and data assessment process per DOE Prime Contractor procedure CP3-ES-5003, *Quality Assured Data*. These items will be considered when evaluating whether the project met their DQOs.	Sample Management Office Personnel, Project, and QA Personnel, Contractor

[a] It is understood that SOPs are contractor specific.

QAPP Worksheet #36
Data Validation Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

This worksheet documents procedures that will be used to validate project data. Data validation is an analyte and sample-specific process for evaluating compliance with contract requirements, methods/SOPs, and MPC. The scope of data validation needs to be defined during project planning because it affects the type and level of documentation required for both field and laboratory activities. If data validation procedures are contained in an SOP or other document, the procedures should be referenced in this table and included as an attachment to the QAPP. The example provided below makes use of terminology contained in *Guidance for Labeling Externally Validated Laboratory Data for Superfund Use*, EPA 540-R-08-005 (EPA 2009), which was developed to promote the use of consistent terminology by external data reviewer to describe the scope and content of data review activities. The validation code and label identifier table, as well as any checklists to be used, should be attached to the QAPP. Any data qualifiers to be applied by the data validator must be defined. Of particular importance, third party data validation should NOT include the rejection of data (noted by the designation of the "R" data qualifier). Data validation should note when performance criteria are not met, but the final rejection of any data and their use is a decision reserved specifically for the project team.

Data Validator: ABC DV, Inc.

Analytical Group/Method:	Volatile Organics–SW-846-8260	Metals–SW-846-6010
Data deliverable requirements:	SEDD Stage 3 plus chromatograms	SEDD Stage 3
Analytical specifications:	WS 28-1, SOP VOA-02 (modified)	WS 28-2, SOP Met-03
Measurement performance criteria:	WS 12	WS 12
Percent of data packages to be validated:	100%	100%
Percent of raw data reviewed:	100%	0
Percent of results to be recalculated:	10%	0
Validation procedure:	EPA Region 11 VOA–Level 4	EPA Region 11 Met–Level 3
Validation code (see attached table*):	SV3EM	SV3E
Electronic validation program/version:	ABC DV Tool V2.2	ABC DV Tool V2.2

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

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
Step IIa/IIb	Soils/Sediments	All	All	National Functional Guidelines; Worksheets #12, #15, and #28; and CP2-ES-0026, CP2-ES-0811, CP2-ES-5102, CP2-ES-5105, CP4-ES-5103, and CP2-ES-5107	Data Validator[a]
Step IIa/IIb	Water	All	All		Data Validator[a]

[a] Validation is to be conducted by a qualified individual, independent from sampling, laboratory, project management, or other decision making personnel for the task. This could be an outside party or someone within FPDP who is not involved in the project.

QAPP Worksheet #37. Data Usability Assessment
(UFP-QAPP Manual Section 5.2.3 including Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

Usability Assessment

This worksheet documents procedures that will be used to perform the data usability assessment. The data usability assessment is performed at the conclusion of data collection activities, using the outputs from data verification and data validation. It is the data interpretation phase, which involves a qualitative and quantitative evaluation of environmental data to determine if the project data are of the right type, quality, and quantity to support the decisions that need to be made. It involves a retrospective evaluation of the systematic planning process, and, like the systematic planning process, involves participation by key members of the project team. The data usability assessment evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence.

Identify personnel (organization and position/title) responsible for participating in the data usability assessment:

Describe how the usability assessment will be documented:

Summarize the data usability assessment process including statistics, equations, and computer algorithms that will be used to analyze the data:

Step 1 Review the project's objectives and sampling design

Review the key outputs defined during systematic planning (i.e., PQOs or DQOs and MPCs) to make sure they are still applicable. Review the sampling design for consistency with stated objectives. This provides the context for interpreting the data in subsequent steps.

Step 2 Review the data verification and data validation outputs

Step 3 Verify the assumptions of the selected statistical method

Step 4 Implement the statistical method

Step 5 Document data usability and draw conclusions

QAPP Worksheet #37. Data Usability Assessment (Continued)
(UFP-QAPP Manual Section 5.2.3 including Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

Usability Assessment

Review available QA reports, including the data verification and data validation reports. Perform basic calculations and summarize the data (using graphs, maps, tables, etc.). Look for patterns, trends, and anomalies (i.e., unexpected results). Review deviations from planned activities (e.g., number and locations of samples, holding time exceedances, damaged samples, noncompliant PT sample results, and SOP deviations) and determine their impacts on the data usability. Evaluate implications of unacceptable QC sample results.

Verify whether underlying assumptions for selected statistical methods (if documented in the QAPP) are valid. Common assumptions include the distributional form of the data, independence of the data, dispersion characteristics, homogeneity, etc. Depending on the robustness of the statistical method, minor deviations from assumptions usually are not critical to statistical analysis and data interpretation. If serious deviations from assumptions are discovered, then another statistical method may need to be selected.

Implement the specified statistical procedures for analyzing the data and review underlying assumptions. For decision projects that involve hypothesis testing (e.g., "concentrations of lead in groundwater are below the action level") consider the consequences for selecting the incorrect alternative; for estimation projects (e.g., establishing a boundary for surface soil contamination), consider the tolerance for uncertainty in measurements.

Determine if the data can be used as intended, considering implications of deviations and corrective actions.

QAPP Worksheet #37. Data Usability Assessment (Continued)
(UFP-QAPP Manual Section 5.2.3 including Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

QAPP Worksheet #37. Usability Assessment

FPDP shall determine the adequacy of data based on the results of validation and verification. The usability step involves assessing whether the process execution and resulting data meet project quality objectives documented in the QAPP.

Summarize the usability assessment process and procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: Field and analytical data are verified and assessed per procedure CP3-ES-5003, *Quality Assured Data*. Data assessment packages will be created per this procedure. Data assessment packages will include field and analytical data, chains-of-custody, data verification and assessment queries, and other project-specific information needed for personnel to review the package adequately. Data assessment packages will be reviewed to document any issues pertaining to the data and to indicate if data quality objectives of the project were met. For data selected for validation, the following procedures are used: CP2-ES-0026, CP2-ES-0811, CP2-ES-5102, CP2-ES-5103, CP2-ES-5105, and CP2-ES-5107.

Describe the evaluative procedures used to assess overall measurement error associated with the project: PARCCS parameters (precision, accuracy, representativeness, comparability, completeness, and sensitivity) will be evaluated per procedure, CP3-ES-5003, *Quality Assured Data*. This information will be included in the data assessment packages for review by project personnel. Data assessment also will include documentation of QC exceedances, trends, and/or bias in the data set. Data assessment will document any statistics used.

Identify the personnel responsible for performing the usability assessment: Project personnel, as verified by QA personnel.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: Data assessment packages will be created, which will include data assessment comments/questions and laboratory comments. Data verification and assessment queries indicating any historical outliers and background exceedances also will be included in the data assessment packages.

THIS PAGE INTENTIONALLY LEFT BLANK

3. REFERENCES

CH2M Hill, 1992. *Results of the Site Investigation, Phase II at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* KY/SUB/13B-97777C P-03/1991/1, U.S. Department of Energy, Paducah, KY, April.

DOE (U.S. Department of Energy) 1998a. *Work Plan for Waste Area Grouping 3 Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1649&D2, U.S. Department of Energy, Paducah, KY, July.

DOE 1998. *Data and Documents Management and Quality Assurance Plan for Paducah Environmental Management and Enrichment Facilities*, DOE/OR/07-1595&D2, U.S. Department of Energy, Paducah, KY.

DOE 2000a. *Remedial Investigation Report for Waste Area Grouping 3 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1895/V1-V4&D1, U.S. Department of Energy, Paducah, KY, September.

DOE 2000b. *Data Report for the Sitewide Remedial Evaluation for Source Areas Contributing to Off-Site Groundwater Contamination at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/07-1845&D1, U.S. Department of Energy, Paducah, KY, January.

DOE 2007. *Site Investigation Report for the Southwest Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2180&D2/R1, U.S. Department of Energy, Paducah, KY, June.

DOE 2010. *Remedial Investigation Report for the Burial Grounds Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0030&D2/R1, U.S. Department of Energy, Paducah, KY, February.

DOE 2011a. *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2010 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PAD/ENR/0130, U.S. Department of Energy, Paducah, KY, August.

DOE 2011b. *Sitewide Evaluation Work Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0228&D2, U.S. Department of Energy, Paducah, KY, May.

DOE 2013. *Paducah Gaseous Diffusion Plant Quality Assurance Project Plan,* DOE/LX/07-1269&D2/R1, U.S. Department of Energy, Paducah, KY, February.

DOE 2014. *Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2179&D2/R2, U.S. Department of Energy, Paducah, KY, September.

DOE 2015. *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume* 1. *Human Health,* DOE/LX/07-0107&D2/R6/V1, U.S. Department of Energy, Paducah, KY, July.

EPA (U.S. Environmental Protection Agency) 2002. *Guidance for Quality Assurance Project Plans*, EPA QA/G-5, EPA/240/R-02/009, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC, December.

EPA 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*, EPA 540-R-08-005, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC, January.

EPA 2012. *Guidance on Quality Assurance Project Plans*, CIO 2106-G-05 QAPP, U.S. Environmental Protection Agency, Washington, DC, January.

EPA 2014. Regional Screening Levels, May 2014. http://www.epa.gov/region9/superfund/prg/.

FPDP (Fluor Federal Services, Inc., Paducah Deactivation Project) 2016. *Environmental Monitoring Plan, Fiscal Year 2016, Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* CP2-ES-0006/R0, Fluor Federal Services, Inc., Paducah Deactivation Project, Kevil, KY.

IDQTF (Intergovernmental Data Quality Task Force) 2005. *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP Manual), EPA: EPA-505-B-04-900B/DoD: DTIC ADA 427785, Intergovernmental Data Quality Task Force comprised of representatives from the U.S. Department of Defense, U.S. Department of Energy, U.S. Environmental Protection Agency, Washington, DC, March.

IDQTF 2012. *Optimized UFP-QAPP Worksheets*, Intergovernmental Data Quality Task Force comprised of representatives from the U.S. Department of Defense, U.S. Department of Energy, U.S. Environmental Protection Agency, Washington, DC, March.

ORNL (Oak Ridge National Laboratory) 2014. Risk Assessment Information System. http://rais.ornl.gov/cgi-bin/tools/TOX_search.

APPENDIX A

COMPARISON OF THE METHOD DETECTION LIMITS TO THE PROJECT ACTION LIMITS DEVELOPED USING 2015 CHILD RESIDENT NO FURTHER ACTION, BACKGROUND, AND MAXIMUM CONTAMINANT LEVEL CONCENTRATIONS (FOR WATER SAMPLES)

THIS PAGE INTENTIONALLY LEFT BLANK

COMPARISON OF THE METHOD DETECTION LIMITS TO THE PROJECT ACTION LIMITS DEVELOPED USING 2015 CHILD RESIDENT NO FURTHER ACTION, BACKGROUND, AND MAXIMUM CONTAMINANT LEVEL CONCENTRATIONS (FOR WATER SAMPLES)

The objective of data collection is to support project decision-making. The development of the data quality objectives (DQOs) for a project should include a determination of whether the method detection limits of the planned analytical methods will be sufficient to support the project decision-making. This appendix summarizes a comparison of the typically obtained method detection limits against potential project benchmarks. [This comparison has been updated using GEL Laboratories' method detection limit (MDLs) and the current project action limit (PALs).]

One benchmark for evaluating whether the method detection limit is low enough for a given project is the child resident no action limit (NAL). Analyses that are sensitive enough to detect constituents at or below their NAL often are sufficient to meet project objectives.

As noted in the charts below, most of the GEL MDLs are below the 2015 child resident NALs;[1] thus, they are low enough to support a risk assessment and meet most project DQOs. However, because there are some constituents that have MDLs that are above their respective NALs, the evaluation was extended to include a comparison against background levels (for soils and groundwater) and MCLs (for groundwater) to support an evaluation of whether lower MDLs should be pursued for a given project.

The charts in the attachment summarize these comparisons. The comparison found the following.

SOILS

- The MDL was below the respective PAL for metals.

- The MDL was below the respective PAL for the polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and semivolatile organic compounds, except N-nitroso-di-n-propylamine. For most projects, the MDL should be sufficient; however, for projects with N-nitroso-di-n-propylamine as a constituent of concern, lower MDLs may be needed. This issue should be addressed in the project-specific quality assurance project plan (QAPP).

- The minimum detectable activity (MDA) is above the PAL for uranium-235; however, the MDA is below the PAL for the other uranium isotopes. Thus, for most projects, the typical MDAs are expected to be sufficient because uranium isotopes cannot be quantitatively separated from one another, thus will be found together at the PGDP site.

- One radionuclide, neptunium-237, has an MDA above the respective PAL. This should be taken into account when developing a project-specific QAPP.

[1] *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1. Human Health,* DOE/LX/07-0107&D2/R6/V1, U.S. Department of Energy, Paducah, KY, July 2015.

WATER

- Metals (in water): Antimony, arsenic, and thallium have NALs less than MDLs, but the MDL is below the respective site background concentration, so the MDL is considered to be low enough to meet the project DQOs. In addition, the MDLs are below the MCLs for those constituents with MCLs. Chromium VI does not have an established background level for the site. It does not have an MCL. California, however, has established an MCL at 0.010 mg/L. The MDL for Chromium VI is below the California MCL; thus, it will be suitable for most projects.

- Uranium-235: The uranium isotope uranium-235 has an NAL below the respective PAL and the interpreted MCL (the MCL is 0.030 mg/L total uranium). Because the mobility of uranium is not affected by isotopic composition and because U-235 cannot be quantitatively separated from other uranium isotopes, the standard PAL will be sufficient for many projects.

- PCBs: The Aroclors (except for Aroclor 1221 and 1232) have PALs that are less than the MDL; however, the MDL is lower than the MCL for Total PCBs. NOTE: Even if you add all the MDLs for all the Aroclors, the total MDL is less than the MCL for the total PCBs and would meet most project DQOs.

- Radionuclides: In evaluating water-based concentrations of alpha-emitting radionuclides, the alpha activity MCL of 15 pCi/L was used.

- VOCs: VOCs that have PALs less than their MDL have MDLs below their respective MCL except for acrylonitrile (that does not have an MCL). Acrylonitrile is not detected in site groundwater; thus, the need for lower MDLs for acrylonitrile should be considered when setting project DQOs.

- SVOCs: Dieldrin, hexachlorobenzene, naphthalene, and N-nitroso-di-n-propylamine have PALs less than the MDL. The need for lower MDLs for these constituents should be considered when setting project DQOs.

In preparing a project-specific QAPP, the expected MDLs should be evaluated against project-specific DQOs (and the related PALs) to identify the need for lower MDLs to meet project objectives. NOTE: For those constituents that have the PALs below the project quantitation limits, the laboratory will be directed to report to the MDL.

ATTACHMENT

ACTION LIMITS VS. METHOD DETECTION LIMITS

THIS PAGE INTENTIONALLY LEFT BLANK

Comparison of Method Detection Limits (MDLs) to Project Action Limits (PALs, Child Resident) and Background (BG) for Soil Samples

Metals	Project Action Limit (mg/kg) Child Resident NALs	Background (mg/kg) Surface	Background (mg/kg) Subsurface	GEL Laboratories		*PAL* (mg/kg)	*PAL-MDL* (mg/kg)	*Surface BG - MDL* (mg/kg)	*Subsurface BG - MDL* (mg/kg)
				PQLs (mg/kg)	MDLs (mg/kg)				
Aluminum	7,740	13,000	12,000	10	3	7,740	7737	12997	11997
Antimony	3.13	0.21	0.21	1	0.33	3.13	2.8	-0.12	-0.12
Arsenic	0.267	12	7.9	1	0.2	0.267	0.067	12	7.7
Barium	1,530	200	170	0.4	0.1	1,530	1529.9	200	169.9
Beryllium	15.6	0.67	0.69	0.1	0.02	15.6	15.58	0.65	0.67
Boron	1,560	NA	NA	3	0.8	1,560	1559	NA	NA
Cadmium	5.07	0.21	0.21	0.2	0.02	5.07	5.05	0.19	0.19
Chromium (total)***	16.4	16	43	0.6	0.2	16.4	16.2	15.80	42.8
Chromium VI	0.301	NA	NA	0.4	0.12	0.301	0.181	NA	NA
Cobalt	2.34	14	13	0.2	0.06	2.34	2.28	13.94	12.94
Copper	313	19	25	0.2	0.066	313	312.93	18.93	24.93
Iron	5,480	28,000	28,000	20	6.6	5,480	5473	27993	27993
Lead	400	36	23	0.4	0.1	400	400	36	23
Manganese	183	1,500	820	1	0.2	183	183	1500	820
Mercury	2.35	0.2	0.13	0.01	0.004	2.35	2.346	0.20	0.126
Molybdenum	39.1	NA	NA	0.2	0.06	39.1	39.04	NA	NA
Nickel	155	21	22	0.4	0.1	155	154.9	20.9	21.9
Selenium	39.1	0.8	0.7	1	0.33	39.1	38.77	0.47	0.37
Silver	39.1	2.3	2.7	0.5	0.1	39.1	39	2.20	2.6
Thallium	0.0782	0.21	0.34	0.4	0.06	0.0782	0.0182	0.15	0.28
Uranium	23.4	4.9	4.6	0.04	0.013	23.4	23.4	4.9	4.6
Vanadium	39.3	38	37	0.5	0.1	39.3	39.2	37.9	36.9
Zinc	2,350	65	60	2	0.4	2,350	2349.6	64.6	59.6

PCBs	Project Action Limit (mg/kg) Child Resident NALs	Background (mg/kg) Surface	Background (mg/kg) Subsurface	GEL Laboratories		*PAL* (mg/kg)	*PAL-MDL* (mg/kg)	*Surface BG-MDL* (mg/kg)	*Subsurface BG-MDL* (mg/kg)
				PQLs (mg/kg)	MDLs (mg/kg)				
Aroclor 1016	0.19	NA	NA	0.0033	0.0011	0.19	0.1889	NA	NA
Aroclor 1221	0.0659	NA	NA	0.0033	0.0011	0.0659	0.0648	NA	NA
Aroclor 1232	0.0659	NA	NA	0.0033	0.0011	0.0659	0.0648	NA	NA
Aroclor 1242	0.0782	NA	NA	0.0033	0.0011	0.0782	0.0771	NA	NA
Aroclor 1248	0.0782	NA	NA	0.0033	0.0011	0.0782	0.0771	NA	NA
Aroclor 1254	0.0543	NA	NA	0.0033	0.0011	0.0543	0.0532	NA	NA
Aroclor 1260	0.0782	NA	NA	0.0033	0.0011	0.0782	0.0771	NA	NA

Comparison of Method Detection
Limits (MDLs) to Project Action Limits (PALs, Child Resident), and Background for Soil Samples (Continued)

Radionuclides	Project Action Limit (pCi/g) Child Resident NALs	Background (pCi/g)	Background (pCi/g)	GEL Laboratories	*PAL*	*PAL-MDA*	*Surface BG-MDA*	*Subsurface BG-MDA*
		Surface	Subsurface	MDAs (pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Americium-241	3.03	NA	NA	1	3.03	2.03	NA	NA
Cesium-137	0.116	0.49	0.28	0.1	0.116	0.016	0.39	0.18
Neptunium-237	0.239	0.1	NA	1	0.239	-0.761	-0.90	NA
Plutonium-238	4.42	0.073	NA	1	4.42	3.42	-0.93	NA
Plutonium-239/240	3.87	0.025	NA	1	3.87	2.87	-0.98	NA
Technetium-99	117.0	2.5	2.8	5	117	112	-2.50	-2.2
Thorium-230	5.22	1.5	1.4	1	5.22	4.22	0.50	0.4
Uranium-234	5.93	1.2	1.2	1	5.93	4.93	0.20	0.2
Uranium-235	0.347	0.06	0.06	1	0.347	-0.653	-0.94	-0.94
Uranium-238	1.28	1.2	1.2	1	1.28	0.28	0.20	0.2

VOCs	Project Action Limit (µg/kg) Child Resident NALs	Background (µg/kg)	Background (µg/kg)	GEL Laboratories		*PAL*	*PAL-MDL*	*Surface BG-MDL*	*Subsurface BG-MDL*
		Surface	Subsurface	PQLs (µg/kg)	MDLs (µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
1,1-Dichloroethene	22,700	NA	NA	1	0.33	22,700	22,700	NA	NA
cis- 1,2-Dichloroethene	15,600	NA	NA	1	0.33	15,600	15,600	NA	NA
trans- 1,2-Dichloroethene	1,300	NA	NA	1	0.33	1,300	1,300	NA	NA
Acrylonitrile	255	NA	NA	5	1.7	255	253	NA	NA
Benzene	1,160	NA	NA	1	0.33	1,160	1,160	NA	NA
Carbon Tetrachloride	653	NA	NA	1	0.33	653	653	NA	NA
Chloroform	316	NA	NA	1	0.33	316	316	NA	NA
Ethylbenzene	5,780	NA	NA	1	0.33	5,780	5,780	NA	NA
Tetrachloroethene	8,100	NA	NA	1	0.33	8,100	8,100	NA	NA
Trichloroethene	412	NA	NA	1	0.33	412	412	NA	NA
Vinyl chloride	59.2	NA	NA	1	0.33	59.2	58.9	NA	NA
Total Xylenes	58,400	NA	NA	3	1.0	58,400	58,399	NA	NA
p-xylene	56,100	NA	NA	2	0.67	56,100	56,099	NA	NA
m-xylene	55,100	NA	NA	2	0.6	55,100	55,099	NA	NA
o-xylene	64,500	NA	NA	1	0.33	64,500	64,500	NA	NA

Comparison of Method Detection
Limits (MDLs) to Project Action Limits (PALs, Child Resident), and Background for Soil Samples (Continued)

SVOCs	Project Action Limit (µg/kg) Child Resident NALs	Background (µg/kg)	Background (µg/kg)	GEL Laboratories		*PAL*	*PAL-MDL*	*Surface BG-MDL*	*Subsurface BG-MDL*
		Surface	Subsurface	PQLs (µg/kg)	MDLs (µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
Acenaphthene	171,000	NA	NA	33.3	10	171,000	170,990	NA	NA
Acenaphthylene*	171,000	NA	NA	33.3	10	171,000	170,990	NA	NA
Anthracene	854,000	NA	NA	33.3	10	854,000	853,990	NA	NA
Carbazole	10,000	NA	NA	33.3	10	10,000	9,990	NA	NA
Dieldrin**	12.6	NA	NA	1.34	0.33	12.6	12.3	NA	NA
Fluoranthene	114,000	NA	NA	33.3	10	114,000	113,990	NA	NA
Hexachlorobenzene	126	NA	NA	333	100	126	26	NA	NA
Naphthalene	3,830	NA	NA	33.3	10	3,830	3,820	NA	NA
2-nitroaniline	33,200	NA	NA	333	110	33,200	33,090	NA	NA
N-nitroso-di-n-propylamine	28.7	NA	NA	333	100	28.7	-71.3	NA	NA
Phenanthrene*	171,000	NA	NA	33.3	10	171,000	170,990	NA	NA
Pyrene	85,400	NA	NA	33.3	10	85,400	85,390	NA	NA
Total PAHs (carcinogenic)	6.19	NA	NA	NA	NA	6.19	NA	NA	NA

Constituent Name Constituent MDL higher than considered potentially-applicable benchmarks/PALs

*Acenaphthylene and Phenanthrene use values for Acenaphthene as a surrogate

MDA = Minimum Detectable Activity

**GEL only reports dieldrin via method SW846-8081, not SW846-8270

***The chromium (III) background value was used

Comparison of Method Detection Limits (MDLs) to Project Action Limits (PALs, Child Resident NAL), Background, and MCLs for Groundwater Samples

Metals	Project Action Limit			RGA Background (mg/L)	MCL (mg/L)	GEL Laboratories		*PAL*	*PAL-MDL*	*BG-MDL*	*MCL-MDL*
	Tapwater RSL or MCL (mg/L)	RSL or MCL	Child Resident NAL (mg/L)			PQLs (mg/L)	MDLs (mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Aluminum	20	RSL	1.99	1.64	NA	0.05	0.015	1.99	1.975	1.6250	NA
Antimony	0.0060	MCL	0.000772	0.060	0.0060	0.003	0.001	0.000772	-0.00023	0.0590	0.0050
Arsenic	0.010	MCL	0.0000516	0.005	0.010	0.01	0.0017	0.0000516	-0.00165	0.0033	0.0083
Barium	2.0	MCL	0.370	0.202	2.0	0.206	0.0006	0.37	0.3694	0.2014	1.9994
Beryllium	0.0040	MCL	0.00219	0.004	0.0040	0.0005	0.0002	0.00219	0.00199	0.0038	0.0038
Boron	4.0	RSL	0.208	NA	NA	0.015	0.004	0.208	0.204	NA	NA
Cadmium	0.0050	MCL	0.000898	0.010	0.0050	0.001	0.00011	0.000898	0.00079	0.0099	0.0049
Chromium (total)	0.10	MCL	2.08	0.134	0.10	0.01	0.002	2.08	2.078	0.1320	0.0980
Chromium VI	0.000035	RSL	0.0000341	NA	NA	0.01	0.0033	0.0000341	-0.0032659	NA	NA
Cobalt	0.0060	RSL	0.000600	0.045	NA	0.001	0.0001	0.0006	0.0005	0.0449	NA
Copper	1.3	MCL	0.0798	0.034	1.3	0.001	0.00035	0.0798	0.07945	0.0337	1.2997
Iron	14	RSL	1.40	3.72	NA	0.1	0.033	1.4	1.367	3.6870	NA
Lead	0.015	MCL	0.0150	0.25	0.015	0.002	0.0005	0.015	0.0145	0.2495	0.0145
Manganese	0.43	RSL	0.0420	0.082	NA	0.005	0.001	0.042	0.041	0.0810	NA
Mercury	0.0020	MCL	0.000556	0.0002	0.0020	0.0002	0.000067	0.000556	0.000489	0.0001	0.0019
Molybdenum	0.10	RSL	0.00997	0.050	NA	0.0005	0.000165	0.00997	0.0098	0.0498	NA
Nickel	0.39	RSL	0.0390	0.530	NA	0.002	0.0005	0.039	0.0385	0.5295	NA
Selenium	0.050	MCL	0.00997	0.005	0.050	0.005	0.0015	0.00997	0.00847	0.0035	0.0485
Silver	0.094	RSL	0.00922	0.011	NA	0.001	0.0002	0.00922	0.00902	0.0108	NA
Thallium	0.002	MCL	0.0000199	0.056	0.0020	0.002	0.00045	0.0000199	-0.00043	0.0556	0.0016
Uranium	0.030	MCL	0.00598	0.002	0.030	0.0002	0.000067	0.00598	0.0059	0.0019	0.0299
Vanadium	0.86	RSL	0.00826	0.139	NA	0.005	0.001	0.00826	0.0073	0.1380	NA
Zinc	6.0	RSL	0.600	0.025	NA	0.01	0.0035	0.6	0.60	0.0215	NA

PCBs	Project Action Limit			RGA Background (µg/L)	MCL (µg/L)	GEL Laboratories		*PAL*	*PAL-MDL*	*BG-MDL*	*MCL-MDL**
	Tapwater RSL or MCL (µg/L)	RSL or MCL	Child Resident NAL (µg/L)			PQLs (µg/L)	MDLs (µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Aroclor 1016	0.5	MCL	0.140	NA	0.5	0.1	0.033	0.1400	0.1067	NA	0.47
Aroclor 1221	0.5	MCL	0.00457	NA	0.5	0.1	0.033	0.00457	-0.0287	NA	0.47
Aroclor 1232	0.5	MCL	0.00457	NA	0.5	0.1	0.033	0.00457	-0.0287	NA	0.47
Aroclor 1242	0.5	MCL	0.0395	NA	0.5	0.1	0.033	0.0395	0.0062	NA	0.47
Aroclor 1248	0.5	MCL	0.0395	NA	0.5	0.1	0.033	0.0395	0.0062	NA	0.47
Aroclor 1254	0.5	MCL	0.0395	NA	0.5	0.1	0.033	0.0395	0.0062	NA	0.47
Aroclor 1260	0.5	MCL	0.0395	NA	0.5	0.1	0.033	0.0395	0.0062	NA	0.47
Total (0.5 µg/L MCL total PCBs	0.5	MCL	0.307	NA	0.5	NA	0.233	0.307	0.0740	NA	0.27

Comparison of Method Detection Limits (MDLs) to Project Action Limits (PALs, Child Resident), Background, and MCLs for Groundwater Samples (Continued)

Radionuclides	Project Action Limit			RGA Background (pCi/L)	MCL** (pCi/L)	GEL Laboratories	*PAL*	*PAL-MDA*	*BG-MDA*	*MCL-MDA*
	Tapwater RSL or MCL (pCi/L)	RSL or MCL	Child Resident NAL (pCi/L)			MDAs (pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
Americium-241	15	MCL	0.504	NA	15	1	0.504	-0.50	NA	14
Cesium-137	4 mRem/year-dose	MCL	1.71	NA	200	10	1.71	-8.29	NA	190
Neptunium-237	15	MCL	0.763	0.21	15	1	0.763	-0.24	-0.79	14
Plutonium-238	15	MCL	0.398	NA	15	1	0.398	-0.60	NA	14
Plutonium-239/240	15	MCL	0.387	0.03	15	1	0.387	-0.61	-0.97	14
Technetium-99	4 mRem/year-dose	MCL	19	10.8	900	25	19	-6.00	-14.2	875
Thorium-230	15	MCL	0.572	0.54	15	1	0.572	-0.43	-0.46	14
Uranium-234	10.24	MCL	0.739	0.7	10.24	1	0.739	-0.26	-0.3	9.24
Uranium-235	0.466	MCL	0.728	0.3	0.466	1	0.728	-0.27	-0.7	-0.534
Uranium-238	9.99	MCL	0.601	0.7	9.99	1	0.601	-0.40	-0.3	8.99

VOCs	Project Action Limit			RGA Background (µg/L)	MCL	GEL Laboratories		*PAL*	*PAL-MDA*	*BG-MDA*	*MCL-MDA*
	Tapwater RSL or MCL (µg/L)	RSL or MCL	Child Resident NAL (µg/L)		(µg/L)	PQLs (µg/L)	MDLs (µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Acrylonitrile	0.052	RSL	0.0523	NA	NA	5	1.5	0.0523	-1.448	NA	NA
Benzene	5.0	MCL	0.453	NA	5.0	1	0.3	0.453	0.153	NA	4.7
Carbon tetrachloride	5.0	MCL	0.452	NA	5.0	1	0.3	0.452	0.152	NA	4.7
Chloroform	80	MCL	0.221	NA	80	1	0.3	0.221	-0.079	NA	79.7
1,1-Dichloroethene	7.0	MCL	0.171	NA	7.0	1	0.3	0.2	-0.129	NA	6.7
cis- 1,2-Dichloroethene	70	MCL	3.56	NA	70	2	0.3	3.56	3.26	NA	69.7
trans -1,2-Dichloroethene	100	MCL	9.26	NA	100	1	0.3	9.26	8.96	NA	99.7
Ethylbenzene	700	MCL	1.49	NA	700	1	0.3	1.49	1.19	NA	699.7
Tetrachloroethene	5.0	MCL	3.95	NA	5.0	1	0.3	3.95	3.65	NA	4.7
Trichloroethene	5.0	MCL	0.281	NA	5.0	1	0.3	0.281	-0.019	NA	4.7
Vinyl Chloride	2.0	MCL	0.0187	NA	2.0	1	0.3	0.0187	-0.281	NA	1.7
Total Xylenes	10,000	MCL	19.2	NA	10,000	3	0.3	19.2	18.9	NA	9999.7
Xylene-o	10,000	MCL	19.2	NA	10,000	1	0.3	19.2	18.9	NA	9999.7
Xylene-m	10,000	MCL	19.3	NA	10,000	2	0.3	19.3	19	NA	9999.7
Xylene-p	10,000	MCL	19.3	NA	10,000	2	0.3	18.7	18.4	NA	9999.7

Comparison of Method Detection Limits (MDLs) to Project Action Limits (PALs, Child Resident), Background, and MCLs for Groundwater Samples (Continued)

SVOCs	Project Action Limit			RGA Background (µg/L)	MCL	GEL Laboratories		*PAL*	*PAL-MDL*	*BG-MDL*	*MCL-MDL*
	Tapwater RSL or MCL (µg/L)	RSL or MCL	Child Resident NAL (µg/L)		(µg/L)	PQLs (µg/L)	MDLs (µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Acenaphthene	530	RSL	44.6	NA	NA	1	0.3	44.6	44.3	NA	NA
Acenaphthylene***	530	RSL	44.6	NA	NA	1	0.3	44.6	44.3	NA	NA
Anthracene	1,800	RSL	176	NA	NA	1	0.3	176	175.7	NA	NA
Carbazole	NA	RSL	1.98	NA	NA	1	0.3	1.98	1.68	NA	NA
Dieldrin****	0.0017	RSL	0.00193	NA	NA	0.04	0.0125	0.00193	-0.011	NA	NA
Fluoranthene	800	RSL	41.7	NA	NA	1	0.3	41.7	41.4	NA	NA
Hexachlorobenzene	1.0	MCL	0.0355	NA	1.0	10	3	0.0355	-2.96	NA	NA
Naphthalene	0.17	RSL	0.143	NA	NA	1	0.3	0.143	-0.157	NA	NA
2-nitroaniline	190	RSL	10.2	NA	NA	10	3	10.2	7.2	NA	NA
N-nitroso-di-n-propylamine	0.011	RSL	0.00799	NA	NA	10	3	0.00799	-2.99	NA	NA
Phenanthrene***	530	RSL	44.6	NA	NA	1	0.3	44.6	44.3	NA	NA
Pyrene	120	RSL	13.7	NA	NA	1	0.3	13.7	13.4	NA	NA
Total PAHs (carcinogenic)	0.20	RSL	0.00224	NA	0.20	NA	NA	0.00224	NA	NA	NA

Red numbers used to highlight negative values Negative values mean that the PAL is less than the benchmark

Constituent Name Constituent MDL higher than all considered potentially-applicable benchmarks/PALs

RSL= Regional Screening Level MCL = U.S.EPA Drinking Water Standard Maximum Contaminant Level RGA = Regional Gravel Aquifer NAL = No Action Level

*Even if EVERY Aroclor present at MDL, Total PCB concentration < MCL

**Gross Alpha MCL = 15 pCi/L

attributed uranium MCL uranium MCL converted from 0.030 mg/L to pCi/L based upon natural composition and activity factors

U-235 not seen alone (i.e., w/o U-238). Uranium-238 MDA < MCL (i.e., uranium issues in water will be detected at PAL with current isotopic MDAs).

***Acenaphthylene and Phenanthrene use values for Acenaphthene as surrogate

****GEL only reports dieldrin via method SW846-8081, not SW846-8270

2015 RSLs from EPA regional screening levels (Target Risk = 1E-6, Hazard Quotient = 0.1) November 2015 http://semspub.epa.gov/work/03/2220579.pdf

APPENDIX B

THE ROLE OF INDEPENDENT THIRD PARTY DATA VALIDATION IN MEETING DATA QUALITY OBJECTIVES AT PADUCAH GASEOUS DIFFUSION PLANT

THIS PAGE INTENTIONALLY LEFT BLANK

THE ROLE OF INDEPENDENT THIRD PARTY DATA VALIDATION IN MEETING DATA QUALITY OBJECTIVES

ISSUE

A balance must be struck and the associated uncertainties acknowledged over the appropriate level of independent third-party data validation that should be conducted for various types of Paducah Gaseous Diffusion Plant (PGDP) projects. In addition, there is uncertainty over how best to ensure that the appropriate level of independent third-party data validation is conducted.

Collected data are evaluated for usability by the project team. In addition, a fraction of these data is subjected to independent third-party validation. This briefing discusses the process by which the fraction of data subjected to independent third-party validation is specified. *As noted in EPA guidance, the principal use of independent third-party validation is to supplement the data assessment process and minimize the potential for fraud.*

BACKGROUND

Collected data are reviewed by the project team as part of a data assessment to ensure that collected data are usable for their intended purpose. This project-team assessment includes elements of data validation. This effort is supplemented further by subjecting a fraction of the data to independent third-party validation. All of the assessment and validation efforts are used to support the data usability assessment.

The cost of higher levels of independent third-party validation should be balanced against the incremental value in meeting project and programmatic data quality objectives (DQOs). Programmatic DQOs are related to the likelihood that collected data may be used to support issues that go beyond the needs of the individual project.

HISTORY

The level of independent third-party validation of data for a given PGDP project is set as part of developing DQOs for that project. This level has varied appropriately for different types of PGDP projects. The following discusses the role of independent third-party validation in the data quality process and discusses how project and programmatic considerations should be evaluated in setting the appropriate level of independent third-party validation for a given project.

FINDINGS

1. The level of independent third-party validation should be set for each project as part of the DQO process;

2. The project DQO process should anticipate (and incorporate where appropriate) programmatic considerations in setting the level of independent third-party validation;

3. Incorporation of programmatic considerations is required by the in-place Quality Assurance Program; this approach is consistent with the approach used at the Portsmouth Gaseous Diffusion Plant (PORTS);

4. Independent third-party validation, by design, duplicates many elements of the Fluor Federal Services, Inc., Paducah Deactivation Project (FPDP) data assessment/verification/validation process;

5. The FPDP's *Quality Assured Data* procedure (CP2-ES-0063) identifies 5% as a minimum of definitive data that typically should be subjected to independent third-party validation;

6. Most PGDP data collection activities generate usable, valid, high-quality data with this approach;

7. There are a few data collection activities [i.e., supporting property transfer for unrestricted use under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120h guidance] where a higher percentage of independent third-party validation may be appropriate (i.e., PORTS has identified some property transfer projects where 100% independent third-party validation is considered appropriate); and

8. Additional independent third-party data validation may be able to be performed at a later time should the DQOs of the project change.

DISCUSSION

Independent third-party validation is one tool used as part of an over-arching program to assure data quality. Per the current *Quality Assured Data* procedure, developed to be consistent with U.S. Environmental Protection Agency (EPA) guidance, 100% of collected definitive (i.e., not screening level) data are subjected to data assessment and verification (which includes elements of data validation) by the project team. However, only a fraction (minimum of 5%) of the definitive data collected for projects at PGDP are subjected to independent third-party validation that uses an external third party to repeat the data validation steps. As noted in EPA guidance, the principal use of independent third-party validation is to support the data assessment process and minimize the potential for fraud by providing detailed review of the data collection and analysis process. NOTE: Because this independent third-party validation does not introduce any additional data or information, this process does not increase the quality of the data.

Per the *Quality Assured Data* procedure, each project establishes a level of independent third-party validation needed to ensure project DQOs are met. The principal goal of a data collection process is to ensure that collected data meet the DQOs for the individual project, which helps assure the data will be considered usable to support decision-making.

To support its Quality Assurance Program, FPDP has been subjecting landfill groundwater data to 100% independent third-party validation in support of the Environmental Monitoring Data Quality Program. By performing 100% independent third-party validation, these landfill groundwater data become a benchmark against which other groundwater data can be compared reliably.

For most other projects, independent third-party validation rates range from 5% to 20%. These levels are set in the project scoping process at levels that are considered sufficient to support the project data quality process. As noted above, the level of independent third-party data validation to be conducted is a project-specific decision that should evaluate all data quality needs, including incorporating programmatic considerations.

Attached is a White Paper that discusses in more detail the considerations that may drive the determination of the appropriate level of independent third-party data validation.

THIS PAGE INTENTIONALLY LEFT BLANK

ATTACHMENT

WHITE PAPER ON THE USE OF INDEPENDENT THIRD-PARTY VALIDATION TO SUPPORT DATA QUALITY ASSURANCE AT PGDP

THIS PAGE INTENTIONALLY LEFT BLANK

WHITE PAPER ON THE USE OF INDEPENDENT THIRD-PARTY VALIDATION TO SUPPORT DATA QUALITY ASSURANCE AT PGDP

ISSUE

Independent third-party validation of laboratory data is one of the tools used to support the data quality assurance program at the Paducah Gaseous Diffusion Plant (PGDP), the Portsmouth Gaseous Diffusion Plant (PORTS), and other Superfund sites. Because there are multiple procedures that are used routinely to evaluate laboratory data quality; the manner in which these reviews are communicated to decision-makers may also vary. Because of this potential variability, and because of the complex nature of commonly used analytical data verification and validation procedures, it is important to minimize ambiguity in communicating the nature of these procedures to data users. This White Paper seeks to summarize the tools Fluor Federal Services, Inc., Paducah Deactivation Project (FPDP) uses to ensure data quality and its approach to the use of independent third-party validation to support its Quality Assurance Program.

BACKGROUND

There are several considerations that factor into the use of independent third-party validation as well as other tools used in the quality assurance program with the overall goal to ensure that the data meet the data quality objectives (DQOs) of the individual project. The data should be of sufficient quality as to ensure data usability to support environmental decision-making. The different objectives of that decision-making (e.g., ranging from simple survey sampling to property transfer) are the largest considerations driving the application of independent third-party validation.

Summary of the FPDP Data Quality Assurance Program

FPDP maintains a graduated program to ensure data quality assurance and usability, as described by *Quality Assured Data*, CP2-ES-0063, which is as follows.

Data Verification is performed on 100% of laboratory data. Data verification is the process for comparing a data set against a standard or contractual requirement. Data verification includes ***laboratory contractual screening***, which is the process of evaluating a set of data against the requirements in the analytical Statement of Work (SOW) to ensure that all requested information is received. The SOW requirements include required analytes, methods, units, and required reporting limits. Data verification includes comparison of newly received data to historical results, permit limits, maximum contaminant limits (MCLs), background values, and evaluates the results of field quality control samples, etc. The goal of data verification is to identify if submitted samples were analyzed appropriately, properly reported, and the results are consistent with historical information.

Data Assessment is performed on 100% of the data to ensure data meet the DQOs of the project and to ensure that data are usable for their intended purpose. Data assessment is used to determine if the data are suitable to make a decision with the desired level of confidence. Data assessment follows data verification/validation. Data qualifiers are taken into consideration during data assessment.

Data Validation is a data review process performed by a qualified individual, independent from sampling, laboratory, project management, or other decision-making personnel. Data validation evaluates the laboratory adherence to analytical method requirements. The percentage and level of data validation

for a given project is defined in project work plans and Quality Assurance Project Plans and is performed in conjunction with data assessment. There are several levels of data validation that are performed by review of data packages as defined below:

- **Level I data packages** are comprised of sample results, methods, and data qualifiers.

- **Level II data packages** include the Level I information plus quality control (QC) information and surrogate results when applicable.

- **Level III data packages** include the Level II information plus calibration information, internal standard results, special instrumentation analysis requirements (i.e., bromofluorobenzene tune data or post digestion spike results).

- **Level IV data packages** include the Level III information plus all the raw data and certificates for standards.

An excerpt from EPA 2009 is reproduced below to clarify how the guidance defines the terms *verification and validation.*

> **5.1 Analytical Data Verification and Validation Stages**
>
> (1) A verification and validation based only on completeness and compliance of sample receipt condition checks should be called a Stage 1 Validation.
>
> (2) A verification and validation based on completeness and compliance checks of sample receipt conditions and ONLY sample-related QC results should be called a Stage 2A Validation.
>
> (3) A verification and validation based on completeness and compliance checks of sample receipt conditions and BOTH sample-related and instrument-related QC results should be called a Stage 2B Validation.
>
> (4) A verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, AND recalculation checks should be called a Stage 3 Validation.
>
> (5) A verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, recalculation checks, AND the review of actual instrument outputs should be called a Stage 4 Validation.
>
> The recommended minimum baseline checks conducted for each stage of analytical data verification and validation are described in more detail in Appendix A of the EPA 2009 guidance.

Independent Third-Party Data Validation is a data validation process performed by a party that is independent of sampling, the laboratory analyzing the sample, and other decision-making personnel. The principal purpose for an independent third-party validation is to minimize the potential for fraud (EPA 2002). With that as its purpose, a random (5%) check may be as effective as greater levels of independent validation for many projects [think 5% validation of random drug test results compared to 100% validation of random drug test results; you achieve your goal (for the independent evaluation) of

evaluating the performance of the drug-testing laboratory]. Note: EPA 2002 states that independent third-party validation alone is not sufficient to meet this goal (of combatting fraud); rather laboratory audits, etc. should be used with validation to identify and correct fraud.

As noted in EPA 2009:

> Note: Using higher stages of analytical verification and validation does not typically result in higher data quality. However, the quality of the analytical data becomes more transparent as more stages of verification and validation are conducted.

Appropriateness of Independent Third-Party Validation. Although the use of 100% independent third-party validation may be appropriate for a few types of data collection efforts at PGDP, the majority of the collected data will meet the project and programmatic DQOs with only a percentage of the results subjected to independent third-party validation. One example of a situation where 100% independent third-party validation may be appropriate would be if DOE were collecting data to support transfer of a parcel of property for unrestricted use and each of the samples (depending upon the sampling protocol) would be uniquely representative of a portion of the land. In that case, independent third-party validation of all the data is prudent to ensure that the data support the land transfer, given that DOE will have no recourse if the data were in error.

Similarly, if a project were collecting data in support of litigation and each of these data points were to be evaluated alone, having every data point subjected to independent third-party validation may have value even though the DQOs would have been met without the additional third-party validation.

Most PGDP data collection efforts will meet project DQOs with only a fraction of the data subjected to independent third-party validation.

- Time-series groundwater monitoring is conducted at PGDP to identify adverse impacts to groundwater. This type of monitoring typically requires several sample results to identify a trend. Thus, any individual sample does not need to be subjected to independent third-party validation as long as the Quality Assurance Program can confirm the quality and data usability of the groundwater data to a reasonable certainty.

- Site investigation results often are grouped for evaluation and used to support risk assessments. Thus, any individual result is not uniquely important; rather, the mean and range of results are used to identify unacceptable risks requiring remedial action. Thus, if sufficient independent third-party validation is used to minimize the potential for fraud, the entire data set will be usable for its intended purpose. Note: Post-remedy ***confirmation samples*** may properly be subjected to a greater percentage of independent third-party validation if the decision rules for the site future use depend upon individual results. But even confirmation sampling results may be aggregated to support calculation of an exposure point concentration used in decision-making and thus, less independent third-party validation would be defensible.

The appropriate level of independent third-party validation should be established in the project-specific QAPP for each project and developed to ensure that the DQOs of the project will be met and the data will be considered usable. However, the degree of independent third-party validation should consider the entire PGDP Quality Assurance Program efforts.

In general, 100% independent third party validation should not be considered necessary for CERCLA projects or solid waste projects where:

The entire data set is evaluated to support decision-making;

1. The analyses can be repeated (or are part of a continuing monitoring program to identify trends);

2. The decision is not dependent upon a single result at a single well at a single time [but rather some different form of evaluation (e.g., upgradient versus downgradient results)]; or

3. The decision is not dependent upon a single result at a location at a single time (but rather from combining multiple results [e.g., an exposure point concentration]).

For these types of projects, independent third-party validation would not increase data usability; however, the cost of the data would increase markedly.

FPDP's Quality Assurance Program's Use of Independent Third-Party Validation. As noted above, all of FPDP's laboratory data are subjected to data verification and data assessment that includes elements of data validation. These processes typically are sufficient to ensure data usability for most projects. FPDP's program also subjects some data for independent third-party validation to support its Quality Assurance Program.

For example, all the groundwater monitoring data collected for the C-746-S&T, C-746-U, and C-404 Landfills are subjected to 100% independent third-party validation (at a Stage 3 Level), because FPDP believes that these samples are representative of the broad range of analyses conducted at PGDP. Performing 100% independent third-party validation of these samples effectively supports the FPDP Environmental Monitoring Quality Assurance Program by evaluating laboratory results from a broad spectrum of analyses. Independent third-party validation of groundwater samples is also more appropriate because these types of samples are not subject to as many heterogeneity issues as other sample matrices.

For most other projects, independent third-party validation rates range from 5% to 20%. These levels are set in the project scoping process at levels that are considered sufficient to support the project data quality process. As noted above, the level of independent third party data validation to be conducted is a project-specific decision that should evaluate all data quality needs, including incorporating programmatic considerations.

FPDP recognizes that should DQOs for a project change, additional third-party data validation could be conducted on the project data. The value of this additional third-party validation will depend, in part, on how old are the collected data. Although there is no theoretical limit on the time that can elapse before independent third-party validation is conducted, the representativeness and usability of any data may be called into question after several years (whether or not those data were subjected to independent third-party validation).

REFERENCES

EPA (U.S. Environmental Protection Agency) 2002. *Guidance on Environmental Data Verification and Data Validation*, EPA/240/R-02/004, U.S. Environmental Protection Agency, Washington, DC, November.

EPA 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*, OSWER No. 9200.1-85, EPA 540-R-08-005, U.S. Environmental Protection Agency, Washington, DC, January.

APPENDIX C

DISCUSSION OF THE QUALITY ASSURANCE CRITERIA TO BE APPLIED TO FIELD ANALYTICAL METHODS

THIS PAGE INTENTIONALLY LEFT BLANK

QUALITY ASSURANCE CRITERIA TO BE APPLIED TO FIELD ANALYTICAL METHODS

Field analytical methods, like X-ray fluorescence (XRF) spectroscopy are used at Paducah Gaseous Diffusion Plant. These methods typically are performed in accordance with a procedure that includes quality assurance criteria associated with instrument calibration and standard result reproducibility. In addition, the quality of the results from field analyses may be further confirmed by subjecting a fraction of the samples to analysis at a fixed-based laboratory.

Although XRF and other field methods typically are used for screening or semiquantitative evaluation, under certain, well-defined circumstances, their use may be extended and used in a definitive analysis if the results can be shown to meet the project data quality objectives. In order to meet project data quality objectives, some data verification or validation may be needed in addition to the comparison of the field data to laboratory analyses.

As part of planning for a project that includes the use of a field method, the quality assurance requirements needed to support the data quality objective should be outlined in the plan or procedure, including a description of how calibration and field data will be collected, logged, and recorded. This process should also anticipate the steps that will be taken as part of the data verification/validation process. For example, the procedure may identify what data/information will be presented in the report, including logbook pages, etc. An example of this approach is presented in *The Standard Operating Procedure for Elemental Analysis Using the X-Met 920 Field X-Ray Fluorescence Analyzer* (EPA 1996).

Depending upon the types of data that are collected and the forms in which these data are recorded, a data review and validation process may be developed for use by the project team and/or an independent third party validator. The *Standard Operating Procedure for the X-Ray Fluorescence Analysis of Particulate Matter Deposits on Teflon Filters* (RTI International 2009) has an outline of the types of activities that could be included to support quality control activities. This type of verification process, when coupled with the comparability evaluation of the field data to laboratory analyses, can bound the range of results and provide verification of whether the results meet the project data quality objectives. Sections 10 and 11 of the RTI report are reproduced in the attachment to this appendix.

REFERENCES

EPA (U.S. Environmental Protection Agency) 1996. *Standard Operating Procedure for Elemental Analysis Using the X-MET 920 Field X-ray Fluorescence Analyzer*, SOP #: X-MET 920, U.S. Environmental Protection Agency, Region I—New England, Boston, MA, October.

RTI International 2009. *Standard Operating Procedure for the X-Ray Fluorescence Analysis of Particulate matter Deposits on Teflon Filters*, RTI International, Environmental and Industrial measurements Division, research Triangle Park, NC, August 19.

THIS PAGE INTENTIONALLY LEFT BLANK

ATTACHMENT

SECTIONS 10 AND 11 OF
STANDARD OPERATING PROCEDURE FOR THE X-RAY FLUORESCENCE ANALYSIS OF PARTICULATE MATTER DEPOSITS ON TEFLON FILTERS

THIS PAGE INTENTIONALLY LEFT BLANK

10.0 Quality Control

Several different QC activities are performed as part of the analysis procedure. These activities, their frequency, the measures of acceptable performance, and action if the item fails performance standards are provided in Table 5.

Table 5. Quality Control Procedures

Item	Inspection Frequency	Inspection Parameter	Action If Item Fails Inspection	Documentation Required
Energy calibration	Daily	Wavelength alignment of the instrument	This is an automated process	Document in the instrument's run logbook
Calibration verification	Monthly	Percentage of recovery of seven elements on thin-film National Institutes of Standards and Technology reference materials	Adjust instrument calibration factors	Document in the instrument's run logbook; results stored in XRF database
	Monthly	90% to 110% recovery analyzing the PM2.5 calibration standards as unknowns		Results stored in instrument's method file
Ongoing calibration verification	Run with every tray of samples	90% to 110% recovery using a multi-element sample containing Ti, Fe, Cd, Se, Pb, and SiO deposits of 5-10 $\mu g/cm^2$	Re-check instrument calibration and adjust if necessary; re-analyze samples	Document in the instrument's run log book

11.0 Data Review and Validation

The analytical dataset undergoes Level 0 and Level 1 validations. These levels of validation will ensure that the dataset being reported will be of good quality.

11.1 Level 0 Validation

A Level 0 validation begins with the analyst, who identifies any problems related to the chain-of-custody, the filter, or any mechanical or software problems that might have occurred during the analysis of the filters. If such items are identified, the analyst notes any problems in the instrument logbook, which is reviewed by the Technical Area Supervisor.

11.2 Level 1 Validation

A Level 1 validation is a more technical review of the analytical data. This review starts with the analyst, but it will primarily be performed by the Technical Area Supervisor. Using the review criteria developed by the QA Manager, the responsibilities of the analyst and the Technical Area Supervisor are provided in Table 6.

If any discrepancies are noted by the analyst or the Technical Area Supervisor, they will be reported on their respective checklist (Figure 1 and Figure 2).

Table 6. Level 1 Validation Responsibilities

Analyst	Technical Area Supervisor
Verify proper custody documentation is provided in batch folder	Ensure analytical dataset is complete and the proper procedures were followed to analyze the filters
Check sample identifications against COC forms and proper number of samples match given COC	Check that proper paperwork is provided in the batch folder and for any notations regarding the analysis of the batch or flaws with the filters that were analyzed
Confirm mass values for each sample are present on final report	Review precision, accuracy, and replicate data for acceptable limits
Make sure sample identifications are consistent between final report versus pre-attenuation report	Check data for any inconsistencies or trends and report to QA Manager
Review pre and post attenuation reports for disparity with attenuated data	Apply flags to data, if applicable

After two levels of review have been performed on the analytical dataset, it is ready to be submitted for upload into the CSN database.

Batch Creation Date:_____ Batch ID Number:_____

Number of Samples:_____

(circle one, if no leave comment why)

Item #1: Custody Documentation

Chain-of-Custody form present Yes No

Signed By:_____

Dated:_____

Sample Identification

No. of samples matches number on COC form Yes No

ID#s on COC match Id #s on samples Yes No

Item #2: Attenuation Correction

Sample IDs consistent with pre-attenuation report Yes No

Mass values present on report Yes No

Item #3: Data Comparison Pre-attenuation vs Attenuated Data

Results consistent between pre and post attenuation Yes No

Comments Regarding Data:_____

_____

_____

_____

Reviewer Signature: _____ Date Signed: _____

Figure 1. EDXRF Analysis Analyst Checklist.

COC Form No. _____ Report Date: _____

Data Review:

Sample Filter No. _____ Comments: _____

Sample Filter No. _____ Comments: _____

Sample Filter No. _____ Comments: _____

Sample Filter No. _____ Comments: _____

Sample Filter No. _____ Comments: _____

Sample Filter No. _____ Comments: _____

Quality Control Review:

Precision Data Acceptable? Yes ____ No_____ Notes: _____

Accuracy Data Acceptable? Yes ____ No_____ Notes: _____

Replicate Data Acceptable? Yes ____ No_____ Notes: _____

Chain-of-Custody Data Letter Yes ____ No_____ Notes: _____

Filter-Loading Masses: Yes ____ No_____ Notes: _____

_____

_____

_____

Reviewer by: _____ _____

Date

Figure 2. EDXRF Analysis Technical Area Supervisor Checklist.