LM-Plan-3-21-1.0-1.0
LMS/MNT/S27252-1.0

Quality Assurance Project Plan Monticello, Utah, Disposal and Processing Sites

May 2023

U.S. DEPARTMENT OF ENERGY | Legacy Management

This document has been designed for online viewing.

Contents

Appendix

Attachments

Abbreviations

AEC	U.S. Atomic Energy Commission
AOA	area of attainment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	contaminant of concern
DOE	U.S. Department of Energy
DOECAP	DOE Consolidated Audit Program
DQI	data quality indicator
EDD	electronic data deliverable
EM	Office of Environmental Management
EPA	U.S. Environmental Protection Agency
FFA	Federal Facilities Agreement
ft	feet
GRO	Groundwater Remedy Optimization
IC	institutional control
ID	identifier
IRA	interim remedial action
LM	Office of Legacy Management
LMS	Legacy Management Support
LTS&M	long-term surveillance and maintenance
MDL	method detection limit
µg/L	micrograms per liter
MMTS	Monticello Mill Tailings Site
MS	matrix spike
MSD	matrix spike duplicate
MVP	Monticello Vicinity Properties
NPL	National Priorities List
OU	operable unit
pCi/L	picocuries per liter
PQL	practical quantitation limit
PRB	permeable reactive barrier
QA	quality assurance
Q&PA	Quality and Performance Assurance

QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
ROD	Record of Decision
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
SOW	statement of work
U	uranium (isotope)
UDEQ	Utah Department of Environmental Quality
UFP	Uniform Federal Policy

1.0 Introduction

The United States Department of Energy (DOE) Office of Legacy Management (LM) objective is to provide long-term environmental monitoring and site maintenance to protect the environment, workers, and the public. The Monticello, Utah, Disposal and Processing Sites (Monticello site) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-remediated site is managed by LM. Routine surface and groundwater monitoring through a mature system of sampling, analysis, data validation, data management, and reporting has been in place to meet performance goals established when sites transferred from the DOE Office of Environmental Management (EM) to LM following completion of remediation.

The Monticello site consisting of (1) the Monticello Mill Tailings Site (MMTS), which includes the property where the former Monticello uranium and vanadium-ore processing mill was located, various peripheral properties near or adjacent to the former mill, and the repository site that includes the onsite disposal cell and (2) the Monticello Vicinity Properties (MVP) site, comprising 424 private and publicly owned properties remediated in and nearby the City of Monticello. The MVP site was delisted from the National Priorities List (NPL) in February 2000.

Deletion of 22 MMTS Operable Unit (OU) II Non-Surface and Groundwater Impacted Peripheral Properties from the NPL occurred in October 2003, resulting in partial deletion of the MMTS properties from the NPL. Remaining on the MMTS are 13 properties located within OUs I and II that have contaminated surface water and groundwater, which is designated as OU III. Deletion of the remaining MMTS properties from the NPL is dependent on meeting the remediation goals for OU III surface water and groundwater. A site chronology listing events leading to the formation and remediation of the MMTS and significant activities thereafter are summarized in Appendix A of this Quality Assurance Project Plan (QAPP).

The Monticello site is near the city of Monticello, Utah, about 250 miles southeast of Salt Lake City, Utah. Monticello is the county seat for San Juan County with a population of approximately 1900 residents.

This QAPP covers quality assurance (QA) measures specific to Monticello site OU III for surface and groundwater remediation. Sample collection, analysis for contaminants of concern, data validation of analytical data packages, and reporting progress toward performance goals are the major elements of this work. This site-specific QAPP replaces the previous *Legacy Management CERCLA Sites Quality Assurance Project Plan* that covered several LM managed sites where post-closure monitoring is required by closure agreements.

The Legacy Management Support (LMS) contractor for LM employs a management system that applies to all programs, projects, and business management systems. The management system incorporates the philosophy, policies, and requirements of safety and health, environmental compliance, and QA in all aspects of project planning and implementation.

The U.S. Environmental Protection Agency (EPA) calls for QAPPs to be consistent with *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5 (EPA 2001). The agency has requested this QAPP be developed using their *Guidance for Quality Assurance Project Plans* EPA QA/G-5 (EPA 2002) (superseded by *CIO 2106-G-05 QAPP*, September 2011) and *Uniform Federal Policy for Quality Assurance Project Plans* (EPA et al. 2005) (UFP-QAPP) with associated worksheets available on the EPA website. The QAPP is not being used as an initial project planning tool and will not be used as a standalone document containing all specifications and procedures necessary for project personnel to conduct their assigned responsibilities. Therefore, a graded approach has been implemented to respond to the worksheet instructions. Worksheet #9 is not used, as this is not a newly defined project. The following table shows a requirements crosswalk between both guidance documents.

Requirements Crosswalk: UFP-QAPP Workbook to 2106-G-05 QAPP

Optimized UFP-QAPP Worksheets		**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 & 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 Requirements, Supplies and Consumables
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

Requirements Crosswalk: UFP-QAPP Workbook to 2106-G-05 QAPP (continued)

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
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

2.0 References

40 CFR 192. "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

DoD (U.S. Department of Defense) and DOE (U. S. Department of Energy), 2021. *Department of Defense (DoD) and Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories*, Based on ISO/IEC 17025:2005(E) and The NELAC Institute (TNI) Standards, Volume 1, (September 2009), DOD/DOE QSM 5.1.

DOE Order 414.1D Chg 1, *Quality Assurance*, May 8, 2013.

DOE (U.S. Department of Energy), 1988. *Monticello (Utah) Site: Monticello Vicinity Properties NPL Site and Monticello Millsite Federal Facility Agreement Pursuant to CERCLA Section 120*, U.S. Environmental Protection Agency, State of Utah Department of Health, U.S. Department of Energy, December 22.

DOE (U.S. Department of Energy), 1990a. *Final Remedial Investigation/Feasibility Study–Environmental Assessment for the Monticello, Utah, Uranium Mill Tailings Site*, January.

DOE (U.S. Department of Energy), 1990b. *Monticello Mill Tailings Site Declaration for the Record of Decision and Record of Decision Summary*, August.

DOE (U.S. Department of Energy), 1998a. *Monticello Mill Tailings Site, Operable Unit III Remedial Investigation*, GJO-97-6-TAR, GJO-MRAP-37, September.

DOE (U.S. Department of Energy), 1998b. *Permeable Reactive Treatment (PeRT) Wall: Characterization Report*, MAC-PTW 1.3.1, Grand Junction Office, Grand Junction, Colorado. September.

DOE (U.S. Department of Energy), 1998c. *Record of Decision for an Interim Remedial Action at the Monticello Mill Tailings Site, Operable Unit III – Surface Water and Ground Water, Monticello, Utah*, GJO-98-51-TAR, Grand Junction Office, August.

DOE (U.S. Department of Energy), 1999a. *Application for Supplemental Standards for Upper, Middle, and Lower Montezuma Creek*, *Volume I*, GJO–98–58–TAR, May.

DOE (U.S. Department of Energy), 1999b. *Application for Supplemental Standards for Government-Owned Properties in Monticello, Utah, DOE ID Nos. MP-00391-VL, MP-01041-VL, and MP-01077-VL*, GJO–98–66–TAR, May.

DOE (U.S. Department of Energy), 2002. *Monticello Mill Tailings Site Operable Unit III Evaluation of the Permeable Reactive Treatment Wall Treatability Study*, Q0027600, Grand Junction Office, Grand Junction, Colorado, September.

DOE (U.S. Department of Energy), 2003. *Draft Final Monticello Site Management Plan*, GJO-2003-493-TAC, Office of Legacy Management, October.

DOE (U.S. Department of Energy), 2004a. *Monticello Mill Tailings Site Operable Unit III Post-Record of Decision Monitoring Plan Draft Final*, DOE-LM/GJ684-2004, Office of Legacy Management, August.

DOE (U.S. Department of Energy), 2004b. *Monticello Mill Tailings Site, Operable Unit III Remedial Investigation Addendum/Focused Feasibility Study*, Office of Legacy Management, January.

DOE (U.S. Department of Energy), 2004c. *Preliminary Close Out Report Monticello Mill Tailings (USDOE) Site Operable Units I, II and III*, IR 011, U.S. Environmental Protection Agency, September.

DOE (U.S. Department of Energy), 2004d. *Record of Decision for the Monticello Mill Tailings (USDOE) Site Operable Unit III, Surface Water and Groundwater, Monticello, Utah*, DOE-LM/GJ629-2004, Office of Legacy Management, May.

DOE (U.S. Department of Energy), 2006a. *Hydraulic Conductivity of the Monticello Permeable Reactive Barrier—November 2005 Update*, DOE-LM/GJ1086-2006, ESL-RPT-2006-01, Office of Legacy Management, Grand Junction, Colorado, January.

DOE (U.S. Department of Energy), 2006b. *Third (March 2006) Coring and Analysis of Zero-Valent Iron Permeable Reactive Barrier, Monticello, Utah*, DOE LM/GJ1379-2006, ESL-RPT-2006-03, Office of Legacy Management, Grand Junction, Colorado, November.

DOE (U.S. Department of Energy), 2007. *Long-Term Surveillance and Maintenance Plan for the Monticello NPL Sites*, DOE-LM/1465-2007, Office of Legacy Management, June.

DOE (U.S. Department of Energy), 2009a. *Explanation of Significant Difference (ESD) for the Monticello Mill Tailings (USDOE) Site Operable Unit III, Surface Water and Ground Water, Monticello Utah*, January.

DOE (U.S. Department of Energy), 2009b. *Monticello Mill Tailings Site Operable Unit III Water Quality Compliance Strategy*, LMS/MNT/S05072, Office of Legacy Management, December.

DOE (U.S. Department of Energy), 2014. *Final Groundwater Contingency Remedy Optimization Remedial Design/Remedial Action Work Plan, for the Monticello Mill Tailings Site Operable Unit III, Monticello, Utah*, LMS/MNT/S10629, Office of Legacy Management, May.

DOE (U.S. Department of Energy), 2016. *Remedial Action Completion Report for Operable Unit III Groundwater Contingency Remedy Optimization System Monticello Mill Tailings Site, Monticello, Utah*, LMS/MNT/S13373, Office of Legacy Management, May.

DOE (U.S. Department of Energy), 2018a. *Groundwater Remedy Optimization System Extraction Well Ranking Test Report Monticello Mill Tailings Site Operable Unit III Monticello, Utah*, LMS/MNT/S18275, Office of Legacy Management, February.

DOE (U.S. Department of Energy), 2018b. *Long-Term Surveillance and Maintenance Plan for Monticello NPL Sites,* LMS/MNT/S00387, Office of Legacy Management, June.

DOE (U.S. Department of Energy), 2022. *Life-Cycle Baseline Estimate Monticello, UT, Disposal and Processing Sites, FY 2022,* September.

DOE (U.S. Department of Energy) and City of Monticello, 1999. *Cooperative Agreement Between the City of Monticello and the U.S. Department of Energy*, DE-FC-99GJ79485, October.

Environmental Data Validation Procedure, LMS/PRO/S15870, continuously updated, prepared by RSI EnTech for the U.S. Department of Energy Office of Legacy Management.

EPA (U.S. Environmental Protection Agency), 2001. *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, March.

EPA (U.S. Environmental Protection Agency), 2002. *EPA Guidance for Preparing Quality Assurance Project Plans,* EPA QA/G-5, December.

EPA (U.S. Environmental Protection Agency), 2010. *Monitored Natural Attenuation of Inorganic Contaminants in Ground Water Volume 3: Assessment for Radionuclides Including Tritium, Radon, Strontium, Technetium, Uranium Iodine, Radium, Thorium, Cesium, and Plutonium-Americium*, EPA/600/R-10/093, September.

EPA (U.S. Environmental Protection Agency), 2017a. *National Functional Guidelines for Inorganic Superfund Methods Data Review*, EPA-540-R-2017-001, January.

EPA (U.S. Environmental Protection Agency), 2017b. *National Functional Guidelines for Organic Superfund Method Data Review*, EPA-540-R-2017-002, January.

EPA (U.S. Environmental Protection Agency), DoD (U.S. Department of Defense), and DOE (U.S. Department of Energy), 2005. *Uniform Federal Policy for Quality Assurance Project Plans*, EPA-505-B-04-900A, DTIC ADA 427785, Intergovernmental Data Quality Task Force, March.

Paar, J.G., and Porterfield, D.R., 1997. *Evaluation of Radiochemical Data Usability*, ES/ER/MS-5, prepared for the U.S. Department of Energy Office of Environmental Management, April.

Quality Assurance Manual, LMS/POL/S04320, continuously updated, prepared by RSI EnTech for the U.S. Department of Energy Office of Legacy Management.

Records Management Manual, LMS/PRO/S04327, continuously updated, prepared by RSI EnTech for the U.S. Department of Energy Office of Legacy Management.

Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites, LMS/PRO/S04351, continuously updated, prepared by RSI EnTech for the U.S. Department of Energy Office of Legacy Management.

State of Utah, 1999. *Ground-Water Management Policy for the Monticello Mill Tailings Site and Adjacent Areas*, Department of Natural Resources Division of Water Rights, May 21.

3.0 Important Links

The *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351) can be found at:
https://www.energy.gov/lm/downloads/sampling-and-analysis-plan-us-department-energy-office-legacy-management-sites

The *Long-Term Surveillance and Maintenance Plan for the Monticello NPL Sites* (LMS/MNT/S00387) and other important site documents can be found at:
https://lmpublicsearch.lm.doe.gov/lmsites/s00387_mnt_ltsm_plan.pdf

The *Department of Defense (DoD) Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* can be found at:
https://doecap.projectenhancement.com/Certifications/QSM_Version_5.4_FINAL.pdf

Note

Some documents referenced in this QAPP such as the Quality Assurance Manual *(LMS/POL/S04320),* Records Management Manual *(LMS/PRO/S04327), and* Environmental Data Validation Procedure *(LMS/PRO/S15870) are internal LMS procedures, and therefore URLs to these procedures cannot be included in this public document. These procedures are regularly reviewed and revised. All LMS personnel who are responsible for performing the activities described in these procedures are trained to them and perform required reads of the procedures upon each revision. Regulatory agencies can access these documents through the shared government electronic file transfer site. Laboratory-specific Standard Operating Procedures and Quality Assurance Plan can also be accessed through this site.*

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

Management for the Monticello, Utah, Disposal and Processing Sites is committed to establishing, maintaining, and implementing an effective Quality Assurance program that achieves quality in all activities through planning, performing, assessing, and continually improving the process. The achievement of quality is an interdisciplinary function led by management and it is the responsibility of all personnel. Work is accomplished through the resources of people, equipment, and procedures. Managers are responsible for ensuring that people have the information, resources, and support necessary to complete the work in a safe, efficient, and quality manner. All work performed for the U.S. Department of Energy Office of Legacy Management at the Monticello, Utah, Disposal and Processing Sites must comply with the requirements of this Quality Assurance Project Plan.

Approved:

Digitally signed by ALISON KUHLMAN
Date: 2023.07.18 11:41:42 -06'00'

Alison Kuhlman, Monticello LM Site Manager
U.S. Department of Energy Office of Legacy Management

JONATHAN DAMIANO Digitally signed by JONATHAN DAMIANO
Date: 2023.07.18 10:23:19 -06'00'

Jonathan Damiano, Quality Assurance Manager
U.S. Department of Energy Office of Legacy Management

JOHN HOMER (Affiliate) Digitally signed by JOHN HOMER (Affiliate)
Date: 2023.07.18 12:08:54 -04'00'

John Homer, LMS Subtask Manager
RSI EnTech, LLC

JESSICA DUGGAN Digitally signed by JESSICA DUGGAN
Date: 2023.08.24 14:42:21 -06'00'

Jessica Duggan, Remedial Project Manager
U.S. Environmental Protection Agency Region 8

Wesley Sandlin Digitally signed by Wesley Sandlin
Date: 2023.08.24 14:04:07 -06'00'

Wes Sandlin, NPL/Federal Facilities Section Manager
State of Utah Department of Environmental Quality

LM and LMS contractor work assignments are subject to change. Names will be updated upon annual QAPP revisions as needed.

[1] **Project Identifying Information**

[a] Monticello, Utah, Disposal and Processing Sites

[b] Monticello, Utah

[c] DOE Legacy Management service contract/DE-LM0000421

[2] **Lead Organization**

[a] LM site manager

[b] LM Quality Assurance manager

LMS Contractor Organization

[a] LMS site lead

[b] LMS Quality and Performance Assurance manager

[3] **Federal Regulatory Agency**

Environmental Protection Agency, Region 8

[4] **State Regulatory Agency**

Utah Department of Environmental Quality (UDEQ)

[5] **Other Stakeholders**

City of Monticello

[6] **List plans and reports from previous investigations relevant to this project**

Key documents for the Monticello site are available to the public at the following website: https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Monticello.

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

The LM organization chart is routinely updated and posted to the public LM website. The Monticello site is managed under LM-21, Environment Team 1. The LMS contractor organization chart is routinely updated and posted to the internal intranet. Figure 1 shows lines of communication between LM and the LMS contractor. Work assignments and phone numbers are subject to change for individuals. The contact numbers below can be used to reach Monticello project personnel.

The official QAPP is maintained by the LM QA Manager and the LM Site Manager.

Monticello Project Contact Information

Contact	Phone Number	Location
Monticello site phone	(435) 587-2098	Monticello Site Administration Building
Bill Cary LMS contractor safety technician	(435) 587-2641	Monticello Site Administration Building
Gary McKinnon LMS contractor operations lead	(435) 587-3115	Monticello Site Administration Building
Ryan Kyle LMS contractor site lead (Oversight of QAPP)	(970) 248-6104	Grand Junction DOE Administration
Alison Kuhlman LM site manager	(970) 778-5528	Grand Junction DOE Administration
LM notification phone	(970) 248-6070	Grand Junction DOE Administration
LM toll-free number	(877) 695-5322	Grand Junction DOE Administration

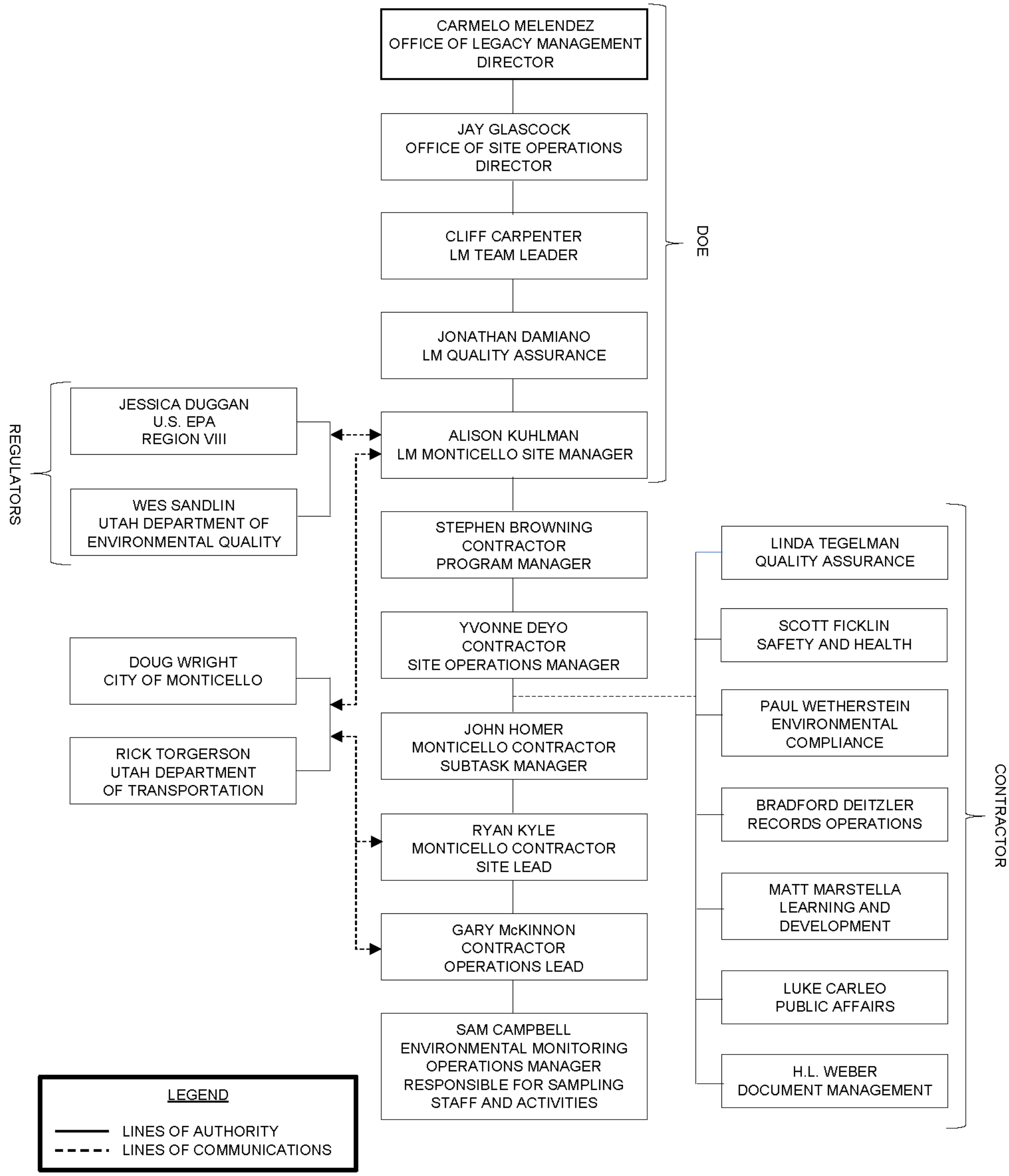

Figure 1. Monticello LM Project Organization

QAPP Worksheet #4, #7, & #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)

Training

Personnel will be qualified to perform their assigned job through meeting basic job description requirements, education standards, experience, and ongoing performance reviews. Training will be provided when needed to maintain proficiency; to adapt to new technologies, equipment, or instruments; and to perform new assigned responsibilities.

All individuals performing work in association with this QAPP have been trained to LMS procedures relating to the work being performed.

The LMS Learning and Development group manages, maintains, and tracks employee training records, provides in-house and online training, and coordinates offsite and vendor-provided training. The LMS Learning and Development group documents training records in an electronic folder for each person working on the LMS contract. This folder can contain the individual's previous transcripts, scored examinations, equivalency forms, certificates of course completions, qualifications, and any other correspondence deemed appropriate to retain.

Site access training requirements and personal protective equipment needs are specified in safety and health procedures and site-specific job safety analyses. Compliance is required prior to access to work areas.

The LMS project manager is responsible for determining site-required training and communicating the requirements to their direct staff and to the managers.

Each manager is responsible for determining the training needs of their staff and for ensuring that required training (including site-specific training) is documented in the training database.

Personnel assigned to project activities are responsible for ensuring that their required training and medical surveillance (if applicable) are documented and are maintained in a current status as required by the project and their position or assignments. At a minimum, individual training requirement will be reviewed annually and updated as needed.

The LMS project manager is responsible for ensuring that personnel assigned to project tasks are sufficiently familiar with the project implementing documents (e.g., plans, procedures, and drawings) and the requirements established for inspection, systems monitoring, sample collection, analysis, documenting and reporting project activities, and demonstrating proficiency.

The LMS site operations lead will ensure that personnel assigned to field sampling activities can demonstrate proficiency when performing the work or that they are properly supervised by a team lead who is proficient.

The LMS site lead will provide oversight of the QAPP and assure that the plan is updated in conjunction with the Quality and Performance Assurance group on an annual basis.

Certifications

LM's mission is to fulfill DOE's post-closure responsibilities and ensure the future protection of human health and the environment. To accomplish their mission for the approximately 100 sites, the LM Contractor has established nationwide systems for performing the work. For each site, an LMS contractor site lead draws from support groups to perform the work. The established work control system verifies personnel qualifications and training needed for each job during work planning, including signatures of the worker that acknowledge they understand the requirements of the work.

LMS contractor work assignments are fluid based on the matrix management organization. The key roles, education and experience, and specialized training and certification in support of environmental monitoring for the Monticello site are shown in the table below.

Personnel assigned to waste shipment activities will be certified in accordance with the appropriate level of U.S. Department of Transportation certified shipper requirements for the work they perform.

Personnel assigned waste management responsibilities must have training in appropriate requirements to insure appropriate storage, characterization, and disposition of waste materials.

Laboratories used for analysis of samples collected for characterization or compliance are required to be accredited under the DOE Consolidated Audit Program (DOECAP). LMS contractor data validation staff may observe some third-party certification audits. State and regional requirements for registration or certification (e.g., state-licensed engineer or surveyor) are addressed in a site-specific long-term surveillance and maintenance (LTS&M) plan, as necessary.

LMS Environmental Monitoring Operations has established contracts with various laboratories based on a common procurement statement of work. Specific laboratories and their personnel are subject to change for the long-term surveillance and maintenance of the Monticello site. Should a change occur, the lab accreditation will be sent to key personnel including EPA and UDEQ for approval. If the lab is approved, the QAPP will be updated with the new lab information and accreditations upon the next yearly review.

Organization: LM and LMS Contractor

Project Title/Role	Education/Experience	Specialized Training/Certifications	Signatures
Alison Kuhlman LM Monticello Site Manager	Bachelor of Science in Environmental Engineering Site management experience in environmental monitoring projects	NA	Alison Kuhlman Digitally signed by ALISON KUHLMAN Date: 2023.07.13 14:46:31 -06'00'
Jonathan Damiano LM Quality Assurance Manager	Master of Science in Systems Engineering Bachelor of Science in Industrial Engineering Experience in Quality Management Systems implementation and oversight of environmental and manufacturing projects	NA	JONATHAN DAMIANO Digitally signed by JONATHAN DAMIANO Date: 2023.07.06 15:43:12 -06'00'
John Homer LMS Contractor Subtask Manager	Master of Environmental Science Experienced in overseeing multiple projects in environmental monitoring environment	NA	JOHN HOMER (Affiliate) Digitally signed by JOHN HOMER (Affiliate) Date: 2023.06.21 10:54:27 -04'00'
Ryan Kyle Monticello Contractor Site Lead—Includes Oversight of the QAPP	Bachelor of Arts Environmental Scientist Project management experience	NA	Ryan W. Kyle Digitally signed by Ryan W. Kyle Date: 2023.06.21 08:39:54 -06'00'
Linda Tegelman LMS Quality Assurance Specialist	Associate of Science in Health Physics/Radiation Protection Quality Assurance experience	American Society for Quality Certified Quality Auditor	LINDA TEGELMAN (Affiliate) LINDA TEGELMAN (Affiliate) 2023.06.21 08:06:42 -06'00'
Al Laase LMS Geoscience Services Manager	Master of Hydrology Groundwater modeling experience	NA	ALAN LAASE (Affiliate) ALAN LAASE (Affiliate) 2023.06.21 14:15:10 -06'00'
Sam Campbell LMS Environmental Monitoring Operations Lead	Applied Geology—hydrogeology Professional Geologist Experience in sampling in environmental monitoring environment	Water Sampling Training (LMS course WS300)	Sam Campbell Digitally signed by Sam Campbell Date: 2023.06.21 14:48:16 -06'00'
LMS Environmental Monitoring Operations Sample Team Members	Science degree Experience in sampling surface and groundwater	Water Sampling Training (LMS course WS300)	Sample Team Members may vary
LMS Environmental Monitoring Operations Data Validation Staff	Chemistry degree Laboratory data validation experience in environmental samples	Experienced DOECAP auditor Validation of Environmental Data (LMS course DVT)	Data Validation Staff may vary

Abbreviation:
NA = not applicable

Organization: GEL Laboratories

Project Title/Role	Education/Experience	Specialized Training/Certifications	Signatures
Bob Pullano Laboratory Quality Control Manager	Laboratory Quality Control Experience	NA	Robert L. Pullano Digitally signed by Robert L. Pullano Date: 2023.06.29 13:21:08 -04'00'
Laboratory Sample Receiving	Science degree Laboratory analysis experience	NA	Laboratory Sample Receiving Personnel may vary
Laboratory Analyst	Science degree Laboratory analysis experience	NA	Laboratory Analysts may vary

Abbreviation:
NA = not applicable

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

Regulatory Interaction with EPA

Regulatory interaction with EPA is defined by the regulatory agreements that describe LTS&M requirements at the Monticello site, originally established prior to the transfer of site responsibilities from EM to LM.

Communication Driver	Organization	Position	Contact Method	Procedure (timing, pathway, documentation, etc.)
Regulatory agency interface	LM	Site Manager	Email Phone Mail	With assigned EPA Region 8 and Utah state representatives (examples annual inspection report, 5-year review)
Field progress reports	LMS Contractor	Sampling Staff	EDGE information available to management	EDGE real time entry during sampling
Stop work due to safety issues	LMS Contractor	Site Lead	Phone	Notify LM site manager at discovery
QAPP changes	LMS Contractor	Site Lead	Email	LMS staff supporting the Monticello site for all changes LM site manager for all changes Post each revision on LM public webpage and notify EPA and UDEQ All signatories review for significant changes
Field corrective actions	LMS Contractor	Sampling Staff	EDGE	LM Contractor Data Management via field notes in EDGE documentation
Sample receipt variances	Contract Laboratory	Laboratory Coordinator	Email	Laboratory project manager contacts laboratory coordinator
Data review corrective actions	LMS Contractor	Laboratory Coordinator	Data report	LMS Contractor site lead
Laboratory data quality issues	LMS Contractor	Laboratory Coordinator	Email	Laboratory coordinator contacts laboratory project manager for issue resolution

Abbreviation:
EDGE = Environmental Quality Information System Data Gathering Engine

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

Project Definition

The objectives of the long-term environmental monitoring program for the Monticello site are to evaluate the success and effectiveness of the remedial actions and selected remedies, demonstrate compliance with applicable regulations, and ensure the long-term protection of human health and the environment.

Background

The former mill site and surrounding properties are situated in and along the valley of Montezuma Creek, a small perennial stream that flows eastward from its origins in the Abajo Mountains, which rise to 11,000 feet (ft) about 5 miles west of the site. In the western part of MMTS, the valley is relatively broad and gentle and contains the site of the former uranium and vanadium ore mill (mill site). The mill site comprises 110 acres at an average elevation of about 7000 ft. East of the MMTS, the valley transitions to a steep canyon. The climate is semiarid with four distinct seasons. Precipitation occurs mainly during spring and late summer. Native woody vegetation is dominated by oak brush, piñon/juniper, sagebrush, and rabbitbrush. Dense willows line much of the riparian zone of Montezuma Creek. Wetlands in the vicinity of Montezuma Creek are considered to be environmentally sensitive areas, as are the mature stands of piñon and juniper forest on and near the Monticello site.

Land and Resource Use

Monticello is the seat of San Juan County and the location of district offices of the U.S. Bureau of Land Management and the U.S. Forest Service. Natural resource use in the area includes recreation, agriculture, and domestic and agricultural use of surface water and groundwater. Montezuma Creek does not support fish and does not contain sufficient flow to support recreational activities such as boating. No mineral, energy, or timber extraction exists within the MMTS. Land use within the MMTS includes ranching, farming, residential, and recreational. Much of the land surrounding Monticello and the MMTS is open range, ranchland, or is cultivated for dry-land farming.

Ownership of the OU I mill site and several adjacent OU II peripheral properties was transferred from DOE to the City of Monticello in June 2000 through the Federal Lands to Parks Program. Transferred lands, identified in Figure 2 as the Deed Restriction City Properties, are managed by the City of Monticello as a public, day-use park as a condition of the land transfer. Figure 3 shows the Monticello site OU III features, and Figure 4 and Figure 5 show monitoring well locations.

The contaminated, shallow alluvial aquifer underlying portions of the MMTS has no current or historical use because of poor yield. Alternate sources of domestic water are readily available within OU III: the municipal water supply and uncontaminated bedrock aquifer sources. Surface water from Montezuma Creek is diverted in several locations for agricultural uses.

History of Contamination

The Monticello mill was constructed in 1941 by the Vanadium Corporation of America, with assistance from the federal government, and it provided vanadium during World War II. The Vanadium Corporation of America operated the mill until early 1944, and again from 1945 through 1946 to also extract uranium. In 1948, the U.S. Atomic Energy Commission (AEC), a predecessor agency of DOE, purchased the site and resumed uranium and vanadium ore milling in 1949. Vanadium processing using a salt-roast and carbonate-leach milling process generated tailings until 1955. After 1955, uranium processing used an acid leach and carbonate-leach process until the mill was permanently closed until 1960. Mill tailings, the pulverized remnants of the processed ore, contain potentially hazardous radiological and non-radiological constituents. The mill tailings were impounded at four tailings piles at the former mill during and after operation. Approximately 1 million tons of ore were processed at the mill.

While the mill operated, some tailings were removed to properties in Monticello for use in construction projects and as fill for open land. The MVP site includes these affected properties. Some mill tailings were also dispersed from the mill site, primarily by wind and water erosion, to surrounding and downstream properties. Eventually these affected peripheral properties were included in MMTS OU II.

In addition, radiological and non-radiological constituents were mobilized from the tailings piles by residual process water and percolating rainwater to contaminate the underlying alluvial aquifer and Montezuma Creek. MMTS OU III consists of contaminated groundwater and surface water that extends approximately 3 miles from the former mill site in the bedrock-bounded alluvial aquifer in the valley of Montezuma Creek. The alluvial aquifer has an average saturated thickness of 3 to 4 ft, while the unconsolidated deposits in the valley are on average 10–15 ft thick and composed of fine soils overlying 3 to 4 ft of alluvial sand and gravel. Uranium is the primary human health risk driver in OU III groundwater and the focus of past and current remedy evaluations for OU III. The uranium plume is present in the shallow alluvial aquifer and extends from the former mill site approximately 1 mile southeast along the Montezuma Creek valley (Figure 3). The Burro Canyon bedrock aquifer underlying the alluvial aquifer is not contaminated.

Initial Response

Cleanup actions at the site before a Record of Decision (ROD) was issued included initial cleanup actions by AEC in the 1960s and activities conducted by DOE under the Surplus Facilities Management Program in the 1980s. These responses predated inclusion of the affected properties (later defined as OU I and OU II) on the NPL. Specific initial response actions are described in Appendix A of this QAPP.

Prior to issuance of *Record of Decision for the Monticello Mill Tailings (USDOE) Site Operable Unit III, Surface Water and Groundwater, Monticello, Utah* (DOE 2004d), an interim ROD, *Record of Decision for an Interim Remedial Action at the Monticello Mill Tailings Site, Operable Unit III—Surface Water and Ground Water, Monticello, Utah* (DOE 1998c), describing an interim remedial action (IRA) was in place. The IRA was implemented until the full impact of ongoing surface remediation of OU I and OU II on the groundwater and surface water could be assessed. Interim actions included: (1) dewatering and treating the alluvial aquifer on the mill site, (2) implementing groundwater institutional controls (ICs) to preclude extraction of contaminated groundwater from the shallow alluvial aquifer for domestic purposes, (3) implementing a permeable reactive barrier (PRB) treatability study, (4) monitoring and data collection, (5) groundwater modeling, and (6) updating the human health and ecological risk assessments. The results of these interim actions, reported in *Monticello Mill Tailings Site, Operable Unit III Remedial Investigation Addendum/Focused Feasibility Study* (DOE 2004b), provided the remaining information necessary to select the OU III remedy.

Selected Remedy

The original OU III remedy is described in *Record of Decision for the Monticello Mill Tailings (USDOE) Site Operable Unit III, Surface Water and Groundwater, Monticello, Utah* (DOE 2004d). The selected remedy (1) monitored natural attenuation of contaminated surface water and groundwater, including biomonitoring to assess the potential for ecological receptors to be affected adversely at wetlands from selenium, and (2) continued implementation of the IC established in the interim remedial action that precludes extraction of contaminated groundwater from the shallow alluvial aquifer for domestic purposes. Contingency actions were specified in the ROD in the event that the progress of aquifer restoration failed to meet established performance criteria. The current contingency remedy was implemented through an Explanation of Significant Difference (DOE 2009a) by:

- Incorporating the ex situ pump-and-treat system that was installed as a technology demonstration project in 2005 and expanded in 2007 as an active remedy component.
- Incorporating the PRB or an equivalent replacement as a groundwater containment device.
- Modifying the OU III remedial action objective to include the State of Utah's uranium standard of 30 picocuries per liter (pCi/L) for domestic-use surface water, which did not exist when the OU III ROD was issued.
- Installation of the groundwater remedy optimization system in 2014 to replace the ex situ system (deactivated in December 2014) for more aggressive capture and treatment of contaminated groundwater.

Area of Attainment

Groundwater contamination at OU III occurs in the alluvial aquifer that underlies the valley of Montezuma Creek. Active groundwater remediation focuses on an area of attainment (AOA) that encompasses approximately 6 acres of land located immediately downgradient (east) of the former mill site. The AOA includes a subset of the contaminant plume. It was selected for active groundwater remediation because it has high concentrations of uranium (between about 300 and 1000 micrograms per liter [µg/L]) that occur in an area with well-defined hydrologic boundaries. Groundwater in the AOA occurs in heterogeneous mixtures of unconsolidated silt, sand, and gravel. Flow is predominantly west to east, parallel to the slope of the valley. The water table is generally within 10 ft of ground surface, and the depth to the bedrock aquitard is generally not more than about 15 ft (see Figure 4).

Basis for Remedial Action

Hazardous substances that have been released in each OU of the Monticello site are summarized in the following table. Major pathways and receptors for site-related contamination are also provided.

Summary of Contaminants and Receptors/Pathways at the Monticello Site

Operable Unit	Medium	Contaminants	Receptors and Pathways
OU I and OU II	Soil/sediment	^{226}Ra, uranium, ^{230}Th, vanadium	Soil/sediment ingestion by humans Direct gamma exposure Indoor radon
OU III	Surface water	Uranium, selenium	Drinking water by humans Terrestrial wildlife drinking water Aquatic life contact with wetlands Terrestrial wildlife ingestion of macroinvertebrates
OU III	Groundwater	Uranium, manganese, vanadium, selenium, arsenic, molybdenum, nitrate, uranium, gross alpha	Drinking water by humans Cattle grazing on vegetation with contaminant uptake

Abbreviations:
^{226}Ra = radium-226
^{230}Th = thorium-230

The two major contaminants of concern for the Monticello site radiological public health evaluation (DOE 1990a) were determined to be radon gas and gamma radiation, both of which were attributable to the tailings piles and contaminated soils and materials on the mill site and other affected properties (DOE 1990b). As an indicator of potential individual risk due to exposure to tailings and soils under baseline radiological conditions, a gross estimate of the lifetime excess cancer incidence to the individual was estimated to be 1×10^{-5}. Although this estimate was within EPA's acceptable risk range, the decision was made to remediate the mill site to comply with pertinent health-based requirements in Title 40 *Code of Federal Regulations* Section 192 (40 CFR 192) Subparts A, B, and C. Potential use of groundwater as the primary source of drinking water was determined to result in significant risks, primarily attributed to the presence of uranium and vanadium.

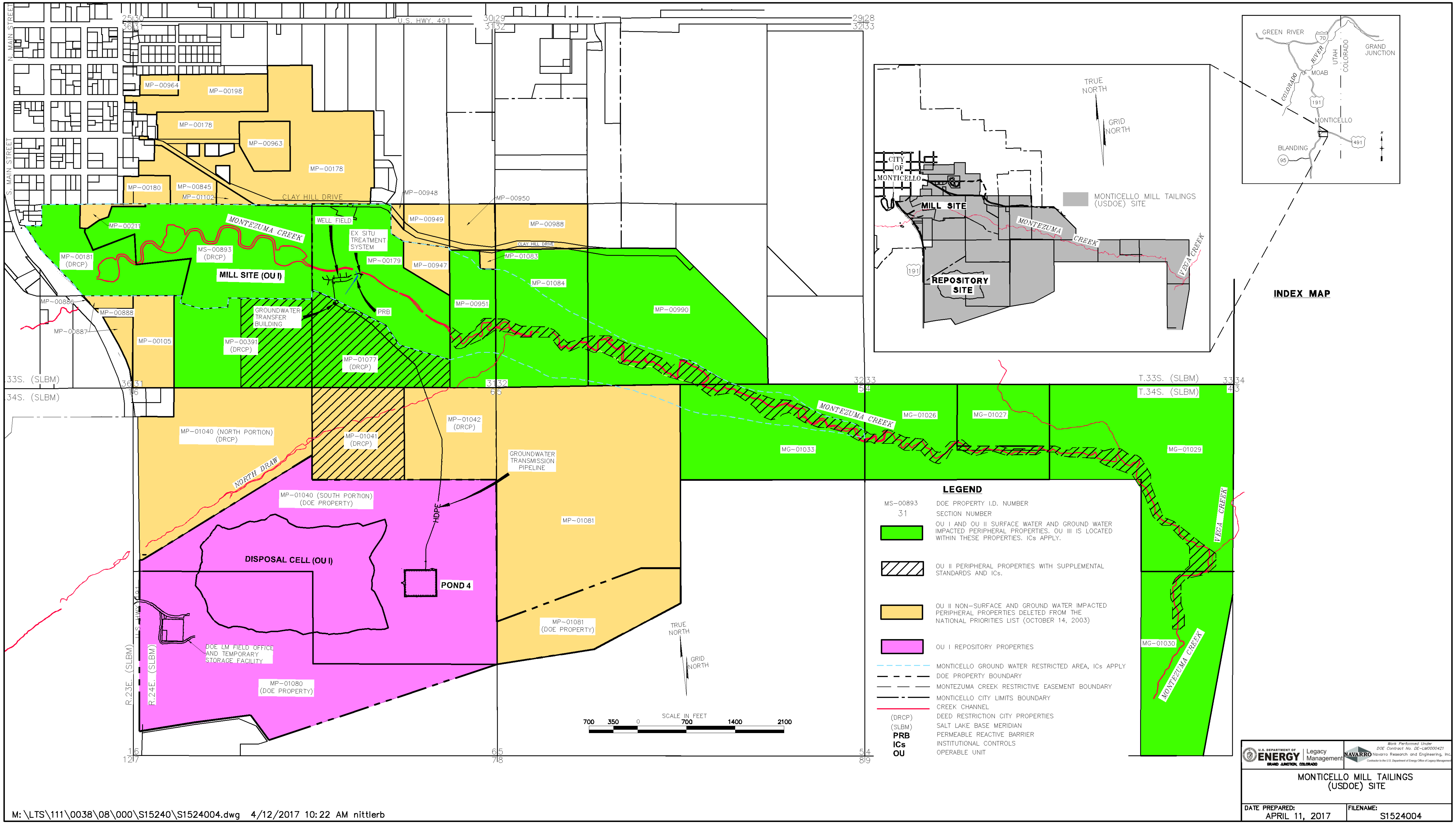

Figure 2. Monticello Mill Tailings Site

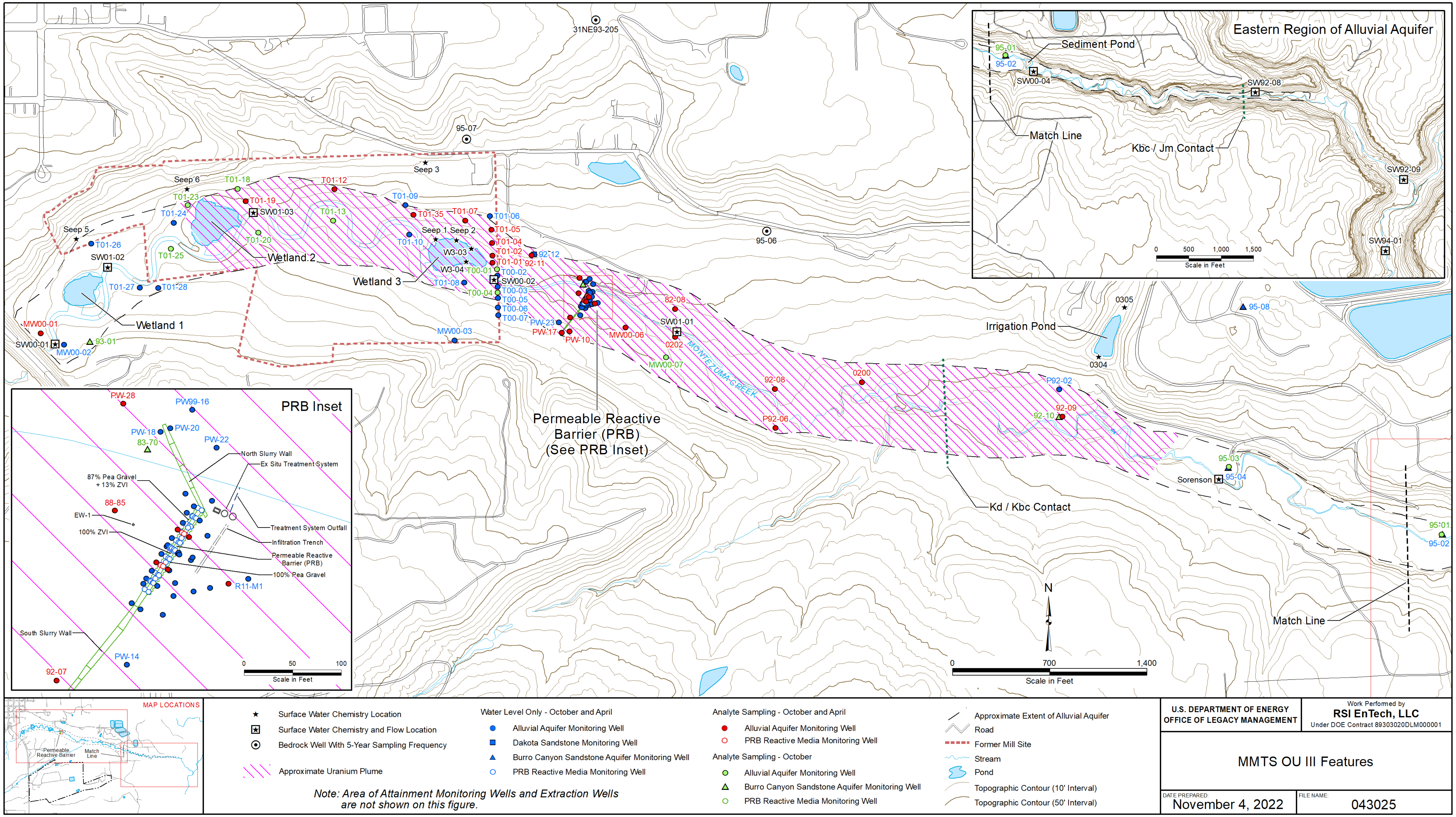

Figure 3. Monticello Site OU III Features

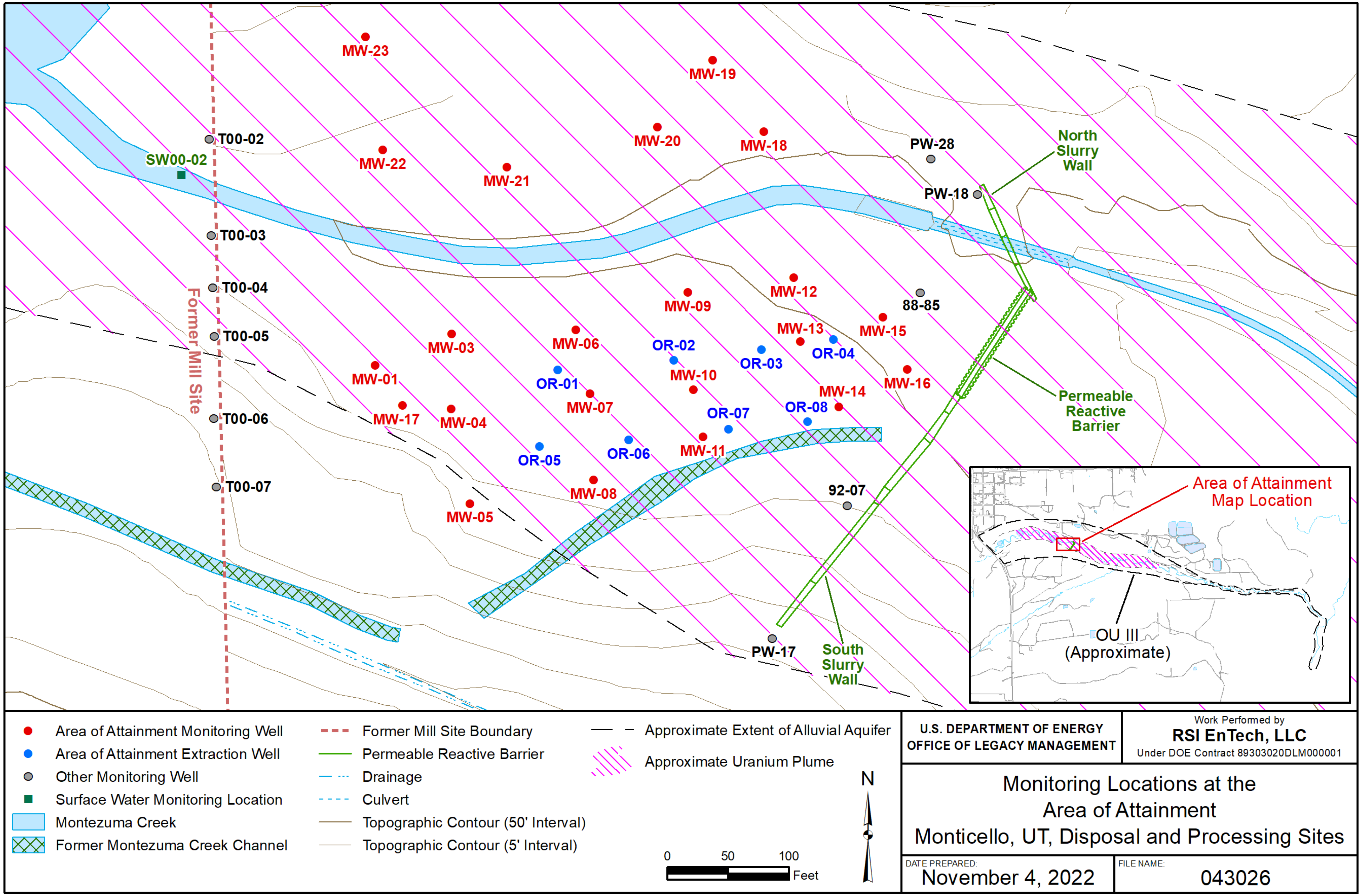

Figure 4. Monitoring Locations at the Area of Attainment

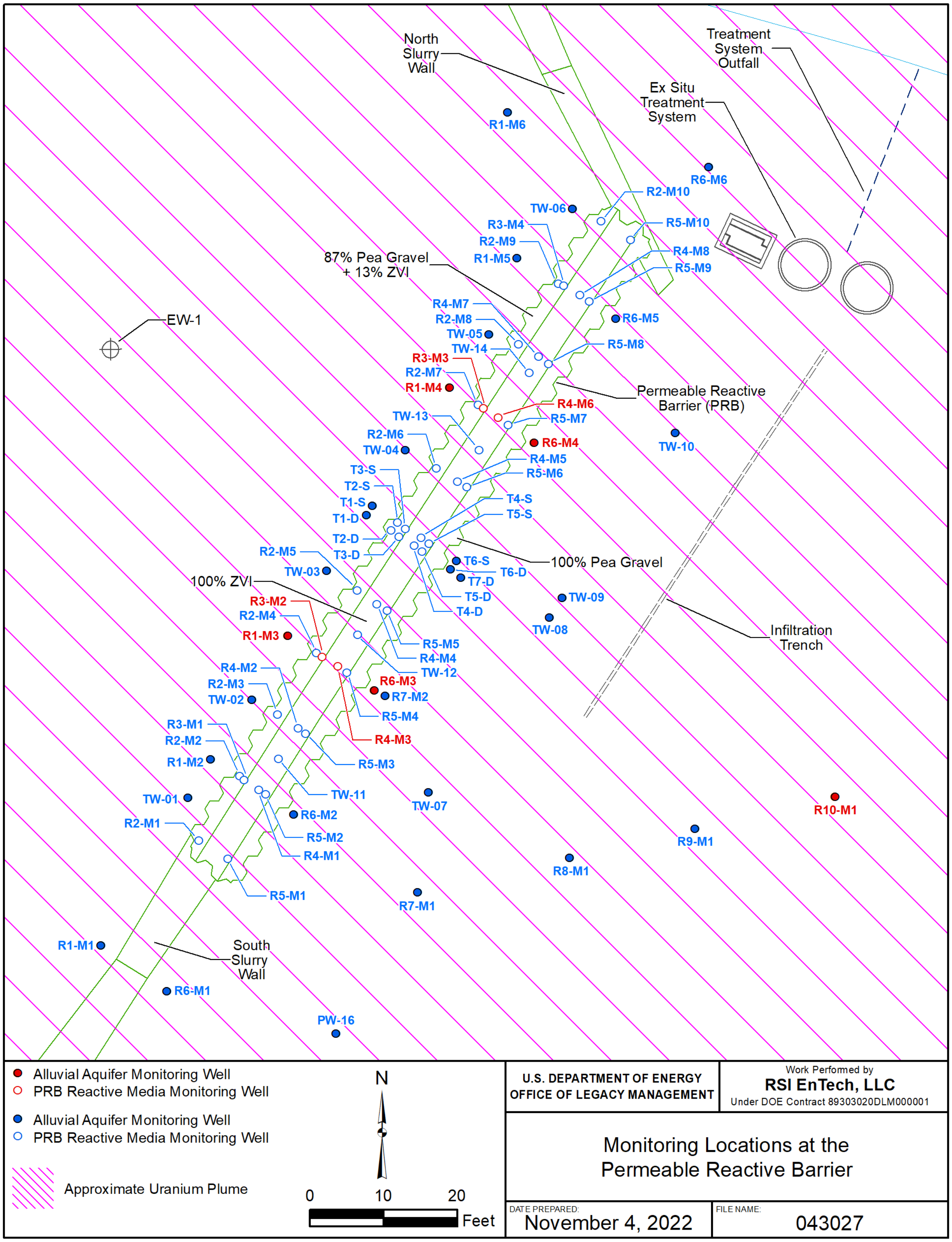

Figure 5. Monitoring Locations at the Permeable Reactive Barrier

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

Quality objectives and criteria of sampling, measurements, and analysis create the basis to evaluate (1) the performance and effectiveness of the remedy and (2) if the goals of the project are met. The DQOs were developed strictly for OU III following guidance provided by EPA, *Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4* (EPA 2006) to guide input data collection and output data evaluation. The steps to the DQO process are (1) problem statement, (2) study question identification, (3) input data/information needs identification, (4) specification of study boundaries, (5) strategy development for information synthesis, (6) performance and acceptance criteria specification, and (7) design optimization for obtaining and generating adequate data or information. These steps are defined in the context of this project in the following table entitled *Data Quality Objectives Evaluation for Groundwater and Surface Water Remedy Evaluation, MMTS OU III*.

Current Regulatory Requirements

The *Record of Decision for the Monticello Mill Tailings (USDOE) Site Operable Unit III, Surface Water and Groundwater, Monticello, Utah* (DOE 2004d) and a Federal Facilities Agreement (FFA) between DOE, EPA, and UDEQ define what surveillance and maintenance is required, the frequency of each required activity, and the surveillance and maintenance locations.

Environmental sampling, analysis, and data management required by the ROD and FFA conforms to this *Quality Assurance Project Plan, Monticello, Utah, Disposal and Processing Sites* and meets the quality assurance and quality control requirements in current EPA guidance. DOE submitted the QAPP to UDEQ and EPA in accordance with the ROD and FFA requirements.

LM will perform sampling and analysis as required by the *Long-Term Surveillance and Maintenance Plan for Monticello NPL Sites* (DOE 2018b) (LTS&M Plan), regardless of Contractor changes. The Monticello site does not anticipate any resource or time constraints that would affect sampling and analysis. Access to sampling sites has been arranged with property owners where necessary. Because of the longer holding times, shipping delays are not expected to affect data quality or the chain of custody for analytes from the Monticello site. If a shipping delay causes a violation of a holding time requirement, the laboratory results may be qualified as per Section 5.1.3 of the *Environmental Data Validation Procedure*.

The LTS&M Plan provides additional implementation detail for use by Monticello personnel. The LTS&M Plan also includes specific infrastructure information so that the document is a comprehensive guide to performing the activities required for the long-term surveillance and maintenance of OU III. The requirements of the LTS&M Plan are based on the Statement of Work for the Monticello disposal and processing sites, as detailed in the *Life-Cycle Baseline Estimate Monticello, UT, Disposal and Processing Sites, FY 2022*.

The LTS&M Plan can be found on the LM public website at:
https://lmpublicsearch.lm.doe.gov/lmsites/s00387_mnt_ltsm_plan.pdf.

Data Quality Objectives Evaluation for Groundwater and Surface Water Remedy Evaluation, MMTS OU III

Step 1—State the Problem	Hazardous substances have been released in each OU of the Monticello site. The release of hazardous substances has required remedial actions and monitoring to ensure compliance with applicable regulations and long-term protection of human health and the environment.		
Step 2—Principal Study Goal	**Study Question**	Does groundwater monitoring data indicate the remedial actions and selected remedies are successful and effective?	Does surface water monitoring data indicate the remedial actions and selected remedies are successful and effective?
	Goal	The goals of the groundwater monitoring program include evaluating the success and effectiveness of the remedial actions and selected remedies, including the PRB, the Groundwater Remedy Optimization (GRO) system, and natural attenuation, to demonstrate compliance with applicable regulations and to ensure the protection of human health and the environment. Remediation goals for constituents of concern (COCs) are shown in Worksheet #17.	The goals of the surface water monitoring program are to achieve compliance with remediation goals for COCs in Montezuma Creek (COCs are shown in Worksheet #17).
Step 3—Input Needs	**Needed Information**	(1) Groundwater chemistry data, (2) groundwater levels, (3) site remedial history, (4) GRO system pumping data, and (5) GRO well discharge collection tank chemistry data.	(1) Surface water chemistry data and (2) surface water discharge measurements.
	Sources of Needed Information	(1) Historical groundwater chemistry database, (2) historical groundwater level measurement database, (3) ongoing monitoring of water chemistry and groundwater levels, and (4) historical documents.	(1) Historical surface water chemistry database, (2) historical surface water discharge database, and (3) ongoing monitoring of water chemistry and discharge measurements.
	Action Levels—How the Data Will Be Used	(1) Updated groundwater chemistry data will be compared to water quality remediation goals (Worksheet #17), and trends will be evaluated to assess monitored natural attenuation progress and to detect if the plume is expanding; (2) groundwater level measurements will be used to document groundwater flow directions; (3) site remedial history will be considered when evaluating concentration trends; (4) GRO system pumping data will be used to assess the volume of water removed from the AOA; and (5) GRO well discharge transfer tank chemistry data will be combined with pumping data to estimate mass removed from the AOA.	(1) Surface water chemistry data will be compared to Montezuma Creek remediation goals to assess if remediation goals have been met (Worksheet # 17), and (2) discharge data will be used to evaluate if surface water chemistry data was collected during a high or low discharge period.
Step 4—Study Boundaries	**Target Population**		
		(1) Well analytical data for COCs (Worksheet #17), (2) well water level data, (3) activity timelines, (4) GRO well discharge data, and (5) GRO well discharge transfer tank analytical data for uranium.	(1) Surface water analytical data for COCs with surface water remediation goals (Worksheet #17) and (2) discharge measurement data.
	Spatial Boundaries		
	Area boundaries extend from data within the valley of Montezuma Creek downstream of the confluence of North and South Creeks and upstream of surface water monitoring station SW94-01. Study area boundaries are shown in Figure 3 in Worksheet #10. Monitored natural attenuation progress will be evaluated using wells and seeps across the site in Figure 3. The effectiveness of the GRO system is evaluated using wells highlighted in Figure 4 in Worksheet #10. PRB effectiveness is evaluated using wells highlighted in Figure 5 of Worksheet #10.		
	Temporal Boundaries		
	(1) Remedial actions and changes to site conditions will be considered when evaluating concentration trends; (2) average monthly pumping will be computed for the GRO wells; and (3) monitoring of the AOA wells every 1 million gallons purged from the GRO system.		
Step 5—Information Synthesis	Samples collected in AOA wells will be primarily used to observe performance in the AOA area (Figure 4 in Worksheet #10). Samples from PRB wells will be primarily used to observe effectiveness of the PRB (Figure 5 in Worksheet #10). The plume will not be considered to be expanding if alluvial wells 95-03 and 95-01 and Burro Canyon wells do not have increasing uranium trends and are below the remediation goals. Uranium trends will be evaluated using an appropriate statistical test (linear regression, Mann-Kendall). Information will be documented in an annual groundwater report.		

Data Quality Objectives Evaluation for Groundwater and Surface Water Remedy Evaluation, MMTS OU III (continued)

Step 6—Performance or Acceptance Criteria	QA and QC measures for acceptance of analytical data is documented in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351), hereafter referred to as the Sampling and Analysis Plan (SAP). Historical concentrations of groundwater and surface water are shown in Table 2 of Worksheet #11 will be used as an approximate measure to determine if data are reasonable. Remedy performance criteria was included as Appendix B to the ROD. This initial remedy performance criteria included comparing uranium concentrations with numerical modeling predictive results. The performance criteria were not met, and an Explanation of Significant Difference (ESD) was established in 2009 that included the addition of groundwater extraction as a remedial measure. No strict performance criteria were set in the ESD. Overall performance and acceptance of the remedy performance is currently based on comparison of ongoing monitoring results to remediation goals presented in Worksheet #17 and evaluation of concentration trends. Specifically, remediation progress for the AOA is accomplished by assessing mass removed by the GRO system and evaluating uranium concentration trends in the AOA wells highlighted in Figure 4 of Worksheet #10. Effectiveness of the PRB is measured by assessing groundwater levels and flow in the vicinity of the PRB and concentrations above and below the PRB. Protection of human health and the environment is evaluated by ensuring the plume is not expanding with the following criteria: COC concentrations remain below remediation goals at alluvial wells 95-03 and 95-01, and there are no increasing trends in these wells; and COC concentrations remain below remediation goals at Burro Canyon wells, and there are no increasing trends in these wells.
Step 7—Plan for Obtaining Data	The monitoring program is based on the requirements specified in the ROD and FFA and was designed to ensure that monitoring data will satisfy applicable regulations and that there will be no unacceptable risks to human health or the environment. Worksheet #17 further details the monitoring program for the Monticello site. Specific documents that describe the program include (1) the LTS&M Plan, which defines the sample locations and sampling frequency and determines the types of analyses that will be conducted on the samples collected from these locations, and (2) the SAP, with Monticello site-specific details specified in Appendix A of the SAP.

Data Quality

Environmental data for the LM CERCLA sites, derived through ongoing monitoring programs and data interpretation, will be of sufficient quantitative and qualitative value for use in determining whether performance criteria are being met. The type and quality of the data provided to the regulating agencies will be used to document the performance of the remedy and attainment of remedial action goals.

The field and analytical methods chosen for use in completing the work are industry standards and, when used in combination with EPA data quality requirements, are consistent with accepted standards for conducting environmental monitoring. Where applicable, method precision, accuracy, and sensitivity are reviewed to determine if they are sufficient to meet project objectives.

Data quality for sampling and analytical data is described in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351) (SAP). Data generated from routine water-sampling activities using procedures specified in the SAP will be of sufficient quality to make defensible decisions regarding compliance with applicable permits and standards, establishment of remediation strategies, assessment of the progress of remedial actions, regulatory issues, assessment of the effectiveness of treatment systems, and assessment of risk to human health and the environment.

The *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351) can be found at: https://www.energy.gov/lm/downloads/sampling-and-analysis-plan-us-department-energy-office-legacy-management-sites.

Data of known, documented quality are produced through the following aspects of the SAP:

- Defensible and comprehensive sampling procedures
- Calibration of field instrumentation
- Collection of field quality control (QC) samples
- Documentation of sampling activities
- Training of sampling personnel
- Records management
- Use of accredited commercial laboratories that:
    - Conform to *Department of Defense (DoD) Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* (QSM) requirements (DOD and DOE, current version)
    - Are accredited under the DOE Consolidated Audit Program
    - Use approved analytical procedures
- Data validation and qualification

The monitoring strategy for sampling and analytical data is described in the SAP, as further detailed in the LTS&M Plan. The range of anticipated analyte concentrations is shown in the following table.

Groundwater and Surface Water Analyte Concentration Ranges

Analyte	Minimum (mg/L)	Maximum (mg/L)
Arsenic	0.000018	0.11
Calcium	0.05	720
Chloride	0.067	1460
Fluoride	0.033	388
Iron	0.0049	27
Magnesium	0.11	220
Manganese	0.00011	11
Molybdenum	0.000032	0.91
Nitrate + Nitrite as Nitrogen	0.003	47
Potassium	0.05	71.9
Selenium	0.000032	0.23
Sodium	0.1	610
Sulfate	0.133	6900
Total Dissolved Solids	5.71	3500
Uranium	0.000005	5.9
Vanadium	0.000015	0.55

Abbreviation:
mg/L = milligrams per liter

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

Matrix: Water
Metals and Wet Chemistry Methods: SM2540C[a], 353.2, 6010, 6020, EPA 300.0

Data Quality Indicator	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field Duplicates	A control limit of ±20% RPD for sample results that are greater than 5 times the PQL. For sample results less than 5 times the PQL, the control limit is plus or minus the PQL.
Analytical Precision (laboratory)	Laboratory Control Sample Duplicates Matrix Spike Duplicates	RPD ≤ 20%
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples	DoD and DOE (2021) (Appendix C)
Analytical Accuracy/Bias (matrix interference)	Matrix Spike Duplicates	DoD and DOE (2021) (Appendix C)
Overall Accuracy/Bias (contamination)	Equipment blanks, method blanks, calibration blanks	No target analyte concentrations >1/10 associated sample concentrations
Sensitivity	Low-Level Calibration Check Standard	All reported analytes within ±20% of the true value
Completeness	Completeness check performed during data validation (see QAPP Worksheet #34)	As specified in and the *Environmental Data Validation Procedure*

Note:
[a] There are no calibration or matrix spike requirements associated with total dissolved solids.

Abbreviations:
PQL = practical quantitation limit
QC = quality control
RPD = relative percent difference

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)

Data type	Source	Data Uses Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
Meteorological	National Weather Service	Estimations of seasonal fluctuations in storm water runoff	Published data are available for past 20 years. No known limitations.
Topographic	U.S. Geological Survey	OU III surface water drainage pathways, well elevations, culverts, water dispersions, and significant topographic changes in the area	OU III was on the Monticello survey grid system which was incompatible with the more accurate State Plane system. OU III was resurveyed in August 2018 to establish better data and switch from the Monticello grid system to the State Plane system. Mill site was regraded.
Environmental	OU III Remedial Investigation reports (DOE 1990a, DOE 1998a, DOE 2004b)	Provide input for the OU III groundwater remedy selection	No known limitations.
Hydrological/ Environmental	Permeable Reactive Barrier reports (DOE 1998b, DOE 2002, DOE 2006a, DOE 2006b)	Effectiveness of treatment	No known limitations.
Hydrological	Groundwater Remedy Optimization system report (DOE 2018a)	Effectiveness of GRO system	No known limitations.
Hydrological	Annual Groundwater Reports	Remedial system performance and alluvial aquafer restoration progress	No known limitations.
Historical soil sample locations	Past site documents and reports	Sample locations	Areas of old mill tailings were removed and some historical soil sample locations may need identified using old maps.
Historical mill operations	Past site documents and reports	Locations of mill tailings and processing areas	Historical reports may not include specific details of locations of all mill tailings and process areas.

Secondary data obtained from the National Weather Service (NWS) and United States Geological Survey (USGS) can be relied upon as data are from reputable sources. Preliminary data from the NWS will not be relied on. Only official and certified climatic data will be used. Topographic data from the USGS may be used to assess general topography outside of the mill site areas and where specific elevation data has not been collected at the site. Historical soil sample locations and locations of past mill site operations will not be considered precisely located.

QAPP Worksheet #14 and #16: Project Tasks & Schedule
(UFP-QAPP Manual Section 2.8.2) (EPA 2106-G-05 Section 2.2.4)

Groundwater monitoring tasks and their frequency are specified in the LTS&M Plan as shown in the table below.

Groundwater and Surface Water Sampling

Location Type	**Location Numbers**		
Alluvial Wells	**Semiannual Sample and Water Levels**	**Annual Sample**	**Water Level Only (semiannual)**
Mill site wells	MW00-01, T01-02, T01-04, T01-05, T01-07, **T01-12**, T01-19, T01-35, **T01-01**	T00-01, T00-04, T01-13, T01-18, T01-20, T01-23, T01-25 (and semiannual water levels)	MW00-02, MW00-03, T00-02, T00-03, T00-05, T00-06, T00-07, T01-06, T01-08, T01-09, T01-10, T01-24, T01-26, T01-27, T01-28
Downgradient wells	**82-08**, **88-85**, 92-07, 92-08, 92-09, 92-11, 0200, 0202, **MW00-06**, P92-06, PW-10, PW-17, PW-28	95-01, 95-03, MW00-07 (and semiannual water levels)	P92-02, PW-14, PW-16, PW99-16, PW-18, PW-20, PW-22, PW-23
PRB wells	R1-M3, R1-M4, R3-M2, R3-M3, R4-M3, R4-M6, R6-M3, R6-M4, R10-M1		R1-M1, R1-M2, R1-M5, R1-M6, R2-M1, R2-M2, R2-M3, R2-M4, R2-M5, R2-M6, R2-M7, R2-M8, R2-M9, R2-M10, R3-M1, R3-M4, R4-M1, R4-M2, R4-M4, R4-M5, R4-M7, R4-M8, R5-M1, R5-M2, R5-M3, R5-M4, R5-M5, R5-M6, R5-M7, R5-M8, R5-M9, R5-M10, R6-M1, R6-M2, T1-D, T1-S, T2-D, T2-S, T3-D, T3-S, T4-D, T4-S, T5-D, T5-S, T6-D, T6-S, T7-D, R6-M5, R6-M6, R7-M1, R7-M2, R8-M1, R9-M1, R11-M1, TW-01, TW-02, TW-03, TW-04, TW-05, TW-06, TW-07, TW-08, TW-09, TW-10, TW-11, TW-12, TW-13, TW-14
AOA wells	**Samples and water levels every 1 million gallons of water removed**	MW-01, MW-03, MW-04, MW-05, MW-06, MW-07, MW-08, MW-09, MW-10, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16, MW-17, MW-18, MW-19, MW-20, MW-21, MW-22, MW-23	
Other Locations			
Surface water (semiannual sample and flow)	SW00-01, **SW00-02**, **SW01-02**, SW01-03, **SW01-01**, **Sorenson**, SW00-04, SW92-08, SW92-09, SW94-01		
Seeps and wetlands (semiannual sample)	Seep 1, **Seep 2**, Seep 3, Seep 5, Seep 6, W3-03, W3-04		
Treatment system	OR-01, OR-02, OR-03, OR-04, OR-05, OR-06, OR-07, OR-08, Transfer Tank Out, Pond 4—samples every 1 million gallons of water removed		
Bedrock wells	83-70, 92-10, 93-01—annual sample and semiannual water levels		
	31NE93-205, 95-07, 95-06—sample every 5 years plus semiannual water levels		
	92-12, 95-02, 95-04, 95-08—semiannual water levels only		

Location Type	Location Numbers		
Alluvial Wells	**Semiannual Sample and Water Levels**	**Annual Sample**	**Water Level Only (semiannual)**
Analytes for Samples			
Arsenic, calcium, chloride, fluoride, iron, magnesium, manganese, molybdenum, nitrate + nitrite (as N), potassium, selenium, sodium, sulfate, total dissolved solids (locations in **bold** only), uranium, vanadium			
Field Parameters for Samples			
Total alkalinity, dissolved oxygen, redox potential pH, specific conductance, turbidity, temperature			

Sampling schedules were identified in Table 5–2, "MMTS and MVP Targets for CERCLA Five-Year Review Period and Beyond" located in the *Draft Final Monticello Site Management Plan* (DOE 2003). Water sampling events are scheduled each October and April.

Locations and wells originally identified for sampling are in Table 2-1 in the *Monticello Mill Tailings Site Operable Unit III Post-Record of Decision Monitoring Plan Draft Final* (DOE 2004a).

Additional wells and sampling locations have been added since 2004, and those locations and analytes are described in the above table.

Specific project tasks and schedule are described in the table below.

Project Tasks and Schedule

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverables	Deliverables Due Date
Water Sampling per Section 5 SMP	EMO	October of each year	October of each year	Data Analysis	November of each year
Data Validation for October Water Sampling	EMO	November of each year	February of each year	Data Validation Report	February of each year
Water Sampling per Section 5 SMP	EMO	April of each year	April of each year	Data Analysis	May of each year
Data Validation for April Water Sampling	EMO	May of each year	August of each year	Data Validation Report	August of each year
Data Analysis	GEL Laboratories	Samples are sent to the lab within 4 days after the sampling trip	28 days after the laboratory receives the samples	Electronic Data Deliverable	28 days after the laboratory receives the samples
Data Usability Assessment	LMS Site Lead and LMS Geosciences Services Manager	August of each year	September of each year	Annual Groundwater Report	September of each year

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverables	Deliverables Due Date
Water Sampling per Remedial Action Completion Report for Operable Unit III Groundwater Contingency Remedy Optimization System Monticello Mill Tailings Site, Monticello, Utah May 2016	EMO	Every 1-million gallons of water removed	Termination of the GRO system	Completion Report	Unknown
Complete the 7th CERCLA 5-Year Review	LMS Site Lead	April 2026	June 30 2027	Completed MMTS and MVP 5-Year Report	June 30, 2027
Review of the QAPP	LMS Site Lead	December of each year	March of each year	Submit Draft QAPP revisions to EPA/UDEQ	March of each year

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)

Water quality remediation goals for surface water and groundwater are listed in the tables below along with the laboratory-specific method detection limits (MDLs) and laboratory-specific practical quantitation limits (PQLs). Analytical methods are chosen such that measurements can be made with low enough detection limits so comparisons to the remediation goals and quantitation limits for the contaminants of concern can be made with confidence.

It should be noted that the full list of remediation goals for surface water and groundwater as established in the *Explanation of Significant Difference (ESD) for the Monticello Mill Tailings (USDOE) Site Operable Unit III, Surface Water and Ground Water, Monticello Utah* (DOE 2009a) are presented in Worksheet #17. Analyses of uranium-234 (^{234}U) and uranium-238 (^{238}U) in groundwater and surface water were discontinued in 2006 with concurrence from EPA and UDEQ and therefore are not discussed in this worksheet. The Utah surface water standard for uranium is set at 30 pCi/L, which converts to approximately 44 µg/L of uranium. Analyses for gross alpha and gross beta activity were also discontinued in 2006 with concurrence from EPA and UDEQ and therefore are also not discussed in this worksheet.

All analytes listed in this worksheet are covered by the SAP. Analytes with groundwater and surface water remediation goals listed "NA" are analyzed to characterize general water quality. Consistent with EPA recommendations for monitored natural attenuation of uranium (EPA 2010), these noncontaminant species and properties are measured to identify changes in groundwater chemistry that may alter the attenuation capacity of the aquifer. For example, increasing levels of alkalinity, calcium, or magnesium could result in reduced uranium sorption capacity within the aquifer.

Matrix: Water
Analytical Method: 6010

Analyte	CAS Reference Number	Groundwater Remediation Goal[a] (µg/L)	Surface Water Remediation Goal[a,b] (µg/L)	Laboratory-Specific MDL (µg/L)	Laboratory-Specific PQL (µg/L)
Calcium	7440-70-2	NA	NA	210	1050
Iron	7439-89-6	NA	NA	30	150
Magnesium	7439-95-4	NA	NA	89	445
Manganese	7439-96-5	880 µg/L[c]	NA	0.49	2.5
Potassium	7440-09-7	NA	NA	130	650
Sodium	7440-23-5	NA	NA	38	190

Notes:
[a] Source: OU III ROD (DOE 2004d).
[b] State of Utah standard for surface water.
[c] EPA's 2003 risk-based concentration.

Abbreviations:
CAS = Chemical Abstracts Service
NA = not applicable

Matrix: Water
Analytical Method: 6020

Analyte	CAS Reference Number	Groundwater Remediation Goal[a] (µg/L)	Surface Water Remediation Goal[a,b] (µg/L)	Laboratory-Specific MDL (µg/L)	Laboratory-Specific PQL (µg/L)
Arsenic	7440-38-2	10[c]	10[c]	0.39	2.0
Molybdenum	7439-98-7	100[e]	NA	0.079	0.4
Selenium	7782-49-2	50[c]	5	0.65	3.3
Uranium	7440-61-1	30[c]	44[b,f]	0.5	2.5
Vanadium	7440-62-2	330[d]	NA	1.5	7.5

Notes:
[a] Source: OU III ROD (DOE 2004d).
[b] State of Utah standard for surface water.
[c] EPA's maximum contaminant level.
[d] EPA's 2003 risk-based concentration.
[e] UMTRCA maximum concentration limit.
[f] The Utah surface water standard for uranium is 30 pCi/L, which converts to approximately 44 µg/L. This standard was formally adopted as cleanup goal in *Explanation of Significant Difference (ESD) for the Monticello Mill Tailings (USDOE) Site Operable Unit III, Surface Water and Ground Water, Monticello Utah* (DOE 2009a).

Abbreviations:
CAS = Chemical Abstracts Service
NA = not applicable

Matrix: Water
Analytical Method: 353.2

Analyte	CAS Reference Number	Groundwater Remediation Goal[a] (µg/L)	Surface Water Remediation Goal[a,b] (µg/L)	Laboratory-Specific MDL (µg/L)	Laboratory-Specific PQL (µg/L)
Nitrate + nitrite as nitrogen	14797-55-8	10,000[c]	4000	30	150

Notes:
[a] Source: OU III ROD (DOE 2004d).
[b] State of Utah standard for surface water.
[c] EPA's maximum contaminant level.

Abbreviation:
CAS = Chemical Abstracts Service

Matrix: Water
Analytical Method: EPA 300.0

Analyte	CAS Reference Number	Groundwater Remediation Goal[a] (µg/L)	Surface Water Remediation Goal[a,b] (µg/L)	Laboratory-Specific MDL (µg/L)	Laboratory-Specific PQL (µg/L)
Chloride	16887-00-6	NA	NA	61	300
Fluoride	16984-48-8	NA	NA	33	170
Sulfate	14808-79-8	NA	NA	300	1500

Notes:
[a] Source: OU III ROD (DOE 2004d).
[b] State of Utah standard for surface water.

Abbreviations:
CAS = Chemical Abstracts Service
NA = not applicable

Matrix: Water
Analytical Method: SM2540C

Analyte	CAS Reference Number	Groundwater Remediation Goal[a] (µg/L)	Surface Water Remediation Goal[a,b] (µg/L)	Laboratory-Specific MDL (µg/L)	Laboratory-Specific PQL (µg/L)
Total dissolved solids	10-33-3	NA	NA	4000	20000

Notes:
[a] Source: OU III ROD (DOE 2004d).
[b] State of Utah standard for surface water.

Abbreviations:
CAS = Chemical Abstracts Service
NA = not applicable

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

Sampling Process Design

The data obtained through monitoring site conditions will be of sufficient quantity and quality to achieve project objectives.

LM has secured access agreements with private landowners to ensure access to the surface water monitoring locations and groundwater monitoring wells.

A mature monitoring program designed for LM sites is used for the Monticello site with specific details based on those requirements specified in the ROD. The monitoring program was designed to ensure that monitoring data will satisfy applicable regulations and that there will be no unacceptable risks to human health or the environment. Site-specific details of the sampling design and rationale were established in the Monticello Mill Tailings Site Operable Unit III Post-Record of Decision Monitoring Plan (DOE 2004a). Sample locations, frequencies, and analytes were selected to achieve a representative site characterization. Representativeness expresses the degree to which sampling data accurately and precisely represent site conditions. The comprehensive sampling design and SOPs for sample collection (Worksheet #21) and analysis (Worksheet #23) help to ensure that samples are representative of site conditions. Sample representativeness is achieved at the Monticello site by following the sample collection and analytical protocols specified in the SAP. The SAP specifies sampling protocols to promote collection of representative samples. These include protocols for well purging, sample handling and preservation, documentation and chain of custody, instrument calibration and operational checks, decontamination of equipment, collection of quality control samples, monitoring well maintenance, and training of sampling personnel. Representativeness is also achieved by using the analytical protocols specified in the SAP, which include use of standard EPA analytical methods, use DOE-CAP accredited laboratories, and validation of analytical data. Section 4.3 of the LTS&M Plan (DOE 2018b) defines the sample locations and sampling frequency and determines the types of analyses that will be conducted on the samples collected from these locations. The SAP, with Monticello site-specific details specified in Appendix A of the SAP, describes the monitoring program.

Appendix A of the SAP shows monitoring wells and their sampling frequency beginning on page A-51.

OU III Contaminants of Concern and Water Quality Remediation Goals

Contaminant of Concern[a]	Groundwater Remediation Goal[a]	Surface Water Remediation Goal[a,b]
Arsenic	10 µg/L[c]	10 µg/L
Manganese	880 µg/L[d]	---
Molybdenum	100 µg/L[e]	---
Nitrate (as N)	10,000 µg/L[c]	4000 µg/L
Selenium	50 µg/L[c]	5 µg/L
Uranium (metal toxicity)	30 µg/L[c]	---
Uranium (radiological dose)	---	44 µg/L[b,i]
Vanadium	330 µg/L[d]	---
^{234}U and ^{238}U (radiological dose)	30 pCi/L[e]	30 pCi/L
Gross alpha activity	15 pCi/L[c,f]	15 pCi/L[g]
Gross beta activity[h]	---	---

Notes:
[a] Source: OU III ROD (DOE 2004d).
[b] State of Utah standard for surface water.
[c] EPA's maximum contaminant level.
[d] EPA's 2003 risk-based concentration.
[e] UMTRCA maximum concentration limit.
[f] Excluding uranium and radon.
[g] Excluding uranium and radon for MMTS OU III.
[h] There is no remediation goal for gross beta because there are no activity-based standards for this constituent, and risk factors to derive a risk-based goal are radioisotope-specific.
[i] The Utah surface water standard for uranium is 30 pCi/L, which converts to approximately 44 µg/L. This standard was formally adopted as cleanup goal in *Explanation of Significant Difference (ESD) for the Monticello Mill Tailings (USDOE) Site Operable Unit III, Surface Water and Ground Water, Monticello Utah* (DOE 2009a).

Abbreviation:
UMTRCA = Uranium Mill Tailings Radiation Control Act

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)

SAP, Section 3.0, "Sampling Protocol," Table 2 and Table 3, show sampling procedures used for groundwater and surface water. Sample identification (related to sampling locations and depths) assignment by Environmental Quality Information System Sample Planning Module is discussed.

Program Directive PD-2021-10-MNT provides additional details on stream discharge measurements in Montezuma Creek beginning on page A-48 in Appendix A of the SAP. Sample container requirements and preservation requirements can be found in Table 3 of the SAP.

Appendix A of the SAP shows monitoring wells and their sampling frequency beginning on page A-51. It also shows a constituent sampling breakdown for the wells on page A-54.

Figure 9 in the LTS&M Plan presents sample locations.

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

Sample Collection Procedures

Procedures for environmental sampling, analysis, and data management for Monticello are provided in the SAP. Field measurements and water-sampling procedures used for Monticello are defined in the SAP with site-specific details located in Appendix A of the SAP. Sample collection will follow procedures in the SAP.

Laboratory: GEL Laboratories, Charleston, SC

Required Accreditations/Certifications: National Environmental Laboratory Accreditation Program (NELAP) and DOE Consolidated Audit Program (DOECAP). See Attachment 2.

Sample Delivery Method: FedEx

Analyte/ Analyte Group	Matrix	Method	Accreditation Expiration Date	Container (number, size, and type per sample)	Preservation	Holding Time	Standard Deliverables Turnaround Time
Nitrate + Nitrite as N	water	353.2	06/30/2023	250 mL HDPE bottle	H_2SO_4 to pH <2	28 days	28 days
Metals	water	6010/6020	06/30/2023	500 mL HDPE bottle	HNO_3 to pH <2	180 days	28 days
Chloride, fluoride, and sulfate	water	EPA 300.0	06/30/2023	125 mL HDPE bottle	Cool 0 to 6 °C for sulfate only	28 days	28 days
Total dissolved solids	water	SM2540C	06/30/2023	125 mL HDPE bottle	Cool 0 to 6 °C	7 days	28 days

Abbreviations:
HDPE = high-density polyethylene
mL = milliliters

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

Field Quality Assurance (QA)/Quality Control (QC)

A variety of instruments, equipment, sampling tools, and supplies will be used to collect samples and to monitor site conditions. Proper inspection, calibration, maintenance, and use of the instruments and equipment are required to ensure field-data quality. In addition, field QA will be implemented through the use of approved standard operating procedures, proper cleaning, decontamination, protective storage of equipment and supplies, and timely data reviews during field activities. The QC objective of these data collection activities is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of the data.

QC samples will consist of field duplicates, equipment rinsate blanks, and trip blanks as appropriate for the matrix and analytes involved. An additional volume of groundwater for selected organic analyses will be collected for matrix spike/matrix spike duplicate (MS/MSD) use, as requested by the laboratory. Requirements for QC samples are specified in Section 5.0 of the SAP. Field QC samples will be used to quantitatively and qualitatively evaluate the analytical performance of the laboratory and to assess external and internal effects on the accuracy and comparability of the reported results. Field QC samples will be uniquely identified in a manner consistent with the project sample-numbering scheme. Additional groundwater sample volume collected for MS/MSD use by the laboratory will receive the same identification as the investigative sample.

Only water samples are collected for routine chemical analysis at the site. QA/QC samples that support those samples are also routinely collected and include:

- Trip blanks, collected at a frequency of one per sample cooler containing “real” field samples that are to be analyzed for volatile organic compounds.
- Field duplicates, collected at a frequency of 1 per 20 “real” samples analyzed for the same constituent(s).
- Equipment blanks, collected at a frequency of 1 per 20 “real” samples collected with reusable equipment that must be decontaminated between locations.

QA/QC samples that are not collected on a routine basis include field blanks and spiked samples. Laboratory QA/QC samples are prepared by the laboratory in accordance with the *Department of Defense (DoD) and Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* (DoD and DOE 2021), hereafter referred to as the Quality Systems Manual (QSM).

The QSM can be found at:
https://doecap.projectenhancement.com/Certifications/QSM_Version_5.4_FINAL.pdf.

Field Quality Control Summary

Matrix	Analyte/ Analyte Group	No. of Field Samples	No. Field Duplicates	No. of MS/MSD	No. of Equip. Blanks	No. Trip Blanks	No. of Other	Total No. of Samples to Laboratory
Water	Metals	TBD	1 per 20	1 per 20	1 per 20 if using non-dedicated equipment	0	0	TBD
Water	Nitrate + Nitrite as N	TBD	1 per 20	1 per 20	1 per 20 if using non-dedicated equipment	0	0	TBD
Water	Chloride, fluoride, and sulfate	TBD	1 per 20	1 per 20	1 per 20 if using non-dedicated equipment	0	0	TBD
Water	Total dissolved solids	TBD	1 per 20	0	1 per 20 if using non-dedicated equipment	0	0	TBD

Abbreviation:
TBD = to be determined

QAPP Worksheet #21: Field Standard Operating Procedures (SOP)
(UFP-QAPP Manual Section 3.1.2) (EPA 2106-G-05 Section 2.3.2)

SOP Number or Reference	Title, Revision, Date, and URL (if available)	Originating Organization	SOP Option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
S04351	*Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* https://www.energy.gov/lm/downloads/sampling-and-analysis-plan-us-department-energy-office-legacy-management-sites	LMS Contractor, Environmental Monitoring Operations	Details in the document	Y	Groundwater and surface water sampling follow section 3.0 of the SAP and further instructions can be found in Program Directive: PD-2021-10-MNT in Appendix A of the SAP

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)

Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites

Field equipment, instruments, and associated supplies used to obtain field measurements and collect samples are described in the SAP and in site-specific documents.

Field personnel will conduct visual inspections and operational checks of field equipment and instruments before they are shipped or carried to the field and before using the equipment or instruments in field-data collection activities. Whenever any equipment, instrument, or tool is found to be defective or fails to meet project requirements, it will not be used, and, as appropriate, it will be tagged defective and segregated to prevent inadvertent use. Vehicles used by field personnel will be stocked with spare parts needed for instrument and equipment maintenance. Typical spare parts used include:

- Extra probes for the multiparameter water quality sonde
- Fittings for bladder pumps
- Extra batteries
- Extra tubing

No specific or unusual parts are required for work at the Monticello site.

The LMS Environmental Monitoring Operations Sample Team Members are responsible for the overall maintenance, operation, calibration, and repairs to field equipment, instruments, and tools. The LMS Environmental Monitoring Operations Sample Team Members are also responsible for ensuring that the field records have adequate documentation that describes any maintenance, repairs, and calibrations performed in the field.

Equipment and instruments used to obtain data will be maintained and calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturers' specifications. Calibration of equipment and instruments will be performed at approved intervals, as specified by the manufacturer, or more frequently as conditions dictate. Calibration standards used as reference standards will be traceable to the National Institute of Standards and Technology or with other recognized standards when available. As recommended by the manufacturers, calibrations should be performed in a controlled environment such as in a designated field preparation room. Field calibration should be avoided since it can introduce error. Calibration is performed in a designated field preparation room at the LM office in Grand Junction, Colorado, prior to the sampling team driving to the Monticello site.

In some instances, calibration periods will be based on usage rather than periodic calibration. Equipment will be calibrated or checked as a part of its operational use. Calibrations and operational checks will be performed and documented in accordance with the SAP.

Field instruments must be calibrated before a sampling event begins. For occupied sites that sample continually and do not sample in distinct events, field instrumentation will be calibrated at least monthly. Calibration and operational check requirements for field instruments are shown in the table below. If the acceptance criteria are not met during the operational check, then a primary calibration of the affected probes and instruments must be conducted. All calibration and testing information (including instrument identification numbers, acceptance criteria, technician observations, and any deficiencies) are documented electronically in forms that will be retained as records.

Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Activity	SOP Reference	Responsible Person	Frequency	Acceptance Criteria	Corrective Action
pH probe	Calibration	SAP Section 3.1.4.2	LMS Environmental Monitoring Operations Sample Team Members	Pre-event	pH4 mV=+127 to +227 pH7 mV=-50 to +50 pH10 mV=-227 to -127	Correct problem, repeat calibration
pH probe	Maintenance	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	As needed	NA	NA
pH probe	Testing	SAP Section 3.1.4.2	LMS Environmental Monitoring Operations Sample Team Members	Day of use & end of event	1-point check: ±0.2	Perform maintenance. Recalibrate if necessary.
pH probe	Inspection	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	Day of use	NA	NA
Specific conductance probe	Calibration	SAP Section 3.1.4.2	LMS Environmental Monitoring Operations Sample Team Members	Pre-event	Cell constant = 4.5 to 5.5	Correct problem, repeat calibration
Specific conductance probe	Maintenance	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	As needed	NA	NA
Specific conductance probe	Testing	SAP Section 3.1.4.2	LMS Environmental Monitoring Operations Sample Team Members	Day of use & end of event	1-point check: ±10% of standard	Perform maintenance. Recalibrate if necessary.
Specific conductance probe	Inspection	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	Day of use	NA	NA

Field Equipment Calibration, Maintenance, Testing, and Inspection Table (continued)

Field Equipment	Activity	SOP Reference	Responsible Person	Frequency	Acceptance Criteria	Corrective Action
Oxidation-reduction potential probe	Calibration	SAP Section 3.1.4.2	LMS Environmental Monitoring Operations Sample Team Members	Pre-event	Offset = -100 to +100	Correct problem, repeat calibration
Oxidation-reduction potential probe	Maintenance	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	As needed	NA	NA
Oxidation-reduction potential probe	Testing	SAP Section 3.1.4.2	LMS Environmental Monitoring Operations Sample Team Members	Day of use & end of event	1-point check: ±10% of standard	Perform maintenance. Recalibrate if necessary.
Oxidation-reduction potential probe	Inspection	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	Day of use	NA	NA
Dissolved oxygen probe	Calibration	SAP Section 3.1.4.2	LMS Environmental Monitoring Operations Sample Team Members	Pre-event	Charge = 25 to 75 Gain = 0.7 to 1.5	Correct problem, repeat calibration
Dissolved oxygen probe	Maintenance	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	As needed	NA	NA
Dissolved oxygen probe	Testing	SAP Section 3.1.4.2	LMS Environmental Monitoring Operations Sample Team Members	Day of use & end of event	+0.3 mg/L of theoretical DO in water-saturated air	Perform maintenance. Recalibrate if necessary.
Dissolved oxygen probe	Inspection	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	Day of use	NA	NA
Turbidity meter	Calibration	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	Pre-event	No error messages during calibration sequence	Correct problem, repeat calibration
Turbidity meter	Maintenance	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	As needed	NA	NA

Field Equipment Calibration, Maintenance, Testing, and Inspection Table (continued)

Field Equipment	Activity	SOP Reference	Responsible Person	Frequency	Acceptance Criteria	Corrective Action
Turbidity meter	Testing	SAP Section 3.1.4.2	LMS Environmental Monitoring Operations Sample Team Members	Day of use & end of event	3-point check: ±10% of standard	Perform maintenance. Recalibrate if necessary.
Turbidity meter	Inspection	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	Day of use	NA	NA
Temperature probe	Calibration	NA	NA	NA	Calibration performed by manufacturer	NA
Temperature probe	Maintenance	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	As needed	NA	NA
Temperature probe	Testing	SAP Section 3.1.4.2	LMS Environmental Monitoring Operations Sample Team Members	Day of use & end of event	±1.5 ºC compared to NIST-traceable thermometer	Perform maintenance. Replace if necessary.
Temperature probe	Inspection	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	Day of use	NA	NA
Pumps	Maintenance	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	As needed	NA	NA
Pumps	Inspection	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	Pre-event and day of use	NA	NA
Generators	Maintenance	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	As needed	NA	NA
Generators	Inspection	Operators Manual	LMS Environmental Monitoring Operations Sample Team Members	Pre-event and day of use	NA	NA

Abbreviations:
DO = dissolved oxygen
mg/L = milligrams per liter
mV = millivolts
NA = not applicable
NIST = National Institute of Standards and Technology

QAPP Worksheet #23: Analytical Standard Operating Procedures
(UFP-QAPP Manual Section 3.2.1) (EPA 2106-G-05 Section 2.3.4)

Analytical Methods

Laboratories shall perform routine sample analyses as specified by line-item code for the constituents or analytical packages specified in an attachment to the statement of work (SOW) provided by the LMS contractor. The analytical techniques and methods to be used are listed in the attachment. The laboratory shall have SOPs that detail how the required method or technique is implemented. Method performance shall meet the requirements specified in the QSM.

Required analytical methods are documented in Appendix A of the SAP.

Subcontracted Laboratory Requirements

Laboratories providing analytical services must be accredited to The NELAC Institute (TNI) Standards. Additionally, laboratories must be accredited under the DOE Consolidated Audit Accreditation Program. Accreditation ensures that the laboratories meet the general QA requirements documented in the QSM, the primary analytical services requirements document for LM. Compliance with the QSM will be verified biennially by audit by the applicable accreditation body.

Data turnaround times, sample disposition, and other requirements of the analytical laboratory are identified in procurement documents (e.g., the SOW).

Work submitted to the laboratory may not be subcontracted by the laboratory without prior consent from the laboratory coordinator. From the analytical methods listed below, each laboratory develops its own detailed SOPs in compliance with the QSM. The adequacy of a laboratory's SOPs is demonstrated through laboratory accreditation.

Analytical Methods

SOP Number	Title and Date	Definitive or Screening Data	Matrix/ Analytical Group	Equipment Type	Modified for Project? Y/N
GL-MA-E-006 REVISION 14	STANDARD OPERATING PROCEDURE FOR ACID DIGESTION OF TOTAL RECOVERABLE OR DISSOLVED METALS IN SURFACE AND GROUNDWATER SAMPLES FOR ANALYSIS BY ICP OR ICP-MS, October 2017	Definitive	Water/Metals	Digestion	N
GL-MA-E-013 REVISION 32	STANDARD OPERATING PROCEDURE FOR DETERMINATION OF METALS BY ICP, January 2021	Definitive	Water/Metals	ICP-AES	N
GL-MA-E-014 REVISION 35	STANDARD OPERATING PROCEDURE FOR DETERMINATION OF METALS BY ICP-MS, September 2021	Definitive	Water/Metals	ICP-MS	N
GL-GC-E-086 REVISION 30	STANDARD OPERATING PROCEDURE FOR ION CHROMATOGRAPHY (IC), February 2022	Definitive	Water/Anions	IC	N
GL-GC-E-001 REVISION 19	STANDARD OPERATING PROCEDURE FOR TOTAL DISSOLVED SOLIDS, August 2021	Definitive	Water/Total Dissolved Solids	Gravimetric	N
GL-GC-E-128 REVISION 11	STANDARD OPERATING PROCEDURE FOR NITRATE/NITRITE (NO3+NO2) ANALYSIS USING THE LACHAT QUIKCHEM FIA+ 8000 SERIES INSTRUMENT, August 2021	Definitive	Water/Nitrate	Colorimetry	N

Abbreviations:
IC = ion chromatography
ICP-AES = inductively coupled plasma-atomic emission spectrometry
ICP-MS = inductively coupled plasma-mass spectrometry

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

Instrument and Equipment Calibration and Frequency

Calibration of analytical laboratory equipment will be based on approved written procedures. The concentration of standards and frequency of initial and continuing calibration of analytical instruments will be as specified in the laboratory SOPs. The analytical laboratory will maintain calibration records. Calibration data will be provided with the analytical data package, as specified in the procurement documents. Analytical instrument calibration details are summarized the in table below.

Analytical Instrument Calibration

Instrument Type	Calibration Procedure	Calibration Range Mg/L	Frequency	Acceptance Criteria	Corrective Action	Position responsible for Corrective Action	QSM[a] Reference
Inductively Coupled Plasma Atomic Emission Spectrometer	SW-846 6010	0 - 500	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, $r^2 \geq 0.99$.	Correct problem, then repeat the calibration	Analyst	Table B-8
Inductively Coupled Plasma/Mass Spectrometer	SW-846 6020	0 – 500	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, $r^2 \geq 0.99$.	Correct problem, then repeat the calibration	Analyst	Table B-9
Ion chromatograph	EPA 300.0	0 – 100	ICAL prior to sample analysis.	$R^2 \geq 0.99$	Correct problem, then repeat the calibration	Analyst	Table B-12
Auto Analyzer	EPA 353.2	0 – 2.0	ICAL prior to sample analysis.	$R^2 \geq 0.99$	Correct problem, then repeat the calibration	Analyst	NA

Note:
[a] As referenced in the QSM (DoD and DOE 2021).

Abbreviations:
ICAL = initial calibration
NA = not applicable
r^2 = coefficient of determination

Field Instrument Calibration

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
pH probe	Operators Manual	pH 4-7	Pre-event	pH4 mV= +127 to +227 pH7 mV= -50 to +50 pH10 mV= -227 to -127	Correct problem, repeat calibration	LMS Environmental Monitoring Operations Sample Team Members	SAP Section 3.1.4.2
Specific conductance probe	Operators Manual	1000 uS/cm	Pre-event	Cell constant = 4.5 to 5.5	Correct problem, repeat calibration	LMS Environmental Monitoring Operations Sample Team Members	SAP Section 3.1.4.2
Oxidation-reduction potential probe	Operators Manual	Zobell solution	Pre-event	Offset = -100 to +100	Correct problem, repeat calibration	LMS Environmental Monitoring Operations Sample Team Members	SAP Section 3.1.4.2
Dissolved oxygen probe	Operators Manual	100% saturated air	Pre-event	Charge = 25 to 75 Gain = 0.7 to 1.5	Correct problem, repeat calibration	LMS Environmental Monitoring Operations Sample Team Members	SAP Section 3.1.4.2
Turbidity meter	Operators Manual	0-800 NTU	Every 3 months	No error messages during calibration sequence	Correct problem, repeat calibration	LMS Environmental Monitoring Operations Sample Team Members	SAP Section 3.1.4.2
Temperature probe	NA: Calibration performed by manufacturer	Certificate value	By manufacturer	Calibration check: +/-1.5 ºC from NIST-traceable thermometer	Replace the probe and repeat the calibration check	LMS Environmental Monitoring Operations Sample Team Members	SAP Section 3.1.4.2

Abbreviations:
mV = millivolts
NA = not applicable
NIST = National Institute of Standards and Technology
NTU = nephelometric turbidity units
uS/cm = microsiemens per centimeter

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)

Field Equipment and Instruments

Field equipment, instruments, and associated supplies used to obtain field measurements and collect samples are described in the SAP and in site-specific documents.

Field personnel will conduct visual inspections and operational checks of field equipment and instruments before they are shipped or carried to the field and before using the equipment or instruments in field-data collection activities. Whenever any equipment, instrument, or tool is found to be defective or fails to meet project requirements, it will not be used, and as appropriate, it will be tagged defective and segregated to prevent inadvertent use. The LMS Environmental Monitoring Operations Sample Team Members are responsible for the overall maintenance, operation, calibration, and repairs made to field equipment, instruments, and tools. The LMS Environmental Monitoring Operations Sample Team Members are also responsible for ensuring that the field records have adequate documentation that describes any maintenance, repairs, and calibrations performed in the field.

Equipment preventive maintenance is performed as recommended by the manufacturer. Equipment users (e.g., LMS Environmental Monitoring Operations Sample Team Members) are responsible for ensuring that routine maintenance is performed and that tools and spare parts used to conduct routine maintenance are available.

Laboratory Equipment and Instruments

As part of the QA/QC program for the analytical laboratory, routine preventive maintenance is conducted to minimize the occurrence of instrument failure and other system malfunctions. Laboratory instruments will be maintained in accordance with the manufacturers' specifications. The laboratory may perform routine maintenance or arrange for vendor maintenance and repair service, as required.

LMS contract laboratories operate under the requirements of the QSM. The QSM is based on ISO/IEC 17025:2005(E), ISO/IEC 17025:2017(E), and The NELAC Institute (TNI) Standards, Volume 1 (September 2009). Requirements for analytical instrument and equipment maintenance, testing, and inspection are documented in Section 5.5 of the QSM. GEL Laboratories, the laboratory used by the Monticello site, also follows their own *Quality Assurance Plan*; document number: GL-QS-B-001, effective date March 2022.

The laboratories are required to have a preventative maintenance program covering testing, inspection, and maintenance procedures and schedule for each measurement system and required support activity. The basic requirements and components of such a program include the following:

Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Instrument	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/ Position Responsible for Corrective Action	SOP Reference1
ICP-AES	Check argon, filters, water level, tubing, nebulizer and spray chamber	Initial calibration	Instrument performance and sensitivity	Daily or as needed	Calibration passes criteria	Recalibrate	Laboratory Analyst	GL-MA-E-013 REVISION 32
ICP-MS	Check argon, filters, water level, tubing, nebulizer and spray chamber	Perform stability check and tune instrument	Instrument performance and sensitivity	Daily or as needed	Calibration passes criteria	Recalibrate	Laboratory Analyst	GL-MA-E-014 REVISION 35
Ion Chromatograph	Clean autosampler, replace guard column	Analyze CCB/CCV	Instrument performance and sensitivity	Daily or as needed	CCV passes criteria	Recalibrate	Laboratory Analyst	GL-GC-E-086 REVISION 30
Autoanalyzer	Clean manifold, repack column	Analyze CCB/CCV	Instrument performance and sensitivity	Daily or as needed	Calibration passes criteria	Recalibrate	Laboratory Analyst	GL-GC-E-128 REVISION 11

Note:
[1] Refer to the Analytical SOPs table (Worksheet #23).

Abbreviations:
ICP-AES = inductively coupled plasma-atomic emission spectrometry
ICP-MS = inductively coupled plasma-mass spectrometry

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

Sample Handling and Custody Requirements

The SAP specifies LM SOPs are used in environmental monitoring activities and is implemented at most sites managed by LM. This document provides detailed procedures for the field sampling teams so that samples are collected in a consistent and technically defensible manner.

Sample handling, custody, and shipping procedures are addressed in the SAP and supplemental implementing procedures. A minimum number of individuals should be involved in sample collection and handling to ensure integrity of the sample and compliance with custody procedures. All samples collected must be properly labeled as specified in the SAP. To maintain the integrity of the sample, proper preservation, storage, and shipping methods will be used.

Unused sampling equipment, sample containers, and coolers that have been shipped or transported to a sampling location will be kept in a clean, temperature-controlled, and secure location to minimize damage, tampering, degradation, and possible cross-contamination.

Identification, Handling, Packaging, and Storage

Sample Identification

Environmental samples and associated QC samples will be assigned a unique identification number. In addition to the unique number, QC samples will be assigned a fictitious location identifier.

Samples will be identified by a label or container markings attached to the sample container that specifies, as appropriate, the project, sample location, unique identification number, preservatives added, date and time collected, and the sampler's name. Sample labels or container markings should be completed with indelible (waterproof) ink. Clear tape may be placed over each sample label for added protection, if needed. An example sample label is included in Attachment 1.

Sample Handling and Storage

During field collection, sample containers may be stored in boxes, trays, or coolers, as dictated by protection and preservation needs. Samples that require refrigeration will be stored in coolers with sufficient ice (or, if appropriate, ice packs such as "blue ice") to maintain the required temperature controls during field collection, packaging, and shipping. Samples that are not transported to the laboratory the day of collection must be stored in containers (including a designated sample refrigerator, if refrigeration is appropriate or required) that will prevent damage or degradation of the sample. In addition, samples must be stored in locked containers, vehicles, or buildings when they are out of the direct control of the responsible custodian. Samples stored overnight or at locations where access is not solely controlled by the contractor will have custody seals placed on the outside of the container (cooler or box) as a measure of security.

Sample Custody

To ensure the integrity of the sample, the field custodian is responsible for the care, packaging, and custody of the samples until they are transferred to the laboratory. The procedures described in the SAP will be implemented to provide security and to document sample custody.

Chain of custody forms will be used to list all samples and transfers of sample possession from contractor personnel to other noncontractor personnel to provide documentation that the samples were in constant custody between collection and analysis. The filled-in chain of custody form, a copy of which is retained by the originator, will accompany samples that are sent or transported to the analytical laboratory. An example chain of custody form is included in Attachment 1.

Sample Packaging and Shipping

All samples will be handled, packaged, and transported or shipped in accordance with applicable U.S. Department of Transportation requirements. Sample storage containers (e.g., boxes or coolers) and sample containers will be securely packaged to protect the contents from damage, spilling, leaking, or breaking. Void space in shipping containers should be filled with an inert material or additional ice, if appropriate, to further protect and secure the contents.

Custody seals are not required for containers or samples that are transported by contractor personnel and taken directly to the analytical laboratory for analysis or interim storage. Custody seals are required for shipping containers (e.g., coolers or boxes) that are sent by common carrier. Clear tape should be placed over the seals as protection against tearing during shipment.

Mailed sample packages will be registered with return receipt requested or otherwise tracked online. Carrier receipts and associated documentation are retained as part of the chain of custody documentation and maintained with the chain of custody records.

Laboratory Requirements

Laboratory Sample Receipt

The subcontracted analytical laboratory personnel are responsible for the care and custody of samples from the time they are received until the time the sample is analyzed and archive portions are discarded. On arrival at the laboratory, laboratory personnel must examine the container and document the receiving condition, including the integrity of custody seals, when applicable. When opening the shipping container, laboratory personnel will examine the contents and record the condition of the individual sample containers (e.g., bottles broken or leaking), the temperature (when applicable), method of shipment, carrier name(s), and other information relevant to sample receipt and log-in. Laboratory personnel verify that the information on the sample containers matches the information on the chain of custody form. An example laboratory sample receipt form is included in Attachment 1.

Discrepancies Identified During Sample Receipt

If discrepancies are identified during the sample receiving process, laboratory personnel will document the discrepancies on the sample receiving form and contact the laboratory coordinator for resolution.

If the laboratory judges the sample integrity to be questionable (e.g., samples arrive damaged or leaking, or the temperature range is exceeded), the laboratory coordinator will be contacted for further instructions. Damaged samples may be rescheduled for collection and analysis, if necessary.

Sample Disposition

Unused sample portions are retained by the laboratory for a minimum of 60 days from the time of receipt of the final report. The laboratory is solely responsible for lawful disposal of all LM samples after the 60-day sample storage requirement is fulfilled, if the exceptions given in items (a) or (b) below do not apply:

(a) LM may request that samples from a specific task be returned to LM.

(b) If, due to the nature of the samples, the laboratory has no outlet for disposal or disposal is prohibitively expensive, then samples may be returned to LM.

Sampling Organization: RSI Environmental Monitoring Organization (EMO)

Laboratory: GEL Laboratories, Charleston, SC

Sample Delivery Method: FedEx

Number of days from reporting until sample disposal: 60

Activity	Organization Responsible for the Activity	SOP Reference [a]
Sample labeling [b]	EMO	SAP 3.1.3
Chain-of-custody form completion [b]	EMO	SAP 3.1.3
Packaging	EMO	SAP 3.1.3
Shipping coordination	EMO	SAP 3.1.3
Sample receipt, inspection, and log-in [b]	Laboratory	202
Sample custody and storage	Laboratory	318
Sample disposal	Laboratory	015

Notes:
[a] An example of this documentation is included in Attachment 3.

Abbreviation:
EMO = Environmental Monitoring Organization

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)

Laboratory QC

Laboratory QC is designed to detect, reduce, and correct deficiencies in a laboratory's internal analytical processes to improve the quality of the results reported by the laboratory. The QC system includes measurement performance criteria for data quality indicators (DQIs). DQIs provide a measure of the accuracy, bias, and precision of the reported results as follows:

Accuracy: Accuracy is the closeness of a measured result to an accepted reference value. Accuracy is usually measured as a percent recovery. QC analyses used to measure accuracy include standard recoveries, laboratory control samples, spiked samples, and surrogates.

Bias: Bias is the systematic or persistent distortion of a measurement process that causes error in one direction (e.g., the sample measurement is consistently lower than the sample's true value). Analytical bias can be assessed by comparing a measured value in a sample of known concentration to an accepted reference value or by determining the recovery of a known amount of contaminant spiked into a sample (matrix spike).

Precision: Precision is the agreement among a set of replicate measurements. Analytical precision is estimated by duplicate/replicate analyses, usually on laboratory control samples, spiked samples and/or field samples. The most commonly used estimates of precision are the relative standard deviation and, when only two samples are available, the relative percent difference (RPD).

Matrix: Water
Analytical Group: Metals
Analytical Method/SOP: 6010/ GL-MA-E-013

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
LDR or High-Level Check Standard	At initial setup and checked every 6 months with a high standard at the upper limit of the range.	Within ±10% of true value.	Dilute samples within the calibration range or reestablish and verify the LDR.	Laboratory Analyst/Laboratory Quality Control Manager	NA
ICAL for All Analytes	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, $r^2 \geq 0.99$.	Correct problem and then repeat ICAL.	Laboratory Analyst/Laboratory Quality Control Manager	NA
ICV	Once after each ICAL. Analysis of a second-source standard prior to sample analysis.	All reported analytes within ±10% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Laboratory Analyst/Laboratory Quality Control Manager	NA

Matrix: Water
Analytical Group: Metals
Analytical Method/SOP: 6010/ GL-MA-E-013
(continued)

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
CCV	After every 10 field samples and at the end of the analysis sequence.	All reported analytes within ±10% of the true value.	Recalibrate, and reanalyze all affected samples since the last acceptable CCV. -Or- Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective action(s) and recalibrate; then reanalyze all affected samples since the last acceptable CCV.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
Low-level Calibration Check Standard (Low-Level CCV)	Daily.	All reported analytes within ±20% of true value.	Correct problem and repeat ICAL.	Laboratory Analyst/ Laboratory Quality Control Manager	All reported analytes within ±20% of the true value.
MB	One per preparatory batch.	No analytes detected >1/2 LOQ or >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Laboratory Analyst/ Laboratory Quality Control Manager	The absolute values of all analytes must be <1/10th the amount measured in any sample.
ICB/CCB	Before beginning a sample run, after every 10 field samples, and at end of the analysis sequence.	No analytes detected >LOD.	Correct problem and repeat ICAL. All samples following the last acceptable calibration blank must be reanalyzed.	Laboratory Analyst/ Laboratory Quality Control Manager	The absolute values of all analytes must be <1/10th the amount measured in any sample.
ICS (Also Called Spectral Interference Checks)	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked project analytes <LOD (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ±20% of true value.	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all samples.	Laboratory Analyst/ Laboratory Quality Control Manager	NA

Matrix: Water
Analytical Group: Metals
Analytical Method/SOP: 6010/ GL-MA-E-013
(continued)

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
LCS	One per preparatory batch.	A laboratory must use the QSM Appendix C limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified.	Correct problem and then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available.	Laboratory Analyst/ Laboratory Quality Control Manager	QSM[a] (Appendix C)
MS	One per preparatory batch.	A laboratory must use the QSM Appendix C limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified.	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst/ Laboratory Quality Control Manager	QSM[a] (Appendix C)
MSD or MD	One per preparatory batch.	A laboratory must use the QSM Appendix C limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified. MSD or MD: RPD of all analytes ≤20% (between MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst/ Laboratory Quality Control Manager	RPD ≤ 20%
Dilution Test	One per preparatory batch if MS or MSD fails.	Fivefold dilution must agree within ±10% of the original measurement.	No specific corrective action, unless required by the project.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
Post-Digestion Spike Addition (ICP Only)	Perform if MS/MSD fails. One per preparatory batch (using the same sample as used for the MS/MSD if possible).	Recovery within 80–120%.	No specific corrective action, unless required by the project.	Laboratory Analyst/ Laboratory Quality Control Manager	NA

Matrix: Water
Analytical Group: Metals
Analytical Method/SOP: 6010/ GL-MA-E-013
(continued)

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
Method of Standard Additions	When dilution test or post digestion spike fails and if required by project.	NA	NA	Laboratory Analyst/ Laboratory Quality Control Manager	NA

Note:
[a] As referenced in the QSM (DoD and DOE 2021).

Abbreviations:
CCV = calibration check verification
ICAL = initial calibration
ICB/CCB = initial and continuing calibration blank
ICP = inductively coupled plasma
ICS = interference check solutions
ICV = initial calibration verification
LCS = laboratory control sample
LDR = linear dynamic range
LOD = limit of detection
LOQ = limit of quantitation
MB = method blank
MD = matrix duplicate
MPC = measurement performance criteria
r^2 = coefficient of determination

Matrix: Water
Analytical Group: Metals
Analytical Method/SOP: 6020/ GL-MA-E-014

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
LDR or High-Level Check Standard	At initial setup and checked every 6 months with a high standard at the upper limit of the range.	Within ±10% of true value.	Dilute samples within the calibration range or reestablish and verify the LDR.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
Tuning	Prior to ICAL.	Mass calibration from the true value; resolution <0.9 amu full width at 10% peak height.	Retune instrument and verify.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
ICAL for All Analytes	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, $r^2 \geq 0.99$.	Correct problem, and then repeat ICAL.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
ICV	Once after each ICAL. Analysis of a second source standard prior to sample analysis.	All reported analytes within ±10% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
CCV	After every 10 field samples and at the end of the analysis sequence.	All reported analytes within ±10% of the true value.	Recalibrate, and reanalyze all affected samples since the last acceptable CCV. -Or- Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective action(s) and recalibrate; then reanalyze all affected samples since the last acceptable CCV.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
Low-Level Calibration Check Standard (Low-Level CCV)	Daily.	All reported analytes within ±20% of the true value.	Correct problem and repeat ICAL.	Laboratory Analyst/ Laboratory Quality Control Manager	All reported analytes within ±20% of the true value.

Matrix: Water
Analytical Group: Metals
Analytical Method/SOP: 6020/ GL-MA-E-014
(continued)

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
IS	Every field sample, standard, and QC sample.	IS intensity in the samples within 30–120% of intensity of the IS in the ICAL blank.	If recoveries are acceptable for QC samples, but not field samples, the field samples may be considered to suffer from a matrix effect. Reanalyze sample at 5-fold dilutions until criteria is met. For failed QC samples, correct problem, and rerun all associated failed field samples.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
MB	One per preparatory batch.	No analytes detected >1/2 LOQ or >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Laboratory Analyst/ Laboratory Quality Control Manager	The absolute values of all analytes must be <1/10th the amount measured in any sample.
ICB/CCB	Before beginning a sample run, after every 10 field samples, and at end of the analysis sequence.	No analytes detected > LOD.	Correct problem and repeat ICAL. All samples following the last acceptable calibration blank must be reanalyzed.	Laboratory Analyst/ Laboratory Quality Control Manager	The absolute values of all analytes must be <1/10th the amount measured in any sample.
ICS (Also Called Spectral Interference Checks)	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked project analytes <LOD (unless they are a verified trace impurity from one of the spiked analytes). ICS-AB: Within ±20% of true value.	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.	Laboratory Analyst/ Laboratory Quality Control Manager	NA

Matrix: Water
Analytical Group: Metals
Analytical Method/SOP: 6020/ GL-MA-E-014
(continued)

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
LCS	One per preparatory batch.	A laboratory must use the QSM Appendix C limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified.	Correct problem and then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available.	Laboratory Analyst/ Laboratory Quality Control Manager	QSM[a] (Appendix C)
MS	One per preparatory batch.	A laboratory must use the QSM Appendix C limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified.	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst/ Laboratory Quality Control Manager	QSM[a] (Appendix C)
MSD or MD	One per preparatory batch.	A laboratory must use the QSM Appendix C limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified. MSD or MD: RPD of all analytes ≤20% (MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst/ Laboratory Quality Control Manager	RPD ≤ 20%
Dilution Test	One per preparatory batch if MS or MSD fails.	Fivefold dilution must agree within ±10% of the original measurement.	No specific corrective action, unless required by the project.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
Post-Digestion Spike Addition	One per preparatory batch if MS or MSD fails (using the same sample as used for the MS/MSD if possible).	Recovery within 80–120%.	No specific corrective action unless required by the project.	Laboratory Analyst/ Laboratory Quality Control Manager	NA

Matrix: Water
Analytical Group: Metals
Analytical Method/SOP: 6020/ GL-MA-E-014
(continued)

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
Method of Standard Additions	When dilution or post digestion spike fails and if the required by project.	NA	NA	Laboratory Analyst/ Laboratory Quality Control Manager	NA

Note:
[a] As referenced in the QSM (DoD and DOE 2021).

Abbreviations:
amu = atomic mass unit
CCV = calibration check verification
ICAL = initial calibration
ICB/CCB = initial and continuing calibration blank
ICP = inductively coupled plasma
ICS = interference check solutions
ICV = initial calibration verification
LCS = laboratory control sample
LDR = linear dynamic range
LOD = limit of detection
LOQ = limit of quantitation
MB = method blank
MD = matrix duplicate
MPC = measurement performance criteria
r^2 = coefficient of determination

Matrix: Water
Analytical Group: Cl, F, SO4
Analytical Method/SOP: EPA 300.0/ GL-GC-E-086

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
ICAL for All Analytes	ICAL prior to sample analysis.	$r^2 \geq 0.99$.	Correct problem, and then repeat ICAL.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
Retention Time Window Position Establishment	Once per multipoint calibration.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA	Laboratory Analyst/ Laboratory Quality Control Manager	NA
RT Window Width	At method setup and after major maintenance (e.g., column change).	RT width is ±3 times standard deviation for each analyte RT over a 24-hour period.	NA	Laboratory Analyst/ Laboratory Quality Control Manager	NA
ICV	Once after each ICAL analysis of a second-source standard prior to sample analysis.	All reported analytes within established RT windows. All reported analytes within ±10% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
CCV	Before sample analysis; after every 10 field samples; and at the end of the analysis sequence.	All reported analytes within established retention time windows. All reported analytes within ±10% of true value.	Recalibrate, and reanalyze all affected samples since the last acceptable CCV. -Or- Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective action(s) and recalibrate; then reanalyze all affected samples since the last acceptable CCV.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
MB	One per preparatory batch.	No analytes detected >1/2 LOQ or >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, re prep and reanalyze MB and all samples processed with the contaminated blank.	Laboratory Analyst/ Laboratory Quality Control Manager	The absolute values of all analytes must be <1/10th the amount measured in any sample.

Matrix: Water
Analytical Group: Cl, F, SO4
Analytical Method/SOP: EPA 300.0/ GL-GC-E-086
(continued)

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
LCS	One per preparatory batch.	A laboratory must use the QSM Appendix C limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified.	Correct problem, and then re prep and reanalyze the LCS and all samples in the associated preparatory batch for all reported analytes, if sufficient sample material is available.	Laboratory Analyst/ Laboratory Quality Control Manager	QSM[a] (Appendix C)
MS	One per preparatory batch.	A laboratory must use the QSM Appendix C limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified.	Follow project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst/ Laboratory Quality Control Manager	QSM[a] (Appendix C)
MSD or MD	One per preparatory batch.	A laboratory must use the QSM Appendix C Limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified. MSD or MD: RPD of all analytes ≤20% (MS and MSD or sample and MD).	Follow project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst/ Laboratory Quality Control Manager	RPD ≤ 20%

Note:
[a] As referenced in the QSM (DoD and DOE 2021).

Abbreviations:
CCV = calibration check verification
ICAL = initial calibration
ICV = initial calibration verification
LCS = laboratory control sample
MB = method blank
MD = matrix duplicate
MPC = measurement performance criteria
r^2 = coefficient of determination
RT = retention time

Matrix: Water
Analytical Group: Nitrate + Nitrite as N
Analytical Method/SOP: 353.2/ GL-GC-E-128

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
ICAL	Daily ICAL prior to sample analysis.	$r^2 \geq 0.99$.	Correct problem, and then repeat ICAL.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
ICV	Once after each ICAL analysis of a second-source standard prior to sample analysis.	All reported analytes within ±10% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
CCV	Daily before sample analysis, after every 15 field samples, and at the end of the analysis sequence.	All reported analytes within ±10% of true value.	Recalibrate, and reanalyze all affected samples since the last acceptable CCV. -Or- Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective action(s) and recalibrate; then reanalyze all affected samples since the last acceptable CCV.	Laboratory Analyst/ Laboratory Quality Control Manager	NA
MB	One per preparatory batch.	No analytes detected >1/2 LOQ or >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, re prep and reanalyze method blank and all samples processed with the contaminated blank.	Laboratory Analyst/ Laboratory Quality Control Manager	The absolute values of all analytes must be <1/10th the amount measured in any sample.
ICB/CCB	Before beginning a sample run; after every 10 field samples; and at end of the analysis sequence. (After ICV and each CCV).	No analyte detected >LOD.	Correct problem, and reanalyze all samples analyzed since the last acceptable calibration blank.	Laboratory Analyst/ Laboratory Quality Control Manager	The absolute values of all analytes must be <1/10th the amount measured in any sample.

Matrix: Water
Analytical Group: Nitrate + Nitrite as N
Analytical Method/SOP: 353.2/ GL-GC-E-128
(continued)

QC Sample	Number / Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC
LCS	One per preparatory batch.	A laboratory must use the QSM Appendix C limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified.	Correct problem and then re prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available.	Laboratory Analyst/ Laboratory Quality Control Manager	QSM[a] (Appendix C)
MS	Once per preparatory batch.	A laboratory must use the QSM Appendix C limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified.	Dilute and reanalyze sample; persistent interference indicates the need to use the method of standard addition, alternative analytical conditions, or an alternative method.	Laboratory Analyst/ Laboratory Quality Control Manager	QSM[a] (Appendix C)
MSD or MD	Aqueous matrix: One per every 10 project samples. Solid matrix: One per preparatory batch.	A laboratory must use the QSM Appendix C limits for batch control if project limits are not specified. If the analyte(s) is not listed, use in-house LCS limits if project limits are not specified. MSD or MD: RPD of all analytes ≤20% (MS and MSD or sample and MD).	Dilute and reanalyze sample; persistent interference indicates the need to use the method of standard addition, alternative analytical conditions, or an alternative method. Re-prep and reanalyze all samples in the prep batch.	Laboratory Analyst/ Laboratory Quality Control Manager	RPD ≤ 20%

Note:
[a] As referenced in the QSM (DoD and DOE 2021).

Abbreviations:
CCV = calibration check verification
ICAL = initial calibration
ICB/CCB = initial and continuing calibration blank
ICV = initial calibration verification
LCS = laboratory control sample
LOD = limit of detection
LOQ = limit of quantitation
MB = method blank
MD = matrix duplicate
MPC = measurement performance criteria

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

Documentation and Records

The LMS site lead for Monticello will coordinate with the Document Management group manager to post the QAPP to the LM Intranet and, with LM concurrence, to the LM public website. Electronic distribution of this QAPP through the LM Intranet will ensure that personnel have the most recent version of this the document.

LMS records requirements are specified in the LMS *Quality Assurance Manual* (LMS/POL/S04320) and records procedures. LTS&M plans describe specific documentation and records requirements for each site.

Field and laboratory data are sufficiently documented to provide a scientifically defensible record of the activities and analyses performed. Records of field variance reports, internal reviews, field and laboratory records of tests and analyses, field logs, chain of custody forms, and project reports are used, as appropriate, to interpret and assess the usability of the data. Standardized forms and computer files, codes, programs, and printouts are designed to eliminate errors made during data entry and reduction. Calculation steps are described in the technical and analytical procedures and software lists. Routine data-transfer and data-entry verification checks are performed.

Records File Plans

Site-specific file plans have been prepared to identify the records to be generated, file locations, and retention schedule for each LM CERCLA site. The file plans are augmented by the *Records Management Manual* (LMS/POL/S04327), which is maintained by the LMS contractor and establishes the requirements for preparing, preserving, and storing records. Project personnel will work with the Records Management lead to ensure that project records are correctly identified and maintained in accordance with the applicable file plan. Modifications to the file plans shall be submitted to the Records Management lead and are subject to review and approval by the project manager.

All records generated during the sampling and analytical process, including analytical reports, field-data sheets, field calibration records, trip reports, chain of custody forms, and data validation documentation, are stored electronically in a task-specific folder in a protected network location. After all the information is completed, the designated records coordinator in the Records Management organization captures the contents of the folder for inclusion as records. Retention time for these records is 75 years.

Document Control and Changes

Company policy and procedures will be followed to ensure that the preparation, issuance, and revisions to project documents and forms will be controlled so that current and correct information is available at the work location. These project documents (e.g., plans, procedures, drawings, and forms) and subsequent revisions will be reviewed for adequacy and approved before being issued for use. Written records and photo documentation will be handled in a manner that ensures association to the activity, the samples, and their locations. At a minimum, personnel assigned to the work will have access to the applicable project documents and will be knowledgeable of the contents before the associated work.

Changes to established routine sampling events will be managed in accordance with each site's LTS&M plan. Nonroutine sampling and field investigations will be documented in sampling plans prepared to meet the specific objectives. The LM site manager will be briefed on all program directives and nonroutine field investigations before the work begins.

The official QAPP is maintained by the LM QA Manager and the LM Site Manager.

Procedure Requirements

Project personnel will comply with the requirements of written procedures or other instructions that have been approved for the work. Any deviation from approved field procedures must be documented by the field supervisor and authorized by the project manager in advance. Field changes to project plans or deviation from procedures will be documented as appropriate as a field variance, communicated to the project manager as soon as possible, and noted in the trip report to management.

The laboratory coordinator will be notified of any substantive changes to subcontract laboratory procedures. The project manager will be informed of changes to laboratory procedures that may impact project objectives. Procedural changes that affect laboratory data will be identified and documented during the data review, verification, and validation activities.

Field Documentation

Field documentation requirements are specified in the sampling procedures that are provided as an appendix to the SAP. Field documents are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the field sampling activities. Most field documentation, including water-sampling data, field measurements, instrument calibration and operational checks, observations, and safety meetings, are collected electronically using a specifically designed field data collection software application. The field data collection application has numerous QC functions that enhance data quality, including user notifications, automated data transfer, built-in calculations, and pass/fail alerts. The field data collection application is loaded on ruggedized field computers and used for data entry and documentation of sampling activities in the field. The use of a ruggedized field computer will protect data from loss or damage from field conditions. Electronic data is backed up daily to a secondary digital storage media (in addition to the hard drive on the ruggedized field computer). Some paper forms will still be used (e.g., chain of custody) and will be stored in a manner that protects them from loss or damage. All entries on the chain of custody form are made with ink and will be legible, accurate, and complete. Corrections on paper forms are made by a single line through the original entry along with the initials of the person making the correction and the date of the correction. A signature/initials log will be maintained to identify personnel who are authorized to record, review, and authenticate field data. At the conclusion of a field task or sampling event, the field and data collection activities are reviewed and summarized in a report to the project manager, as specified in the discussions of data review and QA/QC assessment in this document.

The field sampling team will adequately document and identify field measurements and each sample collected. Field records are completed at the time the observation or measurement is made and when the sample is collected. Project documents and written procedures are stored on the field computer so that they are readily accessible during field work. The field supervisor will ensure that specified requirements are followed so that an accurate record of sample collection and transfer activities is maintained.

Sample disposition is managed by the subcontracted laboratory as specified in the appropriate procurement documents.

The Monticello site prepares a Monticello Mill Tailings Site Operable Unit III Annual Groundwater Report each year that documents evaluation of all the groundwater and surface water sampling results for each May–April performance period.

Field Books and Forms

The field sampling team will manage field data collection software, applicable forms, or a logbook to provide a daily record of field activities associated with drilling and sampling events and to document relevant treatment system operations and measurements. If initials are used in place of signatures, a signature/initials log will be maintained to identify personnel who are authorized to record, review, and authenticate field data.

Field Variance and Nonconformance Documentation

Changes from specified field protocols established in planning documents or SOPs that are necessary prior to field work must be authorized by the project manager or approved planning document and fully documented by the field sampling team. Field variances that are unanticipated and occur during field activities will be reported in a timely manner to evaluate the impact the variance has on the data or system operations. Field variance reporting applies to deviations from (1) prescribed field sampling and measurement requirements; (2) specified shipping, handling, or storage requirements; and (3) decontamination procedures.

A variance must be documented whenever an activity is performed or sample is obtained where:

- The activity performed or sample collection technique does not fall within the methods or protocols specified.
- The monitoring or measurement instrument that was used was out of calibration or had failed an operational check.
- Insufficient documentation results in the inability to trace the activity, measurement, or sample to the prescribed or selected location.
- There is a loss of or damage to records that cannot be duplicated.

The variance should be fully described, and corrective action, if applicable, should be taken immediately. Comments describing the variance will be used during data evaluation to assess the use of associated results and validity of the data. Field variances should be noted in the comments portion of the field-data sheet, on a general log sheet, or in the activity logbook. Nonconformances will be identified in the quality assurance tracking system where initial actions, evaluation of extent of conditions, cause analysis, and corrective and preventive actions are tracked. As appropriate, field variances will be summarized in the trip report at the conclusion of the activity.

Laboratory Documentation

Commercial laboratories provide analytical services to support LM environmental monitoring in accordance with the QSM to ensure that data are of known, documented quality. The QSM provides specific technical requirements, clarifies DOE requirements, and conforms to DOE Order 414.1D Chg 1, *Quality Assurance*. The QSM is based on Volume 1 of The NELAC Institute Standards (September 2009), which incorporates ISO/IEC standard 17025:2005(E), "General requirements for the competence of testing and calibration laboratories." The QSM provides a framework for performing, controlling, documenting, and reporting laboratory analyses.

The laboratory data report will include the following items:

- Analytical method used
- Date and time of analysis
- The chain of custody form
- Sample receiving documentation
- QC data results and report
- Sample data results by analysis, including method detection limits, quantitation limits, and dilution factors
- Summary of analyses (e.g., case narrative)
- Certification by the laboratory that the analytical data meet applicable data quality requirements

Analytical data that do not meet specified criteria are qualified to allow data evaluation before use. Any nonconformances or difficulties encountered during analyses such as missed holding times or quality control failures are documented in the case narrative with each data package.

Reports Received from Subcontractors

Procurement documents will specify the criteria for technical and administrative plans and reporting requirements for technical reports received from subcontracted services. For subcontracted laboratory services, reporting requirements and formats meeting the electronic data deliverable (EDD) specifications will be specifically described or referenced.

Data Management

Project data are generated mainly from routine sampling of monitoring wells, surface water sampling, and routine operations system sampling. The LM environmental data system for project environmental data is managed and maintained in accordance with documented policy and procedural requirements.
Field data books are assembled for most sampling events. These books contain information such as sample location identifier (ID), date, QA sample ID, well purge method, sampling method, and field measurements. These forms are completed at the time of sample collection. Separate

data books may be generated for water levels. From the completed field books, the relevant data (i.e., water levels, temperatures, pH, conductivity, dissolved oxygen, oxidation-reduction potential, and turbidity) are loaded into the database. Electronic field data forms hosted on laptops and other handheld electronic devices may be used to document and temporarily store the information collected during sampling events. The configuration and control of electronic data forms and the supporting software will be managed in accordance with LM software configuration management procedures. Data and information collected using electronic field data forms will be temporarily stored on the electronic device and uploaded to the LM environmental data system at the earliest convenience of the field sampling team.

Data from samples submitted to an analytical laboratory are received in EDD format. The electronic data is loaded into the LM environmental data system maintained by Environmental and Spatial Data Management. The data are accessible using reporting functions designed to provide data users with environmental data and information specific to their needs. The software for performing these reporting functions is maintained and managed in accordance with LM software configuration management procedures. Database security is maintained by keeping the majority of the records in a read-only mode and limiting the ability to change data in the database to a limited set of qualified data analysts who are assigned specific database roles and responsibilities. Access to the database and read-write capabilities are enforced by the relational database management system through configuration of specific database user roles.

The LM environmental data system is strictly controlled in accordance with LM software configuration and data management procedures, which ensures the quality and integrity of the data maintained in the system. In addition, the LM environmental data system includes automated validation functions that support the maintenance of the integrity and quality of data uploaded and stored in the system. The use of standardized and controlled reference values for data reporting and data management tasks provides assurance that information regarding the type, quality, and use of data is available to users of LM environmental data through standardized reporting functions. Data validation procedures are described in *Environmental Data Validation Procedure* (LMS/PRO/S15870). Electronic copies of analytical reports are archived with the project records along with the original field data forms and other relevant hardcopy forms or documents containing project data and categorized in the project records library according to the project Working File Index.

Soil boring logs are generated for some soil sampling events, and well construction and lithology logs are generated for all new wells drilled. These logs are archived in the project records library and are also entered into the LM environmental data system form of geologic log and well construction information software (gINT) logs.

In addition to the data collected from sampling, physical project data are also collected and maintained. Physical project data are those that describe the layout of the site, such as buildings, survey markers, fence lines, utilities, and roads. Any modification to these features requires documentation and base map feature updates. These updates can be documented by redlining an existing as-built map. If a contractor is used, both hardcopy and electronic drawing files are needed. These deliverables will be archived as appropriate. Where appropriate, a detailed as-built set of maps will be created and maintained for a specific area.

Some cases require the services of a licensed surveyor. In these cases, the surveyor must submit both hardcopy and EDD products. These deliverables will then be archived and verified, and the appropriate data sources will be updated.

Sample Collection and Field Records

Record	Generation	Verification	Storage Location/Archival
Field logbooks	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Content Manager
Equipment calibration records	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Content Manager
Chain of custody forms	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Content Manager
Sampling diagrams/surveys	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Content Manager
Drilling logs	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Content Manager
Geophysics reports	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Content Manager
Relevant correspondence	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Content Manager
Change orders/deviations	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Content Manager
Field audit reports	LMS Quality Assurance Specialist	LMS Environmental Monitoring Operations Lead	Content Manager
Field corrective action reports	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Content Manager

Abbreviation:
EMO = Environmental Monitoring Organization

Project Assessments

Record	Generation	Verification	Storage Location/Archival
Quality Assurance Assessment Report	LMS Quality Assurance Specialist	Project Manager	Content Manager, Assessment and Issue Management System
Data validation report	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Content Manager
Corrective Action Reports	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Assessment and Issue Management System
Correspondence	LMS Environmental Monitoring Operations Lead	LMS Quality Assurance Specialist	Content Manager
Annual Inspection Report	LMS Contractor Subtask Manager	Project Manager	Content Manager
Monticello Mill Tailings Site Operable Unit III Annual Groundwater Report	LMS Contractor Subtask Manager	Project Manager	Content Manager
CERCLA 5-Year Review Report	LMS Contractor Subtask Manager	Project Manager	Content Manager

Abbreviations:
EMO = Environmental Monitoring Organization
Q&PA = Quality and Performance Assurance

Laboratory Records

Record	Generation	Verification	Storage Location/Archival
Cover sheet (laboratory identifying information)	Laboratory Project Manager	LMS Environmental Monitoring Operations Lead	Content Manager
Case narrative	Laboratory Project Manager	LMS Environmental Monitoring Operations Lead	Content Manager
Internal laboratory chain of custody	Laboratory Technician	LMS Environmental Monitoring Operations Lead	Content Manager
Sample receipt records	Laboratory Sample Receiving	LMS Environmental Monitoring Operations Lead	Content Manager
Sample chronology (i.e., dates and times of receipt, preparation, and analysis)	Laboratory Analyst	LMS Environmental Monitoring Operations Lead	Content Manager
Communication records	Laboratory Project Manager	LMS Environmental Monitoring Operations Lead	Content Manager
Project-specific PT sample results	Laboratory Analyst	LMS Environmental Monitoring Operations Lead	Content Manager
LOD/LOQ establishment and verification	Laboratory Analyst	LMS Environmental Monitoring Operations Lead	Content Manager
Standards Traceability	Laboratory Analyst	LMS Environmental Monitoring Operations Lead	Content Manager
Instrument calibration records	Laboratory Analyst	LMS Environmental Monitoring Operations Lead	Content Manager
Definition of laboratory qualifiers	Laboratory Project Manager	LMS Environmental Monitoring Operations Lead	Content Manager
Results reporting forms	Laboratory Analyst	LMS Environmental Monitoring Operations Lead	Content Manager
QC sample results	Laboratory Analyst	LMS Environmental Monitoring Operations Lead	Content Manager

Record	Generation	Verification	Storage Location/Archival
Corrective action reports	Laboratory Project Manager	LMS Environmental Monitoring Operations Lead	Content Manager
Raw data	Laboratory Analyst	LMS Environmental Monitoring Operations Lead	Content Manager
Electronic data deliverable	Laboratory Project Manager	LMS Environmental Monitoring Operations Lead	Content Manager

Abbreviations:
EMO = Environmental Monitoring Organization
LOD = limit of detection
LOQ = limit of quantitation
PT = performance testing

Laboratory Data Deliverables

Record	Metals	Anions by Ion Chromatography	Anions by Autoanalyzer
Narrative	X	X	X
COC Form	X	X	X
Sample Results	X	X	X
QC Results	X	X	X
Chromatograms		X	

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

Quality Improvement, Assessment, and Oversight

All personnel must continually seek to improve the quality of their work to provide the highest quality goods and services for customers, both internal and external. This section addresses the activities for assessing the effectiveness of the implementation of the project and associated QA/QC requirements. Processes to detect and prevent problems and improve quality are addressed in the QA program description and associated procedures covering quality improvement, assessment, and oversight.

Quality Improvement

Management encourages innovation and continuous improvement in the work environment by fostering a "no fault" attitude and an atmosphere of openness. All personnel are encouraged to identify problems and suggest improvements.

All personnel have a responsibility to pause or stop work (including work performed by subcontractors) immediately for imminent threats to health, safety, environmental release, or conditions with significant adverse effect on quality. Restarting work related to such stoppages will be at the direction of the project manager.

Quality Assurance Assessment and Response Actions

QA assessments of LMS project activities are planned with appropriate levels of management and scheduled on the oversight schedule managed by the Quality and Performance Assurance (Q&PA) manager. Results are evaluated to measure the effectiveness of the implemented quality system.

At the project or task level, assessment activities include routine oversight reviews, management assessments (planned and conducted within the organization), and independent assessments (usually planned and conducted by the LMS Q&PA organization).

QA assessments are conducted and findings documented and verified in accordance with the requirements of the QA program description and associated procedures.

QA assessments involving subcontracted services are coordinated with appropriate levels of project management and administered in conjunction with the Contract Services organization.

The responsible manager will promptly respond to findings, define corrective actions, and correct deficiencies identified through assessments. Corrective actions are determined by the manager of the assessed organization, and completion is documented, verified, and approved at the next highest level. The Q&PA organization is responsible for tracking the completion of corrective actions related to assessments and for managing the associated records.

QA assessment reports are issued to the responsible manager and distributed internally to project management, the QA lead, and appropriate levels of LMS management.

Typical QA assessments include the following.

- **Management Assessments:** The project/functional manager determines the scope, schedule, and responsibilities for management assessments and notifies the QA manager for inclusion in the oversight schedule.

  These internal assessments typically examine human performance elements, operations, resource allocation, financial performance, financial controls, data quality, outcome-to-mission alignment, product quality, process efficiencies, and customer relations.
- **Independent Assessments:** Independent assessments are planned, performed, and documented by QA staff. Personnel who lead independent assessments must be qualified, have reporting independence, and have access to the areas of inquiry.
- **Surveillances:** Surveillances verify compliance with procedures, practices, and other requirements. Surveillances are performed by Q&PA in support of assigned projects and functional areas.

Reviews

- **Readiness reviews:** To ensure that appropriate planning has taken place to allow the work to proceed safely and effectively and ensure that as many contingencies and prerequisites as possible have been reviewed and addressed. The project manager is responsible for determining the level of rigor and formality of project readiness reviews based on complexity, frequency, and risk of work. Readiness reviews are routinely planned and conducted before the start of major project activities, before the start of new or infrequent tasks, and prior to scheduled sampling events. Review responsibilities are typically delegated based on type and significance to the overall process success.
- **Data review:** To ensure the quality of data collected. The field team will routinely conduct data reviews to ensure the adequacy of field activities. In addition, data review, verification, and validation will be conducted after a sampling event to provide a tabulated summary of the field activities to the project manager. Analytical data will be reviewed and summarized in the laboratory report. The results will include a tabulation of analytical data and an explanation of any laboratory QA/QC problems and their possible effects on data quality.

Reports to Management

CERCLA Reports

Results of environmental monitoring and maintenance and other ongoing activities are summarized in quarterly and annual reports as required by the LTS&M Plan. These reports are provided to EPA and UDEQ and are available to the public. In addition, the site prepares CERCLA 5-year review reports. The next 5-year review report is due in 2027.

Assessments

Planned assessments are recorded on a schedule maintained by the LMS contractor Q&PA organization. All records created during the course of planning or assessment activities are maintained in accordance with Q&PA and records management procedures.

Assessments

Assessment Type	Responsible Party & Organization	Number/ Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Readiness Review	Monticello Contractor Site Lead or Delegate	Conducted before the start of major project activities, before the start of new or infrequent tasks, and prior to scheduled sampling events.	After work has been planned and prior to the authorization of work activities.	Readiness Review Checklist	Immediately following the review.
Quality Assurance Assessment	Monticello Contractor Site Lead and LMS Quality Assurance Specialist	Planned and conducted as needed or as requested by LM or LMS management.	QA assessments are performed to evaluate project activities and therefore can be conducted whenever those activities are being performed. Planned assessments are recorded on a schedule maintained by the LMS contractor Q&PA organization.	Quality Assurance Assessment Report	30 days following the end of assessment activities.
Data Review	LMS EMO Data Validation Staff	Prepared for each validation performed.	Following each sampling event.	Data Review and Validation Report	After data validation has been performed.
Weekly, Monthly, and Quarterly Inspections	Monticello Contractor Site Lead	Weekly, monthly, or quarterly.	Weekly, monthly, or quarterly according to the LTS&M Plan.	FFA Quarterly Report	Every quarter according to the LTS&M Plan.
Annual Inspection	Monticello Contractor Site Lead	Annually.	September every year.	Annual Inspection Report	December 31 of each calendar year.
CERCLA Five-Year Review	Monticello Contractor Site Lead	Every 5 years. The next review report is due June 2027.	Summary will be prepared prior to the due date in June of 2027.	CERCLA Five-Year Review Report	June every 5 years. The next report is due June 2027.

Abbreviation:
EMO = Environmental Monitoring Organization

Assessment Response and Corrective Action

Assessment Type	Responsibility for Responding to Assessment Findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for Monitoring Corrective Action Implementation
Readiness Review	Monticello Contractor Site Lead or Delegate	LMS Assessment and Issue Management System	Following the completion of the review, prior to the authorization of work activities.	As directed by contractor site lead.	LMS Quality Assurance Specialist
Quality Assurance Assessment	Responsible Manager of the Deficient Condition (e.g., Monticello Contractor Site Lead, LMS EMO Lead, LMS Quality Assurance Specialist)	LMS Assessment and Issue Management System	Corrective action plans are due two weeks after the assessment finding was issued. Due dates for corrective actions are determined by the responsible manager in concurrence with the LMS Quality Assurance Specialist.	The assigned responsible manager or delegate.	LMS Quality Assurance Specialist
Data Review	LMS EMO Data Validation Staff	Data Review and Validation Report	Report is due 3 weeks after data are loaded into the environmental database.	EMO or the laboratory, depending on the appropriate corrective action. Follow-up action may include one or more of the following: consultation with the laboratory to check for errors; reanalysis of samples; comparison to results from the next sampling event; and qualification of data with a “J” (estimated) or “R” (unusable) flag.	LMS EMO Data Validation Staff

Assessment Response and Corrective Action (continued)

Assessment Type	Responsibility for Responding to Assessment Findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for Monitoring Corrective Action Implementation
Weekly, Monthly, and Quarterly Inspections	Monticello Contractor Site Lead or Delegate	FFA Quarterly Report and Site Inspection Checklists. If finding is not able to be quickly resolved, it can be tracked in the LMS Assessment and Issue Management System.	Due dates for corrective actions are determined by the responsible manager in concurrence with the Q&PA representative	Contractor Site Lead or Delegate	Monticello Contractor Site Lead, LMS Quality Assurance Specialist
Annual Inspection	Monticello Contractor Site Lead or Delegate	Annual Site Inspection Report and Annual Site Inspection Checklist. If finding is not able to be quickly resolved, it can be tracked in the LMS Assessment and Issue Management System.	Due dates for corrective actions are determined by the responsible manager in concurrence with the Q&PA representative.	Contractor Site Lead or Delegate	Monticello Contractor Site Lead, LMS Quality Assurance Specialist
CERCLA Five-Year Review	NA. This is a summary report of the quarterly and annual inspections performed over 5 years. Any assessment findings should have been resolved following issuance of the original quarterly or annual report.	NA	NA	NA	NA

Abbreviations:
EMO = Environmental Monitoring Organization
NA = not applicable

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)

Data Verification and Validation Inputs

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
4	Field SOPs	X	
5	Laboratory SOPs	X	
Field Records			
6	Field logbooks	X	X
7	Equipment calibration records	X	X
8	Chain of custody forms	X	X
9	Sampling diagrams/surveys		
10	Drilling logs		
11	Geophysics reports		
12	Relevant correspondence	X	X
13	Change orders/deviations	X	X
14	Field audit reports		
15	Field corrective action reports		
Analytical Data Package			
16	Cover sheet (laboratory identifying information)	X	X
17	Case narrative	X	X
18	Internal laboratory chain of custody	X	X
19	Sample receipt records	X	X
20	Sample chronology (i.e. dates and times of receipt, preparation, and analysis)	X	X
21	Communication records	X	X
22	Project-specific PT sample results		
23	LOD/LOQ establishment and verification	X	X
24	Standards Traceability	X	X
25	Instrument calibration records	X	X
26	Definition of laboratory qualifiers	X	X
27	Results reporting forms	X	X
28	QC sample results	X	X
29	Corrective action reports	X	X
30	Raw data	X	X
31	Electronic data deliverable	X	X

Abbreviations:
LOD/LOQ = limit of detection / limit of quantitation
PT = performance testing

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

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Field Activities Records	SAP[a], QAPP	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected. Verify that calibration or operational check records are available. Verify that any required field monitoring was performed and results are documented.	Daily –LMS Environmental Monitoring Operations Sample Team Members At conclusion of field activities – LMS Environmental Monitoring Operations Data Validation Staff (both report to Environmental Monitoring Operations Manager – see QAPP Worksheet #3 and #5)
Chain-of-Custody forms	SAP[a], QAPP	Verify the completeness of chain of custody records. Examine entries for consistency with the field records. Check that appropriate methods and sample preservation have been recorded. Verify that all required signatures and dates are present. Check for transcription errors.	Daily –LMS Environmental Monitoring Operations Sample Team Members At conclusion of field activities – LMS Environmental Monitoring Operations Data Validation Staff (both report to Environmental Monitoring Operations Manager – see QAPP Worksheet #3 and #5)
Laboratory Deliverable	SOW[b], QAPP	Verify that the laboratory deliverable contains all records specified in the SOW. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported as required. Compare the data package with the chain of custody forms to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. Verify that necessary signatures and dates are present.	LMS Environmental Monitoring Operations Data Validation staff (reports to Environmental Monitoring Operations Manager – see QAPP Worksheet #3 and #5)
Audit Reports, Corrective Action Reports	QAPP	Verify that all planned audits were conducted. Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	LMS Quality Assurance Specialist – see QAPP Worksheet #3 and #5

Notes:
[a] As referenced in *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*.
[b] As referenced in *Statement of Work for Laboratory Analytical Services*.

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

Data Validation and Usability

Data validation is a rigorous data review of the field and laboratory data generated during sampling events. The work is performed by the Environmental Monitoring Operations group. Data validation is the principal means of assessing the usability of data. Validation also improves overall data quality by allowing the laboratory coordinator to closely monitor laboratory performance and to provide feedback to each laboratory regarding its ability to produce quality data that meets subcontract requirements. Data validation is performed as specified in the *Environmental Data Validation Procedure*. This procedure is based on the following guidance documents:

- EPA Contract Laboratory Program *National Functional Guidelines for Inorganic Superfund Methods Data Review* (EPA 2017a)
- EPA Contract Laboratory Program *National Functional Guidelines for Organic Superfund Methods Data Review* (EPA 2017b)
- *Evaluation of Radiochemical Data Usability* (Paar and Porterfield 1997)
- Results of data validation documented in task-specific data validation reports that become part of the project record

Field Measurement Data

The objective of field data validation is to ensure that data are collected in a consistent manner and in accordance with the SAP and site-specific environmental planning documents. Field data validation procedures include a review of documentation generated during field sampling events. The data are reviewed for completeness, transcription errors, compliance with SOPs, and accuracy of calculations.

Laboratory Data

Validation of laboratory data is performed to determine if data meet the specific technical and quality criteria established in the QSM and other applicable documents and to establish the usability and extent of bias of any data not meeting those criteria. Data validation includes the evaluation of data quality indicators associated with the data. DQIs are the quantitative and qualitative descriptors that are used to interpret the degree of acceptability or utility of data. Indicators of data quality include the analysis of laboratory control samples to assess accuracy, duplicates and replicates to assess precision, and interference check samples to assess bias. The DQIs comparability, completeness, and sensitivity are also evaluated during the validation process.

All data are considered valid unless problems are identified during data validation that require data qualification. When it is necessary to qualify individual data records, standard qualifier codes are applied.

Common data qualifiers used by LM are defined below. Refer to the *Environmental Data Validation Procedure* for further information.

- U—For organic and inorganic analytes, the analyte was not detected at a concentration greater than the method detection limit. For radiochemistry, the analyte was not detected at a concentration greater than the decision-level concentration.
- J—The associated numerical value is an estimated quantity.
- R—The data are unusable (analyte may or may not be present). Resampling and reanalysis may be necessary for verification.

Qualification of Data and Corrective Actions

Qualification criteria are defined in the *Environmental Data Validation Procedure*. Additional corrective action may be required, such as reanalysis of the sample by the laboratory or resampling the affected locations.

Determination of Anomalous Data

New data are assessed for potential outliers by comparison to the historical data set when appropriate. Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers can result from transcription errors, data coding errors, or measurement system problems. However, outliers can also represent true extreme values of a distribution and can indicate more variability in the population than was expected. Data are initially screened for values that fall outside a designated historical data range. Outlier data are further evaluated by the data validation lead. That evaluation may include any of the following:

- The use of statistical outlier tests that give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and, therefore, is a statistical outlier
- Trends in the analytical data
- Correlation with other analytes or other analytical methods
- Possible sample misidentification
- Possible sample contamination

The outlier evaluation may result in one or more follow-up actions, including the following:

- Additional laboratory review of the suspect data
- Sample reanalysis
- Resampling
- Comparison to results from the next sampling event

Based on the results of the follow-up action, the data validator will make a final determination of validity of the data point and document the results of the evaluation in the Data Validation Report.

Data Validation Procedures
Matrix: Water
Metals and Wet Chemistry Methods: SM2540C[a], 353.2, 6010, 6020, EPA 300.0

Data Validator:	Environmental Monitoring Operations group
Validation procedure:	*Environmental Data Validation Procedure*
Data deliverable requirements:	Level 3 data package, DOE_EQEDD electronic data deliverable
Measurement performance criteria:	*Department of Defense (DoD) Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* QAPP Worksheet #12
Percent of data packages to be validated:	100%
Percent of raw data reviewed:	100%
Percent of results to be recalculated:	0%
Electronic validation program/version:	SMSPlugin, current version

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

The data usability assessment is performed at the conclusion of data collection activities using the outputs from data verification and validation. It is performed to qualitatively and quantitatively interpret environmental data associated with the Monticello site to determine if the project data are of the right type, quality, and quantity to support the decisions that need to be made. Details of the data usability assessment are described below.

Personnel responsible for participating in the data usability assessment are as follows:

- LM Monticello Site Manager
- Monticello Contractor Site Lead
- LMS Geoscience Services Manager
- LMS Quality Assurance Specialist

Evaluation and interpretation of site monitoring data is documented in annual groundwater reports, and conclusions regarding data usability are included in annual groundwater reports.

Data Usability Assessment Process

Step 1	**Review the project's objectives and sampling design.** *Review the data quality objectives for long-term monitoring. Review the monitoring plan to ensure that it continues to be consistent with the monitoring goals.*
Step 2	**Review the data verification and data validation outputs.** *Review data validation reports, field verification checklists, and trip reports. Review deviations from planned activities to determine their impacts on data usability. Evaluate implications of unacceptable quality control sample results. Summarize the data with tables, time series plots, or maps. Assess the reliability and importance of anomalous data.*
Step 3	**Verify assumptions.** *Review statistical methods used to evaluate uranium trends, such as Mann-Kendall trend tests or linear regression. Review assumptions, which will depend on the method employed and may include linearity, constant variance, statistical independence, or normality of regression residuals. Verify assumptions using standard qualitative and quantitative techniques, such as scatter plots of the data, scatter plots of regression residuals, quantile-quantile plots, or statistical tests on regression residuals (e.g., Shapiro-Wilk test for normality, Breusch-Pagan test for constant variance, and Durbin-Watson test for serial correlation). Evaluate whether data transformations are necessary to satisfy assumptions. Minor deviations from assumptions are not considered critical to meeting the data quality objectives. If serious deviations from assumptions are discovered, assess alternative methods for trend evaluation.* *Review interpolation methods for generating water level contour maps or plume maps. Select data for interpolation that represent distinct or homogenous populations (e.g., separate uranium results from different geologic units before generating plume maps). Use evaluations from Step 2 of the data usability assessment to account for outliers and verify that datasets used for interpolation are representative of the intended populations.*
Step 4	**Implement data analysis methods.** *Apply data transformations as necessary. Perform uranium trend analysis. Perform interpolation to generate water level contour maps or plume maps. Perform additional data analyses as appropriate or as necessary. Review results for consistency with the conceptual site model. Consider the reliability of conclusions regarding aquifer restoration progress.*
Step 5	**Document data usability and draw conclusions.** *Document significant conclusions regarding data usability in annual groundwater reports.*

Appendix A

Chronology of MMTS Events

Chronology of MMTS Events

Event	Date
Vanadium and uranium ore milling at the Monticello mill resulted in four tailings piles. Operations and tailings piles resulted in contamination of soils, buildings, processing equipment, surface water and groundwater, and peripheral properties.	1941–1960
AEC, a predecessor agency of the DOE, regraded and stabilized the tailings piles. Fill dirt and rock were spread over the tops and sides of all tailings piles.	1964
Contaminated soils were removed from surrounding ore storage areas and used as fill material to partially bury the mill foundations.	1965
AEC began radiological surveys of Monticello properties.	1971
Monticello mill accepted into the DOE Surplus Facilities Management program as a government facility retired from service but still containing radioactive contamination.	1980
Monticello Remedial Action Project, which included the mill site, mill site peripheral properties, and vicinity properties, was established.	1980
The Monticello Remedial Action Project was separated into the Monticello Radioactively Contaminated Properties site, also known as the MVP site and the MMTS.	1983
Federal Facility Agreement signed by EPA, Utah Department of Health, and DOE to establish roles and responsibilities for conducting remedial actions at the MMTS (DOE 1988).	December 1988
The MMTS was placed on the NPL.	November 21, 1989
Final Remedial Investigation/Feasibility Study–Environmental Assessment for the Monticello, Utah, Uranium Mill Tailings Site, which analyzed remedial action alternatives for OU I and OU II of the MMTS, is completed (DOE 1990a).	January 1990
Monticello Mill Tailings Site Declaration for the Record of Decision and Record of Decision Summary (ROD), selecting remedies for OU I and OU II, is signed (DOE 1990b). OU III is designated.	September 1990
MMTS OU I and OU II remedial actions initiated.	1992
MMTS OU III Remedial Investigation/Feasibility Study initiated.	1992
Selection of the onsite disposal alternative is finalized by DOE.	December 22,1994
Explanation of Significant Difference issued to explain increased scope and costs of remediation for MMTS OU I.	April 1995
Pre-final design and specification package for mill site remediation completed.	April 28, 1995
EPA notification of stipulated penalty against DOE (in accordance with the Federal Facility Agreement) for noncompliant discharges into Montezuma Creek.	May 1995
Repository construction initiated.	October 27, 1995
First CERCLA Five-Year Review report completed.	February 13, 1997
Four MVP sites were administratively transferred to MMTS to accommodate construction of the repository (MS-01040, MS-01041, MS-01042, and MS-01080).	April 1997
Remediation of the mill site started.	May 1997
MMTS OU III Remedial Investigation/Feasibility Study completed and ROD signed (DOE 1998). The Interim ROD implemented an IRA until the OU III ROD was issued.	August 1998

Event	Date
Explanation of Significant Difference issued to provide rationale for applying supplemental standards to MMTS OU II properties in which contamination was left in place. Rationale for applying supplemental standards is found in *Application for Supplemental Standards for Upper, Middle, and Lower Montezuma Creek* (DOE 1999a) and *Application for Supplemental Standards for Government-Owned Properties in Monticello, Utah, DOE ID Nos. MP-00391-VL, MP-01041-VL, and MP-01077-VL* (DOE 1999b).	February 1999
Ground-Water Management Policy for the Monticello Mill Tailings Site and Adjacent Areas (State of Utah 1999) issued by the Utah State Engineer. The policy established the groundwater restricted area and serves as an institutional control to prohibit the use of contaminated groundwater for domestic purposes.	May 21, 1999
Remediation of soil and sediment contamination from MMTS properties in the Montezuma Creek canyon, originally part of OU III remedy, was transferred for inclusion under the OU II remedy.	Spring 1999
Cooperative Agreement Between the City of Monticello and the U.S. Department of Energy (DOE and City of Monticello 1999) signed. The agreement includes specifications for restoration of the mill site.	June 1999
Permeable reactive barrier treatability study started for OU III.	June 1999
Tailings removal completed from OU I and OU II.	August 1999
Covenant Deferral Request allowing transfer of federal property prior to completion of cleanup activities signed.	February 6, 2000
Transfer of mill site and other peripheral properties from DOE to the City of Monticello completed through a quitclaim deed. Some restrictions in the deed serve as ICs to restrict groundwater use. Some restrictions are related to site-specific cleanup standards. Other restrictions are related to land transfer not contamination.	June 28, 2000
Repository construction completed (OU I).	July 30, 2000
Remedial Action Report for Monticello Mill Tailings Site National Priorities List Site Operable Unit II Non-Surface and Ground-Water Impacted Peripheral Properties Proposed for Partial Deletion: MP-00105-VL, MP-00178-RS, MP-00180-CS, MP-00198-VL, MP-00211-VL, MP-00845-VL, MP-00886-VL, MP-00887-VL, MP-00888-VL, MP-00947-VL, MP-00948-VL, MP-00949-RS, MP-00950-VL, MP-00963-OT, MP-00964-VL, MP-00988-VL, MP-01040-VL, MP-01041-VL, MP-01042-VL, MP-01081-VL, MP-01083-MR, and MP-01102-VL (DOE 2001) established “construction complete” status for 22 OU II properties where surface water and groundwater contamination do not exist.	April 2001
Mill site restoration completed (OU I).	August 2001
MVP and MMTS transferred to DOE’s LTS&M program.	October 1, 2001
LTS&M Plan for the Monticello NPL sites issued.	April 2002
Second CERCLA Five-Year Review report completed.	June 2002
MMTS OU II nonsurface and groundwater impacted peripheral properties deleted from the NPL.	October 14, 2003
After LM is formed, MVP and MMTS transferred to LM for LTS&M.	December 2003
MMTS OU III Remedial Investigation/Feasibility Study interim action implemented.	September 1998–January 2004
Monticello Mill Tailings Site, Operable Unit III Remedial Investigation Addendum/Focused Feasibility Study finalized (DOE 2004b).	January 2004

Chronology of MMTS Events (continued)

Event	Date
Record of Decision for the Monticello Mill Tailings (USDOE) Site Operable Unit III, Surface Water and Groundwater, Monticello, Utah signed (DOE 2004d).	May 2004
Remedial Action Report for Monticello Mill Tailings (USDOE) Site National Priorities List Site Operable Units I and II Surface and Ground Water Impacted Properties (Soil and Sediment Remediation): MP-00179-VL, MP-00181-OT, MP-00391-VL, MS-00893-OT (the former millsite), MP-00951-VL, MP-00990-CS, MG-01026-VL, MG-01027-VL, MG-01029-VL, MG-01030-VL, MG-01033-VL, MP-01077-VL, MP-01084-VL issued.	August 2004
Remedial Action Report for Monticello Mill Tailings (USDOE) Site Repository issued.	August 2004
MMTS OU III IRA report issued documenting interim action is complete.	September 2004
Preliminary Close Out Report Monticello Mill Tailings (USDOE) Site Operable Units I, II and III issued (DOE 2004c). Established “construction complete” status for OU I properties, 12 OU II properties where contaminated surface water or groundwater is present, and OU III.	September 29, 2004
Ex situ groundwater treatment system installed as a treatability study for OU III.	2005
Ex situ groundwater treatment system expanded.	2007
Cooperative Agreement between DOE and City of Monticello extended to December 31, 2016.	April 2007
Third CERCLA Five-Year Review report completed.	June 2007
Long-Term Surveillance and Maintenance Plan for the Monticello NPL Sites updated, consolidated from volumes I–IV, April 2002 (DOE 2007). The plan established procedures for conducting LTS&M at the MMTS to ensure that the remedy remains protective.	June 2007
MMTS OU III Analysis of Uranium Trends in Groundwater issued, confirming that ROD’s specified performance metrics were not met for groundwater restoration.	August 2007
Explanation of Significant Difference (ESD) for the Monticello Mill Tailings (USDOE) Site Operable Unit III, Surface Water and Ground Water (DOE 2009a) issued to implement the contingency remedy for MMTS OU III.	January 2009
Monticello Mill Tailings Site Operable Unit III Water Quality Compliance Strategy (DOE 2009b) issued.	December 2009
Fourth CERCLA Five-Year Review report completed.	June 2012
Final Groundwater Contingency Remedy Optimization Remedial Design/Remedial Action Work Plan, for the Monticello Mill Tailings Site Operable Unit III, Monticello, Utah (DOE 2014) issued.	February 2014
Groundwater remediation system expanded in area of attainment under *Final Groundwater Contingency Remedy Optimization Remedial Design/Remedial Action Work Plan, for the Monticello Mill Tailings Site Operable Unit III, Monticello, Utah* (DOE 2014).	January 2015
Seep 6 sampling by DOE.	September 2015
Remedial Action Completion Report for Operable Unit III Groundwater Contingency Remedy Optimization System Monticello Mill Tailings Site, Monticello, Utah (DOE 2016) issued.	May 2016
Cooperative Agreement between DOE and City of Monticello extended to March 31, 2022.	March 31, 2017
Fifth CERCLA Five-Year Review report completed.	June 2017
Revision to LTS&M Plan.	June 2018
Monticello Mill Tailings Site Operable Unit III, Groundwater Flow Conceptual Site Model Update (DOE 2019b) issued.	April 2019
Monticello Mill Tailings Site Operable Unit III, Geochemical Conceptual Site Model Update (DOE 2020b) issued.	July 2020

Chronology of MMTS Events (continued)

Event	Date
Monticello Mill Tailings Site Operable Unit III, Groundwater Flow and Contaminant Transport Model Report (DOE 2021e) issued.	June 2021
Seep 6 sampling completed by DOE.	October 2021
Monitored Natural Attenuation Demonstration Report, Operable Unit III, Monticello Mill Tailings Site, Monticello, Utah (DOE 2021c) issued.	December 2021
Cooperative Agreement between DOE and the City of Monticello extended to January 30, 2023	January 2022
Fifth CERCLA Five-Year Review report completed.	June 2022

Attachment 1

Examples of Sample Handling and Custody Documentation

Laboratory Sample Receipt Form

Login Sample Receipt Checklist

Client: RSI EnTech LLC

Job Number: 280-165100-1

Login Number: 165100
List Number: 1
Creator: Lee, Jerry

List Source: Eurofins Denver

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Bottle Label

Project: Monticello Monitoring

Task: MNT01-01.2204011

Sample ID: MNT01-01.2204011-001

Location Code: 0200

Lab: PAR

Matrix: GW

Containter: HDPE 500 ML

Preservative: 4 C

Filtered: Yes No

Composite: No

Analytes: IC: Cl, F, SO4

Sampler(s):___________________ Date: ____________ Time: __________

Chain of Custody / Sample Submittal Form

Task Code: MNT01-01.2204011 **COC ID:** MNT01-01.2204011-COC.1 **TURNAROUND TIME:** 28

PROJECT INFORMATION		LABORATORY		SAMPLING / SHIPPING	
Facility Name	Monticello Disposal and Process Sites	Lab Name:	ALS Laboratory Group	Shipping Company:	
Project Number	LMIDIQ.202.03.02.01.050.CMTGWM	Address:	225 Commerce Dr.	Tracking Number:	
Project Name:	Monticello Monitoring	City:	Ft. Collins State: CO	Cooler Count:	
		Postal Code:	80524	Team Lead:	
		Phone Number:	970-490-1511	Sampler 1:	
		PO Number:		Sampler 2:	

SAMPLE DETAILS / **ANALYSIS REQUESTED** — Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Location	Matrix	Date	Time (24hr)	G=Grab C=Comp	QC	# of Cont	IC: Cl, F, SO4	ICP: Ca, Fe, Mn, Mg, K, Na	ICPMS: As, Mo, Se, U, V	NO3/NO2-N	TDS
Container								HDPE 500 ML	HDPE 500 ML		HDPE 250 ML	HDPE 500 ML
Filtered								N	N		N	N
Preserv.								4 C	HNO3		4 C, H2SO4	4 C
MNT01-01.2204011-001	0200	GW			G		3	1 N	1 N	X	1 N	
MNT01-01.2204011-002	0202	GW			G		3	1 N	1 N	X	1 N	
MNT01-01.2204011-003	2690	GW			G		3	1 N	1 N	X	1 N	
MNT01-01.2204011-004	2691	GW			G		3	1 N	1 N	X	1 N	
MNT01-01.2204011-005	2692	GW			G		3	1 N	1 N	X	1 N	
MNT01-01.2204011-006	2693	GW			G		3	1 N	1 N	X	1 N	
MNT01-01.2204011-007	82-08	GW			G		3	X	1 N	X	1 N	1 N
MNT01-01.2204011-008	88-85	GW			G		3	X	1 N	X	1 N	1 N
MNT01-01.2204011-009	92-07	GW			G		3	1 N	1 N	X	1 N	
MNT01-01.2204011-010	92-08	GW			G		3	1 N	1 N	X	1 N	
MNT01-01.2204011-011	92-09	GW			G		3	1 N	1 N	X	1 N	
MNT01-01.2204011-054	92-11	GW			G		3	1 N	1 N	X	1 N	
MNT01-01.2204011-013	MW00-01	GW			G		3	1 N	1 N	X	1 N	
MNT01-01.2204011-014	MW00-06	GW			G		3	X	1 N	X	1 N	1 N

X = shared container

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY	DATE/TIME	ACCEPTED BY	DATE/TIME
	Signature by Relinquisher	8/3/2022 12:00	*Signature by Recipient*	8/3/2022 12:00

Attachment 2

Copy of the Certificate of Accreditation for GEL Laboratories

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

GEL LABORATORIES, LLC[6]
2040 Savage Road
Charleston, SC 29414
Robert L. Pullano Phone: (843) 556-8171
rlp@gel.com

ENVIRONMENTAL

Valid To: June 30, 2023 Certificate Number: 2567.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2017, the 2009 and 2016 TNI Environmental Testing Laboratory Standard, the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) and the requirements of the Department of Energy Consolidated Audit Program (DOECAP) as detailed in version 5.3 of the DoD/DOE Quality Systems Manual for Environmental Laboratories), accreditation is granted to this laboratory to perform the following radiochemical tests in various matrices, including soils, drinking water, wastewater, groundwater, fiber air filters, vegetation, animal tissues, milk, and construction debris:

Test(s)	Preparation SOP(s)	Analytical SOP(s)
Alpha Spectrometry: Alpha: Am-241, Am-243, Cf-252, Cm-242, Cm-243/244, Cm-245/246, Np-237, Po-208, Po-209, Po-210, Pu-236, Pu-238, Pu-239/240, Pu-242, Pu-244, Ra-224, Ra-226, Th-228, Th-229, Th-230, Th-232, U-232, U-233/234, U-235/236, U-238	GL-RAD-A-011, GL-RAD-A-015 GL-RAD-A-016, GL-RAD-A-021, GL-RAD-A-026 GL-RAD-A-032, GL-RAD-A-036, GL-RAD-A-038, GL-RAD-A-046, GL-RAD-A-053, GL-RAD-A-066, GL-RAD-A-069	GL-RAD-I-009, GL-RAD-I-015, GL-RAD-I-018
Radon Emanation: Ra-226	GL-RAD-A-008, GL-RAD-A-015, GL-RAD-A-021, GL-RAD-A-026, GL-RAD-A-028	GL-RAD-I-007

<u>Test(s)</u>	<u>Preparation SOP(s)</u>	<u>Analytical SOP(s)</u>
<u>Gamma Spectrometry</u>:		
Gamma: 46 to 1836 keV, I-129, I-131, Ni-59	GL-RAD-A-006, GL-RAD-A-013, GL-RAD-A-015, GL-RAD-A-021, GL-RAD-A-022, GL-RAD-A-026	GL-RAD-I-001
<u>Gas Flow Proportional Counting</u>:		
Alpha: Total Radium	GL-RAD-A-010, GL-RAD-A-044, GL-RAD-A-063	GL-RAD-I-006, GL-RAD-I-015, GL-RAD-I-016, GL-RAD-I-021
48 Hour Gross Alpha	GL-RAD-A-047	
Gross Alpha/Gross Beta	GL-RAD-A-001, GL-RAD-A-001B, GL-RAD-A-001C, GL-RAD-A-001D	
Beta: Cl-36, I-131, Pb-210, Ra-228, Sr-89, Sr-90	GL-RAD-A-004, GL-RAD-A-015, GL-RAD-A-017, GL-RAD-A-018, GL-RAD-A-021, GL-RAD-A-026, GL-RAD-A-029, GL-RAD-A-030, GL-RAD-A-033, GL-RAD-A-058, GL-RAD-A-063, GL-RAD-A-071	

Test(s)	**Preparation SOP(s)**	**Analytical SOP(s)**
Liquid Scintillation Spectrometry: Gross Alpha/Gross Beta Alpha: Rn-222 Beta: C-14, Ca-45, Cl-36, Fe-55, H-3, Ni-63, P-32, Pm-147, Pu-241, S-35, Se-79, Sr-89/90, Sr-90, Tc-99 Pyrolysis Preparation C-14, H-3 (Special Matrices)	GL-RAD-A-056 GL-RAD-A-007 GL-RAD-A-002, GL-RAD-A-003, GL-RAD-A-005, GL-RAD-A-015, GL-RAD-A-019, GL-RAD-A-020, GL-RAD-A-021 GL-RAD-A-022, GL-RAD-A-026 GL-RAD-A-031, GL-RAD-A-033, GL-RAD-A-035, GL-RAD-A-040, GL-RAD-A-041 GL-RAD-A-048, GL-RAD-A-049, GL-RAD-A-050, GL-RAD-A-051, GL-RAD-A-052, GL-RAD-A-059, GL-RAD-A-064, GL-RAD-A-065, GL-RAD-A-067	GL-RAD-I-004, GL-RAD-I-014, GL-RAD-I-017, GL-RAD-I-018
ICP-MS: Uranium Isotopes (U-233, U-234, U-235, U-236, U-238), Tc-99	GL-RAD-A-005, GL-RAD-A-015, GL-RAD-A-021, GL-RAD-A-026, GL-RAD-A-060, GL-RAD-A-070	GL-RAD-B-034

Additionally, In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2017, the 2009 and 2016 TNI Environmental Testing Laboratory Standard, the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) and the requirements of the Department of Energy Consolidated Audit Program (DOECAP) as detailed in version 5.3 of the DoD/DOE Quality Systems Manual for Environmental Laboratories), accreditation is granted to this laboratory to perform recognized EPA, Standard Methods for the Examination of Water and Wastewater, ASTM, California and Connecticut test methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies
Atomic Absorption/ICP-AES Spectrometry, ICP/MS, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Gravimetry, High Performance Liquid Chromatography, Ion Chromatography, Methylene Blue Active Substances, Misc.-Electronic Probes (pH, O_2), Oxygen Demand, Hazardous Waste Characteristics Tests, Spectrophotometry (Visible), Spectrophotometry (Automated), IR Spectrometry, Titrimetry, Total Organic Carbon, Total Organic Halide, Turbidity, Liquid Chromatography/Mass Spectrometer/Mass Spectrometer, and Various Radiochemistry Techniques

Parameter/Analyte	**Potable Water**	**Aqueous Film Forming Foams (AFFF)**	**Non-potable Water**	**Tissue**	**Solid Hazardous Waste (Liquids and Solids)**
Per-and Polyfluoroalkyl Substances (PFAS)					
Perfluoro(2-ethoxyethane) Sulfonic Acid (PFEESA)	EPA 533	-------------	-------------	-------------	-------------
Hexafluoropropyleneoxide Dimer Acid (HFPO-DA) (GenX)	EPA 533	-------------	-------------	-------------	-------------
Nonafluoro-3,6-dioxaheptanoic Acid (NFDHA)	EPA 533	-------------	-------------	-------------	-------------
Perfluorooctane Sulfonic Acid (PFOS)	EPA 533	-------------	-------------	-------------	-------------
Perfluoroundecanoic Acid (PFUnA)	EPA 533	-------------	-------------	-------------	-------------
Perfluoropentanoic Acid (PFPeA)	EPA 533	-------------	-------------	-------------	-------------
Perfluoropentane Sulfonic Acid (PFPeS)	EPA 533	-------------	-------------	-------------	-------------
1H, 1H, 2H, 2H-Perfluorooctane Sulfonic Acid (6:2 FTS)	EPA 533	-------------	-------------	-------------	-------------
Perfluorohexanoic Acid (PFHxA)	EPA 533	-------------	-------------	-------------	-------------
Perfluorododecanoic Acid (PFDOA)	EPA 533	-------------	-------------	-------------	-------------
Perfluorooctanoic Acid (PFOA)	EPA 533	-------------	-------------	-------------	-------------
Perfluorodecanoic Acid (PFDA)	EPA 533	-------------	-------------	-------------	-------------
Perfluorohexane Sulfonic Acid (PFHxS)	EPA 533	-------------	-------------	-------------	-------------
Perfluorobutanoic Acid (PFBA)	EPA 533	-------------	-------------	-------------	-------------
Perfluorobutane Sulfonic Acid (PFBS)	EPA 533	-------------	-------------	-------------	-------------
Perfluoroheptanoic Acid (PFHpA)	EPA 533	-------------	-------------	-------------	-------------
Perfluoroheptane Sulfonic Acid (PFHpS)	EPA 533	-------------	-------------	-------------	-------------
Perfluorononanoic Acid (PFNA)	EPA 533	-------------	-------------	-------------	-------------
Perfluoro-3-methoxypropanoic Acid (PFMPA)	EPA 533	-------------	-------------	-------------	-------------
1H, 1H, 2H, 2H-Perfluorodecane Sulfonic Acid (8:2 FTS)	EPA 533	-------------	-------------	-------------	-------------
9-Chlorohexadecafluoro-3-oxanonane-1-Sulfonic Acid (9Cl-PF3ONS)	EPA 533	-------------	-------------	-------------	-------------
1H, 1H, 2H, 2H-Perfluorohexane Sulfonic Acid (4:2 FTS)	EPA 533	-------------	-------------	-------------	-------------

Parameter/Analyte	**Potable Water**	**Aqueous Film Forming Foams (AFFF)**	**Non-potable Water**	**Tissue**	**Solid Hazardous Waste (Liquids and Solids)**
11-Chloroeicosafluoro-3-oxaundecane-1-Sulfonic Acid (11-Cl-PF3OUdS)	EPA 533	--------------	--------------	--------------	--------------
Perfluoro-4-methoxybutanoic Acid (PFMBA)	EPA 533	--------------	--------------	--------------	--------------
4,8-Dioxa-3H-perfluorononanoic Acid (ADONA)	EPA 533	--------------	--------------	--------------	--------------
1H, 1H, 2H, 2H-Perflourooctane sulfonic acid (6:2 FTS)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
1H, 1H, 2H, 2H-Perfluorodecane Sulfonic Acid (8:2 FTS)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorobutane Sulfonic Acid (PFBS)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorobutanoic Acid (PFBA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorodecane Sulfonic Acid (PFDS)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorodecanoic Acid (PFDA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15

Parameter/Analyte	**Potable Water**	**Aqueous Film Forming Foams (AFFF)**	**Non-potable Water**	**Tissue**	**Solid Hazardous Waste (Liquids and Solids)**
Perfluorododecanoic Acid (PFDOA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoroheptane Sulfonic Acid (PFHpS)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoroheptanoic Acid (PFHpA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorohexane Sulfonic Acid (PFHxS)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorohexanoic Acid (PFHxA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorononane Sulfonic Acid (PFNS)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorononanoic Acid (PFNA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorooctane Sulfonamide (PFOSAm)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15

Parameter/Analyte	Potable Water	Aqueous Film Forming Foams (AFFF)	Non-potable Water	Tissue	Solid Hazardous Waste (Liquids and Solids)
Perfluorooctanoic Acid (PFOA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoropentanoic Acid (PFPeA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorotetradecanoic Acid (PFTDA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorotridecanoic Acid (PFTrDA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoroundecanoic Acid (PFUnDA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoropentane Sulfonic Acid (PFPeS)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorooctane Sulfonic Acid (PFOS)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15

Parameter/Analyte	**Potable Water**	**Aqueous Film Forming Foams (AFFF)**	**Non-potable Water**	**Tissue**	**Solid Hazardous Waste (Liquids and Solids)**
N-methyl perfluorooctanesulfonamido acetic acid (NMeFOSAA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Hexafluoropropyleneoxide dimer acid (HFPA-DA) (GenX)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
1 1-Chloroeicosafluoro-3- oxaundecane-1-sulfonic acid (1 1-C1-PF3OUdS)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
9-Chlorohexadecafluoro-3- oxanonane-1-sulfonic acid (9-C1- PF3ONS)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
4,8-Dioxa-3H-perfluorononanoic Acid (ADONA)	EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
N-Ethylperfluorooctane sulfonamide (EtFOSAm)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
N-Ethylperfluorooctane sulfonamido ethanol (EtFOSE)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15

Parameter/Analyte	Potable Water	Aqueous Film Forming Foams (AFFF)	Non-potable Water	Tissue	Solid Hazardous Waste (Liquids and Solids)
1H, 1H, 2H, 2H-Perfluorododecane sulfonic acid (10:2 FTS)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
N-Methylperfluorooctane sulfonamide (MeFOSA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
N-Methylperfluorooctane Sulfonamido Ethanol (MeFOSE)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorohexadecanoic Acid (PFHxDA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorooctadecanoic Acid (PFODA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoro-2-methoxyacetic acid (PFMOAA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoro-3-methoxypropanoic acid (PFMPA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15

Parameter/Analyte	**Potable Water**	**Aqueous Film Forming Foams (AFFF)**	**Non-potable Water**	**Tissue**	**Solid Hazardous Waste (Liquids and Solids)**
Perfluoro-4-methoxybutanoic acid (PFMBA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoro(3,5-dioxahexanoic) acid (PFO2HxA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoro(3,5,7-trioxaoctanoic) acid (PFO3OA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoro(3,5,7,9-tetraoxadecanoic) acid (PFO4DA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Nafion Byproduct 1 (NAFION_BP1)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Nafion Byproduct 2 (NAFION_BP2)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoro-3,5,7,9,11-pentaoxadodecanoic acid (PFO5DOA) (TAF)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15

Parameter/Analyte	Potable Water	Aqueous Film Forming Foams (AFFF)	Non-potable Water	Tissue	Solid Hazardous Waste (Liquids and Solids)
4-Heptafluoroisopropoxy) hexafluoro butanoic acid (PFECA-G)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluoroethoxypropyl carboxylic acid (PEPA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
Perfluorododecane sulfonic acid (PFDoS)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
2-Perfluorohexyl ethanoic acid (6:2FTA) (FHEA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
2-Perfluorooctyl ethanoic acid (8:2FTA) (FOEA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
2-Perfluorodecyl ethanoic acid (10:2FTA) (FDEA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
4,4,5,5,6,6-Heptafluorohexanoic acid (3:3 FTCA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15

Parameter/Analyte	Potable Water	Aqueous Film Forming Foams (AFFF)	Non-potable Water	Tissue	Solid Hazardous Waste (Liquids and Solids)
2H, 2H, 3H, 3H-Perfluorooctanoic acid (5:3 FTCA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15
2H, 2H, 3H, 3H-Perfluorodecanoic acid (7:3 FTCA)	EPA 537.1 (M)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Metals		
Aluminum	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Antimony	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B[2]
Arsenic	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Barium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Beryllium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Bismuth	EPA 200.8/6020 EPA 6020A/6020B	EPA 6020A/6020B
Boron	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Cadmium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Calcium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Chromium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Cobalt	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Copper	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Hafnium	EPA 200.8 EPA 6020A/6020B	EPA 6020A/6020B
Iron	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Lead	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Lithium	EPA 200.8 EPA 6020A/6020B	EPA 6020A/6020B
Magnesium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Manganese	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Mercury	EPA 245.1/245.2 EPA 7470/7470A EPA 1631E	EPA 7470/7470A EPA 7471A/7471B
Molybdenum	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Nickel	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Phosphorous	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Potassium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Rhenium	EPA 200.8 EPA 6020A/6020B	EPA 6020A/6020B
Rhodium	EPA 200.8 EPA 6020A/6020B	EPA 6020A/6020B
Selenium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Silicon[1]	EPA 200.7 EPA 6010C/6010D	EPA 6010C/6010D
Silica as SiO2	EPA 200.7 EPA 6010C/6010D	EPA 6010C/6010D

Parameter/Analyte	**Nonpotable Water**	**Solid Hazardous Waste (Liquids and Solids)**
Silver	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B[2]
Sodium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Strontium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Sulfur	EPA 200.7 EPA 6010C/6010D	EPA 6010C/6010D
Tantalum	EPA 6020A/6020B	EPA 6020A/6020B
Thallium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Thorium	EPA 200.8 EPA 6020A/6020B	EPA 6020A/6020B
Tin	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B[2]
Titanium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Tungsten	EPA 200.8 EPA 6020A/6020B	EPA 6020A/6020B
Uranium	EPA 200.8 EPA 6020A/6020B ASTM D5174-02/97 DOE U-02	EPA 6020A/6020B DOE U-02
Isotopic Uranium	EPA 200.8 EPA 6020A/6020B	EPA 6020A/6020B
Vanadium	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Zinc	EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B	EPA 6010C/6010D EPA 6020A/6020B
Zirconium	EPA 200.8 EPA 6020A/6020B	EPA 6020A/6020B
General Chemistry		
Acidity	EPA 305.1 SM 2310B	----------
Adsorbable Organic Halogens (AOX)	EPA 1650	----------
Alkalinity	EPA 310.1 SM 2320B	----------
Ammenable Cyanide	EPA 9012A/9012B EPA 335.1 SM 4500-CN^- G	EPA 9012A/9012B

Parameter/Analyte	**Nonpotable Water**	**Solid Hazardous Waste (Liquids and Solids)**
Ammonia Nitrogen (and distillation)	EPA 350.1 SM 4500NH_3 B/H	EPA 350.1 Modified
Biochemical Oxygen Demand (BOD)	EPA 405.1 SM 5210 B	----------
Bromide	EPA 300.0 EPA 9056A	EPA 9056A[3]
Carbon Dioxide (Total and Free by calculation)	SM 4500-CO_2 D	----------
Carbonaceous BOD (CBOD)	EPA 405.1 SM 5210B	----------
Chemical Oxygen Demand (COD)	EPA 410.4	----------
Chloride	EPA 300.0 EPA 9056A	EPA 9056A[3]
Chlorine (residual)	EPA 330.5 SM 4500-Cl G	----------
Chromium VI	EPA 7196A SM 3500-Cr B	EPA 7196A
Color	EPA 110.2 SM 2120B	----------
Corrosivity toward Steel	----------	EPA 1110/1110A
Cyanide	EPA 335.4 EPA 9012A/9012B SM4500-CN^-E/G	EPA 9012A/9012B
Density	----------	ASTM D5057
Extractable Organic Halides (EOX)	----------	EPA 9023
Fluoride	EPA 300.0 EPA 9056A	EPA 9056A[3]
Ignitability	EPA 1020A/1020B/1020C	EPA 1020A/1020B/1020C
Iodide	EPA 300.0 EPA 9056A	EPA 9056A
Hardness (by calculation/titration)	EPA 130.2 EPA 200.7/200.8 EPA 6010C/6010D EPA 6020A/6020B SM 2340B/C	EPA 6010C/6010D EPA 6020A/6020B
Kjeldahl Nitrogen (TKN)	EPA 351.2 SM 4500N_{org} D	EPA 351.2 Modified
MBAS/Surfactants	SM 5540C	----------
Nitrate (as N)	EPA 300.0 EPA 9056A SM4500-NO_3-F	EPA 9056A[3]
Nitrate-nitrite (as N)	EPA 300.0, 353.2 EPA 9056A SM 4500 NO_3-F	EPA 9056A[3]
Nitrite (as N)	EPA 300.0 EPA 9056A	EPA 9056A[3]
Oil & Grease	EPA 1664A	EPA 1664A[2]

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Organic Nitrogen	EPA 350.1 EPA 351.2 TKN – Ammonia	----------
Orthophosphate (as P)	EPA 300.0 EPA 9056A	EPA 9056A[3]
Oxygen, Dissolved	SM 4500 G	----------
Paint Filter Liquids Test	----------	EPA 9095B
Perchlorate	EPA 314.0 EPA 6850	EPA 314.0 Modified EPA 6850
pH	EPA 150.1 EPA 9040B/9040C EPA 9041A SM 4500-H^+ B	EPA 9040B/9040C EPA 9045C/9045D EPA 9041A
Reactive Cyanide	Sec 7.3.3 SW846	Sec 7.3.3 SW846
Reactive Sulfide	Sec 7.3.4 SW846	Sec 7.3.4 SW846
Residue- Filterable (TDS)	EPA 160.1 SM 2540C	----------
Residue- Nonfilterable (TSS)	EPA 160.2 SM 2540D	----------
Residue- Total	EPA 160.3 SM 2540B	----------
Residue- Total, fixed, and volatile	SM 2540G	----------
Residue- Volatile	EPA 160.4 SM 2540E	----------
Salinity	SM 2520B	----------
Specific conductance	EPA 120.1 EPA 9050A/120.1 SM 2510B	----------
Sulfate	EPA 300.0 EPA 9056A	EPA 9056A[3]
Sulfite	SM 4500-SO_3^{2-} B	----------
Sulfide	EPA 376.2 EPA 9030B EPA 9034 SM 4500 S^{2-}D	EPA 9030B EPA 9034
Total Nitrate-Nitrite	EPA 353.2 SM 4500-NO_3^-F	----------
Total Organic Carbon (TOC)	EPA 9060/9060A SM 5310B/415.1	EPA 9060/9060A[2]
Total Organic Halides (TOX)	EPA 9020B	EPA 9020B[2]
Total Petroleum Hydrocarbons	EPA 1664A	EPA 1664A
Total Phenolics	EPA 420.4 EPA 9066	EPA 9066
Total Phosphorous	EPA 365.4 SM 4500-P H	EPA 365.4 Modified
Turbidity	EPA 180.1 SM 2130B	----------

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Organic Analytes		
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1 EPA 624.1 EPA 8011 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,2 Dibromoethane (EDB)	EPA 504.1 EPA 624.1 EPA 8011 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,2,3-Trichloropropane	EPA 504.1 EPA 624.1 EPA 8011 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Purgeable Organics (Volatiles)		
1,1,1,2-Tetrachloroethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,1,1-Trichloroethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,1,2,2-Tetrachloroethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
1,1,2-Trichloroethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,1-Dichloroethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,1-Dichloroethene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,1-Dichloropropene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,2,3-Trichlorobenzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,2,3-Trichloropropane	EPA 504.1 EPA 624.1 EPA 8011 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
1,2,4-Trichlorobenzene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E SM 6200B	EPA 8260C/8260D EPA 8270D/8270E
1,2,4-Trimethylbenzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260B/8060C/8260D
1,2-Dichlorobenzene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E SM 6200B	EPA 8260C/8260D EPA 8270D/8270E
1,2-Dichloroethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,2-Dichloropropane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,3,5-Trimethylbenzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,3-Dichlorobenzene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E SM 6200B	EPA 8260C/8260D EPA 8270D/8270E
1,3-Dichloropropane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
1,4-Dichlorobenzene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E SM 6200B	EPA 8260C/8260D EPA 8270D/8270E
1,4-Dioxane	EPA 522 EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E [4]	EPA 8260C/8260D EPA 8270D/8270E [4]
1-Chlorohexane	EPA 8260D	EPA 8260B/8260D
2,2-Dichloropropane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
2-Butanone (Methyl Ethyl Ketone)	EPA 624.1 EPA 8015C/8015D EPA 8260C/8260D	EPA 8015C/8015D EPA 8260C/8260D
2-Chloroethyl vinyl ether	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
2-Chlorotoluene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
2-Hexanone	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
2-Nitropropane	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
2-Pentanone	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
4-Chlorotoluene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
4-Isopropyltoluene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
4-Methyl-2-pentanone	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Acetone	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Acetonitrile	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Acrolein (propanol)	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Acrylonitrile	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Allyl Chloride	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Benzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Benzyl chloride	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Bis(2-chloro-1 methyl-ethyl) ether	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E	EPA 8260C/8260D EPA 8270D/8270E
Bromobenzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Bromochloromethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Bromodichloromethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Bromoform	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Bromomethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Carbon disulfide	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Carbon tetrachloride	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Chlorobenzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Chloroethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Chloroform	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Chloromethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Chloroprene	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
cis-1,2-Dichloroethene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
cis-1,3-Dichloropropene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
cis-1,4-Dichloro-2-butene	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Cyclohexane	EPA 8260C/8260D	EPA 8260C/8260D
Cyclohexanone	EPA 8260C/8260D	EPA 8260C/8260D
Cyclohexene	EPA 8260B/8260D	EPA 8260B/8260D
Dibromochloromethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Dibromomethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Dichlorodifluoromethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Diethyl ether	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Ethyl Acetate	EPA 624.1 EPA 8015C/8015D EPA 8260C/8260D	EPA 8015C/8015D EPA 8260C/8260D
Ethyl Benzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Ethyl methacrylate	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Ethyl tert-butyl ether	EPA 8260D	EPA 8260B/8260D

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Hexachlorobutadiene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E SM 6200B	EPA 8260C/8260D EPA 8270D/8270E
Hexane	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Iodomethane	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Isobutyl alcohol	EPA 624.1 EPA 8015B/8015C EPA 8260C/8260D	EPA 8260C/8260D
Isopropyl alcohol	EPA 8260B/8260D	EPA 8260B/8260D
Isopropylbenzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Isopropyl ether	EPA 8260D SM 6200B	EPA 8260D
m+p-Xylene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Methacrylonitrile	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Methyl acetate	EPA 8260C/8260D	EPA 8260C/8260D
Methyl methacrylate	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Methyl tert-amyl ether (TAME)	EPA 8260D	EPA 8260D
Methyl tert-butyl ether (MTBE)	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Methylcyclohexane	EPA 8260C/8260D	EPA 8260C/8260D
Methylene chloride	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Naphthalene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E [4] SM 6200B	EPA 8260C/8260D EPA 8270D/8270E [4]
n-Butyl alcohol	EPA 624.1 EPA 8015C/8015D EPA 8260C/8260D	EPA 8015C/8015D EPA 8260C/8260D
n-Butylbenzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
n-Propylbenzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
o-Xylene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Pentachloroethane	EPA 624.1 EPA 8260C/8260D EPA 8270D/8270E	EPA 8260C/8260D EPA 8270D/8270E
Propionitrile	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Sec-Butylbenzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Styrene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
tert-Butyl Alcohol	EPA 8260C/8260D	EPA 8260C/8260D
tert-Butylbenzene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Tetrachloroethene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Tetrahydrofuran	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Toluene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
trans-1,2-Dichloroethene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
trans-1,3-Dichloropropene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
trans-1,4-Dichloro-2-butene	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Trichloroethene	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Trichlorofluoromethane	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Trihalomethanes	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Vinyl Acetate	EPA 624.1 EPA 8260C/8260D	EPA 8260C/8260D
Vinyl Chloride	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D
Xylenes, Total	EPA 624.1 EPA 8260C/8260D SM 6200B	EPA 8260C/8260D

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Semivolatile Compounds		
1,2,4,5-Tetrachlorobenzene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
1,2,4-Trichlorobenzene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E SM 6200B	EPA 8260C/8260D EPA 8270D/8270E
1,2-Dichlorobenzene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E SM 6200B	EPA 8260C/8260D EPA 8270D/8270E
1,2-Diphenylhydrazine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
1,3,5-Trinitrobenzene	EPA 625.1 EPA 8330A/8330B[5] EPA 8270D/8270E	EPA 8330A/8330B[5] EPA 8270D/8270E
1,3-Dichlorobenzene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E SM 6200B	EPA 8260C/8260D EPA 8270D/8270E
1,3-Dinitrobenzene	EPA 625.1 EPA 8330A/8330B[5] EPA 8270D/8270E	EPA 8330A/8330B[5] EPA 8270D/8270E
1,4-Dichlorobenzene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E SM 6200B	EPA 8260C/8260D EPA 8270D/8270E
1,4-Dioxane	EPA 522 EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E	EPA 8260C/8260D EPA 8270D/8270E
1,4-Dinitrobenzene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
1,4-Naphthoquinone	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
1,4-Phenylenediamine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
1-Methylnaphthalene	EPA 625.1 EPA 8270D/8270E[4]	EPA 8270D/8270E[4]
1-Naphthylamine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2,2-Dichlorobenzil	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2,3,4,6-Tetrachlorophenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
2,3-Dichloroaniline	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2,4,5-Trichlorophenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2,4,6-Trichlorophenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2,4-Dichlorophenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2,4-Dimethylphenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2,4-Dinitrophenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2,4-Dinitrotoluene	EPA 625.1 EPA 8330A/8330B[5] EPA 8270D/8270E	EPA 8330A/8330B[5] EPA 8270D/8270E
2,6-Dichlorophenol	EPA 625.1/8270C/8270D/8270E	EPA 8270D/8270E
2,6-Dinitrotoluene	EPA 625.1 EPA 8330A/8330B[5] EPA 8270D/8270E	EPA 8330A/8330B[5] EPA 8270D/8270E
2-Acetylaminofluorene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2-Butoxyethanol	EPA 8270D/8270E	EPA 8270C/8070D/8270E
2-Chloronaphthalene	EPA 625.1 EPA 8270D/8270E[4]	EPA 8270D/8270E[4]
2-Chlorophenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2-Ethoxyethanol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2-Methyl-4,6-Dinitrophenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2-Methylnaphthalene	EPA 625.1 EPA 8270D/8270E[4]	EPA 8270D/8270E
2-Methylphenol (o-cresol)	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2-Naphthylamine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2-Nitroaniline	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2-Nitrophenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
2-Picoline (2-Methylpyridine)	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
3,3'-Dichlorobenzidine	EPA 625.1 EPA 8270C/8270D[4]/8270E	EPA 8270D/8270E
3,3'-Dimethylbenzidine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
3/4-Methylphenols(m/p cresols)	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
3-Methylcholanthrene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
3-Nitroaniline	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
4,4-Dichlorodiphenyl sulfone	EPA 8270D/8270E	EPA 8270D/8270E
4-Aminobiphenyl	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
4-Bromophenyl phenyl ether	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
4-Chloro-3-methylphenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
4-Chloroaniline	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
4-Chlorophenyl phenyl ether	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
4-Nitroaniline	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
4-Nitrophenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
5-Nitro-o-toluidine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
7,12-Dimethylbenz(a)anthracene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Acenaphthene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Acenaphthylene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Acetophenone	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
alpha, alpha-Dimethylphenethylamine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
alpha-Terpineol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Aniline	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Anthracene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Aramite	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Atrazine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Benzaldehyde	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Benzidine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Benzo (a) anthracene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Benzo (a) pyrene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Benzo (b) fluoranthene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Benzo (ghi) perylene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Benzo (k) fluoranthene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Benzoic acid	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Benzyl alcohol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Biphenyl	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Bis(2-chloroethoxy) methane	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Bis(2-chloroethyl) ether	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Bis(2-chloro-1 methyl-ethyl) ether	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Bis(2-ethylhexyl) phthalate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Butyl benzyl phthalate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Caprolactam	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Carbazole	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Chlorobenzilate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Chrysene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
cis-Diallate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Diallate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Dibenzo (a,e) pyrene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Dibenzo (a,h) anthracene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Dibenzofuran	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Diethyl phthalate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Dimethoate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Dimethyl phthalate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Di-n-butyl phthalate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Di-n-octyl phthalate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Dinoseb	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Diphenylamine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Disulfoton	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Ethyl Methacrylate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Ethyl Methanesulfonate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Famphur	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Fluoranthene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Fluorene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Hexachlorobenzene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Hexachlorobutadiene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E SM 6200B	EPA 8260C/8260D EPA 8270D/8270E
Hexachlorocyclopentadiene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Hexachloroethane	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Hexachlorophene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Indeno (1,2,3-cd) pyrene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Isodrin	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Isophorone	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Isosafrole	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Kepone	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Methapyrilene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Methyl methacrylate	EPA 8270D/8270E	EPA 8270D/8270E
Methyl methanesulfonate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Methyl parathion	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Methylene bis(2-chloroaniline)	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Naphthalene	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E [4] SM 6200B	EPA 8260C/8260D EPA 8270D/8270E [4]

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Nitrobenzene	EPA 625.1 EPA 8330A EPA 8270D/8270E	EPA 8330A EPA 8270D/8270E
Nitroquinoline-1-oxide	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
n-Decane	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
n-Nitrosodietheylamine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
n-Nitrosodimethylamine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
n-Nitrosodimethylethylamine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
n-Nitrosodi-n-butylamine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
n-Nitrosodi-n-propylamine	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E
n-Nitrosodiphenylamine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
n-Nitrosomorpholine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
n-Nitrosopiperidine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
n-Nitrosopyrrolidine	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E
n-Octadecane	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
o,o,o-Triethyl phosphorothioate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
o-Toluidine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Parathion, ethyl	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
p-Dimethylaminoazobenzene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Pentachlorobenzene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Pentachloroethane	EPA 624.1 EPA 625.1 EPA 8260C/8260D EPA 8270D/8270E	EPA 8260C/8260D EPA 8270D/8270E
Pentachloronitrobenzene	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Pentachlorophenol	EPA 625.1 EPA 8151A EPA 8270D/8270E	EPA 8151A EPA 8270D/8270E
Phenacetin	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Phenanthrene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Phenol	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Phorate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Prometon	EPA 625.1 EPA 8270D/8270E	EPA 625.1 EPA 8270D/8270E
Pronamide (Kerb)	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Pyrene	EPA 625.1 EPA 8270D/8270E [4]	EPA 8270D/8270E [4]
Pyridine	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Safrole	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Sulfolane	EPA 625.1 EPA 8270D/8270E	EPA 625.1 EPA 8270D/8270E
Sulfotepp	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Thionazin (Zinophos)	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
trans-Diallate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Tributyl Phosphate	EPA 625.1 EPA 8270D/8270E	EPA 8270D/8270E
Pesticides & PCBs		
2,4'-DDD	EPA 8081B	EPA 8081B
2,4'-DDE	EPA 8081B	EPA 8081B
2,4'-DDT	EPA 8081B	EPA 8081B
4,4'-DDT	EPA 608.3 EPA 8081B	EPA 8081B
4,4'-DDD	EPA 608.3 EPA 8081B	EPA 8081B
4,4'-DDE	EPA 608.3 EPA 8081B	EPA 8081B
Aldrin	EPA 608.3 EPA 8081B	EPA 8081B
alpha-BHC	EPA 608.3 EPA 8081B	EPA 8081B
beta-BHC	EPA 608.3 EPA 8081B	EPA 8081B
Chlordane (N.O.S)	EPA 608.3 EPA 8081B	EPA 8081B
cis-Chlordane (alpha-Chlordane)	EPA 608.3 EPA 8081B	EPA 8081B
cis-Nonachlor	EPA 8081B	EPA 8081B
delta-BHC	EPA 608.3 EPA 8081B	EPA 8081B
Dieldrin	EPA 608.3 EPA 8081B	EPA 8081B
Endonsulfan sulfate	EPA 608.3 EPA 8081B	EPA 8081B

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Endosulfan I	EPA 608.3 EPA 8081B	EPA 8081B
Endosulfan II	EPA 608.3 EPA 8081B	EPA 8081B
Endrin	EPA 608.3 EPA 8081B	EPA 8081B
Endrin aldehyde	EPA 608.3 EPA 8081B	EPA 8081B
Endrin ketone	EPA 608.3 EPA 8081B	EPA 8081B
gamma-BHC	EPA 608.3 EPA 8081B	EPA 8081B
Heptachlor	EPA 608.3 EPA 8081B	EPA 8081B
Heptachlor epoxide	EPA 608.3 EPA 8081B	EPA 8081B
Hexachlorobenzene	EPA 8081B	EPA 8081B
Methoxychlor	EPA 608.3 EPA 8081B	EPA 8081B
Mirex	EPA 8081B	EPA 8081B
Oxychlordane	EPA 8081B	EPA 8081B
Toxaphene	EPA 608.3 EPA 8081B	EPA 8081B
trans-Chlordane	EPA 608.3 EPA 8081B	EPA 8081B
trans-Nonachlor	EPA 8081B	EPA 8081B
PCB-1016 (Aroclor)	EPA 608.3 EPA 8082A	EPA 8082A
PCB-1221	EPA 608.3 EPA 8082A	EPA 8082A
PCB-1232	EPA 608.3 EPA 8082A	EPA 8082A
PCB-1242	EPA 608.3 EPA 8082A	EPA 8082A
PCB-1248	EPA 608.3 EPA 8082A	EPA 8082A
PCB-1254	EPA 608.3 EPA 8082A	EPA 8082A
PCB-1260	EPA 608.3 EPA 8082A	EPA 8082A
PCB-1262	EPA 608.3 EPA 8082A	EPA 8082A
PCB-1268	EPA 608.3 EPA 8082A	EPA 8082A
Total Aroclors	EPA 608.3 EPA 8082A	EPA 8082A
FID Compounds		
1,1,1-Trichloroethane	EPA 8015C/8015D	EPA 8015C/8015D

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
2-Butanone (Methyl Ethyl Ketone)	EPA 624.1 EPA 8015C/8015D EPA 8260C/8260D SM 6200B	EPA 8015C/8015D EPA 8260C/8260D
4-Methyl-2-Pentanone	EPA 8015C/8015D	EPA 8015C/8015D
Acetone	EPA 8015C/8015D	EPA 8015C/8015D
Benzene	EPA 8015C/8015D	EPA 8015C/8015D
Chloroform	EPA 8015C/8015D	EPA 8015C/8015D
Diesel Range Organics (DRO)	EPA 8015C/8015D	EPA 8015C/8015D
DRO/Motor Oil (DRO/ORO)	EPA 8015C/8015D	EPA 8015C/8015D
Diethylene glycol	EPA 8015C/8015D	EPA 8015C/8015D
Ethanol	EPA 8015C/8015D	EPA 8015C/8015D
Ethyl acetate	EPA 624.1 EPA 8015C/8015D EPA 8260C/8260D	EPA 8015C/8015D EPA 8260C/8260D
Ethylbenzene	EPA 8015C/8015D	EPA 8015C/8015D
Ethylene glycol	EPA 8015C/8015D	EPA 8015C/8015D
Gas Range Organics (GRO)	EPA 8015C/8015D	EPA 8015C/8015D
Kerosene	EPA 8015C/8015D	EPA 8015C/8015D
Isobutyl alcohol	EPA 624.1 EPA 8015C/8015D EPA 8260C/8260D	EPA 8015C/8015D EPA 8260C/8260D
Isopropyl alcohol (2-Propanol)	EPA 8015C/8015D	EPA 8015C/8015D
m, p-Xylenes	EPA 8015C/8015D	EPA 8015C/8015D
Methanol	EPA 8015C/8015D	EPA 8015C/8015D
Methylene chloride	EPA 8015C/8015D	EPA 8015C/8015D
n-Butyl alcohol	EPA 624.1 EPA 8015C/8015D EPA 8260C/8260D	EPA 8015C/8015D EPA 8260C/8260D
o-Xylene	EPA 8015C/8015D	EPA 8015C/8015D
Propylene glycol	EPA 8015C/8015D	EPA 8015C/8015D
Toluene	EPA 8015C/8015D	EPA 8015C/8015D
Triethylene glycol	EPA 8015C/8015D	EPA 8015C/8015D
Volatile Petroleum Products	NWTPH-Gx(WDOE)	NWTPH-Gx(WDOE)
Semi-Volatile Petroleum Products	NWTPH-Dx(WDOE)	NWTPH-Dx(WDOE)
C8-C10 Aliphatic, Aromatic EPH	WDOE EPH	WDOE EPH
>C10-C12 Aliphatic, Aromatic EPH	WDOE EPH	WDOE EPH
>C12-C16 Aliphatic, Aromatic EPH	WDOE EPH	WDOE EPH
>C16-C21 Aliphatic, Aromatic EPH	WDOE EPH	WDOE EPH
>C21-C34 Aliphatic, Aromatic EPH	WDOE EPH	WDOE EPH
Alaska GRO	AK-101 (GRO)	AK-101 (GRO)
Alaska DRO	AK-102 (DRO)	AK-102 (DRO)
Alaska RRO	AK-103 (RRO)	AK-103 (RRO)
EPH Aliphatic C9-C18	MADEP EPH	MADEP EPH
EPH Aliphatic C19-C36	MADEP EPH	MADEP EPH
EPH Aromatic C11-C22 Unadjusted	MADEP EPH	MADEP EPH

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Nitrosamines, Nitroaromatics	**8330A is by either LC/MS/MS or HPLC. 8330B is by LC/MS/MS**	
1,3,5-Trinitrobenzene	EPA 625.1 EPA 8330A/8330B[5] EPA 8270D/8270E	EPA 8330A/8330B[5] EPA 8270D/8270E
1,3-Dinitrobenzene	EPA 625.1 EPA 8330A/8330B[5] EPA 8270D/8270E	EPA 8330A/8330B[5] EPA 8270D/8270E
2,4,6-Trinitrotoluene	EPA 8330A/8330B[5]	EPA 8330A/8330B[5]
2,4-Dinitrotoluene	EPA 625.1 EPA 8330A/8330B[5] EPA 8270D/8270E	EPA 8330A/8330B[5] EPA 8270D/8270E
2,6-Dinitrotoluene	EPA 625.1 EPA 8330A/8330B[5] EPA 8270D/8270E	EPA 8330A/8330B[5] EPA 8270D/8270E
2-Amino-4,6-Dinitrotoluene	EPA 8330A/8330B[5]	EPA 8330A/8330B[5]
2-Nitrotoluene	EPA 8330A/8330B[5]	EPA 8330A/8330B[5]
Nitrosamines, Nitroaromatics	**8330B is by LC/MS/MS. 8330A is by either LC/MS/MS or HPLC.**	
3,5-Dinitroaniline	EPA 8330B[5]	EPA 8330B[5]
3-Nitrotoluene	EPA 8330A/8330B[5]	EPA 8330A/8330B[5]
4-Amino-2,6-Dinitrotoluene	EPA 8330A/8330B[5]	EPA 8330A/8330B[5]
4-Nitrotoluene	EPA 8330A/8330B[5]	EPA 8330A/8330B[5]
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	EPA 8330A/8330B[5]	EPA 8330A/8330B[5]
Nitrobenzene	EPA 625.1 EPA 8330A/8330B[5] EPA 8270D/8270E	EPA 8330A/8330B[5] EPA 8270D/8270E
Nitroglycerin	EPA 8330A/8330B[5]	EPA 8330A/8330B[5]
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330A/8330B[5]	EPA 8330A/8330B[5]
Pentaerythritoltetranitrate (PETN)	EPA 8330A/8330B[5]	EPA 8330A/8330B[5]
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330A/8330B[5]	EPA 8330A/8330B[5]
Dissolved Gases by FID		
Ethane	RSK 175	-------------------
Ethene	RSK 175	-------------------
Methane	RSK 175	-------------------
Herbicides		
2,4-D	EPA 8151A	EPA 8151A
2,4-DB	EPA 8151A	EPA 8151A
Dalapon	EPA 8151A	EPA 8151A
Dicamba	EPA 8151A	EPA 8151A
Dichloroprop	EPA 8151A	EPA 8151A
Dinoseb	EPA 625.1 EPA 8151A EPA 8270D/8270E	EPA 8151A EPA 8270D/8270E
MCPA	EPA 8151A	EPA 8151A
MCPP	EPA 8151A	EPA 8151A
2,4,5-T	EPA 8151A	EPA 8151A

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
2,4,5-TP (Silvex)	EPA 8151A	EPA 8151A
Pentachlorophenol	EPA 8151A EPA 8270D/8270E	EPA 8151A EPA 8270D/8270E
Radiochemistry		
Barium 133	DOE 4.5.2.3	DOE 4.5.2.3
Cesium 134	EPA 901.1 DOE 4.5.2.3	DOE 4.5.2.3
Cesium 137	EPA 901.1 DOE 4.5.2.3	DOE 4.5.2.3
Cobalt-60	EPA 901.1 DOE 4.5.2.3	DOE 4.5.2.3
Gamma Emitters	EPA 901.1 DOE 4.5.2.3	DOE 4.5.2.3
Gross Alpha	EPA 900.0 EPA 9310	EPA 9310
Gross Beta	EPA 900.0 EPA 9310	EPA 9310
Radioactive Iodine	EPA 901.1 EPA 902.0 DOE 4.5.2.3	DOE 4.5.2.3
Radium-226	EPA 903.1 DOE Ra-04	DOE Ra-04
Radium-228	EPA 904.0 EPA 9320 DOE 4.5.2.3	EPA 9320 DOE 4.5.2.3
Total Alpha Radium	EPA 903.0 EPA 9315	EPA 9315
Radon-222	SM 7500 Rn-B	----------
Strontium-89	EPA 905.0 DOE Sr-01	DOE Sr-01
Strontium-90	EPA 905.0 DOE Sr-02	DOE Sr-02
Thorium	EMSL-LV	EMSL-LV
Tritium	EPA 906.0	EPA 906.0 Modified
Uranium	EPA 200.8 EPA 6020A ASTM D5174-02/97 DOE U-02	EPA 6020/6020A DOE U-02
Zinc-65	EPA 901.1 DOE 4.5.2.3	DOE 4.5.2.3
Preparatory and Clean-up Methods		
Toxicity Characteristic Leaching Procedure (Inorganics, Extractable Organics, Volatile Organics)	EPA 1311	EPA 1311
Synthetic Precipitation Leaching Procedure	EPA 1312	EPA 1312
Waste Extraction Test (W.E.T.)	CCR Ch. 11, Article 5, Appendix II	CCR Ch. 11, Article 5, Appendix II
Anion Preparation	EPA 9056A[3]	EPA 9056A[3]

Parameter/Analyte	Nonpotable Water	Solid Hazardous Waste (Liquids and Solids)
Cyanide Distillation	EPA 9010B/9010C SM 4500CN⁻ C	EPA 9010B/9010C[3]
Sulfide Distillation	EPA 9030B	EPA 9030B
Metals Digestion	EPA 200.2 EPA 3005A EPA 3010A	EPA 3050B
Alkaline Digestion for Hex Chromium	----------	EPA 3060A
Bomb Preparation for Solid Waste	----------	EPA 5050
Mercury Preparation	EPA 245.1/245.2 EPA 7470/7470A	EPA 7471A/7471B
Separatory Funnel Liquid-Liquid Extraction	EPA 3510C	----------
Solid Phase Extraction	EPA 3535A	EPA 3535A (Liquid)
Automated Soxhlet Extraction	----------	EPA 3541
Ultrasonic Extraction	----------	EPA 3550C
Waste Dilution	----------	EPA 3580A
Waste Dilution for Volatile Organics	----------	EPA 3585
Purge and Trap for Volatile Organics	EPA 5030A/5030B/5030C	EPA 5030A EPA 5035/5035A/5035H/5035L
Alumina Clean-up	----------	EPA 3610B EPA 3611B
Florisil Clean-up	EPA 3620B/3260C	EPA 3620B/3620C
Silica Gel Clean-up	----------	EPA 3630C
Gel Permeation Clean-up	----------	EPA 3640A
Sulfur Clean-up	EPA 3660B	EPA 3660B
Sulfuric Acid/Permanganate Clean-up	EPA 3665A	EPA 3665A

[1] Calculated from silica determination
[2] Applicable only to liquid 'Solid Hazardous Waste', where liquids may include aqueous, non-aqueous, and oily wastes. Solids may include soils, sediments, sludges, tissues, filters and any matrix deemed non-liquid.
[3] The referenced method is modified to include a simple prep for non-aqueous and/or solid matrix samples.
[4] The analytes may be determined by Selective Ion Monitoring (SIM) using either 8270C or 8270D.
[5] 8330B analysis is performed on LC/MS/MS. 8330A may be performed on either LC/MS/MS or HPLC.

Drinking Water Organics	Drinking Water
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1
1,2 Dibromoethane (EDB)	EPA 504.1
1,2,3-Trichloropropane	EPA 504.1
1,4-Dioxane	EPA 522
Cannabinoids	**Hemp Vegetation, Oils, and Solids**
Cannabidiol (CBD)	GEL SOP GL-OA -E-078
Cannabidiolic Acid (CBDA)	GEL SOP GL-OA -E-078
delta-9-Tetrahydrocannabinol (delta-9-THC)	GEL SOP GL-OA -E-078
delta-9-Tetrahydrocannabinolic acid (delta-9-THCA)	GEL SOP GL-OA -E-078
Cannabinol (CBN)	GEL SOP GL-OA -E-078
delta-8-Tetrahydrocannabinol (delta-8-THC)	GEL SOP GL-OA -E-078
Tetrahydrocannabivarin (THCV)	GEL SOP GL-OA -E-078
Cannabigerol (CBG)	GEL SOP GL-OA -E-078
Cannabichromene (CBC)	GEL SOP GL-OA -E-078
Cannabigerolic Acid	GEL SOP GL-OA -E-078

Additionally, in recognition of the successful completion of the A2LA evaluation process (including an assessment of the laboratory's compliance with the 2009 and 2016 TNI Environmental Testing Laboratory Standard Requirements), accreditation is granted to this laboratory to perform the following bioassay analyses on <u>bone, tissue, urine, fecal, and nasal swabs</u>:

<u>Bioassay Analysis(s)</u>	<u>Preparation SOP(s)</u>	<u>Analytical SOP(s)</u>
<u>Alpha Spectrometry</u>: Alpha: Am-241, Cm-242, Cm-243/244, Cm 245/246, Cf-252, Np-237, Po-208, Po-209, Po-210, Pu-236, Pu-238, Pu-239/240, Pu-242, Pu-244, Ra-224, Ra-226, Th-228, Th-229, Th-230, Th-232, U-232, U-233/234, U-235/236, U-238	GL-RAD-B-001, GL-RAD-B-002, GL-RAD-B-010, GL-RAD-B-012, GL-RAD-B-013, GL-RAD-B-038, GL-RAD-B-040, GL-RAD-B-041 GL-RAD-B-042	GL-RAD-B-009
<u>Liquid Scintillation Spectrometry:</u> C-14, Fe-55, Gross Alpha, H-3, Ni-59, Ni-63, Pu-241, Tc-99	GL-RAD-B-001, GL-RAD-B-008, GL-RAD-B-011, GL-RAD-B-012, GL-RAD-B-013, GL-RAD-B-016, GL-RAD-B-020, GL-RAD-B-023, GL-RAD-B-039	GL-RAD-I-004, GL-RAD-I-014, GL-RAD-I-017
<u>Gas Flow Proportional Counting</u>: Beta: Sr-90	GL-RAD-B-001	GL-RAD-I-006, GL-RAD-I-015, GL-RAD-I-016
Gross Alpha/Gross Beta	GL-RAD-B-022	GL-RAD-I-006
<u>Radon Emanation:</u> Ra-226	GL-RAD-B-002	GL-RAD-I-007
<u>Refractometer</u>: Specific Gravity	GL-RAD-B-027	GL-RAD-B-027
<u>ICP-MS</u>: Uranium Isotopes (U-233, U-234, U-235, U-236, U-238), Th-230	GL-RAD-B-001, GL-RAD-B-035	GL-RAD-B-034
<u>Gamma Spectrometry</u>: Gamma: I-129, I-131, Ni-59, 46 to 1836 keV	GL-RAD-B-020, GL-RAD-A-013, GL-RAD-B-029, GL-RAD-B-030	GL-RAD-I-001

[6]HASQARD Reviewed Laboratory

Accredited Laboratory

A2LA has accredited

GEL LABORATORIES, LLC

Charleston, SC

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2017, the 2009 and 2016 TNI Environmental Testing Laboratory Standard, the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP), and the requirements of the Department of Energy Consolidated Audit Program (DOECAP) as detailed in Version 5.3 of the DoD/DOE Quality System Manual for Environmental Laboratories (QSM), accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

Presented this 16th day of June 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2567.01
Valid to June 30, 2023

For the tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.