Quality Assurance Program Plan
for the
West Virginia Department of Environmental Protection
Division of Land Restoration
Office of Environmental Remediation

Brownfields Section

Prepared by:
Office of Environmental Remediation
601 57th Street SE
Charleston, WV 25304

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Signature/Approval Page

Casey E. Korbini

Digitally signed by Casey E. Korbini
DN: cn=Casey E. Korbini, o, ou, email=Casey.E.Korbini@wv.gov, c=US
Date: 2023.07.06 15:50:23 -04'00'

Casey Korbini, Deputy Director — Date
WVDEP DLR/OER

Erin R. Brittain

Digitally signed by Erin R. Brittain
Date: 2023.07.06 15:46:11 -04'00'

Erin Brittain, Brownfields Program Manager — Date
WVDEP DLR/OER

Ross Brittain, PhD

Digitally signed by: Ross Brittain, PhD
DN: CN = Ross Brittain, PhD email = ross.a.brittain@wv.gov C = US O = WVDEP Office of Environmental Remediation OU = WVDEP-DLR-OER
Date: 2023.07.06 15:33:40 -04'00'

Ross Brittain, Quality Assurance Manager — Date
WVDEP DLR/OER

BRUCE SALYER

Digitally signed by BRUCE SALYER
Date: 2023.07.07 13:26:20 -04'00'

Delegated Approving Official (DAO) — Date
USEPA Region 3 Applied Science and Quality Assurance Branch (ASQAB)

Nowak, Joseph

Digitally signed by Nowak, Joseph
Date: 2023.07.07 11:53:57 -04'00'

Joseph Nowak, Brownfields Project Officer — Date
USEPA Region 3 Brownfields & Revitalization Branch

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Distribution List

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Acronym List

ATSDR	Agency for Toxic Substances and Disease Registry
BTAG	Biological Technical Assistance Group
CCV	Continuing Calibration Verification
CEL	Certified Environmental Laboratory
CLP	Contract Laboratory Program
COC	Chain of Custody
CSM	Conceptual Site Model
DAS	USEPA Delivery of Analytical Services
DL	Detection Limit
DLR	Division of Land Restoration, WVDEP
DOT	Department of Transportation
DQI	Data Quality Indicator
DQO	Data Quality Objective
EPCRA	Emergency Planning and Community Right-to-Know Act
ERT	Emergency Response Team
FID	Flame Ionization Detector
FOIA	Freedom of Information Act
FOM	Field Operations Manager
FSP	Field Sampling Plan
GIS	Geographic Information System
GPS	Global Positioning System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
IATA	International Air Transport Association
ICP	Inductively Coupled Plasma (spectroscopy)
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IS	Internal Standard
ITRC	Interstate Technology and Regulatory Council
LUST	Leaking Underground Storage Tank
LCS	Laboratory Control Sample
LOQ	Limit of Quantitation
LRS	Licensed Remediation Specialist
MB	Method Blank
MD	Matrix Duplicate
MDL	Method Detection Limit
MOA	Memorandum of Agreement
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAPL	Non-Aqueous Phase Liquid
OER	Office of Environmental Remediation, WVDEP
OSHA	Occupational Safety and Health Administration

PARCCS	Precisions, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PCB	Polychlorinated Biphenyl
PCP	Presumptive Conformance Program
PFAS	Per- and polyfluoroalkyl substances
PID	Photoionization Detector
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
QAPrP	Quality Assurance Program Plan
QA	Quality Assurance
QAM	Quality Assurance Manager
QAP	Quality Assurance Plan
QC	Quality Control
QMP	Quality Management Plan
RL	Reporting Limit
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
RSL	USEPA Regional Screening Level
SAR	Site Assessment Report
SAWP	Site Assessment Work Plan (aka SAP for Sampling Analysis Plan)
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitation Leaching Procedure
SQL	Sample Quantitation Limit
SVOC	Semi-Volatile Organic Compound
TCAU	Tanks Corrective Action Unit, WVDEP
TCLP	Toxicity Characteristic Leaching Procedure
TSA	Technical Systems Audit
UECA	Uniform Environmental Covenants Act
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VISL	Vapor Intrusion Screening Levels
VOC	Volatile Organic Compound
VRP	Voluntary Remediation Program
WQS	Water Quality Standard
WVDEP	West Virginia Department of Environmental Protection
XRF	X-Ray Fluorescence

1.0 Introduction

1.1 Background

1.1.1 Purpose

United States Environmental Protection Agency (USEPA) CIO 2105.0 (formerly Order 5360.1 A2) and the applicable Federal regulations establish a mandatory Quality System that applies to all USEPA organizations and organizations funded by USEPA. Organizations, such as the West Virginia Department of Environmental Protection (WVDEP), must ensure that data collected for the characterization of environmental processes and conditions are of the appropriate type and quality for the intended use and that environmental technologies are designed, constructed and operated according to defined expectations.

The *Quality Assurance Program Plan (QAPrP)* is intended for use by the WVDEP Division of Land Restoration (DLR), Office of Environmental Remediation (OER), Brownfields Section. The WVDEP-OER Brownfields Section administers the Brownfields Assistance Program, Voluntary Remediation Program (VRP), and the Uniform Environmental Covenants Act – Leaking Underground Storage Tank (UECA-LUST) Program. The Brownfields Assistance Program conducts environmental site assessments. The VRP and UECA-LUST Programs are both risk-based cleanup programs. However, they are different in both the scope of remediation and final completion documentation. The VRP assesses and remediates all contamination associated with identified historical property use, and applicants receive a Certificate of Completion to document remediation completion. The UECA-LUST Program is an alternative risk-based remediation option for releases from underground storage tanks (USTs) that would otherwise be remediated through the WVDEP Tanks Corrective Action Unit (TCAU); the UECA-LUST Program only assesses and remediates contamination associated with the UST release, and responsible parties receive a "No Further Action at this time" to document remediation completion. All VRP requirements contained within this *QAPrP* also apply to UECA-LUST sites, unless otherwise specified.

The *QAPrP* integrates all technical and quality aspects of a project, including planning, implementation, assessment, data validation, and usability. The ultimate success of an environmental program or project depends on the quality of the environmental data collected and used in decision-making. This *QAPrP* is intended as a generic description of procedures and practices that will be followed by WVDEP personnel, contractors, and sub-contractors in conducting typical brownfield, VRP, and UECA-LUST site assessments.

Quality Assurance (QA) is a system of management activities that involves planning, implementation, assessment, reporting, and quality improvement. WVDEP-OER strives to ensure that the information collected for environmental projects (whether collected by our office or by contractors) will allow us to make informed, legally defensible decisions.

The purpose of the *QAPrP* is to serve as a guidance document describing how WVDEP-OER will identify the type and quality of the environmental data needed for site assessment. WVDEP-OER will utilize the Data Quality Objectives (DQOs) Process to identify the type and quality of environmental data needed for sites requiring investigation. DQOs are qualitative and quantitative statements that allow the user to:

- Clarify the intended use of the data to be collected.
- Define the type of data needed to support the decision.
- Identify the conditions under which the required data should be collected.
- Specify the acceptable limits on the probability of making a decision error based on uncertainly in the data.

The seven steps of the DQO Process provide guidance on developing data quality criteria and performance specifications for decision making. They are used during the planning of projects to ensure that field activities, data collection operations, and the resulting data meet the project objectives. A summary of the DQO Process is provided below:

Step 1 – State the Problem – *The project will be concisely summarized, with prior studies and existing information reviewed. Answer the question; What is the purpose of the project?*

Step 2 – Identify the Decision – *Determine the available options under consideration and identify the decision(s) that need to be made based on the environmental data collected.*

Step 3 – Identify Inputs to the Decision – *Identify the information that is needed to make informed, defensible decision(s).*

Step 4 – Define the Boundaries of the Study – *The time periods and geographical area of study will be identified, including when and where data will be collected. Also, budgetary constraints of the project will be identified.*

Step 5 – Develop a Decision Rule – *The specific screening levels and parameters of interest will be defined and integrated with the previous DQO outputs to describe a logical basis for choosing an appropriate action based on the results. Formulate "if...then" statements that relate the data to the decision to be supported.*

Step 6 – Specify Limits on Decision Errors – *An estimate of how much uncertainty in the data that is acceptable will be determined. The acceptable decision error rate will be based on the possible consequences of making an incorrect decision.*

Step 7 – Optimize the Design for Obtaining Data – *The information from the previous steps will be evaluated to generate alternative data collection designs to meet and satisfy the*

DQOs in the most efficient and cost-effective manner while ensuring that the resulting data meets the project objectives.

Application of the seven step DQO process is a common-sense approach that translates broad consensus-based goals into specific tasks. In this way, the DQO process is used to prepare a road map, which can then guide the project, inform the public and other interested parties, and bring newcomers to the project up to speed quickly.

1.1.2 Applicable Programs

1.1.2.1 The Voluntary Remediation Program

The Voluntary Remediation and Redevelopment Act (W. Va. Code § 22-22, et seq.) was enacted by the WV Legislature in 1996 for the purpose of encouraging the voluntary cleanup of contaminated sites and redevelopment of abandoned and under-utilized properties. The Voluntary Remediation and Redevelopment Rule (W. Va. Legislative Rule 60CSR3), which became effective on July 1, 1997, describes the administrative process for this program. The VRP utilizes established risk-based remediation standards, as outlined in the Voluntary Remediation Program Guidance Manual, to determine the extent of contamination on a site and the appropriate remedial action. Data is collected during an environmental site assessment to delineate the extent of contamination and model the potential fate and transport of contaminants. After completion of an environmental site assessment, a risk assessment is conducted, and selection and implementation of a remedy occurs. Upon achievement of remediation standards, applicants receive a Certificate of Completion, which provides certain liability protections under WV law. Long-term oversight of the remedy is conducted as necessary. All site work within the VRP is conducted by a Licensed Remediation Specialist (LRS), with WVDEP-OER oversight, whose duty is to protect the safety, health, and welfare of the public in the performance of his or her professional services.

Parties with CERCLA liability protections (bona fide prospective purchasers, innocent landowners, contiguous property owners, and certain government entities), parties without CERCLA liability protections who did not cause or contribute to the contamination, and parties without CERCLA liability protections who did cause or contribute to the contamination (responsible parties) are permitted to enter properties into the VRP. However, the VRP makes a distinction between parties who did not cause or contribute to the contamination and responsible parties. Responsible parties are liable for all on-site and off-site contaminants that originated from their property/processes, whereas other applicants are only liable for the current contamination on their site and making sure it does not migrate off-site.

1.1.2.2 Uniform Environmental Covenants Act – Leaking Underground Storage Tank Program

The UECA (W. Va. Code § 22-22B, et seq.) was enacted by the WV Legislature in 2008 to allow sites using risk-based standards to utilize institutional controls through environmental covenants, which further encourages the voluntary cleanup of contaminated sites and redevelopment of abandoned and/or under-utilized properties. The UECA-LUST Program originated from this Act and was developed as an alternative risk-based remediation option for releases from USTs that would otherwise be remediated through the WVDEP Tanks Corrective Action Unit (TCAU) until impacted soils and groundwater meet established cleanup standards. Through the UECA-LUST Program, applicants may instead remediate these sites to risk-based standards utilizing engineering and institutional controls, such as caps, covers, and land use restrictions. Any LUST site may enter into the UECA-LUST Program; however, the program is most beneficial for more complicated sites that may have free product, extensive or deep soil contamination, groundwater contamination, or vapor intrusion impacts.

In the UECA-LUST pathway to closure for LUST sites, responsible parties may choose to remediate the site to risk-based standards for only the contaminants associated with the petroleum release by entering into a UECA-LUST agreement with the agency and hiring an LRS to conduct all site-related work under WVDEP-OER supervision. The UECA-LUST Program utilizes established risk-based remediation standards, as outlined in the VRP Guidance Manual, to determine the extent of contamination on a site and the appropriate remedial action. Data is collected during an environmental site assessment to delineate the extent of contamination and model the potential fate and transport of contaminants. After completion of an environmental site assessment, a risk assessment is conducted, and selection and implementation of a remedy occurs. Upon achievement of remediation standards, the responsible party receives a "No Further Action at this time" closure of the LUST leak similar to what is achieved by following the traditional LUST corrective action path; however, the closure also requires an environmental covenant with property use restrictions to appropriately control the risks and exposures to achieve the remediation standards.

1.1.2.3 Brownfields Assistance Program

The Brownfields Assistance Program empowers communities, developers, and stakeholders to assess, cleanup, and sustainably reuse brownfields. WVDEP provides guidance and technical assistance throughout the brownfield redevelopment process, including reviewing and explaining environmental reports, providing technical and programmatical guidance to assess and remediate sites, assisting with educating stakeholders and conducting community outreach, and identifying potential project funding sources.

WVDEP-OER receives funding from the USEPA Brownfields Program to conduct environmental site assessments of brownfield sites throughout WV. WVDEP-OER uses this funding to assist municipalities and non-profits to conduct Phase I and Phase II Environmental Site Assessments (ESAs), asbestos inspections, and lead-based paint testing at properties that are potentially contaminated by hazardous substances or petroleum. These services are provided at no cost, but sites are prioritized based on potential for redevelopment, community engagement/support, and need. Sites conducting a Phase I or Phase II Environmental Site Assessment as part of the Brownfields Assistance Program, regardless of their intentions to enter the VRP or UECA-LUST Program, must comply with the requirements outlined within this *QAPrP*.

1.2 The EPA Quality System, and ANSI/ASQC E4-2004

The USEPA Quality System, based on the American National Standard ASQ/ANSI E4-2014, *Quality Management Systems for Environmental Information and Technology Programs – Requirements with Guidance for Use*, provides the framework for planning, implementing, assessing, and improving work performed and for quality assurance (QA) and quality control (QC) activities. The EPA Quality System includes Policy, Organization/Program, and Project components. This generic *QAPrP* is part of the Organization/Program component to inform the development of Project components that involve the generation, acquisition, and use of environmental data. The Project Life Cycle includes the three Project components of planning, implementation, and assessment, which lead to a specific product or decision.

1.2.1 Brownfields Assistance Program Project Life Cycle

1. *Planning*

The WVDEP Brownfields Assistance Program will utilize the USEPA Region 3 Presumptive Conformance Program (PCP) to conduct ESAs with this *WVDEP-OER Brownfields Section QAPrP* to expedite the process. The PCP document will be signed by a WVDEP-OER representative and a USEPA Region 3 representative. The WVDEP-OER contractor prepares a Site Assessment Work Plan (SAWP), which includes a site-specific Field Sampling Plan (FSP) and a site-specific Health and Safety Plan (HASP), and adopts this *WVDEP-OER Brownfields Section QAPrP* and applicable OER Field Activities Standard Operating Procedures (SOPs). The SAWP is submitted to WVDEP-OER for review and approval by the WVDEP-OER Project Manager and WVDEP-OER Quality Assurance Manager (QAM). Upon receiving the SAWP, the USEPA Region 3 Applied Science and Quality Assurance Branch will archive the SAWP without the need for immediate review. Upon confirmation of receipt of the SAWP by USEPA Region 3, the WVDEP-OER may proceed with the planned site assessment. (Note that USEPA Region 3 reserves the right to audit archived SAWPs per the requirements of the PCP.)

2. *Implementation*

Upon USEPA confirmation of receipt, the WVDEP-OER contractor conducts site assessment activities in accordance with the SAWP and prepares a Phase II ESA Report.

3. Assessment
WVDEP-OER reviews the report and makes recommendations to the Phase II ESA User for further investigation and/or remediation, if warranted.

1.2.2 VRP and UECA-LUST Program Project Life Cycle for Sites Not Utilizing USEPA Brownfields Funding

1. Planning
After a site has been accepted into either the VRP or UECA-LUST Program, the LRS prepares a SAWP in order to determine the full extent of contamination on the site. The SAWP includes a site-specific QAPP, site-specific FSP, and a site-specific HASP. The site-specific QAPP may reference various sections of the *WVDEP-OER Brownfields Section QAPrP* and OER Field Activities SOPs, or adopt the entirety by reference as the site-specific QAPP. The SAWP is submitted to WVDEP-OER for review and approval by the WVDEP-OER Project Manager and the WVDEP-OER QAM.

2. Implementation
Upon approval of the SAWP, the LRS conducts site assessment activities in accordance with the SAWP and prepares a Site Assessment Report (SAR).

3. Assessment
If the investigation determines that contaminants of concern (COCs) are known to be present, a risk assessment based on the results of the SAR is initiated. The results of the SAR will provide the analytical data necessary for all potential pathways of exposure to fully assess the site. However, supplemental site assessments are often necessary to complete this work.

1.2.3 VRP Project Life Cycle for Sites Utilizing USEPA Brownfields Funding

1. Planning

a. Applicant-led Planning: When ESAs are conducted within the VRP, the LRS prepares a SAWP, which includes a site-specific FSP, a site-specific HASP, and a site-specific QAPP, which can reference the *WVDEP-OER Brownfields Section QAPrP*. The SAWP is submitted to WVDEP-OER for review and approval by the WVDEP-OER Project Manager and WVDEP-OER QAM. The USEPA Region 3 Applied Science and Quality Assurance Branch will also review and approve the SAWP. USEPA requires that all approving parties must sign the final documents before field work can proceed.
b. Presumptive Conformance Program (PCP) Planning: When ESAs are conducted within the VRP, the Applicant has the option to use the *WVDEP-OER Brownfields Section QAPrP* to expedite plan approval via the PCP. Applicants utilizing this

option will have to sign the PCP document, along with a WVDEP representative and a USEPA Region 3 representative. The LRS prepares a SAWP, which includes a site-specific FSP and a site-specific HASP, and adopts the *WVDEP-OER Brownfields Section QAPrP* and applicable OER Field Activities SOPs. The SAWP is submitted to WVDEP-OER for review and approval by the WVDEP-OER Project Manager and WVDEP-OER QAM. Upon receiving the WVDEP approved SAWP from the Applicant, the USEPA Region 3 Applied Science and Quality Assurance Branch will archive the SAWP without the need for immediate review. Upon confirmation of receipt of the SAWP by USEPA Region 3, the Applicant may proceed with the planned site assessment. (Note that USEPA reserves the right to audit archived SAWPs per the requirements of the PCP.)

c. Memorandum of Agreement (MOA) Planning: When ESAs are conducted within the VRP, the Applicant has another option to use the *WVDEP-OER Brownfields Section QAPrP* to expedite plan approval via a MOA. Applicants utilizing this option will have to sign the MOA document, along with a WVDEP representative. The LRS prepares a SAWP, which includes a site-specific FSP and a site-specific HASP, and adopts the *WVDEP-OER Brownfields Section QAPrP* and applicable OER Field Activities SOPs. The SAWP is submitted to WVDEP-OER for review and approval by the WVDEP-OER Project Manager and WVDEP-OER QAM. The USEPA Region 3 Applied Science and Quality Assurance Branch will also review and approve the SAWP. USEPA requires that all approving parties must sign the final documents before field work can proceed.

2. Implementation

Upon approval of the SAWP by WVDEP and USEPA, as applicable, the LRS conducts site assessment activities in accordance with the SAWP and prepares a SAR.

3. Assessment

If the investigation determines that COCs are known to be present, a risk assessment based on the results of the SAR is initiated. The results of the SAR will provide the analytical data necessary for all potential pathways of exposure to fully assess the site. However, supplemental site assessments are often necessary to complete this work.

SAWPs produced for site assessments funded by the USEPA Brownfields Program will include signature spaces for the WVDEP-OER Project Manager, WVDEP-OER QAM, EPA Region 3 Brownfields Project Officer, and the EPA Region 3 Delegated Approving Official.

1.3 The Graded Approach and the EPA Quality System

This *QAPrP* contains general procedures and protocols which will be used to assure that suitable analytical results will be obtained during Brownfields Assistance Program, VRP, and UECA-LUST Program site assessments in WV that will allow valid conclusions to be drawn from the results. WVDEP-OER is the organization responsible for this *QAPrP*, with USEPA oversight

and approval. The *QAPrP* covers all areas of field sampling that are subject to review and interpretation as well as laboratory QA objectives and requirements.

1.4 Intended Audience

The following list identifies the intended audience of the quality of the data generated under this program; it includes, but is not limited to:

- WVDEP's Brownfields Assistance Program
- WVDEP's Voluntary Remediation Program
- WVDEP's Uniform Environmental Covenants Act – Leaking Underground Storage Tank Program
- WVDEP's Division of Water and Waste Management
- Environmental Consulting Industry
- United States Environmental Protection Agency
- Environmental Remediation Contractors
- State Legislature
- County Governments
- Municipal Governments
- Property Owners
- Potential Purchasers
- Potential Future Residents
- Potential Future Workers
- Lending Institutions
- Developers
- Surrounding Property Owners
- Surrounding Residents

1.5 Period of Applicability

This *QAPrP* is applicable for a period of five years from the effective date.

1.6 Points of Contact

1.6.1 Program Managers

The key decision makers of the WVDEP-OER Brownfields Section are the Brownfields Program Managers. Their responsibilities include overseeing the daily operations of the Brownfields Assistance Program, VRP, and UECA-LUST Program and supervising the WVDEP-OER Brownfields Section staff. The Brownfields Program Managers are also responsible for implementation of the *QAPrP* (whether program or site-specific) and final review/approval of all data and documents generated. The Brownfields Program Managers are managed by the

WVDEP-OER Deputy Director. The WVDEP-OER Deputy Director is managed by the WVDEP Division of Land Restoration Director.

1.6.2 Procurement Specialist

The WVDEP-OER Procurement Specialist has overall fiscal responsibility, including selection and payment of contractors, for the WVDEP-OER Brownfields Section. The Procurement Specialist is responsible for the payment to WVDEP Certified Environmental Laboratories (CELs).

1.6.3 Quality Assurance Manager

The WVDEP-OER Quality Assurance Manager (QAM) has overall quality assurance and quality control (QA/QC) responsibility, including systems and performance auditing, for the WVDEP-OER Brownfields Section. This individual is independent of the data generators (i.e., laboratories and contractors). All decisions regarding this *QAPrP* and related issues should be made by the WVDEP-OER QAM in consultation with the WVDEP-OER Brownfields Program Managers.

1.6.4 Data Users

The users of the data generated under this *QAPrP* are generally the contractors, LRSs, the WVDEP-OER Brownfields Program Managers, and the WVDEP-OER Project Managers. For a listing of stakeholders that may also be interested in the data, please refer to Section 1.4. It should be noted that the different stakeholders may use the data for different purposes and some of the data may not be publicly available.

1.6.5 Contractors

The contractors (vendors registered with the State of West Virginia OASIS system) are selected by the WVDEP-OER Brownfields Program Managers, the WVDEP-OER Procurement Specialist, and a representative of the WVDEP Purchasing Department. The contractors are selected based upon evaluation criteria that include their qualifications. Contractors include the WV CELs that analyze split samples collected by WVDEP-OER Project Managers. In the context of Brownfields Assistance Program projects, contractors are also environmental professionals performing Phase I and Phase II ESAs. In the context of VRP and UECA-LUST Program projects, the LRSs are generally responsible for the selection and assignment of a Field Operations Manager (FOM), performance and quality control of sampling operations, sampling quality control, data processing, documentation, and report generation as it applies to the specific tasks required by the WVDEP-OER approved SAWP, but they are hired by the applicant and are not contractors of WVDEP.

1.6.6 Subcontractors

The contractors are responsible for the selection of subcontractors. However, a subcontractor cannot be used without the approval of the WVDEP-OER Brownfields Program Managers. Subcontractors are required to follow the guidelines of the *QAPrP*. It is the responsibility of the primary contractor to ensure that potential subcontractors are familiar with the *QAPrP* and provide oversight of the subcontractor.

1.6.7 Data Analysis

All WVDEP-OER projects use WVDEP CELs through WVDEP's Laboratory Quality Assurance Program and the agency's USEPA approved Quality Management Plan (QMP). The selection of laboratories will be determined by the LRS and WVDEP-OER Project Manager within the site-specific SAWP based on factors such as location of site, scope of analytical request, laboratory certification, laboratory capacity, turn-around time requirements, analytical costs, etc. Note that WVDEP's Laboratory Quality Assurance Program does not certify laboratories for vapor samples, and the primary method for analyzing per- and polyfluoroalkyl substances (PFAS) in soils and tissues (Draft Method 1633) has not yet been certified. The laboratories to be used for vapor and PFAS analysis will need to be determined on a site-specific basis with WVDEP approval.

1.6.8 Data Validation

Data validation will be performed by a third-party contractor arranged by the WVDEP-OER Brownfields Section (for Brownfields Assistance Program projects) or the LRS (for VRP and UECA-LUST Program projects). The contractor performing the data validation will be responsible for the data quality review. The selection of the organization to perform the data validation will be determined by the site-specific SAWP and/or *QAPrP* based on factors such as scope of validation request, turn-around time requirements, validation costs, etc. The organization performing the data validation must be independent of the analytical laboratory(ies) that generated the data.

Once all analyses of samples have been completed, the data validator (an individual independent of the data generation group) will initiate a quality assurance review of the results. The data validator will perform data review, assign codes to the data, and determine its usability as per the *USEPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*, January 2009; *USEPA Contract Laboratory Program Statement of Work for Superfund Analytical Methods (Multi-Media, Multi-Concentration)* (SFAM01.1), November 2020; and *USEPA Contract Laboratory Program Statement of Work for High Resolution Superfund Methods (Multi-Media, Multi-Concentration)* (HRSM02.1), November 2020, or most current procedures.

The data validator will submit the results and a Quality Assurance Report directly to the WVDEP-OER Project Manager (for Brownfields Assistance Program projects) or to the LRS, who will in turn provide the information to the WVDEP-OER Project Manager (for VRP and UECA-LUST Program projects). The report will include data review and data processing quality control.

1.6.9 Organizational Chart

The organizational chart provided in **Figure 1**, ***WVDEP Brownfields Section Organizational Chart***, depicts lines of authority and reporting responsibilities.

Certain individuals may be responsible for more than one of the aforementioned project functions. The organizational chart provides sufficient evidence that the lines of authority for all referenced organizations (including contractors and subcontractors) are appropriate to accomplish the quality assurance objectives of the WVDEP-OER Brownfields Section programs.

1.7 Disclaimer

Mention of trade names or commercial products in this document does not constitute endorsement or recommendation for use.

2.0 *QAPrP* Requirements

It is the policy of WVDEP to collect the minimum number of samples necessary to adequately assess any potential pathways of exposure to any site-related receptors. At a minimum, the Impacted Media (i.e., surface and/or subsurface soils) need to be thoroughly assessed and then any potential Exposure Media (e.g., groundwater, surface water, sediment, vapor intrusion, fish consumption) will also need to be characterized as needed. The purpose of these samples is to ensure that the risks for all receptors can be assessed for every potentially complete pathway of exposure, as applicable to sites within the VRP and UECA-LUST Program. The Site Assessment Work Plans (SAWP) or functionally equivalent plans (hereafter, all are referred to as SAWP) for any VRP or UECA-LUST site within WVDEP-OER will need to comply with this *QAPrP*.

At the program level, this policy will be fulfilled by having the WVDEP-OER QAM oversee updating the *QAPrP* every five years. No later than 48 months after the effective date, the WVDEP-OER QAM will begin a review of the *QAPrP* to ensure that all policies, content, and SOPs of the *QAPrP* are updated to comply with the latest information from the USEPA and relevant organizations, such as the ITRC. A draft of any updates to the *QAPrP* should be presented by the WVDEP-OER QAM to the WVDEP-OER Brownfields Program Managers for WVDEP internal review. A WVDEP internally approved draft should be prepared and submitted to the USEPA for review. The final version of an updated *QAPrP* should be approved

by both WVDEP and USEPA no later than 60 months after the current effective date. The updated and approved *QAPrP* will replace the current *QAPrP* upon its effective date.

3.0 *QAPrP* Elements

3.1 Content Requirements

The primary documents expected to be produced during any Brownfields Assistance Program project as part of this *QAPrP* are the Phase I ESA Report, SAWP, and the Phase II ESA Report. The primary documents expected to be produced during any VRP or UECA-LUST Program project as part of this *QAPrP* are the SAWP and SAR.

All Phase I ESA Reports will conform to ASTM E1527-13 entitled "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process", or the most current version of the standard. All Phase II ESA Reports will conform to ASTM E1903-11 entitled "Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process", or the most current version of the standard.

The SAWP will include the following sections (in no particular order), including those listed in Attachment 6 *Site Assessment Work Plan Checklist* of the VRP Guidance Manual:

- Introduction
- Purpose and Objectives
- General Description
- Site Location
- Adjacent Property Descriptions
- Physical/Geological Description
- Site History
- Historical Environmental Investigations
- Identification of Project Personnel
- Project Chain of Command and Project Roles
- Personnel Training Requirements
- Identification of WVDEP Certified Environmental Laboratory
- Contaminants of Potential Concern
- Conceptual Site Model
- Potential Exposure Pathways
- Potential Receptors
- Project Tasks and Schedule
- Sample Locations (tables and figures)
- Field Sampling Rationale/Justification
- Field Screening and Sampling Collection Requirements

- Field Quality Control Sample Summary
- Field SOPs
- Field Equipment Calibration, Maintenance, Testing and Inspection
- Sample Containers, Labeling, Preservation and Hold Times
- Sample Handling, Custody and Disposal
- Decontamination Procedures
- Analytical Methods (tables)
- Project Screening Levels and Laboratory-Specific Detection/Quantitation Limits (tables)
- Project Data Quality Objectives (DQOs)
- Project Data Quality Indicators (DQIs)
- Measurement Performance Criteria
- Precision
- Accuracy
- Representativeness
- Completeness
- Comparability
- Sensitivity
- Data Validation Procedures, including Data Validation Stage
- Data Acquisition and Management Process
- Investigation Derived Waste Storage, Documentation, Transportation and Disposal
- Health and Safety Plan (HASP)
- Quality Assurance Project Plan (*QAPrP*)
- Project Schedule
- References, as applicable
- Figure showing Project Location Map
- Figures showing proposed sample locations for Soil, Groundwater, Surface Water, Vapor, and Sediment as needed

The SAR will include the following sections:

- Introduction
- Project Management
- Site Description and History
- Current Site Investigation description
- Chemicals of Potential Concern
- Chemicals of Concern
- Field descriptions
- Deviations from the approved SAWP
- Field data
- Bore/Well logs
- Certifications of Subcontractors
- Shipping documentation

- Photo documentation
- Data Validation
- Data Quality Objectives
- Data Quality Indicators
- Precision
- Accuracy
- Representativeness
- Completeness
- Comparability
- Sensitivity
- Investigation Derived Waste
- Analytical summary tables of sample results compared to appropriate screening levels
- Exposure Pathway Evaluation
- Environmental Setting
- Conceptual Site Model
- Laboratory analytical reports and validation reports
- Copies of Right of Entry Forms, as applicable
- Copies of Field Notes
- Figures showing sampling locations of Soil, Groundwater, Surface Water, Sediment and Vapor
- Figures showing samples, locations and results
- Tables showing results of sample analyses
- Tables showing results of screening analyses to determine the Contaminants of Concern
- Groundwater, surface water, soil exposure, and air pathways discussions
- Summary and recommendations
- References, as applicable

3.2 Program Management

3.2.1 Title and Approval Sheet

Each document submitted under the *QAPrP* (i.e., SAWP and SAR) must have a Title Page that should at least include a title, site name, site location, VRP or UECA-LUST Program number (as applicable), project number (as applicable), and date. After the Title Page should be an Approval Page signed and dated by the principal authors and responsible personnel (e.g., LRS). Sites receiving USEPA Brownfields funding will also need to include a signature page for WVDEP and USEPA representatives per the requirements outlined in Section 1.2.

3.2.2 Table of Contents and Document Control Format

The Table of Contents should include a list of all sections and subsections of the document, followed by a list of figures, tables, and appendices. Preferably, the Table of Contents sections

would be linked directly to the relevant section to improve the reader's ability to find the information they require.

3.2.3 Distribution List

The Distribution List should include a list of all persons receiving a copy of the *QAPrP*, including their position/title and last known contact information.

3.2.4 Program/Task Organization and Planning Documentation

This section should list the general tasks planned for the project and the personnel responsible for oversight of each task.

3.2.5 Problem Definition/Background

Site background information will be provided in the site-specific SAWP to be reviewed and approved by the WVDEP-OER Project Manager. Site background information should include as applicable:

- A list of the known and suspected contaminants in each medium and estimates of their concentration, variability, distribution, and location.
- The site's physical and chemical characteristics that influence migration and associated human, environmental, and physical targets.
- A conceptual site model (CSM) and exposure pathways.
- A summary of the outcome and status of any previous response(s) at the site, such as early actions or previous data collection activities.
- Site Maps (historical & present).

WVDEP-OER will determine whether site investigation activities are warranted to assess potential risk associated with a site and whether the site should undergo further investigation or action under the VRP or UECA-LUST Program. These site investigation activities can include supplemental site assessments to fill in data gaps necessary for a complete risk characterization.

3.2.5.1 Decisions

Decisions that will be made based upon the outcome of the investigations may be to proceed to:

- Human Health and Ecological Risk Assessment
- Final Report
- Referral to another federal or state program

3.2.5.2 Actions

If site assessment results indicate that potentially unacceptable risks are associated with the site, as determined by exceedances of relevant screening level benchmarks, then the project will proceed to conduct a Human Health and Ecological Risk Assessment. However, if the results of the site assessment indicate that no risks associated with site contamination are present, as determined by all contaminants of potential concern being below their relevant screening level benchmarks, then the project may proceed to the Final Report and Certificate of Completion or "No Further Action at this time".

3.2.5.3 Information

The types of informational inputs needed for decision making, if applicable, are field data, laboratory analytical results, field screening results, natural background concentrations (site-specific or published), data validation results, database searches identifying exposure pathways and targets, and risk-based screening levels.

3.2.5.4 Screening Levels

In order to determine if there is potential risk to human health and/or the environment at the site, contaminants known to be present or contaminants potentially present based upon the historical use of the property will be assessed. A listing of contaminants that could potentially be investigated in the VRP is provided in USEPA's *List of Lists: Consolidated List of Chemicals Subject to the Emergency Planning and Community Right to Know Act (EPCRA), Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Section 112(r) of the Clean Air Act* (2019). UECA-LUST Program sites should be investigated for the contaminants associated with the type of fuel that was released at the site. However, OER has developed De Minimis Standards for a subset of those chemicals on the List of Lists. All site-related chemicals will first be compared to the De Minimis Standards for residential and industrial exposures to soil as well as groundwater. The Groundwater De Minimis Standards already include the relevant Requirements Governing Groundwater Standards from W. Va. Legislative Rule 46CSR12. Contaminant concentrations will be compared to the USEPA Regional Screening Levels (RSL) when there are no De Minimis Standards. The RSL tables also provide comparison values for residential and commercial/industrial exposures to soil, air, and tap water (drinking water).

Current De Minimis Standards and other requirements for the VRP and UECA-LUST Program can be found on the WVDEP-OER Technical Guidance and Templates webpage, and current RSLs can be found on the *USEPA Regional Screening Levels* webpage. These websites provide tables of risk-based screening levels, calculated using the latest toxicity values, default exposure assumptions, and physical and chemical properties. The

RSL website also provides a calculator where default parameters can be changed to reflect site-specific risks or alternate receptors, such as recreators.

Surface water screening levels for both human and ecological receptors are first determined by the Water Quality Standards (WQS) developed by WVDEP in the Requirements Governing Groundwater Standards Rule (W. Va. Legislative Rule 47CSR12). In the absence of a WQS, ecological exposures should be screened using the *USEPA Region 3 Biological Technical Advisory Group (BTAG)* screening values. Sediment should be screened against the Residential De Minimis Standard for human receptors and BTAG values for ecological values. If a chemical of concern at a site is not listed in the BTAG list of screening values, or a potential medium is not listed in BTAG, then the *USEPA Region 4 Ecological Risk Assessment Supplemental Guidance* screening values should be used. The potential for vapor intrusion should also be screened using the benchmarks for groundwater, soil gas, and indoor air available in the *USEPA Vapor Intrusion Screening Levels (VISL)*.

All of the relevant benchmark screening levels, including RSL, VISL, BTAG, USEPA Region 4 Ecological Risk Assessment Supplemental Guidance, Water Quality Standards, and De Minimis Standards, are available on the WVDEP-OER Technical Guidance and Templates webpage in an Excel spreadsheet labeled, "De Minimis and Relevant Benchmarks."

3.2.5.5 Decision Rule

If any contaminant is greater than its applicable screening level, it is to be considered a contaminant of concern (COC). All COCs require some type of action. Note that for soils, a chemical is labeled a COC when it exceeds the relevant residential soil screening level. The type of action will be determined by the concentration of the contaminant, the calculated exposure point concentration (e.g., 95% Upper Confidence Limit), the source of the contamination, the media impacted, the exposure pathway, and the receptors to the contaminants. The decision as to what course of action should be taken is the responsibility of the LRS and WVDEP-OER Project Manager.

3.2.6 Program/Task Description

Project description and schedule information will be provided in the site-specific SAWP to be reviewed and approved by the WVDEP-OER Project Manager. Project description and schedule information should include as applicable:

- A description of the work to be performed, providing sufficient information as to the project's goals and types of activities to be conducted.

- Special personnel and equipment requirements that may indicate the complexity of the project (particularly for any new or innovative sampling or analytical technique being employed).
- Project schedule timeline (graphical or tabular format), including start and completion dates for all project activities (including quality assurance assessments).
- A procedure for notification of project participants concerning schedule delays (identify job function, organization name, personnel responsible for providing and receiving such notification, and personnel responsible for approving schedule changes).
- Discussion of resource and time constraints, such as seasonal sampling restrictions and considerations (if applicable).

3.2.7 Training

WVDEP-OER Deputy Director is responsible for ensuring that each OER staff member has received the necessary training and certifications required for site assessment. WVDEP-OER Brownfields Section Program Managers and Project Managers should have a working knowledge of the DQO process and the WVDEP-OER Brownfields Section *QAPrP* requirements. Training will be coordinated by the WVDEP Brownfields Program Managers. OER staff are required to complete 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training from OSHA and be up to date on subsequent annual 8-hour refresher courses. OER staff members are also encouraged to take advantage of numerous relevant training courses from the USEPA, Interstate Technology and Regulatory Council (ITRC), the Agency for Toxic Substances and Disease Registry (ATSDR), and other entities.

Data validators should have completed at least one USEPA approved training course on data validation, in addition to the required degrees in higher education. Laboratory personnel shall complete all training required by their respective employers to comply with the WV Certified Environmental Laboratory Program.

3.2.8 Quality Objectives and Criteria for Measurement Data

When conducting a site assessment, all measurements will be made so that results are reflective of the medium and conditions being measured. Data collected will be used to:

- Ascertain if there is a threat to public health or the environment;
- Locate and identify potential sources of contamination, along with their fate and transport;
- Delineate the extent of any contamination and its potential migratory pathways;
- Determine the potential pathways of exposure to contaminants (e.g., ingestion, inhalation, and dermal contact); and
- Ascertain if contamination present equals or exceeds applicable Screening Levels listed in Section 3.2.4.4 above.

Prior to all environmental measurement activities, site-specific Data Quality Objectives (DQOs) and measurement performance criteria (e.g., DQIs) will be determined. DQIs are mostly quantitative measurements used to determine if the data are of sufficient quality to be used for risk assessments. DQIs include precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS, see Section 3.2.8.2 for details), and are determined for each site based on the nature of the contaminants of potential concern and likely receptors.

DQOs are qualitative and quantitative statements that follow the seven-step process and specify the quality of the environmental monitoring data required in order to support decisions. DQOs are established in accordance with the anticipated end uses of the data that are to be collected. DQOs are applicable to phases and aspects of the data collection process including site investigation, design, construction, and remedy operations. This *QAPrP* provides generalized DQOs below that should be sufficient for the majority of sites. However, site-specific conditions may require deviations from or additions to these generalized DQOs and such deviations/additions will need to be detailed in the site-specific SAWP.

Step 1 – State the Problem – *There is a site with real or perceived contamination that is detrimental to current operations or redevelopment due to potential risks associated with the contaminants. The nature and extent of any contamination is unknown and needs to be characterized before redevelopment can proceed, known violations can be rectified or risks to human health and the environment can be mitigated.*

Step 2 – Identify the Decision – *Determine if the nature and extent of contamination exceeds the WV De Minimis Standards and any other relevant benchmarks, and any remedies that may be necessary to mitigate risk to human health and the environment.*

Step 3 – Identify Inputs to the Decision – *The nature and extent of contaminant concentrations in surface soils, subsurface soils, groundwater, surface water, vapor, and sediment. Decisions will be made on the basis of screening field data and Exposure Point Concentrations (EPC) against the WV De Minimis Standards and relevant benchmarks outlined in Section 3.2.5.4. Site history, pre-existing hydrogeologic information, ecological receptor information and any other historic information may be considered when making site decisions. A Conceptual Site Model indicating the release mechanisms, pathways of migration, pathways of exposure and all potentially exposed receptors should also be developed. Additionally, the process must comply with the procedures outlined in the VRRP Rule and VRP Guidance Manual.*

Step 4 – Define the Boundaries of the Study – *The time periods and geographical area of study will be identified, including when and where data will be collected. SAWPs should include a timeline, current property boundaries and the location of all relevant receptors. If there are additional boundaries that would influence the project's scope of work, they should also be included in the SAWP. Also, budgetary constraints of the project will be identified.*

Step 5 – Develop a Decision Rule – *Utilizing the inputs of the study, if the EPCs are below the WV De Minimis and relevant benchmarks, then no further remedial action is necessary. However, if the EPCs are above the WV De Minimis and/or relevant benchmarks then a remedy should be implemented following the procedures outlined in the VRP Guidance Manual, or the site may conduct a Site-Specific Risk Assessment following the procedures outlined in the VRP Guidance Manual. After a Site-Specific Risk Assessment has been conducted, if the risks are all deemed to be acceptable, then no further remedial action is necessary, but any risks that were identified as being unacceptable must have a remedy implemented following the procedures outlined in the VRP Guidance Manual. Should the remedy prove to be ineffective, then alternative remedies must be implemented until the remedial goals have been achieved following the procedures outlined in the VRP Guidance Manual.*

Step 6 – Specify Limits on Decision Errors – *All EPCs should be determined as the lower value of either the maximum concentration or the 95% Upper Confidence Level in order to minimize false negative risk-based decisions. The quality of the data used to determine the EPCs will be limited by complying with the PARCCS requirements outlined in section 3.2.8.2.*

Step 7 – Optimize the Design for Obtaining Data – *The information from the previous steps will be evaluated to generate alternative data collection designs to meet and satisfy the DQOs in the most efficient and cost-effective manner while ensuring that the resulting data meets the project decision objectives. Optimization of the study is based on conformance with applicable accepted standards and procedures (e.g., SW-846 and the VRP Guidance Manual). The acceptability of the project outcomes will be evaluated by validation of a minimum of 10% of the data from each medium using the National Functional Guidelines listed in Section 3.2.8.2. If the project outcomes are found to be unacceptable the study will be evaluated and redesigned to obtain more suitable data.*

3.2.8.1 Measurement Methods

The purpose of performing a site assessment is to determine the presence and identity of contaminants along with the extent to which they have become integrated into the surrounding environment. The objective of this effort is to collect and analyze a sample that is representative of the media under investigation. The measurement methods used for analyzing the media vary with the associated physical properties and contaminants for which the media is to be analyzed. Due to the nature of the assessment work performed, the concentration of the parameters of interest is anticipated to be low but may involve free-product or Non-Aqueous Phase Liquid (NAPL). Project specific screening levels, project required quantitation limits, and laboratory detection limits will be outlined in a site-specific SAWP.

To ensure that uniform and acceptable measurement methods are being used, the following measurement methods will be required:

West Virginia State Contract Laboratory

If a CEL under contract to the WVDEP is to be utilized, measurement methods will follow the guidelines found in the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition (SW-846)* as applicable. Selection of the SW-846 method to be used will be provided in the site-specific SAWP. If the analysis method measurement is not provided in *SW-846*, the selected laboratory *QAPrP* and SOPs will be utilized. **Note: MS/MSDs remain applicable to VOC and SVOC analyses if *SW-846* is used**.

Field Screening

If the measurements are to be obtained in the field utilizing field screening technologies such as X-Ray Fluorescence (XRF), immunoassay test kits, photoionization detector (PID), flame ionization detector (FID), etc., a minimum of 10% of the media must be submitted to an analytical laboratory for confirmation. The criteria for selecting which field results are confirmed are (1) select samples whose results are closest to the screening level and (2) select at least one non-detect sample result per day.

3.2.8.2 PARCCS

It is important to note that the level of detail and data quality needed will vary with the intended use of the data. DQOs are typically assessed by evaluating precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) of all aspects of the data collection process. The PARCCS parameters are Data Quality Indicators (DQI) or Data Quality Measures. PARCCS is defined as:

Precision

Precision is a measure of the reproducibility of analyses under a given set of conditions. Precision examines the spread of data about their mean. The spread presents how different the individual reported values are from the average reported values. Precision is thus a measure of the magnitude of errors and will be expressed as the relative percent difference (RPD) or the relative standard deviation (RSD). The lower these values are, the more precise that data. Field measures of precision are typically field duplicates, matrix spikes/matrix spike duplicates, matrix duplicates, and using the appropriate sampling procedure. Conversely, laboratory measures of precision include laboratory control samples/laboratory control sample duplicates, matrix spike duplicates, and historical data trends. The applicable RPD and RSD quantities are defined as follows:

$$\text{RPD (\%)} = 100 \times \frac{(S - D)}{(S + D)/2}$$

OR

$$\text{RPD (\%)} = 100 \times \frac{2\,(S - D)}{(S + D)}$$

where S = Analyte or compound concentration in a sample
D = Analyte or compound concentration in a duplicate sample

Or when there are more than two measurements:

$$\textbf{RSD (\%)} = 100 \frac{(s)}{\bar{X}}$$

Where *s* = Standard deviation of replicate measurements
x = Mean of replicate measurements

The samples utilized to evaluate precision include laboratory matrix duplicate (MD), matrix spike (MS), matrix spike duplicate (MSD), and field duplicates samples. The goal is to maintain a level of analytical and sampling precision consistent with the objectives of the sampling event. To maximize precision, consistent sampling and analytical procedures are to be followed as presented in the *QAPrP*. Unless provided in a site-specific SAWP, the control limit for field duplicate sample analyses depends on the media being sampled. For example, soils are typically more heterogeneous, and the control limit goal for soil/sediment field duplicates should be no more than 50%. Conversely, the control limit goal for aqueous field duplicates should be no more than 30%. Control limit goals for laboratory MS, MSD, and MD sample analyses are usually determined by the laboratory's internal QA plan or SOP.

Accuracy

Accuracy is a measure of the bias that exists in a measurement system determined by comparing the analysis of a known standard or reference to its true value. Accuracy measures the average or systematic error of a measurement method or sampling method. This measure is defined as the difference between the average of reported values and the actual value, which can be influenced by both field and laboratory procedures. Measurements of field accuracy include matrix spikes/matrix spike duplicates, "blind" samples, appropriate sampling procedures, appropriate sampling containers, appropriate sample preservation, handling and holding times, and equipment/field blanks. Measurements of laboratory accuracy include laboratory control samples, matrix spikes/matrix spike duplicates, internal standards, surrogate recovery, initial calibration, continuing calibration, and standard reference material. Each of these measurements can impact accuracy in different ways and may have different methods of assessment. The DQI acceptance criteria or goals for accuracy are somewhat dependent on the analyte and methods used to measure the analytical concentration. Measurements of field accuracy are difficult to define and usually based on the needs of the project.

WVDEP-OER will primarily express measurements of laboratory accuracy as the percent bias for standard reference samples. The closer this value is to zero, the more accurate the data. This quantity is defined as follows:

$$\textbf{Bias (\%)} = \frac{\textbf{(MC – SC)}}{\textbf{SC}} \textbf{ x 100}$$

Where SC = Known analyte or compound (i.e., reference) concentration
MC = Measured analyte or compound concentration

The site-specific accuracy goals when measuring the percent bias are variable, usually specified within the analytical method or laboratory SOP, but generally ±20%. Data with percent bias greater than ±20% are not necessarily rejected but should have their usability assessed using a multiple lines of evidence approach as outlined in the *Data Quality Assessment and Data Usability Evaluation Technical Guidance* from the New Jersey Department of Environmental Protection (2014), including potential corrections. Additionally, data percent bias should meet the requirements of the *USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review* (ISM02.4) and the *USEPA National Functional Guidelines for Organic Superfund Methods Data Review* (SOM02.4), as applicable. However, any measurement of percent bias exceeding ±50% should automatically be rejected or qualified.

In cases where accuracy is determined from spiked samples, such as the laboratory control sample (LCS) or surrogate compounds, accuracy is expressed as the percent recovery. The closer the value is to 100, the more accurate the data. Recovery is calculated as follows:

$$\textbf{Recovery (\%)} = \frac{\textbf{(MC)}}{\textbf{SC}} \textbf{ x 100}$$

Where SC = Known analyte or compound (i.e., spike) concentration
MC = Measured analyte or compound concentration

The site-specific accuracy goals when measuring percent recovery are also variable, usually specified within the analytical method or laboratory SOP, but generally 80-120%. Data with percent recovery less than 80% or greater than 120% are not necessarily rejected but should have their usability assessed using a multiple lines of evidence approach as outlined in the *Data Quality Assessment and Data Usability Evaluation Technical Guidance* from the New Jersey Department of Environmental Protection (2014), including potential corrections. Additionally, data percent bias should meet the requirements of the *USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review* (ISM02.4) and the *USEPA National Functional Guidelines for Organic Superfund Methods Data Review* (SOM02.4), as applicable. However, any measurement of percent recovery below 50% or greater than 150% should automatically be rejected or qualified.

Matrix spike percent recovery will be calculated as follows:

$$\textbf{Recovery (\%)} = \frac{\textbf{(MC – USC)}}{\textbf{SC}} \textbf{ x 100}$$

Where SC = Known analyte or compound (i.e., spike) concentration
MC = Measured analyte or compound concentration
USC = Unspiked sample concentration

The site-specific accuracy goals when measuring matrix spike percent recovery are the same as the percent recovery goals above.

For investigations conducted in accordance with this *QAPrP*, accuracy is also defined as the percent recovery of QA/QC samples that are spiked with a known concentration of an analyte of interest. The QA/QC samples used to evaluate analytical accuracy include instrument calibration, internal standards, ICP serial dilution analysis, laboratory control samples, MS/MSD samples, and surrogate compound recoveries. Control limits for instrument calibration, internal standards, ICP serial dilution analysis, laboratory control samples, MS/MSD samples, and surrogate compound recoveries are provided in the applicable USEPA approved methods or determined by the laboratory's internal QA plan.

Representativeness

Representativeness qualitatively expresses the degree to which data accurately and precisely represent the environmental condition. Representativeness is primarily accomplished through the chosen sample locations, quantities, and analyses to properly assess potential exposures along all pathways developed in the CSM. Field measures of representativeness include using appropriate sampling procedures (SOPs), appropriate sample containers, appropriate sample preservation, appropriate number of samples, and incorporating field screening data. Laboratory measures of representativeness include laboratory homogenization, appropriate sub-sampling, and appropriate dilutions. Representativeness is also accomplished by maintaining sample integrity with appropriate preservation and meeting technical holding times. Those data from samples either inappropriately preserved or failing to meet technical holding times will be qualified per the current USEPA Region 3 data validation guidelines. Sample preservation requirements and technical holding times should follow the requirements of the *USEPA Sampler's Guide: Contract Laboratory Program Guidance for Field Samplers* (2014), summarized in **Table 2**, ***Sample Containers, Preservation, Volumes and Holding Times***.

Completeness

Completeness is the measurement of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under "normal" conditions. Completeness establishes whether a sufficient number of valid measurements were obtained. The closer this value is to 100, the more complete the measurement process. Unless provided in a site-specific SAWP, the minimum level of

completeness expected for any project is 90%. Data rejected, whether due to sampling design error or measurement error, during the data validation process will be considered invalid measurements. If applicable, the site-specific SAWP should provide a discussion of critical samples that would trigger resampling if data were rejected, such as hotspots or samples that assess exposures to sensitive receptors. Completeness will be calculated as follows:

$$\textbf{Completeness (\%)} = \frac{\mathbf{V}}{\mathbf{P}} \textbf{ x 100}$$

Where V = Number of valid measurements
P = Number of planned measurements

Field measures of completeness include the percent planned samples collected and having all critical samples collected. Laboratory measures of completeness include the percent sample per batch analyzed and reported, and having all critical samples reported and unqualified.

Comparability

Comparability expresses the confidence with which one set of data can be compared to another. Field measures of comparability include comparisons of previous data points, comparison to similar data points, and ensuring similar methods are used each time samples are collected at a site. Laboratory measures of comparability include Gas Chromatography/Mass Spectrometry tuning, calibration, and using the same analytical methods for each round of samples. Laboratory measures of comparability are also quantitative measurements to ensure sampling and analytical procedures are consistent within and between data sets. When traceable standards are used, such as single blind performance evaluation samples, the analytical results can be compared to the known concentration and its acceptable range. If the laboratory reports any standard outside the acceptance range, there is little confidence in the result and the result should be qualified.

Analytical comparability can also be made with split samples sent to a secondary laboratory. At the discretion of WVDEP, the collection of split samples may also be performed at a frequency of up to 50 percent, typically limited to a frequency of 10 percent. Unless provided in a site-specific SAWP, any RPD of 40 or greater should be investigated further by either data validation or an audit of the laboratory quality system.

A third analytical comparability can be made by comparing field screening data with confirmatory results. Unless provided in a site-specific SAWP, any RPD of 40 or greater should result in the qualification of the field screening data.

Sampling procedure comparability can be made by collecting field duplicate samples. Unless provided in a site-specific SAWP, the control limit for field duplicate sample

results is 40 RPD. An RPD of 40 or greater should result in the qualification of all data collected by the same methodology.

Sensitivity

Sensitivity refers to the ability of an analytical procedure to detect and quantify an analyte at a given concentration and is related to the Reporting Limit (RL). The RL is usually synonymous with the Limit of Quantitation (LOQ) and Sample Quantitation Limit (SQL), although a Practical Quantitation Limit (PQL) may also be acceptable (see Section 3.3.4.1 for more details). Field measures of sensitivity include equipment blanks/field blanks and collecting the appropriate sample volume or mass. Laboratory measures of sensitivity include method blanks, instrument blanks, reporting limits, and using the appropriate analytical method. Generally, the instrument or method should be able to detect and provide an accurate analyte concentration that is not greater than the applicable standards and/or screening levels listed in Section 3.2.4.4. Since the RL cannot be specifically determined ahead of time, it is acceptable to use the Method Detection Limit (MDL) as a preliminary goal for Sensitivity, but the lab should have a reasonable estimate of their RLs that are preferable. Additionally, the relevant RL should be used to determine if the Sensitivity goals have been met for the site. Analytical results that are non-detect and have RLs greater than the applicable standards cannot confidently demonstrate compliance with those standards. Every reasonable effort should be made to improve the RLs as necessary to meet the sensitivity requirement by using different analytical methods, sample preparation, etc. to increase sensitivity. However, exceedances of the standards by the RLs may not be possible to rectify and may also be insignificant in situations where other compounds are driving the remediation decisions such that the RL issue is moot.

To assess if environmental monitoring measurements are of an appropriate quality, the general PARCCS requirements above and any site-specific measurements for precision, accuracy and completeness will be compared to the quality objectives and measurement performance criteria. Due to the nature of the assessment work performed, the potential consequences for decision error near the screening levels are low.

The table below for measurement quality objectives provides an example of the site-specific measurement quality objectives that must be provided in each site-specific SAWP. In the absence of site-specific project measurements quality objectives, the minimal DQOs outlined above will apply.

Measurement Quality Objectives Table

Compound	Matrix	Screening Level[1]	Project Required Quantitation Limit[1*]	Precision	Accuracy	Completeness
Arsenic	Soil	0.43 mg/kg	0.5 mg/kg	40%	20%	90%
Benzene	Water	5 µg/L	0.50 µg/L	25%	20%	90%
Naphthalene	Water	0.17 µg/L	0.10 µg/L	25%	20%	90%

[1] Include the concentration units. The Project Required Quantitation Limits should follow the WV Certified Environmental Laboratory Required Quantitation Limits for organic, inorganic, and dioxins/furans/PCBs/congeners.

3.2.9 Special Training/Certification

3.2.9.1 OER Personnel and Contractors

Specialized training or certification requirements may be necessary for performing work at a given project location. As appropriate, OER personnel and contractors performing work at project locations will have specialized training. Specialized training/certification may include, but is not limited to, the following:

- Hazardous Waste Operations and Emergency Response (HAZWOPER) training;
- Department of Transportation (DOT) training if waste materials are to be moved off-site;
- International Air Transport Association (IATA) Dangerous Goods Regulations for air carriers transporting hazardous materials;
- Underground storage tank training/certification;
- Licensed Remediation Specialist certification;
- Risk assessment training;
- Groundwater modeling and soil leaching modeling training;
- Geographic Information Systems (GIS) training;
- WV groundwater monitoring well driller certification;
- Training for applicable remedial systems;
- Training for non-routine field sampling techniques or field screening methods; and/or
- Training for data validation services.

3.2.9.2 Analytical Laboratory Personnel

All analytical work for the Brownfields Assistance Program, VRP, and UECA-LUST Program must be performed by a WV Certified Environmental Laboratory. WVDEP laboratory certification is conducted in accordance with the requirements of the Environmental Laboratories Certification and Standards of Performance Rule (W. Va. Legislative Rule 47CSR32). Education and experience requirements for laboratory

supervisors are found in Table 2 of this regulation. The Quality Assurance Plans (QAPs) of the contracted laboratories have been approved by the WVDEP. During this review/approval process, WVDEP verifies that the laboratory's personnel, facilities, sample handling procedures, equipment, instrument calibration procedures, analytical methods, standard operating procedures, and data management procedures are acceptable. Information on WVDEP's Laboratory Quality Assurance Program can be at: http://www.dep.wv.gov/WWE/Programs/lab/Pages/default.aspx.

3.2.10 Internal Audit Plan

The *QAPrP* policies and procedures will be audited annually via a review of a random subsample of five SAWPs and SARs conducted by the WVDEP-OER QAM with the assistance of the respective WVDEP-OER Project Managers. The WVDEP-OER QAM will submit an annual report of the internal audit to the WVDEP-OER Deputy Director, noting issues that were discovered and recommendations for policy changes, as applicable. Any programmatic issues identified through the audit will be addressed by the WVDEP-OER QAM through the process of updating the *QAPrP*, as necessary, and communicating the issues to the WVDEP-OER stakeholders. Any site-specific issues identified through the audit will be addressed by the respective WVDEP-OER Project Manager, as necessary.

3.2.11 Record Keeping and Retention Time

Documentation and record keeping practices will follow USEPA policies and procedures where applicable.

3.2.11.1 Field Documentation

The field operations manager (FOM), an employee of the LRS, will be responsible for maintaining a logbook(s) that documents field activities. Copies of the field documentation will be provided by the LRS to the WVDEP-OER Project Manager on request. The field documentation will be retained by the contractor for a minimum period of ten years.

3.2.11.2 Chain of Custody

Copies of the chain of custody (COC) form sent to the laboratory with the samples will be provided by the LRS to the WVDEP-OER Project Manager. A copy of the COC shall be retained by the contractor for a minimum period of ten years. A copy will be retained by the WVDEP forever. The original COC will be retained by the laboratory for a minimum period of five years.

3.2.11.3 Laboratory Records

All laboratory records, including raw data sheets, calculations, data handling records, electronic instrument files, and analytical reports will be retained by the laboratory for a minimum period of ten years. The records will be retained in a location easily accessible as well as fire and water damage proof.

3.2.11.4 Project Records

All records or documents applicable to a project, including final reports, site assessment reports, risk assessments, remedial action completion reports, audit reports, and communication records will be retained by the WVDEP forever in electronic format, with regular backup functions.

3.2.11.5 *QAPrP*

All versions of the approved WVDEP-OER Brownfields Section *QAPrP* will be retained by the WVDEP forever. The records will be electronically retained on a digital server with regular backup functions. The WVDEP will review, and if necessary, update the *QAPrP* every five years.

If changes to the *QAPrP* are required, the requesting party will initiate the desired change by editing the existing procedure (indicating changes by underlining) and developing a schedule for implementation. The revision will be submitted with a cover letter to the WVDEP-OER QAM for review, comment, and approval before being incorporated into the *QAPrP*. Upon acceptance or approval of the revision, the revised *QAPrP* will be submitted to USEPA Region 3 for review and approval.

3.2.12 Project Plan

Individual sites working in the WVDEP-OER Brownfields Section must follow the directives of this *QAPrP*. WVDEP-OER Brownfields Section projects must submit SAWPs that contain the sections and information outlined in Section 3.1 of this *QAPrP* and receive WVDEP-OER approval of the SAWP before conducting any of the site assessment work. Similarly, WVDEP-OER Brownfields Section projects must submit SARs that contain the sections and information outlined in Section 3.1 of this *QAPrP* and receive WVDEP-OER approval of the SAR before proceeding to the risk assessment phase of the project.

3.3 Data Generation and Acquisition

3.3.1 Sampling Design and Methods

Prior to the on-site initiation of an investigation, the WVDEP-OER Project Manager will review the files and, if applicable, review the subject facility's compliance history and any relevant submissions or other historical data that might be relevant to the project. If appropriate, the WVDEP-OER Brownfields Program Manager will confer with counterparts from other programs to determine if there are any multimedia or cross-program concerns that should be considered during the inspection. Finally, the WVDEP-OER Project Manager ascertains what equipment (such as field screening equipment or sampling materials) will be necessary to accomplish the investigation goals.

Prior to the initiation of data collection activity designed to evaluate environmental conditions at a site, a site-specific SAWP will be prepared. The SAWP shall generally include the content specified in Section 3.1, including the following:

- Project-specific goals and objectives.
- Clearly stated Data Quality Objectives (DQOs).
- Goals of the sampling effort and data to be generated.
- Type of data to be generated (screening vs. definitive).
- Site history, previous investigations, and results.
- Historical data generation, conclusions, and decisions made.
- Maps of past sample locations.
- Groundwater potentiometric surface maps with flow direction indicated (if known).
- Sample locations and frequency (presented in a tabular format as well as mapping).
- A preliminary CSM based on the current knowledge.
- Identification of critical samples.
- Documentation of decision process for site-specific analytical parameters.
- Sampling and analysis Methods.
- Sample matrices.
- Sample type (composite, grab, field screening, etc.) and number of samples required.
- Justification for type and number of samples.
- Screening limit rationale (see example table below).
- Project required quantitation limit rationale (see example table below) and impact if not met.
- Identification and location of background samples.
- Identification of field QC samples (field duplicates, rinsates, trip blanks, etc.).
- Identification of laboratory QC samples (MS, MSD, and/or MD).
- If applicable, each measurement parameter classified as either critical or needed for information only. If not classified, all measurements are assumed to be critical.
- Data usability and acceptance criteria through clearly stated Data Quality Indicators (DQIs)
- Level of data validation required.

Laboratory Data Reporting – Example Groundwater Data Table

Analyte	CAS Number	Screening Criteria[1]	Contract Required Quantitation Limit	Analytical Method (Method 8260C)		Achievable Laboratory Limits	
				MDLs[2]	Method QLs[2]	MDLs[3]	QLs[3]
Benzene	71-43-2	5 ug/L	0.5 ug/L	0.03 ug/L	1 ug/L	0.10 ug/L	0.50 ug/L

[1] Applicable De Minimis Standard, RSL, WQS, VISL, or other screening level.
[2] Analytical Method MDLs and QLs documented in validated methods. QLs are also called reporting limits.
[3] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

The environmental sampling design will generally not be random. Rather, the sampling design used will be conducted in a judgmental manner, with sample locations carefully selected to represent areas most likely to reveal the presence of contaminants of potential concern (COPCs) (i.e., sampling in known areas of potential concern). This conservative approach will reduce the chances of an underestimation of the risk at any site. Other sampling methods, such as incremental sampling, may also be used for purposes of generating Exposure Point Concentrations, with approval by the WVDEP-OER Project Manager. Note that incremental sampling may be the cheapest, most efficient way to determine Exposure Point Concentrations, but information on the variability of the contaminant concentrations is limited with incremental sampling and may lead to larger areas than necessary requiring remedies.

A site-specific project organizational chart showing personnel involved in the site inspection and a description of their assigned tasks will be included. (Note that names are personally identifiable information and therefore contractor names cannot be released via FOIA requests.) As much as possible, a time schedule of proposed operations will also be included in the SAWP, with the understanding that changes will undoubtedly occur. Site contacts, such as owners, owners' agents, facility operators, appropriate state, county, and local personnel, etc. will be included along with addresses and phone numbers but are also not released via FOIA requests.

In the site-specific HASP, all necessary safety contacts, including the local fire department, police department, hospital and emergency services, and state police, will be listed with emergency phone numbers. A description of the personal protective equipment (PPE) level anticipated and equipment on-site as well as provisions for upgrading the level of protection will be included along with the necessary contingency information.

3.3.2 Sampling Methods Requirements

3.3.2.1 Standard Operating Procedures

Samples will be collected in a manner consistent with the *USEPA Sampler's Guide - Contract Laboratory Program Guidance for Field Samplers*.

To ensure that uniform and acceptable sampling protocols for each project are being used, the sampling requirements should follow the applicable *WVDEP Office of Environmental Remediation Field Activities Standard Operating Procedures* available on the OER Technical Guidance and Templates webpage, or the Standard Operating Procedures (SOPs) available on the *USEPA ERT Standard Operating Procedures* webpage. Additional and/or alternate procedures proposed by an LRS may also be utilized, pending approval by the WVDEP-OER Project Manager and WVDEP-OER QAM.

There are 13 WVDEP-OER SOPs to cover the most common sampling techniques used at VRP sites. Site-specific SAWPs may reference the WVDEP-OER SOPs as the procedures to be followed during sampling activities and thereby receive pre-approval for those techniques without further review by WVDEP. For any sample technique proposed in the SAWP that is not covered by the WVDEP-OER SOPs, the LRS should use ERT SOPs or develop their own for WVDEP approval. The OER Field Activities SOPs include:

- General Decontamination Procedures for Non-Disposable Field Sampling Equipment (SOP OER-100)
- PID/FID Field Screening (SOP OER-101)
- XRF Field Screening (SOP OER-102)
- Groundwater Well Sampling Procedures (SOP OER-110)
- Soil Sampling (SOP OER-120)
- Soil Sampling Using Direct-Push Drilling (SOP OER-121)
- Soil Sampling Method 5035 (SOP OER-122)
- Soil Gas Sampling (SOP OER-130)
- Indoor Air Sampling (SOP OER-131)
- Sediment Sampling (SOP OER-132)
- Surface Water Sampling (SOP OER-133)
- SPLP and TCLP Sampling (SOP OER-134)
- Passive Diffusion Bag Sampling (SOP OER-135)

Relevant ERT SOPs that LRSs may wish to utilize include, but are not limited to:

- *Field Description of Soil and Sediment Borings*
- *Investigation-Derived Waste Management*
- *Slug Tests*
- *Groundwater Monitoring Well Installation*
- *Manual Fluid Level Measurements in Wells*
- *Borehole Packer Testing*
- *Controlled Pumping Tests*

- *Monitoring Well Development*
- *Standard Test Method for Particle Size Analysis*
- *Construction and Installation of Permanent Sub-Slab Soil Gas Vapor Probes*
- *Benthic Invertebrate Sampling*
- *Soil Gas Sampling*
- *Fish Handling and Processing*
- *Vegetation Assessment Field Protocol*
- *Tree Coring and Interpretation*
- *Plant Biomass Determination*
- *Waste Pile Sampling*
- *Sediment Sampling*
- *Surface Water Sampling*
- *Chip, Wipe and Sweep Sampling*
- *Tank Sampling*
- *General Air Monitoring and Sampling Guidelines*
- *Groundwater Well Sampling*
- *Terrestrial Plant Community Sampling*
- *Sample Documentation*
- *Incremental Sampling Methodology for Soil*
- *SUMMA Canister Sampling*
- *Sample Receiving, Handling and Storage*
- *Synthetic Precipitation Leaching Procedure (SPLP)*
- *Toxicity Characteristic Leaching Procedure (TCLP)*
- *Soil Sampling*
- *Pore Water Sampling*

Any deviations from the SOPs must be documented in the site-specific SAWP and approved by the WVDEP-OER QAM before use. Furthermore, these new SOPs may be added to the *QAPrP* upon review and revision, as appropriate. Also, it is noted that SOPs are not provided for the various laboratories used by WVDEP-OER since WVDEP-OER only allows the use of CELs. For WVDEP certification, laboratories must submit their SOPs to the WVDEP Laboratory Quality Assurance Program Manager who is responsible for ensuring that CELs meet state requirements.

Sample containers, preservation techniques, sample volumes, and technical holding times are summarized in **Table 2**, ***Sample Containers, Preservation, Volumes and Holding Times***. All sample containers must be unused, pre-cleaned, and certified pure of contaminants of concern not to exceed a concentration above the laboratory method detection limit (MDL). It is noted that additional analytical parameters in addition to those listed in **Table 2** may be required for specific projects. In this event, the site-specific SAWP will list the additional analytical parameters and provide the sampling

requirements for those parameters. Furthermore, these new analytical parameters may be added to the *QAPrP* upon review and revision, as appropriate.

Field sampling equipment maintenance, testing, inspections, and calibrations will follow recommended guidelines by the manufacturer.

3.3.2.2 Sample Handling, Tracking, and Custody Requirements

Sampling handling, tracking, and COC requirements depend on the laboratory. In general, samples should follow the *USEPA Sampler's Guide: Contract Laboratory Program Guidance for Field Samplers*.

All field documentation should be written in indelible ink. Errors in field sampling documents will be corrected by drawing a single line through the error, writing in the correction, and initialing and dating the correction.

Sample labels and/or tags are required to properly identify the samples. All samples will be labeled in the field and care will be taken to assure that each sample container is properly labeled. The samples will be placed in sealed plastic bags to prevent the labels from soaking off or becoming illegible from exposure to ice/water during transport to the laboratory. Labels and/or tags will contain the following information:

- Site name and designated project number.
- Sample identification number.
- Date and time the sample was collected.
- Name of the sampler (optional: can be in field logbook or COC).
- Description of the sample (optional: can be in field logbook).
- Sampling location (optional: can be in field logbook).
- Notation of whether preservatives were added to the sample and type of preservative.
- Type of sample (such as a grab or composite; but can be in field logbook).
- Type of analysis requested.

COC procedures provide documentation of the handling of each sample from the time it is collected until analysis is completed. COC procedures are implemented so that a record of sample collection, transfer of samples between personnel, sample shipping, and receipt by laboratory that will analyze the sample is maintained. The COC record serves as a legal record of possession of the sample. To simplify records and eliminate potential litigation problems, as few people as possible should handle the samples during the investigation. All samples will be maintained in accordance with the following COC procedures. A sample is considered under custody if one or more of the following criteria are met:

- In a person's physical possession.

- In view of that person after he/she has taken possession.
- Secured by that person so that no one can tamper with the sample.
- Secured by that person in an area which is restricted to authorized personnel.

A COC record must always be maintained from the time of sample collection until final deposition. An example of a COC form is found in **Figure 2**, ***WVDEP Chain of Custody***. Every transfer of custody will be noted and signed for with a copy of the record being kept for each individual who endorsed it. At a minimum, the COC record includes the following information:

- Project number and site location.
- Sample identification number.
- Name of Project and/or Program Manager.
- Description of the sample.
- Time and date sample was taken.
- Notation of whether preservatives were added to the sample and type of preservative added.
- Type of sample such as a grab or composite.
- Matrix of sample (i.e., water, soil, sludge, and so forth).
- Amount of sample being transported to the laboratory.
- The appropriate analytical parameters to be tested.
- Any other information, such as field screening data, that the sampler feels is pertinent to the analysis of the sample(s).
- Names and signatures of samplers.
- Signatures of all individuals who have had custody of the samples.

Custody seals will be placed on all shipping containers that contain samples. The custody seals will be used to demonstrate that a shipping container has not been opened or tampered with. The individual who has sample custody shall always sign, date, and affix the custody seal to the shipping container in such a manner that it cannot be opened unless it is broken. When samples are not under direct control of the individual responsible for them, they will be stored in a container which will be affixed with a custody seal.

Samples will then be placed in an appropriate transport container and packed with an appropriate absorbent material. All sample containers will be packed to maintain a temperature of ≤6°C, without freezing. A temperature blank will be added to each transport container. All sample documentation will be placed in a plastic bag and affixed to the underside of each transport container lid. The transport container lid will then be closed and affixed with custody seal accordingly. Samplers will transport environmental samples directly to the laboratory within 24 hours of sample collection or utilize an overnight delivery service within 24 hours of sample collection.

All of the appropriate Department of Transportation (DOT) regulations for packaging, marking/labeling, and shipping hazardous materials and wastes will be followed. Air carriers that transport hazardous materials will comply with the current edition of the International Air Transport Association (IATA) Dangerous Goods Regulations. The IATA regulations detail the procedures to be used to enable the proper shipment and transportation of hazardous materials by a common air carrier. Following the current IATA regulations should ensure compliance with State and Federal Department of Transportation regulations.

3.3.2.3 Analytical Methods Requirements

Analytical methods will be selected that will achieve project objectives. Each site-specific SAWP will identify analytical method numbers, extraction and/or digestion method numbers, screening levels, and project required quantitation limits for each parameter.

Any CEL under contract to the WVDEP must use analytical methods found in the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Final Update V, 3rd Edition (SW-846)* as applicable. If the analytical methods are non-standard (i.e., not provided in either the CLP *SOW* or in *SW-846*), the selected laboratory QAP and SOPs will be utilized.

If field screening technologies are used, a minimum of 10% of the media must be submitted to an analytical laboratory for confirmation. The criteria for selecting which field results are confirmed are (1) select samples whose results are closest to the screening level and (2) select at least one non-detect sample result per day.

Regardless of the laboratory and analytical method, all soils should be reported on a dry-weight basis.

3.3.3 Program-Defined Field Quality Control Requirements

Field QC is as vital to a project as is QC within the laboratory. Proper execution of each project task is needed in order to yield consistent reliable information that is representative of the media and conditions being measured. The overall quality assurance objective is to ensure that data of known quality is generated so that it will be useful in meeting the intended project objectives. The WVDEP-OER Brownfields Program Manager(s) and/or WVDEP-OER QAM will be responsible for seeing that field personnel adhere to the *QAPrP* and site-specific SAWP.

The general field quality control requirements (QC sample type, frequency, acceptance criteria, and corrective action) found in **Table 5**, ***Quality Control Requirements***, shall serve as a guideline for all OER projects. It is noted that the field quality control requirements provided in **Table 5** are for guidance purposes only and that field quality control requirements for a specific

project will be dependent upon the data quality objectives of that project and may differ from those criteria listed in this table. In cases where the field quality control requirements are different than those listed in **Table 5**, the appropriate requirements will be specified in the site-specific SAWP.

Field QC samples typically consist of the following:

3.3.3.1 Blanks

A blank is a sample subjected to the usual analytical or measurement process to establish a zero baseline or background value. It is never to be used to adjust or correct routine analytical results. It is a sample that is intended to contain none of the analytes or compounds of interest. A blank can be used to detect contamination during sample collection, handling, or shipment. If contamination is detected in any blank associated with a field sample, the field sample result is qualified according to the USEPA Region 3 data validation procedures. There are many types of blanks, each with a specific purpose including:

- ***Equipment (Rinsate) Blank*** - Monitor for potential contamination from decontamination procedures of field equipment or from other sources of equipment contamination like oil or other lubricants. To be collected in the field following standard decontamination procedures; one per 20 samples of the same media, analytical request, and equipment used. For example, if 21 soil samples are to be collected using stainless steel scoops for SVOC and pesticide/polychlorinated biphenyls (PCB), one would collect a total of two equipment blanks for both SVOCs and pesticide/ PCBs following decontamination of the scoop by pouring deionized water over the equipment into the appropriate container(s).

- ***Trip Blank*** - A clean sample of a matrix that is taken to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures; typically submitted for aqueous VOC analysis only. One trip blank is required with each sample shipment containing samples for VOC analysis.

- ***Temperature Blank*** - An aqueous sample, typically submitted as water in a 40-ml VOC vial, is transported to the laboratory for temperature verification of the samples. One temperature blank is required with each sample shipment container.

3.3.3.2 Duplicate Samples

Duplicate samples are two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical

manner. Duplicate samples are used to assess variance of the total method, including sampling and analysis. There are different types of duplicate samples that provide information on the precision of specific types of environmental data operations. These typically are:

- ***Field Duplicates*** - Independent samples that are collected as close as possible to the same point in time and space. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently. These types of duplicates are useful in characterizing the precision of the sampling process.

- ***Replicate Samples*** - Two or more samples representing the same population, characteristic, time, and place, which are independently carried through all steps of the sampling and measurement process in an identical manner (e.g., fish tissue samples). Replicate samples are used to assess total (sampling and analysis) method variance.

- ***Split Samples*** - Two or more representative portions taken from one sample in the field or in the laboratory and analyzed by different analysts or laboratories. Split samples are quality control (QC) samples that are used to assess analytical variability and comparability.

- ***Lab Replicates*** - A sample that is split into subsamples at the laboratory. Each subsample is then analyzed and the results compared to test the precision of the measurements.

3.3.4 Program-Defined Laboratory Quality Control Requirements

Analytical work performed for WVDEP-OER projects shall be performed by a WV CEL. The laboratory's General Manager and QA/QC Officer will be responsible for ensuring that their personnel adhere to their laboratory's SOPs and QAP. The number and types of internal QC checks for each analytical method must be defined in the laboratory's QAP.

The site-specific SAWP will reference the required minimum quality control requirements for the laboratory. The laboratory must follow the quality objectives for precision, accuracy, representativeness, comparability, completeness, sensitivity, and method detection limits as set forth in their laboratory QAP. Laboratory internal QC results should include information about agreement between replicate analyses, spike, and surrogate recoveries. Analysis of laboratory control samples, method blanks, matrix spikes, and duplicates must be included with each analytical batch in accordance with analytical method requirements.

The general laboratory quality control requirements for matrix spikes and duplicates are found in **Table 5**, ***Quality Control Requirements***, and shall serve as a guideline for all WVDEP-OER

projects. It is noted that the matrix quality control requirements provided in **Table 5** are for guidance purposes only and that quality control requirements for a specific project will be dependent upon the data quality objectives of that project and may differ from those criteria listed in this table. In cases where the matrix quality control requirements are different than those listed in **Table 5**, the appropriate requirements will be specified in the site-specific SAWP.

Laboratory QC samples typically consist of the following:

3.3.4.1 Detection Limit

A DL is a measure of the capability of an analytical method to distinguish samples that do not contain a specific analyte from samples that contain low concentrations of the analyte; the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. DLs are analyte, instrument, and matrix specific and may be laboratory dependent. Some of the more commonly used definitions are described below:

- ***Instrument Detection Limit (IDL)*** - The lowest concentration or mass an instrument can detect above background instrument noise under ideal conditions. IDLs are typically applied to the analysis of metals. Sample preparation is not considered in the determination of an IDL.

- ***Method Detection Limit (MDL)*** - A statistically derived estimate of the lowest concentration or mass detectable under method conditions at the concentration evaluated. A series of standards at an estimated limit of detection is analyzed multiple times (usually seven), a standard deviation of these seven replicate analyses is determined and the standard deviation is multiplied by the Student's t-distribution statistic at 6 degrees of freedom. Sample preparation is considered in the determination of an MDL.

- ***Practical Quantitation Limit (PQL)*** - A measure of the lowest limit of detection under the conditions of a particular method. The PQL is often determined by multiplying the MDL by a factor between three and 10.

- ***Reporting Limit (RL), Limit of Quantitation (LOQ), or Sample Quantitation Limit (SQL)*** - For a target analyte, the RL, LOQ, or SQL (these acronyms are synonymous) is instrument dependent and based on the lowest concentration point of the instrument's current calibration curve. It is also sample specific, as percent moisture, dilution factor, and sample preparation variables are to be included in the calculation of the final RL, LOQ, or SQL.

For WVDEP-OER projects, each compound of interest will be reported at its appropriate MDL and RL, LOQ, or SQL. See Section 3.2.8.2 for the appropriate use of MDLs, RLs, LOQs, and SQLs to assess Sensitivity goals.

Where technologically feasible, the MDLs must meet the screening levels listed in Section 3.2.4.4. If the MDLs are not technologically feasible by the laboratory, the laboratory must communicate this prior to sample receipt and reporting.

3.3.4.2 Instrument Calibrations

A calibration is a comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments. Laboratory instrument calibrations typically consist of two types: initial calibration verification (ICV) and continuing calibration verification (CCV).

- ***Initial Calibration Verification (ICV)*** **–** ICV procedures establish the calibration range of the instrument and determine instrument response over that range. Typically, a minimum of three to five analyte concentrations are used to establish instrument response over a concentration range. The instrument response over that range is commonly expressed as a correlation coefficient or response factor. Any detected compound whose response is below the calibration range of the instrument must be considered quantitatively estimated, qualified with a "J," and reported as such to the data user.

- ***Continuing Calibration Verification (CCV)*** - A CCV usually includes measurement of one or more calibration standards. The response is compared to the initial measured instrument response. Continuing calibration is performed at least once per operating shift for laboratory analyses. Where required, the CCV standard must be a separate source (i.e., a different vendor, or if same vendor, a different lot number) from the ICV standard.

Instrument calibration procedures, both ICV and CCV, are to be analyzed according to the requirements of the USEPA approved methodologies performed. Any deviations from the above must be documented and reported to the user of the data.

Any detected compound whose response is above the calibration range of the instrument must be considered quantitatively estimated and reanalyzed at an appropriate dilution to achieve a response within the calibration range of the instrument. If a dilution is not possible, the result is to be reported and qualified with an "E." If multiple dilutions result in multiple compounds of interest falling within the calibration range of the instrument, all dilutions will be reported by the laboratory to the user of the data. Additionally, if the dilution causes any compounds identified in the first analysis to be below the calibration

range in the second analysis, the results of both analyses shall be reported and the diluted samples shall have the "DL" suffix appended to the sample number.

3.3.4.3 Laboratory Control Samples

Laboratory control samples (LCS) are used to evaluate the accuracy of the laboratory's procedures. An LCS, or blank spike, is prepared and analyzed once per 20 samples of the same media within the same preparation or analytical batch. Any LCS that does not meet the laboratory established recovery criteria must be prepared and analyzed again, along with any associated samples until acceptable recovery is achieved. Procedures for the preparation and analysis of the LCS are according to the requirements of the USEPA approved methods and must be the same as the samples to which the LCS is compared. Any deviations from the above must be documented by the laboratory and reported to the data user.

3.3.4.4 Method Blank

Method blank (MB) samples are used to evaluate the presence and/or effect of laboratory contamination. A MB must be analyzed once per 20 samples of the same media within the same preparation or analytical batch. A method blank is prepared to represent the sample matrix as closely as possible and analyzed exactly like the samples for which it is associated. Any method blank that demonstrates contamination (i.e., any positive response of compounds of interest) must be prepared and analyzed again, along with any associated samples that demonstrated the same compounds of interest detected. The only acceptable deviation from this is if the compound sample concentration is greater than ten times the concentration detected in the method blank. Procedures for the MB are analyzed according to the requirements of the USEPA approved methods performed. Any deviations from the above must be documented and reported by the laboratory to the data user, with impacted results qualified with a "B."

3.3.4.5 Internal Standard

An internal standard (IS) is a standard unlikely to be found in environmental samples but has similar properties to the compounds of interest. The IS is added to the sample in a known amount and carried through the entire determination procedure as a reference for calibrating and controlling the precision and bias of the applied analytical method. Any sample for which an IS did not meet the USEPA approved method established recovery and retention time criteria, must be analyzed again. If the IS failure is duplicated, matrix interference is assumed and both results are to be reported by the laboratory to the data user.

3.3.4.6 Surrogate Standard

A surrogate standard of known concentration is added to environmental samples for quality control purposes. A surrogate standard is unlikely to be found in environmental samples but has similar properties to the compounds of interest. Surrogate standards are intended to monitor recovery differences, problems during the extraction phase of the analysis, and for any potential matrix interferences. Any sample that a surrogate standard did not meet the laboratory established recovery criteria must be prepared and analyzed again. If the surrogate standard failure is duplicated, matrix interference is assumed and both results are to be reported by the laboratory to the data user.

3.3.4.7 Matrix Quality Control Samples

Matrix spike (MS) and matrix spike duplicate (MSD) samples, performed by the laboratory, are used to evaluate the accuracy and precision of the sample matrix for the organic analyses. MS and matrix duplicate (MD) samples are used to evaluate the accuracy and precision of the matrix for the inorganic analyses. A MS, MSD, or MD that did not meet the laboratory established accuracy or precision criteria is indicative of possible matrix interference. Only matrix quality control samples selected from media specific to this project are to be reported. Procedures for the MS, MSD, and MD are performed according to the same requirements of the USEPA approved methods.

3.3.4.8 Technical Holding Times

A sample's technical holding time is the period of time a sample may be stored prior to its required preparation and analysis by the laboratory. While exceeding the holding time does not necessarily negate the usability of the analytical results, it causes the qualifying of any data as not meeting the specified acceptance criteria. If the technical holding time of any sample is exceeded, it is to be reported by the laboratory to the data user immediately. A summary of the technical holding times is presented in **Table 1**, ***Sample Containers, Preservation, Volumes and Holding Times***.

3.3.4.9 Sample Preservation

A sample's preservation requirements are media and analysis specific. Preservation is required at sample collection in order to preserve the contaminants in their original state prior to analysis by the laboratory. The laboratory is required to maintain the preservation of the samples once they are in the custody of the laboratory. If the sample is found to be outside the preservation required, it is to be reported by the laboratory to the data user immediately. A summary of the preservation requirements is presented in **Table 1**, ***Sample Containers, Preservation, Volumes and Holding Times***.

3.3.5 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

3.3.5.1 Field Equipment

All field equipment will be maintained in accordance with each respective instrument manufacturer's operating instructions. All maintenance activities will be recorded in a logbook. For field equipment, the preventive maintenance information found in **Table 3**, ***Preventative Maintenance - Field Equipment***, will be provided in the site-specific SAWP to be utilized in the field.

3.3.5.2 Laboratory Equipment

The WV CEL will be responsible for ensuring that their personnel adhere to the instrument/equipment maintenance requirements outlined in their QAP. The instrument/equipment maintenance requirements shall conform to the manufacturer's specifications for each instrument and shall comply with all requirements of the analytical methods used as well as the WVDEP laboratory certification program. All maintenance activities will be recorded in a logbook.

3.3.6 Instrument Calibration and Frequency

All field equipment will be calibrated following the manufacture's procedures and/or specifications. For field equipment, the calibration frequency, acceptance limits, and corrective action information found in **Table 4**, ***Calibration and Corrective Action – Field Equipment***, will be provided in the site-specific SAWP to be utilized in the field. When the acceptance criteria are not met, the corrective action will be implemented. The equipment cannot be used until appropriate corrective actions correct the deficiency.

The laboratory instrument calibration, frequency, acceptance limits, and corrective action shall conform to the requirements of the analytical methods used. All calibration activities will be recorded. Corrective action may include equipment maintenance, repair, and/or sample reanalysis. Data generated on an instrument with an unacceptable calibration must be reported as qualified with the explanation for its qualification outlined in a case narrative to the data user.

3.3.7 Inspection/Acceptance Requirements for Supplies and Consumables

Supplies and consumables will be inspected before each use by the party responsible for their purchase. Packing slips will be compared to the purchase order to confirm the correct supply was received. If a supply item has the wrong identification, appears damaged or tampered with, it will not be used. All disposable supplies (i.e., consumables) must be unused, clean, and, if necessary, decontaminated prior to use. Consumables will be disposed of following each use in order to eliminate cross-contamination.

3.3.8 Data Acquisition Requirements for Non-Direct Measurements

Non-direct measurements refer to data and other information that has been previously collected or generated under some effort outside the specific project being addressed. Non-direct measurement data may include data from inspection activities, computer models, literature files, or computer databases.

The use of data from non-direct measurements should be evaluated to determine its appropriateness for a specific project. It is anticipated that the use of non-direct measurement data for specific projects will be addressed in a site-specific SAWP. The following issues regarding information on how non-direct measurements are acquired and used on the project will be addressed in the site-specific plans for the project:

- The need and intended use of each type of data or information to be acquired;
- How the data will be identified or acquired, and the expected sources of the data;
- The method of determining the underlying quality of the data; and
- The criteria established for determining whether the level of quality for a given set of data is acceptable for either qualitative or quantitative use on the project.

3.3.9 Data Management

3.3.9.1 Paperwork Requirements

All hand-written sample documents will be legibly written in water-proof ink. Any corrections or revisions to sample documentation shall be made by lining through the original entry, initialing and dating any changes. As per WVDEP-OER recommendations, the contractor should also use the USEPA *Scribe* or similar computer program to prepare, track, and manage field sampling documentation.

3.3.9.2 Analytical Requests

Analytical requests need to be submitted to the CEL at least four weeks prior to scheduled sampling. Requests for unusual analyses or for analytes not listed on the requested method should be submitted at least six weeks prior to sampling. When submitting an analytical request, a table with the analyte, CAS number, screening level, and project required quantitation limit should be attached to the request form for each method and matrix being requested. The site-specific SAWP should also be submitted with the analytical request.

3.3.9.3 Sample Numbering

The contractor should use the *Scribe* or similar software tool to assign unique sample numbers. Unique sample numbers will be assigned to each sample. All unused sample

labels will be destroyed to prevent potential accidental duplication of any sample numbers.

Organic sample numbers are in the format CXXXX (five characters). The "C" indicates that this sample is organic, the second letter indicates the Region, and the remaining letters and numbers are used for sequential sample numbering.

Inorganic sample numbers are in the format MCXXXX (six characters). The "MC" indicates that this sample is inorganic, the second letter indicates the Region, and the remaining letters and number are used for sequential sample numbering.

3.3.9.4 Sample Labeling and Tags

After samples have been collected, they will be placed into certified pre-cleaned, containers (**Table 2**, ***Sample Containers, Preservation, Volumes and Holding Times***). Each container should have a sample label and tag generated using *Scribe* or similar software tool. *Scribe* can be downloaded from the following website: https://response.epa.gov/site/site_profile.aspx?site_id=ScribeGIS.

Each sample container label will have the following information:

- Sample number
- Analysis required

Each sample container tag will have the following information:

- Tag number
- Sample number
- Station name
- Station location
- Date and time of sample collection
- Type of sample (composite or grab)
- Initials of sampler
- Signature of sampler
- Preservative information
- Analysis information

3.3.9.5 Sample Packaging and Shipping

Sample containers will be labeled and shipped with a label and sample tag affixed to each container. Samples will be placed in plastic zipping bags. Bagged containers will be placed in appropriate transport containers and the containers will be packed with appropriate absorbent material and bubble wrap. All sample/COC documents will be

affixed to the underside of each transport container lid. The lid will be sealed with shipping tape and custody seals affixed to the transport container. Transport containers will be labeled with the origin and destination locations.

3.3.9.6 Custody Seals

Each sample shipping chest will be sealed with at least two custody seals. Custody seals can be generated as needed using blank labels. The custody seals will be placed so that they will be broken at the signature section of the custody seal when the shipping chest is opened. Each custody seal shall include the following information:

- Date the samples were sealed
- Signature of sampler

3.3.9.7 Chain of Custody

COC forms will be generated by field personnel utilizing the *Scribe* or similar software tool, or use another WVDEP approved COC, and will provide at least the following minimum information requirements:

- Project number and site location.
- Sample identification number.
- Name of Project and/or Program Manager.
- Description of the sample.
- Time and date sample was taken.
- Notation of whether preservatives were added to the sample and type of preservative added.
- Type of sample, such as a grab or composite.
- Matrix of sample (i.e., water, soil, sludge, and so forth).
- Amount of sample being transported to the laboratory.
- The appropriate analytical parameters to be tested.
- Any other information, such as field screening data, that the sampler feels is pertinent to the analysis of the sample.
- Names and signatures of samplers.
- Signatures of all individuals who have had custody of the sample.

Each COC form will be distributed as follows:

- One copy to the FOM
- One copy to the WVDEP-OER Project Manager
- The original will be placed into a zip-lock type bag, which will then be placed into the shipping chest to accompany the sample containers to the laboratory. If

more than one shipping chest is used, a copy of the COC will be placed into each shipping chest.

3.3.9.8 Field Logbook

The FOM will be responsible for maintaining a logbook(s) that documents field activities. Criteria for the logbook include:

- Bounded notebook
- Indelible ink used for entries
- Entries should be factual, detailed, and objective
- Date and time of all entries
- Each individual page signed by the person recording the information

The FOM will document on a daily basis in the logbook on-site personnel, visitors, and activities. Information to be recorded will include, at a minimum:

- Project name and number as applicable.
- Date and time of entry.
- Purpose of sampling.
- Name, address, and affiliation of personnel performing sampling.
- Name and address of the responsible party, if known.
- Type of sample (e.g., surface soil, groundwater, etc.).
- Description of sample containers.
- Description of samples.
- Chemical components and concentration, if known.
- Number and size of samples taken.
- Description and location of the sampling point.
- Date and time of sample collection.
- Difficulties experienced in obtaining sample if applicable.
- Visual references, such as maps or photographs of the sampling site. Include the film roll number or memory card number, the frame number, and a written description of the photograph.
- Field observation, such as weather conditions during sampling periods.
- Field measurements of the materials (e.g., XRF data, immunoassay kit data, specific conductivity, pH, temperature).
- COC form numbers.
- Global Positioning System (GPS) related information (latitude and longitude) for the site and each sampling location.
- Laboratory name, address, and date shipped.
- Method of shipment and air bill number.

3.3.10 Corrective Action

3.3.10.1 Paperwork Corrections

The laboratory will inform the LRS or WVDEP-OER Project Manager when an error or discrepancy has occurred. The following procedures to be followed for correcting errors and omissions on original legal documents are as follows:

- Errors and discrepancies discovered before shipment of samples from the site will be corrected by the FOM by drawing a single line in indelible ink through the error and entering the correct information. The FOM will initial and date each correction.
- All paperwork errors and discrepancies discovered post-shipment will be corrected by a memo-to-file.

3.3.10.2 Memo-to-File (Letter to File)

WVDEP-OER considers a memo-to-file (or letter to file) to be a business letter on company letterhead, and not a memorandum, which becomes part of the evidentiary file for the project. The memo-to-file must include a synopsis of the error and an explanation of the information that should have been sent or the action that should have occurred. The memo-to-file will be signed by either the FOM or LRS. The memo-to-file, at a minimum, must include the following information:

- Carrier used.
- Air bill number.
- Shipment date.
- Sample number(s).
- Sample station location.
- Time and date of sampling.
- Sample tag number(s).
- COC form number.
- Error or discrepancy.

The LRS will distribute memos-to-file as applicable to the following:

- Laboratory
- WVDEP-OER Project Manager
- LRS project file

3.3.10.3 Data Reduction

Data will be reduced either manually on calculation sheets or by computer on formatted printouts. The following responsibilities will be delegated in the data reduction process:

- Technical personnel will document and review their own work and are accountable for its correctness.
- Major calculations will receive both a method and an arithmetic check by an independent checker (peer review). The checker will be accountable for the correctness of the checking process.
- In the case of data generated in the field, the FOM will be responsible for ensuring that data reduction is performed in a manner that produces quality data through review and approval of calculation.
- In the case of data generated in the laboratory, the laboratory's General Manager and QA/QC Officer will be responsible for ensuring that data reduction is performed in a manner that produces quality data through review and approval of calculation.

Hand calculations will be legibly recorded on calculation sheets and in logical progression with sufficient descriptions. Major calculations will be checked by an engineer or scientist of professional level equal to or higher than that of the originator. After completing the check, the checker will initial and date the calculation sheet immediately below the originator. Both the originator and checker are responsible for the correctness of calculations. A calculation sheet will contain the following, as applicable:

- Project title and brief description of the task.
- Date performed.
- Initials of person who performed the calculation.
- Basis for calculation.
- Assumptions made or inherent in the calculation.
- Complete reference for each source of input data.
- Methods used for calculations.
- Results of calculations clearly annotated.

Computer analyses of data are typical in the laboratory and include the use of models, formulas, programs, and data management systems. For published software with existing documentation, hand calculations will be performed periodically to verify that the software is performing correctly. The frequency of this evaluation should be outlined in the laboratory's QAP. Both systematic and random errors will be investigated, and appropriate corrective action measures taken before potentially impacted data is released.

3.3.10.4 Analytical Data Deliverable Requirements

At a minimum, analytical data deliverable packages provided by the laboratory will be in an organized, legible, and tabulated manner and will include the following as applicable:

- Sample documentation (location, date, and time of collection and analysis, etc.)
- COC
- Determination and documentation of detection limits
- Analyte(s) identification
- Analyte(s) quantitation
- Data qualifiers
- Sample paperwork, both preparatory and analysis
- Chromatograms
- Retention times
- Peak integration and labels
- Mass spectral library comparisons, including tentatively identified compounds
- ICV results
- CCV results
- LCS results
- Method Blank/Instrument Blank
- MS/MSD/MD
- Surrogate recovery
- Internal standards recovery and retention time
- Dilution factor
- Moisture content
- Confirmation data
- Signature of laboratory representative

This deliverable format is typically referred to as a "CLP-like data deliverable." The analytical data deliverable format should be a PDF document that may be submitted electronically via a CLP Electronic Data Deliverable (EDD) that includes, (1) a SEDD xml package, (2) an analytical data summary, and (3) a lab narrative. In addition, a spreadsheet of the data results and RLs for each chemical, including CAS numbers, should be provided to WVDEP-OER and the Applicant/LRS to ease the process of screening the results. Prior to the submission of laboratory data to WVDEP-OER, the laboratory's Quality Assurance Officer will review the data for precision, accuracy, completeness and sensitivity in accordance with the guidelines of this *QAPrP* and their own quality assurance program.

The analytical data deliverable packages provided by the laboratory will be forwarded to the data validation contractor for review.

3.3.10.5 Data Validation Process

Field samples procured for a WVDEP-OER project will undergo data verification and data validation. All definitive data will undergo a full "CLP-like" data deliverable package review, completed by an independent third party. The third party will be selected prior to sampling and should not include personnel working for the same laboratory that did the analyses or the same consulting company as those who collected the data. The consultant will coordinate these activities with the WVDEP-OER Project Manager.

USEPA Region 3 data validation procedures consist of four main stages of data validation, with Stage 2 separated into two substages:

Stage 1:	A verification and validation based only on completeness and compliance of sample receipt condition checks should be called a Stage 1 Validation.
Stage 2A:	A verification and validation based on completeness and compliance checks of sample receipt conditions and ONLY sample-related QC results should be called a Stage 2A Validation.
Stage 2B:	A verification and validation based on completeness and compliance checks of sample receipt conditions and BOTH sample-related and instrument-related QC results should be called a Stage 2B Validation.
Stage 3:	A verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, *AND* recalculation checks should be called a Stage 3 Validation.
Stage 4:	A verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, recalculation checks, AND the review of actual instrument outputs should be called a Stage 4 Validation.

The data validation requirements are determined on a site-specific basis as part of the DQOs, but all data within WVDEP-OER must be verified using Stage 1 procedures. Based on the DQOs to be used in Brownfields Assistance Program and VRP risk assessments, 100% of the data must be verified to Stage 1 and a minimum of 10% of the site assessment data for each medium must also be validated following Inorganic Level 2 (aka IM-2) and Organic Level 2 (aka M-3) procedures as adopted by USEPA Region 3. Inorganic Level 2 and Organic Level 2 procedures are outlined in the current applicable USEPA National Functional Guidelines for data review (organic, inorganic, high resolution). For sites utilizing USEPA Brownfields Program funding, the funding agency may require a greater amount of data be validated to Stage 4, and those funding requirements must also be met. Similarly, a minimum of 10% of the data from each medium used in UECA-LUST program site assessments must be validated to Stage 2B before they can be used in a risk assessment, in addition to the 100% Stage 1 verification

requirement. All data used to demonstrate natural attenuation after the risk assessment has been approved by WVDEP only needs to be verified to Stage 1.

Following data validation, a report from the data validation contractor will be submitted to the LRS for review and incorporation into the SAR. A draft final SAR will be submitted for review by the WVDEP-OER Project Manager. When the review is complete, the comments will be incorporated, and a final SAR will be submitted to the WVDEP-OER Project Manager by the LRS. It is important that the LRS follow up on any modifications or rejection of data due to the validation process to determine the impact on the rest of the data. Note that any data validation process that modifies or rejects data will likely mean modifying or rejecting all of the samples from that analytical batch, and not just those that went through validation, depending on the nature of the issues.

3.3.10.6 Data Management Procedures

All data collected during WVDEP-OER activities, including field and laboratory activities, will be recorded, reduced, reviewed, and reported. All data will be digitized in a format that can be readily imported and utilized by the *Scribe* or similar software tool, and all data will be managed using WVDEP-OER approved Electronic Data Deliverable (EDD) formats.

WVDEP-OER and the contractor are responsible for field sample data being recorded, reduced, reviewed, and reported in the appropriate format as indicated above.

Each off-site contract laboratory receiving field samples are responsible for the recording, reduction, reviewing, and reporting of the corresponding analytical results. These data management procedures, including data recording, data validation, data transformation, data transmittal, data reduction, data analysis, data tracking, and data storage and retrieval will be outlined in the laboratory's QAP. The review and approval of the laboratory data management practices is the responsibility of the WVDEP laboratory certification program.

3.4 Assessment and Oversight

3.4.1 Assessment and Response Actions

Internal and external audits are one of the principal tools for determining the effectiveness of QA components. Audits will be conducted in accordance with established procedures and appropriate protocols. Audit frequency and scheduling varies with the type of audit conducted.

Internal and external performance and systems audits will be undertaken to evaluate the capability and performance of the total measurement system. Audits will be utilized to ensure that field and laboratory activities will provide data reflective of the site conditions.

A performance audit is conducted to evaluate the accuracy of the total measurement system or component thereof. A systems audit focuses on evaluating the principal components of a measurement system to determine proper selection and use. In regard to field sampling operations, this oversight activity is completed to critique the quality control procedures that are to be employed. Systems audits of this nature may be done periodically prior to or shortly after field operations commence and until the project is completed.

A technical systems audit (TSA) is conducted to assess the sampling and analytical quality control procedures used to generate environmental data. WVDEP-OER will use TSAs to evaluate laboratory and field procedures used by WVDEP personnel, LRSs, and subcontractors. TSAs may entail a comprehensive, on-site, evaluation of facilities, equipment calibration, personnel qualifications and training, record keeping procedures, data validation, data management, and reporting of field and laboratory activities. Both laboratory and field TSAs may be performed.

3.4.1.1 WVDEP Technical Systems Audits

The WVDEP QMP requires that all programs that employ environmental data collection and analyses are subject to a TSA performed by WVDEP personnel. The TSA involves a thorough review of the equipment, sampling and analysis procedures, documentation, data validation and management, training procedures, and reporting aspects of the technical system for collecting or processing environmental data. TSAs may be routinely planned by the WVDEP-OER QAM, specifically requested by a WVDEP Brownfields Program Manager, or result from other audit or review findings. A TSA should be performed two years after the effective date of each *QAPrP* update and again four years after the effective date in preparation for the next scheduled *QAPrP* update. The WVDEP-OER QAM is responsible for scheduling the TSA, assembling the audit team, and participating in the TSA. Results will be reported to the audited organization in the form of a report.

3.4.1.2 WVDEP Management System Reviews

In accordance with the WVDEP QMP, Management System Reviews (MSRs) will be performed at least once every five years. The MSR will qualitatively assess the program's organization and data collection procedures to determine whether the quality system in place is adequate to ensure the quality of the program's data. The Secretary or his/her designee is responsible for assembling the audit team (if necessary) and coordination of audit activities. Results of any MSR conducted will be promptly shared with the Secretary upon completion of the review (but prior to a final written report). The Division Directors

are responsible for taking any necessary corrective actions and determining whether additional audit activities are required.

3.4.1.3 Field Performance Audits

Field sampling and associated activities will be audited at least once annually by the WVDEP-OER Project Managers. The purpose of field performance audits is to ensure that the methods and protocols detailed in the *QAPrP* are being consistently adhered to in the field.

These activities will be reviewed for their adherence to the procedures established in the SAWP and this *QAPrP*. As part of the field audit, the field logbook maintained by the FOM will be reviewed to verify that field-related activities were performed in accordance with appropriate project procedures. Items reviewed will include, but are not limited to, field equipment calibration records, daily field logbook, and adherence to data management procedures.

3.4.1.4 Laboratory Performance Audits

A performance evaluation audit of all analyses being performed by all CELs must be performed once annually in accordance with Section 3.10 of the Environmental Laboratories Certification and Standards of Performance Rule (W. Va. Legislative Rule 47CSR32). The WVDEP Laboratory Quality Assurance Program Manager is responsible for ensuring that CELs meet state requirements and ensure that they perform audits and implement corrective actions as necessary to maintain their certifications.

3.4.1.5 Field Corrective Action

If a problem occurs in the field that might jeopardize the integrity of the project or cause some specific QA objective to not be met, it is the responsibility of all field project personnel to report it. Field project personnel must report all such suspected problems to the FOM. The FOM must report all such suspected problems to the WVDEP-OER Project Manager. The FOM in conjunction with the WVDEP-OER Project Manager will document the problem, develop the corrective action, and document the results. The FOM will initiate the corrective action and identify and direct the appropriate personnel to implement the corrective action.

3.4.1.6 Laboratory Corrective Action

If a problem occurs in the laboratory that might jeopardize the integrity of the project or cause some specific QA objective to not be met, it is the responsibility of the laboratory to correct it by reanalysis if possible. If limited sample volumes or exceeded holding times make reanalysis impractical or impossible, the laboratory must report the problem.

This reporting may include a case narrative explaining in detail the problem or may be communicated by qualifying the data with defined flags. The problem may also require re-sampling in order to meet the critical DQOs.

3.4.2 Reports to Management

Reports to management will consist of prior notification of activities and reports on activities. Reports will encompass both routine reports and special reports, including written reports and memoranda documenting data assessment activities, results of data validations, audits, non-conformance, corrective actions, and quality notices.

Notifications of all quality assurance activities will be provided in the SAR and describe the progress, the completion, and sometimes the results of quality assurance activities. Description of the completion of activities will serve as notice to all managers of the availability of quality assurance reports.

3.4.2.1 Reports to USEPA

WVDEP prepares quarterly or semi-annual reports for cooperative agreements with the USEPA. The following information is included in the reports, as well as other pertinent information.

- Status of projects
- Programmatic updates
- Changes (i.e., additions and deletions) to the cooperative agreement, as applicable
- Changes to the *QAPrP*, as applicable

3.4.2.2 Field Audit Reports

The WVDEP-OER Project Managers will prepare the field audit results, including situations identified, corrective actions implemented, and overall assessment of field operations, and will submit them to the WVDEP-OER QAM within 30 days of the completion of the audit. Serious deficiencies identified during field audits will be reported to the WVDEP Brownfields Program Managers within two business days of their discovery.

3.4.2.3 Laboratory Audit Reports

When a CEL is audited by the WVDEP, the laboratory audit results, including major and minor situations identified, laboratory response to the problems, impact on data quality, and overall assessment of the laboratory will be completed by the WVDEP Laboratory Quality Assurance Program Manager, and will be made available to WVDEP-OER or USEPA Region 3 upon request.

If changes to the *QAPrP* or site-specific SAWP are required, the requesting party will initiate the desired change by editing the existing procedure (indicating changes by underlining) and developing a schedule for implementation. The revision will be submitted with a cover letter for review, comment, and/or approval. Revisions to existing procedures must be reviewed and approved by the WVDEP-OER QAM before being incorporated into the SAWP or *QAPrP*. Upon acceptance or approval of the revision, the change will be added to the appropriate section of the SAWP or *QAPrP*. Changes will be incorporated and documented by marking the revised pages with the revision number and date in the upper righthand corner.

3.5 Data Review

3.5.1 Data Review

The criteria used to review data for accuracy and precision will be done in a manner consistent with the *USEPA Contract Laboratory Program Statement of Work for Superfund Analytical Methods (Multi-Media, Multi-Concentration)* (SFAM01.1), November 2020; and *USEPA Contract Laboratory Program Statement of Work for High Resolution Superfund Methods (Multi-Media, Multi-Concentration)* (HRSM02.1), November 2020, or most current procedures.

Data review documents possible effects on the data that results from various quality control failures both in the field and in the laboratory. The initial inspection of the data is used to screen for errors and inconsistencies. The individual contracted to perform the data validation will check the COC forms, sample handling procedures, analyses requested, sample description, sample identification, and cooler receipt forms. Sample holding times and preservation are checked and noted. The next phase of data quality review is an examination of the actual data. By examining data from laboratory matrix spikes and duplicates, blind duplicates, trip blanks, equipment blanks, laboratory surrogate recoveries, field samples, and instrument output, the data validation contractor can determine whether the data are of acceptable quality. Refer to **Table 6**, ***Data Evaluation***, for guidelines used in evaluating data.

3.5.2 Data Verification and Validation Methods

To ensure that measurement data generated when performing VRP activities are of an appropriate quality, all fixed laboratory data should be verified and at least some data must be validated. *USEPA Quality Assurance Handbook Volume II, Section 17.0, Revision No: 1* (2008), defines data verification as confirmation, through provision of objective evidence that specified requirements have been fulfilled. By comparison, data validation can be defined as confirmation through provision of objective evidence that the particular requirements for a specific intended use are fulfilled. The data verification process includes the inspection, analysis, and acceptance of field data or samples equivalent to a Stage 1 data validation process based on completeness and compliance of sample receipt condition by ensuring that:

- Documentation identifies the laboratory receiving samples and conducting analyses, and the analyses requested.
- Requested analytical methods were performed and the date(s) of the analyses.
- Requested target analyte results are reported along with laboratory data qualifiers and definitions for each result.
- Requested target analyte result units are reported.
- Requested reporting limits for all samples are present.
- Sampling dates, date and time of laboratory receipt of samples, and sample conditions upon receipt at the laboratory are documented.

Data validation is a systematic review of data against a set of established criteria to provide a specified level of assurance of its validity prior to its intended use, requiring that the techniques utilized be applied to the data in a methodical and uniform manner. The process of data validation must be close to the origin of the data, independent of the data production, and objective in its approach.

As discussed previously in Section 3.3.10.5, the amount and stages of data validation are determined on a site-specific basis, but all data from WVDEP-OER sites must by reviewed via a Stage 1 verification and validation of completeness and compliance of sample receipt condition process. Before they can be used in a Brownfields Assistance Program or VRP risk assessment, 100% of the data must undergo Stage 1 verification and a minimum of 10% of fixed laboratory data from each medium in all site assessments must also be validated following Stage 4 procedures as outlined in the *USEPA Contract Laboratory Program Statement of Work for Superfund Analytical Methods (Multi-Media, Multi-Concentration)* (SFAM01.1), November 2020; and *USEPA Contract Laboratory Program Statement of Work for High Resolution Superfund Methods (Multi-Media, Multi-Concentration)* (HRSM02.1), November 2020, or most current procedures. Data validation must also meet the requirements of the *Guidance for Labelling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA 540-R-08-005, 2009). Sites using federal funds (e.g., Brownfields grants) may need to validate more data following Stage 4 procedures to meet the minimum specifications required by the funding agency. UECA-LUST site assessments only need to validate 10% of the data from each medium to Stage 2B, in addition to the 100% Stage 1 verification, before being used in a risk assessment since these sites only achieve "NFA at this time" closure. Any data used to demonstrate natural attenuation after WVDEP-OER approval of the risk assessment only need Stage 1 verification.

If a data issue is discovered during the validation process that might jeopardize the integrity of the project or cause some specific QA objective to not be met, it is the responsibility of the data validation contractor to document and report it to the LRS and WVDEP-OER Project Manager. Depending on the nature of the issues, any modification or rejection of data during the validation process will trigger an assessment of the rest of the data from the same batches of analyses as those that went through validation to determine if the same issues apply. The entire data

validation deliverable, along with the data validation report, must be submitted with the SAR so that the results can be conveyed to the data users.

3.5.3 Data Quality Assessment

Data quality assessments will be prepared to document the overall quality of data collected in terms of the established DQOs and the effectiveness of the data collection and generation processes. The data assessment parameters calculated from the results of the field measurements and laboratory analyses will be reviewed to ensure that all data used in subsequent evaluations are scientifically valid, of known and documented quality, and where appropriate, legally defensible. In addition, the performance of the overall measurement system will be evaluated in terms of the completeness of the project plans, effectiveness of the field measurement and data collection procedures, and relevance of laboratory analytical methods used to generate data as planned. Finally, the goal of the data quality assessment is to present the findings in terms of data usability.

Generally, to achieve an acceptable level of confidence in the decisions that will be made from the data, the degree to which the total error in the results derived from data collected and generated must be controlled. The methods and procedures used to implement and accomplish these QC objectives are as follows:

1) Assess the quality of data values measured and generated to ensure that all are scientifically valid, of known and documented quality, and, where appropriate, legally defensible. This will be accomplished by assessing actual data values generated or measured against the established DQOs for parameters such as precision, accuracy, completeness, representativeness, comparability, and sensitivity, and by testing generated data against acceptance criteria established for these parameters.

2) Achieve an acceptable level of confidence in the decisions that are to be made from measurements and data by controlling the degree of total error permitted in the data through QC checks. Data that fail the QC checks or do not fall within the acceptance criteria established will be rejected from further use or qualified for limited use.

The major components of the data quality assessment are presented below and show the logical progression of the assessment leading to determination of data usability:

- ***Data Validation Summary –*** Summarizes the individual data validation reports for all sample delivery groups by analytical method. Systematic problems, data generation trend, general conditions of the data, and reasons for data qualification are presented.
- ***Data Evaluation Procedures –*** Describes the procedures used to further qualify data caused by such factors as dilution, reanalysis, matrix effect, and duplicate analysis of samples. Examples of the decision logic are provided to illustrate the methods by which qualifiers are applied.

- ***QC Sample Evaluation –*** Evaluates QC samples such as field blanks, trip blanks, equipment rinsates, field duplicates, and laboratory control samples to assess the quality of the field activities and laboratory and field control samples in relation to objectives established.
- ***Assessment of DQOs –*** Assesses the quality of data measured and generated in terms of precision, accuracy, representativeness, completeness, and sensitivity through the examination of laboratory and field control samples in relation to objectives established.
- ***Summary of Data Usability –*** Summarizes the usability of data, based on the assessment of data conducted during the previous four steps. Sample results for each analytical method will be qualified as acceptable, rejected, estimated, biased high, or biased low.

3.5.4 Reconciliation with Data Quality Objectives

All data generated from the project will be assessed for precision, accuracy, representativeness, completeness, comparability, and sensitivity. The methods for calculating accuracy, precision, sensitivity and completeness and for evaluating representativeness and comparability are summarized in Section 3.2.8.2. Generally, data that do not meet the established acceptance criteria may be cause for re-sampling and re-analysis. However, in some cases data that do not meet acceptance criteria are usable with specified limitations. Data that are marked as usable with limitations will be included in the project reports but will be clearly marked as having limited usability. This is particularly necessary when overall completeness is not achieved and especially for critical samples, if identified.

4.0 REFERENCES

The following reference materials were used in compiling the information contained in this *QAPrP*.

American National Standard *Quality Management Systems for Environmental Information and Technology Programs – Requirements with Guidance for Use* (ASQ/ANSI E4-2014), September 2014, ANSI Webstore.

ASTM E1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, ASTM International, West Conshohocken, PA, 2013, www.astm.org.

ASTM E1903-11, Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process, ASTM International, West Conshohocken, PA, 2011, www.astm.org.

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Figure 1. Brownfields Section Organization Chart

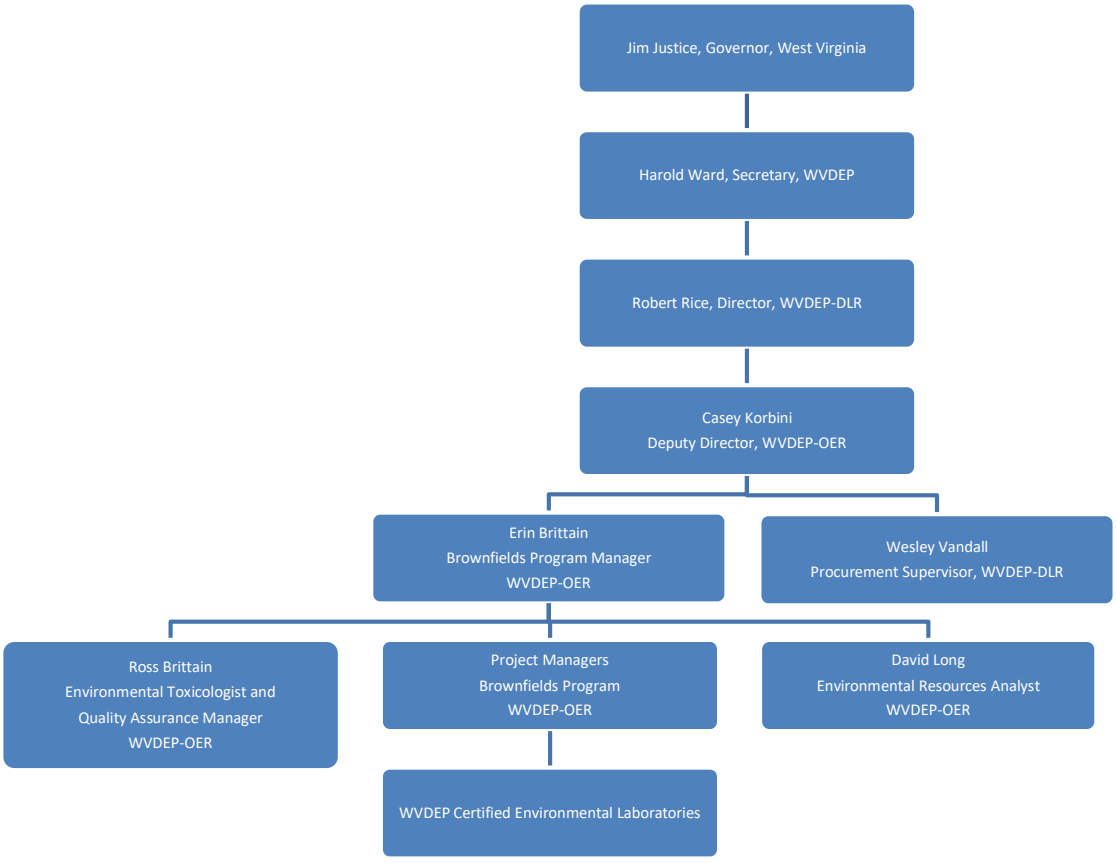
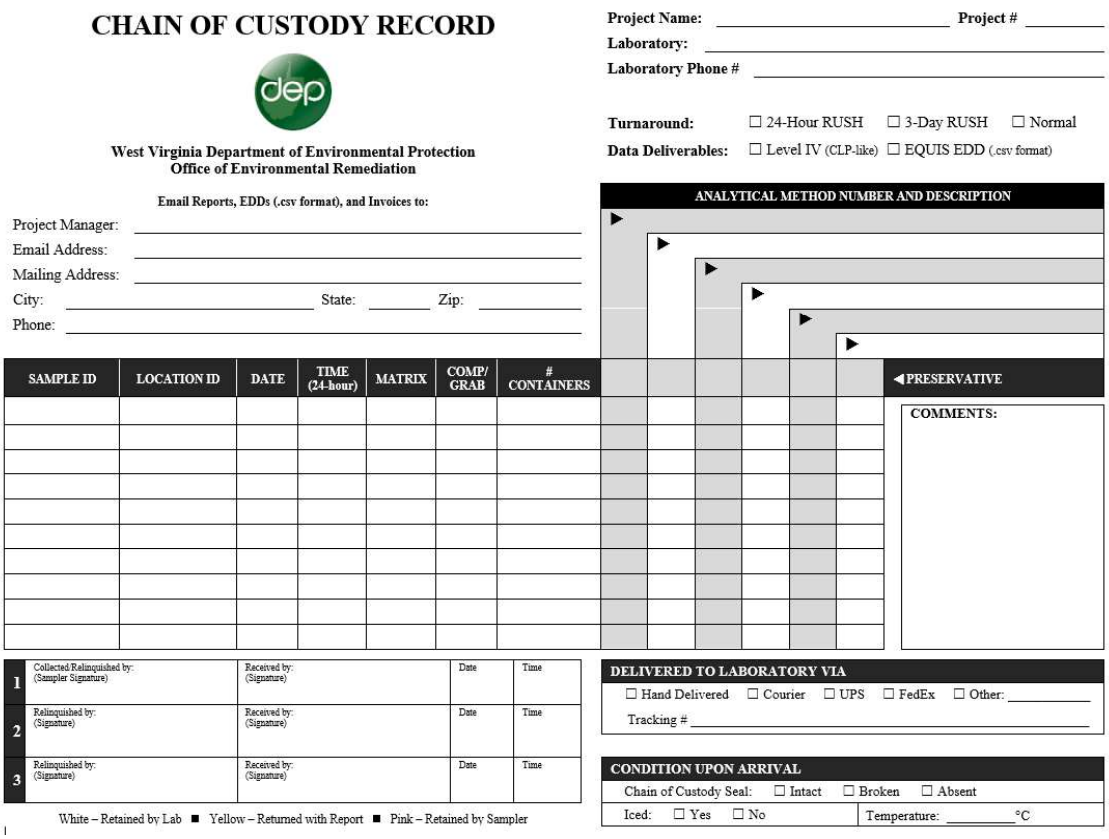


Figure 2. Laboratory Chain of Custody Form (Tier 4 option only)



CHAIN OF CUSTODY RECORD

West Virginia Department of Environmental Protection
Office of Environmental Remediation

Email Reports, EDDs (.csv format), and Invoices to:

Project Manager: _____
Email Address: _____
Mailing Address: _____
City: _____ State: _____ Zip: _____
Phone: _____

Project Name: _____ **Project #** _____
Laboratory: _____
Laboratory Phone # _____

Turnaround: ☐ 24-Hour RUSH ☐ 3-Day RUSH ☐ Normal
Data Deliverables: ☐ Level IV (CLP-like) ☐ EQUIS EDD (.csv format)

SAMPLE ID	LOCATION ID	DATE	TIME (24-hour)	MATRIX	COMP/ GRAB	# CONTAINERS

ANALYTICAL METHOD NUMBER AND DESCRIPTION ▶ ▶ ▶ ▶ ▶ ▶

◀**PRESERVATIVE**

COMMENTS:

1	Collected/Relinquished by: (Sampler Signature)	Received by: (Signature)	Date	Time
2	Relinquished by: (Signature)	Received by: (Signature)	Date	Time
3	Relinquished by: (Signature)	Received by: (Signature)	Date	Time

White – Retained by Lab ■ Yellow – Returned with Report ■ Pink – Retained by Sampler

DELIVERED TO LABORATORY VIA
☐ Hand Delivered ☐ Courier ☐ UPS ☐ FedEx ☐ Other: _____
Tracking # _____

CONDITION UPON ARRIVAL
Chain of Custody Seal: ☐ Intact ☐ Broken ☐ Absent
Iced: ☐ Yes ☐ No Temperature: _____ °C

Table 1. Sample Containers, Preservation, Volumes, and Holding Times

Matrix/Method	**Fraction**	**Minimum Sample Volume**	**Container Type (see Table 2)**	**Sample Preservation**	**Technical Holding Time**
Soil/Sediment 8260	VOCs	3 cores, ~5 g each. 4-ounce jars with stir bar, or 3 Encore or 3 TerraCore samples, plus dry weight sample. 12 containers with MS/MSD.	F Encore or TerraCore sample kit	Cool, ≤6° (without freezing), $NaHSO_4$ for low-level concentrations (5-500 µg/kg) Methanol for high-level concentrations (>250 µg/kg) TerraCore comes with preservative No headspace	48 hours with no preservative 14 days with preservative TerraCore = 14 days Encore = 48 hours
SVOCs: 8270 PAHs: 8270SIM BNAs: 625.1	BNAs/SVOCs	4-ounce for VRP, 8-ounce or 2 x 4-ounce ≥150 g total for CERCLA/Federal sites. 2 x 8-ounce or 4 x 4-ounce for MS/MSD.	E or F	Cool, ≤6° (without freezing) No headspace	Extract in 14 days Analyze extract within 40 days of extraction
PCBs: 8082A Herb: 8151 Pest: 8081	Pesticides, Herbicides, PCBs	4-ounce for VRP, 8-ounce or 2 x 4-ounce ≥150 g total for CERCLA/Federal sites. 2 x 8-ounce or 4 x 4-ounce for MS/MSD.	E or F	Cool, ≤6° (without freezing)	Extract in 14 days Analyze extract within 40 days of extraction
6010	Total Metals (except Hg & Cr+6)	4-ounce for VRP, 8-ounce for CERCLA/Federal sites	E or F	Cool, ≤6° (without freezing)	180 days
9016	Cyanide	4-ounce for VRP, 8-ounce for CERCLA/Federal sites	E or F	Cool, ≤6° (without freezing) Fill to capacity. Preservatives are variable	14 days
7471	Mercury	4-ounce for VRP, 8-ounce for CERCLA/Federal sites	E or F	Cool, ≤6° (without freezing)	28 days

Matrix/Method	**Fraction**	**Minimum Sample Volume**	**Container Type (see Table 2)**	**Sample Preservation**	**Technical Holding Time**
Soil/Sediment 8290A	Dioxins/Furans	4-ounce for VRP, 8-ounce for CERCLA/Federal sites	E or F	Cool, ≤6° (without freezing) Fill to capacity	30 days to extraction, 45 days to analysis
7196A	Cr+6	4-ounce	F	Cool, ≤6° (without freezing)	30 days
1633 (Draft)	PFAS	500 mL	J (75% full)	Cool, ≤6° (without freezing)	90 days, if cold & dark
Aqueous 8260	VOCs	3 x 40 mL vial 5 x 40 mL vials with MS/MSD	B	Cool, ≤6° (without freezing) HCL to pH<2, no headspace	14 days
SVOCs: 8270 BNAs:	BNAs/SVOCs	1 Liter for VRP, 2 x 1 Liter for CERCLA/Federal sites 6 x 1 Liter with MS/MSD	G	Cool, ≤6° (without freezing) No headspace	Extract in 7 days Analyze extract within 40 days of extraction
PCBs: 8082A Herb: 8151 Pest: 8081	Pesticides, Herbicides, PCBs	1 Liter for VRP, 2 x 1 Liter for CERCLA/Federal sites 6 x 1 Liter with MS/MSD	G	Cool, ≤6° (without freezing)	Extract in 7 days Analyze extract within 40 days of extraction
6010	Total Metals (except Hg & Cr+6)	500 mL for VRP, 1 Liter for CERCLA/Federal sites, 2L with MSD	C or A	HNO_3 to pH<2	180 days
6010	Dissolved Metals (except Hg & Cr+6)	500 mL for VRP, 1 Liter for CERCLA/Federal sites, 2L with MSD	C or A	HNO_3 to pH<2 after filtration	180 days
7470	Mercury	500 mL for VRP, 1 Liter for CERCLA/Federal sites, 2L with MSD	C or A	HNO_3 to pH<2	28 days

Matrix/Method	**Fraction**	**Minimum Sample Volume**	**Container Type (see Table 2)**	**Sample Preservation**	**Technical Holding Time**
Aqueous 9014	Cyanide	250 mL for VRP, 1 Liter for CERCLA/Federal sites, 2L with MSD	A, C or D	Add 0.6 g ascorbic acid per liter of sample Cool, ≤6° (without freezing) NaOH to pH>10	14 days
8290A	Dioxins/Furans	1 Liter for VRP, 2 x 1 Liter for CERCLA/Federal sites	G	Cool, ≤6° (without freezing) If residual chlorine is present, add 80 mg sodium thiosulfate per L of water.	30 days to extraction, 45 days to analysis
218.6	Cr+6	250 mL	D	Cool, ≤6° (without freezing)	24 hours
1633 or 537.1	PFAS	3 x 500 mL	J	Cool, ≤6° (without freezing)	28 days, variable
Vapor/ TO-15	VOCs	1 Liter	H	Keep out of sunlight	30 days
SPLP/TCLP 1312	VOCs	≥25 g Preferably 50 g	B, G or I	Cool, ≤6° (without freezing) No headspace	Extract in 14 days Analyze extract within 7 days of extraction
	BNAs/SVOCs	≥300 g Preferably 500 g	E, F, G or I	Cool, ≤6° (without freezing) No headspace	Extract in 14 days Analyze extract within 40 days of extraction
	Pesticides	≥300 g Preferably 500 g	E, F, G or I	Cool, ≤6° (without freezing)	Extract in 14 days Analyze extract within 40 days of extraction
	Metals	≥100 g	E, F, G or I	Cool, ≤6° (without freezing)	Extract in 180 days Analyze extract within 180 days of extraction
	Mercury	≥100 g	E, F, G or I	Cool, ≤6° (without freezing)	Extract in 28 days Analyze extract within 28 days of extraction

Table 2. Container Types

Container Type	Parts	Description
A	Container Closure	500 mL HDPE bottle Polyethylene cap, ribbed; polyethylene liner
B	Container Closure Septum	40 mL amber VOA glass vial, 24-mm neck finish Polyproplyene or phenolic, open-top, screw cap, 15-cm opening, 24-400 size 24-mm disc of 0.005-inch Polytetrafluoroethylene (PTFE) bonded to 0.120-inch silicon
C	Container Closure	1 L high density polyethylene, cylinder-round bottle, 28-mm neck finish Polyethylene cap, ribbed, 28-410 size: F217 polyethylene liner
D	Container Closure	250 mL HDPE bottle HDPE or polyethylene cap, ribbed; no liner
E	Container Closure	8-ounce short, wide mouth, straight-sided, flint glass jar, 70-mm neck finish Polypropylene or phenolic solid cap, 70-400 size: 0.015-inch PTFE liner
F*	Container Closure	4-ounce tall, wide mouth, straight-sided, flint glass jar, 48-mm neck finish Polypropylene or phenolic solid cap, 48-400 size: 0.015-inch PTFE liner
G	Container Closure	1 Liter, amber Boston round, glass bottle, 33-mm pour out neck finish Polypropylene or phenolic solid cap, 33-430 size: 0.015-inch PTFE liner
H	Container	Tedlar Bag / Summa Canister
I	Container Closure	32-ounce tall, wide mouth, straight sided, flint amber glass, 89-mm neck finish Polypropylene or phenolic solid cap, 89-400 size: 0.015-inch PTFE liner
J	Container Closure	500 mL HDPE bottle HDPE or polyethylene cap, ribbed; no liner; lot-certified PFAS free

*Containers to achieve requirements of Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition (SW-846) Method 5035, Closed-System Purge and Trap Extraction for Volatile Organics in Soil and Waste Samples.

Table 3. Preventative Maintenance – Field Equipment

Site Name:

Site Location:

Project Number:

Preventative Maintenance – Field Equipment			
Instrument	**Activity**	**Date**	**Frequency**

Notes: Identify field equipment and/or systems requiring periodic preventative maintenance. Describe the activity to be performed (i.e., such as check battery) and record the frequency of the activity.

Table 4. Calibration and Corrective Action for Field Equipment

Site Name:

Site Location:

Project Number:

Calibration and Corrective Action for Field Equipment						
Instrument	**Date**	**Calibration Standards**	**Frequency Initial Calibration**	**Frequency Continuing Calibration**	**Acceptance Criteria**	**Corrective Action**

Table 5. Field Quality Control Requirements

Type of QC Sample	Frequency	Acceptance Criteria[3]	Corrective Action[4]
Field Duplicate	At least one per twenty samples per matrix or one per day, whichever is more frequent[2]	50% of Relative Percent Difference (RPD) for soil/sediment samples, or 30% of RPD for aqueous samples.	Corrective actions may include any of the following: reanalyzing suspect samples; resampling and reanalyzing; accepting data with an acknowledged level of uncertainty; re-calibrating analytical instruments; and/or discarding the data.
Split Sample	10% of field screening data will be confirmed with data from a fixed laboratory.[1,2]	50% of Relative Percent Difference (RPD) or 2 times the method detection limit (MDL)	Corrective actions may include any of the following: reanalyzing suspect samples; resampling and reanalyzing; accepting data with an acknowledged level of uncertainty; re-calibrating analytical instruments; and/or discarding the data.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	At least one per twenty samples per matrix or one per day, whichever is more frequent.[2] **Not applicable to VOC and SVOC if SOW SOM01.1 is used.**	Recovery within 50% for spikes at 10 times MDL	Corrective actions may include any of the following: Review chromatograms and raw data quantitation reports; check instrument response using calibration standard; attempt to correct matrix problem and reanalyze sample; resampling and reanalyzing; accepting data with an acknowledged level of uncertainty; and/or discarding the data.
Equipment Rinsate Blank	At least one per twenty samples per matrix per equipment type per decontamination event or one per day, whichever is more frequent.[2]	< minimum detection limit or < 30% of lowest sample up to 2 times the MDL	Corrective actions may include any of the following: reanalyzing suspect samples; resampling and reanalyzing; qualify data as necessary, accepting data with an acknowledged level of uncertainty; re-calibrating analytical instruments; and/or discarding the data.
Field Blank	At least one per twenty samples per matrix or one per day, whichever is more frequent.	< minimum detection limit or < 30% of lowest sample up to 2 times the MDL	Corrective actions may include any of the following: reanalyzing suspect samples; resampling and reanalyzing; qualify data as necessary, accepting data with an acknowledged level of uncertainty; re-calibrating analytical instruments; and/or discarding the data.
VOA Trip Blank	One for each cooler which contains samples for VOA analyses.	< minimum detection limit or < 30% of lowest sample up to 2 times the MDL	Corrective actions may include any of the following: reanalyzing suspect samples; resampling and reanalyzing; qualify data as necessary, accepting data with an acknowledged level of uncertainty; re-calibrating analytical instruments; and/or discarding the data.
Cooler Temperature Blank	One per cooler.	6 degrees Celsius	Corrective actions may include any of the following: resampling; qualify data as necessary, and/or accepting data with an acknowledged level of uncertainty.

1) The frequency cited is per Superfund Data Quality Objectives Process for Superfund Sites and may not be applicable to all WVDEP-OER project sites. The collection of split samples will be dependent upon the data quality objectives for a given site.
2) Sufficient sample will be collected to allow the laboratory to perform this analysis.
3) The acceptance criteria provided are for guidance purposes only. The acceptance criteria for a specific project will be dependent upon the data quality objectives of that project and may differ from those criteria listed in this table. In cases where the acceptance criteria are different than that listed above, it will be specified in the site-specific Site Assessment Work Plan (SAWP).
4) The corrective actions provided are for guidance purposes only. The corrective action procedures listed may vary depending upon the data quality objectives and the acceptance criteria provided in the site-specific SAWP.

Table 6. Data Evaluation[1]

QC Element (Sample Type, Analysis, or Condition)	Type of Failure	Possible Cause[2]	Major PARCCS Affected[3]	Possible Effect on Data	Possible Worst-Case Data Evaluation Scenario[4]
Chain of Custody	Chain broken or not kept	Missing signatures, missing seals, missing dates/times	Representativeness Completeness	Incomplete data	Data not legally defensible
Sample Labeling	Sample labels missing, not attached to containers, or illegible	Failure to protect sample containers from moisture, failure to use appropriate marker, improper SOP	Representativeness Completeness	Incomplete data False positives False negatives	Invalidation of sample results
Sample Labeling	Samples mislabeled	Sampler error, improper SOP	Representativeness Completeness	Incomplete data False positives False negatives	Invalidation of sample results
Sample Containers	Plastic containers used for organic analytes	Sampler unaware of requirements to use glass, SAP not followed or incorrect, improper SOP	Representativeness Accuracy Comparability Completeness	False positives False negatives High or low bias Phthalate interference	Invalidation of sample results
Headspace	Air bubbles in aqueous VOC vials; visible headspace in soil VOC container	Poor sampling technique, caps not sealed tight, septum caps not used, dirt between rim and cap, soil not packed tight, improper SOP	Representativeness Accuracy Comparability Completeness	False negatives low bias	Invalidation of sample results
Preservation	No preservative or wrong pH	No preservative added, improper amount of preservative added, overfilling container with sample, improper SOP	Representativeness Accuracy Comparability Completeness	False negatives low bias	Invalidation of sample results, affects legal defensibility of data, Sample results greater than detection limit considered as minimum values only
Preservation	Wrong preservative	Improper SOP, failure to read SAP, SAP incorrect	Representativeness Accuracy Comparability Completeness	Incomplete data False positives False negatives	Invalidates or qualifies some or all of the sample results, affects legal defensibility of data,

QC Element (Sample Type, Analysis, or Condition)	Type of Failure	Possible Cause[2]	Major PARCCS Affected[3]	Possible Effect on Data	Possible Worst-Case Data Evaluation Scenario[4]
Preservation	Samples not properly cooled, placed on ice	Insufficient ice used, shipping container not adequately insulated, transport time too long.	Representativeness Accuracy Comparability Completeness	False negatives low bias	Invalidation of sample results, affects legal defensibility of data, Sample results greater than detection limit considered as minimum values only
Sample Filtration	Samples not filtered and preserved in field for dissolved metals	Sampler error, sampler unaware of requirement, improper SOP, failure to read SAP, SAP incorrect, filtration apparatus not available or damaged	Representativeness Accuracy Comparability Completeness	False positives False negatives High or low bias	Invalidation of sample results for dissolved metals
Holding Times[5]	Holding times exceeded	Excessive analysis time, holding samples too long prior to shipment, shipping samples prior to a weekend or holiday, inappropriate shipping method	Representativeness Accuracy Comparability Completeness	False negatives Low Bias False positives of breakdown products	Invalidation of sample results, affects legal defensibility of data, Sample results greater than detection limit considered as minimum values only
Analysis Method	Wrong method	Incorrect method listed on Chain of Custody, failure to read SAP, incorrect SAP, laboratory analyst error	Representativeness Accuracy Comparability Completeness Sensitivity	False negatives False positives High or low bias	Invalidates or qualifies all or some of the sample results
Detection Limit	Detection limit too high	Insufficient sample, high dilution factor, wrong or inappropriate method	Accuracy Comparability Completeness Sensitivity	Incomplete data False positives False negatives	Invalidation of sample results
Method Blank[6]	Method blank absent	Lost during analysis, improper SOP	Representativeness Accuracy Completeness Sensitivity	False negatives Low sensitivity	Invalidation of sample results greater than detection limit, sample results less than detection limit are valid
Method Blank	Contamination greater than detection limit	Contaminated reagents or glassware, poor laboratory technique, improper SOP	Representativeness Accuracy Comparability Completeness Sensitivity	False positives High bias	Invalidates all sample results where method blank contamination is greater than 5% of sample concentration
Equipment rinsate blank	Contamination greater than the detection limit	Improper decontamination of field sampling equipment, contaminated rinsate water, containers, or preservatives	Precision Representativeness Accuracy Comparability Completeness	False positives High bias	Invalidates all sample results where equipment blank contamination is greater than 5% of sample concentration

QC Element (Sample Type, Analysis, or Condition)	Type of Failure	Possible Cause[2]	Major PARCCS Affected[3]	Possible Effect on Data	Possible Worst-Case Data Evaluation Scenario[4]
Trip Blank (applies to volatiles analysis only)	Trip Blank absent	Improper SOP, trip blank broken during shipment, trip blank lost during analysis	Representativeness Accuracy Comparability Completeness	False positives	Invalidation of sample results greater than detection limit, sample results less than detection limit are valid
Trip Blank (applies to volatiles analysis only)	Contamination greater than detection limit	Cross contamination during shipment or storage, contaminated reagent water, glassware, or preservative	Precision Representativeness Accuracy Comparability Completeness Sensitivity	False positives High Bias	Invalidates all sample results were trip blank contamination is greater than 5% of sample concentration
Surrogate recoveries in method blank	Low recoveries	Method failure, improper spiking, degraded spiking solution, failed spiking device	Representativeness Accuracy Comparability Completeness	False negatives Low bias	Invalidation of sample results
Surrogate recoveries in method blank	High recoveries	Method failure, improper spiking, degraded spiking solution, failed spiking device, contaminated reagents or glassware	Representativeness Accuracy Comparability Completeness	High bias Possible false positives	Invalidation of sample results
Surrogate recoveries in samples	Low recoveries	Matrix effects, inappropriate method, method failure, improper spiking, degraded spiking solution, failed spiking device	Representativeness Accuracy Comparability Completeness	False negatives Low bias	Qualifies all sample results (i.e., possible matrix effects), rejection of individual sample results
Surrogate recoveries in samples	High recoveries	Matrix effects, inappropriate method, method failure, improper spiking, degraded spiking solution, failed spiking device	Representativeness Accuracy Comparability Completeness	High bias False positives	Qualifies all sample results (i.e., possible matrix effects), rejection of individual sample results
Matrix spike and/or matrix spike duplicate	Matrix spike and/or matrix spike duplicate missing	Insufficient sample, lost during analysis, improper SOP	Representativeness Accuracy Precision Comparability	False negatives False positives High or low bias	Qualifies all sample results (i.e., no measure of matrix effects)
Matrix spike and/or matrix spike duplicate[7]	Low recoveries	Matrix effects, inappropriate method, method failure, inadequate cleanup, inadequate background correction, failure to use method of standard additions, improper spiking, degraded spiking solution, failed spiking device	Accuracy Precision Sensitivity Comparability	False negatives Low bias	Qualifies all sample results (i.e., possible matrix effects)

QC Element (Sample Type, Analysis, or Condition)	Type of Failure	Possible Cause[2]	Major PARCCS Affected[3]	Possible Effect on Data	Possible Worst-Case Data Evaluation Scenario[4]
Matrix spike and/or matrix spike duplicate	High recoveries	Matrix effects, inappropriate method, method failure, inadequate cleanup, inadequate background correction, failure to use method of standard additions, improper spiking, degraded spiking solution, failed spiking device, contaminated reagents or glassware	Accuracy Precision Sensitivity Comparability	False positives High bias	Qualifies all sample results greater than detection limit (i.e., possible matrix effects)
Matrix spike and/or matrix spike duplicate	High relative percent difference	Sample is not homogeneous, inadequate sample mixing in laboratory, samples misidentified, method failure, improper spiking, degraded spiking solution, failed spiking device, contaminated reagents or glassware	Representativeness Precision Comparability Sensitivity Accuracy	Non-representative sample Poor precision	Qualifies all sample results greater than the detection limit (i.e., possibly highly variable results)
Dilution Factors	Extremely high dilution factors	High concentrations of interferences or analytes, inappropriate method	Accuracy Comparability Completeness Sensitivity	False negatives Poor accuracy Low sensitivity	Invalidation of samples with high dilution factors, may qualify samples results as estimated
Field Quality Control Samples[8]	Field and QC sample concentrations do not compare within acceptable limits	Samples were not homogeneous, insufficient mixing in the field, samples not split but collocated, insufficient mixing in lab	Representativeness Precision Comparability	Non-representative sample Poor precision High or low bias	Qualifies all sample results greater than detection limit (i.e., possible highly variable results), Sample results less than detection limit are valid
Field Quality Assurance Samples[9]	Quality assurance sample results do not agree with project and/or QC sample results	Improper SOP (QA and primary lab used different analytical methods), inadequate cleanup, inadequate background correction, laboratory contamination, preservative problems, method failure, sample misidentification, samples were not homogeneous	Accuracy Comparability Completeness Representativeness Precision	Non-representative sample False positives False negatives High or low bias	Qualifies or invalidates all or part of the data set.

1) Entries in the possible causes, PARCCs parameters affected, effect on data, and possible data evaluation columns assume that only one type of failure occurred at any given time. The cumulative or synergistic effects of more than one failure type occurring at the same time makes data evaluation more complex and is beyond the scope of this table.
2) The most common possible causes are listed.
3) PARCCS parameters most affected are listed, it is quite possible other PARCCS are affected.
4) All data evaluation must take into account the specific data quality objectives for a given project; therefore, it is possible that even suspect data may be used, depending upon the DQOs established for a project.
5) Generally, exceeding the holding times of a sample will result in false negatives and/or low bias; however, exceeding holding times on certain types of samples (carbonates, DO) may result in a false positive or high bias. Furthermore, high bias and false positives can occur when degradation products of contaminants are also themselves analytes.
6) Method blanks are not appropriate for all analyses (i.e., pH, conductivity, % solids, total suspended solids, etc.).
7) When native sample concentrations are significantly greater than the effective spike concentration then the conclusion of a matrix effect is only tentative. As a general rule, the native sample concentration should be no more than four times higher than the matrix spike concentration for the matrix effect to be considered probably present.
8) Conventional sampling protocols for some analyte classes (VOCs, BTEX, GRO) prohibit sample mixing and splitting because it results in the loss of major fractions of the analytes. Field and QC samples for these analytes are appropriately collected as collocated sample pairs. Such "split" samples should be handled as discrete samples in any risk assessments.
9) Use of field QA sample data to evaluate project sample data assumes that the field QA sample data is supported by a complete set of in-control laboratory quality control data.