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2022

DATA-VALIDATION PROGRAM PLAN

DOT&PF Statewide PFAS

VARIOUS SITES, ALASKA

SHANNON & WILSON

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Attn: Samantha Cummings

Subject: 2022 DATA-VALIDATION PROGRAM PLAN, DOT&PF STATEWIDE PFAS, VARIOUS SITES, ALASKA

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ACRONYMS

AAC	Alaska Administrative Code
CCV	continuing calibration verification
COC	chain-of-custody
°C	degrees Celsius
CSP	Contaminated Sites Program
DEC	Alaska Department of Environmental Conservation
DQO	data quality objective
DVPP	Data-Validation Program Plan
EB	equipment blank
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FB	field blank
GRO	gasoline range organics
ICV	initial calibration verification
IDA	isotope dilution analyte
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
MB	method blank
mm	millimeter
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
%R	percent recovery
PFAS	per- and polyfluoroalkyl substances
PQL	practical quantitation limit
QAPP	quality assurance program plan
QA	quality assurance
QC	quality control
RPD	relative percent difference
SDG	sample delivery group
SGS	SGS North America, Inc.
SOP	standard operating procedure
SRF	sample receipt form
TB	trip blank
USACE	US Army Corps of Engineers
VOA	volatile organic analysis
VOC	volatile organic compound
WO	work order

Exhibit 1-1: Definition of Flags

Flag	Displayed as	Description
U	< [reporting limit]	The analyte was not detected; the result is listed as less than the reporting limit.
UJ	< [reporting limit] J*	The analyte was not detected; the listed reporting limit may not represent the true reporting limit due to sample-handling or laboratory quality-control (QC) failures (i.e., the listed reporting limit may be inaccurate or imprecise).
UB	< [LOQ or reported concentration] B*	The analyte is considered not detected due to sample-contamination identified in a blank; the result is listed as less than the limit of quantitation (LOQ) or the concentration originally reported in the sample (higher of the two values).
J	[Result] J – Flag applied by laboratory [Result] J* – Flag applied by reviewer	The result is an estimated quantity. The analyte was detected below the LOQ or was affected by QC failures.
JL	[Result] JL*	The result is an estimated quantity and may be biased low due to QC failures.
JH	[Result] JH*	The result is an estimated quantity and may be biased high due to QC failures.
N	[Result] JN*	The analyte was tentatively identified, and the result is an estimated quantity.
R	R*	The results are unusable. The sample results are rejected due to severe QC deficiencies. The analyte may or may not be present in the sample.

NOTES:

* Flag applied by reviewer.

LOQ = limit of quantitation, QC = quality control

1 INTRODUCTION

This Data-Validation Program Plan (DVPP) was prepared to describe Shannon & Wilson's procedures for reviewing and qualifying analytical data in an objective and consistent manner.

This DVPP describes the process for qualifying analytical data based on quality assurance/quality control (QA/QC) review of Level II laboratory reports and electronic data deliverables (EDDs). This DVPP is intended to provide guidance for conducting a U.S. Environmental Protection Agency (EPA) Stage 2a Validation (EPA 2009). A more critical level of validation is beyond the scope of this DVPP, but the DVPP does present guidance for determining whether additional review should be conducted, based on information received from the laboratory. This DVPP also assesses the quality of the analytical data using PARCCS parameters (precision, accuracy, representativeness, comparability, completeness, and sensitivity).

This DVPP provides information about references used during the data-validation process and presents data qualifiers used to "flag" analytical data. The standard set of flags used to validate analytical data along with their definitions are presented in Exhibit 1-1. Methods for applying data qualifiers are referenced primarily from the following EPA guidance documents:

- EPA National Functional Guidelines for Organic Superfund Methods Data Review, November 2020 (EPA 2020b);
- EPA National Functional Guidelines for Inorganic Superfund Methods Data Review, November 2020 (EPA 2020a); and
- EPA Data Review and Validation Guidelines for Perfluoroalkyl Substances (PFASs) Analyzed Using EPA Method 537, November 2018 (EPA 2018a)

In some cases, the following US Army Corps of Engineers (USACE) guidance document is also referenced to formulate opinions when EPA guidance documents recommend exercising professional judgment:

- USACE Engineering Manual 200-1-10, Guidance for Evaluating Performance-Based Chemical Data, June 2005 (USACE 2005).

Additional references are listed in Section 12.0 and cited throughout the text.

In general, most data review guidelines included in this DVPP are drawn from federal guidance documents. However, in some cases federal guidance is not consistent, is outdated, or does not account for specific issues addressed in this DVPP; in these cases, the guidance presented in the DVPP is based on standard industry practice or site-specific

considerations, which are based on Shannon & Wilson chemists' years of professional experience and discussions with the Alaska Department of Environmental Conservation (DEC).

Most quality assurance program plans (QAPPs) specify data quality objectives (DQOs) for items such as laboratory control sample (LCS) recovery and target reporting limits. This document does not present such limits, but instead defers to internal laboratory control limits that are statistically derived, frequently updated, and within the requirements of the laboratory's national certification, and thus compliant with federal requirements. A glossary of terms is included in Appendix A.

2 LABORATORY CERTIFICATION AND DELIVERABLES

2.1 Laboratory Certification

The DEC Contaminated Sites Program (CSP) has an approval process for laboratories conducting analytical testing of various analytes; other DEC programs have their own laboratory certification programs. When using a new laboratory or analytical method, the DEC website is checked to verify that the laboratory analyzing project samples is certified as "approved." Laboratory certification is not required in cases where DEC does not list an analytical method. The websites do not appear to be updated frequently and laboratories may be certified without being listed on the website. Certifications can be requested from the laboratory.

In cases where the original laboratory subcontracts analysis to a network or referral laboratory, "ref lab", the referral laboratory shall also be verified for DEC approval, where applicable. This information may be found in the following websites listed in Exhibit 2-1, below:

Exhibit 2-1: Links to DEC-Approved Laboratories

DEC-Approval Authority	Website
Contaminated Sites Program	https://dec.alaska.gov/spar/csp/lab-approval/list-of-approved-labs
Drinking Water Program - Chemical Laboratories	https://dec.alaska.gov/eh/lab/chem-lab-cert-status.aspx
Drinking Water Program - Microbiological Laboratories	https://dec.alaska.gov/eh/lab/micro-lab-cert-status.aspx

2.2 Laboratory Deliverables

Laboratory Level II reports and EDDs are obtained directly from the laboratory via e-mail or laboratory data websites. The laboratory reports and EDDs are reviewed for completeness and revised reports are requested where there is missing or incorrect information. Laboratory reports are provided in Adobe Acrobat (.pdf) format, while EDDs are provided in extensible markup language (.xml) format, or another similar format. It may be necessary to engage with the laboratory regarding a database compatible EDD format.

Laboratory reports and EDDs are grouped by the work order (WO) number assigned when the laboratory receives the sample delivery group (SDG). SDGs are determined by the samples and analyses listed on the chain-of-custody (COC) record.

3 CHAIN-OF-CUSTODY

Evidence of sample custody from the time of collection to the time of receipt by the laboratory is documented on the COC record. A COC contains the signatures of individuals collecting, shipping, and receiving each sample. The COC is reviewed to verify it is signed and dated by the sampler, the local receiving staff (unless shipped directly), and the laboratory's receiving staff. Carriers who are only involved in the transport of sealed coolers (e.g., Lynden Transport, Inc.) are not required to sign the COC. We consider a sample to be in custody if it is:

- in a person's actual possession;
- in view, after being in physical possession;
- sealed so no one can tamper with it, after having been in physical custody; or
- in a secured area, restricted to authorized personnel.

If the COC record is not complete and accurate (e.g., signatures missing, date/time discrepancies, lack of custody seals), professional judgment must be used as to whether to qualify the data. The reviewer should consider rejecting data and recollecting the samples, if possible, if it is suspected that custody was intentionally breached, and the samples may have been tampered with. However, if there is a simple omission or minor discrepancy, the data may be usable without qualification if the source of the omission or discrepancy is known and accounted for.

The COC also provides the requested analyses for each documented sample. COCs are reviewed to verify the correct analyses were requested, and that sample names match those on the sample-collection logs. Where discrepancies are noted, the laboratory will coordinate

with the sampling team to confirm the correct sample names are used in reporting the results.

4 SAMPLE HANDLING, CONDITION, PRESERVATION, AND HOLDING TIMES

Evidence of sample condition is documented on the laboratory's sample receipt form (SRF) upon delivery. SRFs document QC non-conformance issues during sample handling, where such information exists. When samples are delivered to a local sample-receiving office prior to transport to the analytical laboratory, SRFs are completed at each location.

The following sections generally apply to soil and water. For sample-handling requirements for other media besides soil and water samples, data reviewers should reference the individual EPA sampling and analysis methods and/or laboratory sampling guides. In general, data qualification based on sample-handling failures is the same for other media as for soil and water samples; however, the sample-handling requirements may be different and must be assessed on a method-specific basis.

4.1 Acceptable Temperatures

SRFs are reviewed to verify samples were received within the acceptable temperature range. Temperature of the coolers and/or temperature blanks should be documented at each receiving location. Samples are considered to be within the acceptable temperature range if received between 0 degrees Celsius (°C) and 6 °C, where temperature preservation is required. This range is referenced in multiple guidance (e.g., EPA 2020a, 2020b, 2018b), noting that water samples received below this cutoff are acceptable in the absence of ice.

Data qualification based on temperatures outside the acceptable criteria may vary for different analyses and sample matrices. For example:

- PFAS have high chemical and biological stability. Samples with temperature exceedances submitted for PFAS analysis are unlikely to be adversely affected by elevated cooler temperatures. The data reviewer should note the discrepancy on the LDRC; however, we do not consider the PFAS results affected if the temperature is below 0 °C, or 6 °C and 10 °C.
- Some volatile organic compounds (VOCs) have low chemical stability and may be reduced in concentration by elevated cooler temperatures. The data reviewer should note the discrepancy and note that the VOC analysis results may be affected.
- Samples that are collected frozen (<-7 °C) may be maintained frozen until sub-sampled and preserved, if allowed by the project work plan (DEC 2019a).

Exhibit 4-1 provides general guidelines for qualifying results for samples received outside the acceptable temperature range; however, the individual extraction or analytical methods should be consulted, and professional judgment used.

Exhibit 4-1: Sample-Temperature Actions

Matrix	Criteria	Action	
		Detected Analytes	Analytes Not Detected
Water	0 °C – 6 °C	No qualification	
	0 °C – 6 °C; ice in samples	J	UJ
	< 0 °C; no ice in samples	No qualification	
	< 0 °C; ice in samples	J	UJ
	> 6 °C	JL	UJ[1]
Soil	0 °C – 6 °C	No qualification	
	< 0 °C	No qualification[2]	
	> 6 °C	JL	UJ[1]
PFAS Impacted Soil and Water	0 °C – 10 °C[3]	No qualification	
	< 0 °C	No qualification[2]	
	> 10 °C	N	UN

NOTES:

1 Use professional judgment when qualifying sample results based on temperature exceedance, considering the volatility of the analyte. If temperatures are higher than 10 °C or are suspected to have been above 6 °C for an extended period (e.g., over 24 hours), reviewer should consider rejecting sample results for volatile analytes that were not detected.

2 Use professional judgment and refer to method-specific requirements for non-standard analyses and matrices.

3 Samples shall be protected from light and refrigerated at ≤ 6°C (but not frozen) from the time sample collection until receipt at the laboratory.

°C = degrees Celsius, PFAS = per- and polyfluoroalkyl substances

4.2 Sample Preservation

Some analyses require additional sample preservatives along with maintaining the samples within the acceptable temperature range. Various guidance documents (EPA 2018b; USACE 2005) and individual EPA extraction methods list sample-preservation requirements for individual methods and matrices. SGS North America, Inc. (SGS) has condensed this information into one concise table including bottle type and volume requirements; this bottle guide table is included in Appendix B. The laboratory SRF documents whether samples were received with proper preservative and within relevant pH limits.

Not all data are affected the same way by failure to properly preserve samples, therefore, individual extraction or analytical methods should be consulted, and professional judgement used. For example:

- If the pH is outside method requirements for inorganic analytes in aqueous samples and the laboratory adjusts the pH immediately upon receipt at the laboratory within the method-specified holding time, allowing time for the sample to equilibrate prior to digestion, the sample results are not affected (EPA 2020a).
- In the case where one analyte is the degradation byproduct of another analyte, the degraded species may increase in a sample following storage with inadequate preservation (USACE 2005); the same may occur if holding times are exceeded (see Section 4.3, below).
- For metals speciation (e.g., Fe2+ vs. Fe3+), acidification can result in an increase in the reduced form and a decrease in the oxidized form. Professional judgment should be used for qualifying data for any samples with preservation issues.

In most cases where sample preservation is inadequate, sample results should be considered estimated and qualified using the criteria listed in Exhibit 4-2 below.

Exhibit 4-2: Preservation Actions

Criteria	Action	
	Detected Analytes	Analytes Not Detected
Adequate Preservation[1,2]	No qualification	
Inadequate Preservation[1,2]	JL	UJ

NOTES:

1 Per regulatory guidance and/or method specific or preservation requirements.

2 Use professional judgment and refer to method-specific requirements for non-standard analyses and matrices.

4.3 Holding Times

Samples are required to be extracted and/or analyzed within method-specific holding times. The holding time begins immediately following sample collection and are calculated on a per-day basis, except for short-holding-time analyses where the holding time is measured in hours (typically for analyses listed with a holding time of 72 hours or less). Holding times are included on the bottle guides in Appendix B for standard analyses.

Holding times are evaluated based on the matrix and method. Certain methods list a collection-to-analysis holding time (e.g., analysis of volatile organic compounds in soil, where extraction occurs in the field at the time of collection), while others list separate holding times for collection to extraction and for extraction to analysis.

In general, where holding times are exceeded, sample results shall be qualified using the criteria listed in Exhibit 4-3.

Exhibit 4-3: Holding-Time Actions

Analysis	Criteria	Action	
		Detected Analytes	Analytes Not Detected
PFAS	t ≤ HT	No qualification	
	t > HT	N	UN
	t > 2x HT (gross exceedance)	N	UN
All Others[1]	t ≤ HT	No qualification	
	HT < t ≤ 2 x HT (marginal exceedance)	JL	UJ
	t > 2x HT (gross exceedance)	JL	R

NOTES:

1 Use professional judgment and refer to method-specific requirements for non-standard analyses and matrices.

HT = method (technical) holding time; t = actual holding time

A sample with a *marginal hold time exceedance* is described as sample that was analyzed outside of the method hold time, but within twice the hold time. A sample with a *gross hold time exceedance* is described as a sample analyzed after more than twice the hold time.

As with sample preservation, professional judgment must be used when qualifying data based on holding-time exceedance, as there can be situations where certain analytes are affected differently than others. For example:

- For analytes that are degradation byproducts of one another, the degraded species may increase if a sample is analyzed outside of the method hold time (USACE 2005).
- PFAS are stable substances and are unlikely to experience degradation within typical laboratory hold time limit exceedances. PFAS samples with marginal or gross hold time exceedances are tentatively identified and flagged with a "N". PFAS analytical results should not be rejected for hold time failures unless professional judgement deems otherwise.
- Preservation failures coupled with a marginal holding-time exceedance may warrant rejection of results for analytes that were not detected.

4.4 Sample Condition

Sample condition is documented on the laboratory's SRFs. Professional judgment should be used to determine if qualification of analytical results is necessary for cases where sample condition is compromised. Some common circumstances that may affect sample results are listed below:

1. **Broken Container**: Sometimes 1-L bottle lids crack upon tightening, but no liquid is lost. As long as the lid is replaced prior to sample shipment, often by the laboratory sample-receiving office, results are considered not affected. Most water analyses require at least one duplicate bottle to be filled. If only one of the bottles is broken and the analysis is performed with the intact bottle, no qualification is required other than noting the broken container on the data-review checklist (DEC 2019b). However, if the sample with the broken container was used for analysis, the analytes in question could oxidize, volatilize, degrade, or react, causing the concentration to at least be considered estimated ; professional judgment should be used to determine if the analyses are affected by the addition of air. Affected sample results shall be qualified using the criteria listed in Exhibit 4-4.
2. **Leaking methanol** (soil volatile organic analysis [VOA]): When collecting soil samples for volatile analysis, 25 mL of methanol is added to the sample container to perform the sample extraction and preserve the target analytes in the sample. If the methanol leaks out, it leads to a low bias in the calculated soil mass. The overall concentration of the analyte is determined by dividing the mass of the analyte by the mass of the soil, thus imparting a high bias to the sample result (see calculation below). The results for samples with leaking shall be qualified using the criteria listed in Exhibit 4-4. Professional judgment shall be used to determine if results should be rejected due to severely compromised sample integrity (e.g. complete loss of methanol, etc.)

$$Mass_{soil} = Mass_{total} - Mass_{MeOH} - Mass_{jar}$$

$$Concentration_{analyte} = Mass_{analyte}/Mass_{soil}$$

3. **Headspace in VOA vial**: For the analysis of gasoline range organics (GRO) and VOCs in water samples, the absence of headspace is necessary to prevent volatile analytes from partitioning out of the aqueous phase. As noted in the VOC method 5021A, "it is possible for the sample to generate some headspace during storage. This headspace will appear in the form of microbubbles and should not exceed 5-6 millimeters (mm)… Studies conducted by the EPA indicate that [bubbles not exceeding 6 mm in diameter] did not adversely affect volatiles data." This assessment is applied to the VOC analyses; bubbles larger than 6 mm in diameter are considered an unacceptable level of headspace. When unacceptable headspace is present, results shall be qualified using the criteria listed in Exhibit 4-4.
4. **Soil analysis reported using "wet weight"**: When collecting soil samples, an additional jar is provided for the laboratory to determine the percent solids. In the absence of the additional percent-solids jar, the laboratory may report soil concentrations using the "wet weight." The overall concentration of the analyte is determined by dividing the mass of the analyte by the mass of the soil. In cases where a dry weight was not determined, the concentration may be reported using a wet weight. The results for samples reported using the wet weight shall be qualified using the criteria listed in Exhibit 4-4.

Other sample-condition anomalies than those listed above may occur. These anomalies should be addressed using available guidance, individual extraction or analytical methods, and the reviewer's professional judgement.

Exhibit 4-4: Sample Condition Actions

Criteria	Action	
	Detected Analytes	Analytes Not Detected
Broken Container	JL	UJ[1]
Leaking Methanol (soil VOA)	JH[2]	No qualification[3]
Headspace in VOA Vial ≤ 6 mm	JL	UJ
Headspace in VOA Vial > 6 mm	JL	R
Soil Analysis Reporting "Wet Weight"	JL	UJ

NOTES:

1 Use professional judgement and consider rejecting data depending on how much sample leaked or the volatility of the analyte.

2 Use professional judgement and consider rejecting data if the sample integrity has been severely compromised (e.g. complete loss of methanol, etc.)

3 Not detected analytes are not considered affected if there is sufficient methanol to run the analysis.

mm = millimeter; VOA = volatile organic analysis

4.5 Sample Processing

Many laboratory methods require additional sample processing at the laboratory prior to analysis. Preparatory batches are groups of analytical project samples and QC samples that processed together at the laboratory, including required steps such as extraction or digestion. Laboratory methods for GRO, DRO, and VOCs require additional preparation to extract a subsample or add surrogate analytes to the samples. The laboratory reports a unique preparation batch ID and extraction date and time. Any QC failures are often applied with the batch group.

The analytical batch is a set of prepared samples (e.g., extracts for GRO or DRO), or samples not requiring preparation (e.g., PFAS or metals analysis) that are analyzed on the instrument together, without interruption. Samples within a preparatory batch may be split into multiple analytical batches.

5 ANALYTICAL SENSITIVITY

Analytical sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected or quantified (USACE 2005). Analytical sensitivity is

evaluated by comparing the appropriate laboratory reporting limit for not-detected results to the relevant cleanup level or action limit, where such standards exist.

In general, regulatory limits used to check analytical sensitivity are listed in Chapter 75 of Title 18 of the Alaska Administrative Code (18 AAC 75) for soil and water; analytes without regulatory limits are compared to the relevant, project-specific or analyte-specific action limit at the time of comparison.

In cases where the reporting limit exceeds the regulatory limit, a note will be added to the DEC data-review checklist (DEC 2019) and associated results tables noting the reporting limit is elevated. Reporting limits that exceed regulation limits should be identified using the following criteria listed in Exhibit 5-1.

Exhibit 5-1: Elevated Reporting Limit Actions

Criteria	Action
Reporting Limit[1] ≤ Cleanup Level / Action Level	No note
Reporting Limit[1] > Cleanup Level / Action Level	Note should be added to the Checklist and Results Tables

NOTES:

1 The reporting limit used for the analytical sensitivity comparison should be described in the DEC data-review checklist.

5.1 Reporting Limit Terminology

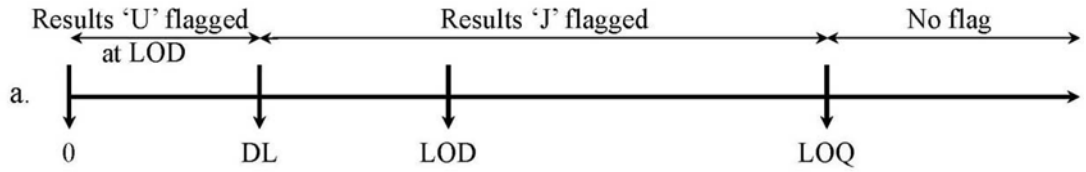
SGS typically uses reporting limits described in the Department of Defense (DoD)/ Department of Energy (DOE) Quality Systems Manual (QSM) for Environmental Laboratories Version 5.3. and reports a detection limit (DL), limit of detection (LOD), and limit of quantification (LOQ) for each analyte. These definitions are summarized below.

- Detection limit (DL): "the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate (Type I error) is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific analyte in a specific matrix with a specific method with 99% confidence." Analytes not detected above the DL are reported at the LOD value.
- Limit of detection (LOD): "the smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate (Type II error) is 1%. A LOD may be used as the lowest concentration for reliably reporting non-detect of a specific analyte in a specific matrix with a specific method at 99% confidence." SGS establishes the LOD as half the LOQ.
- Limit of quantification (LOQ): "the smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and

within the calibration range." Results reported between the DL and LOQ are considered estimated and flagged with a 'J' by the laboratory.

Exhibit 5-2 illustrates the relationship between the DL, LOD, and LOQ.

Exhibit 5-2 Summary of DOD QSM Reporting Limits



Eurofins TestAmerica reporting limits are summarized below:

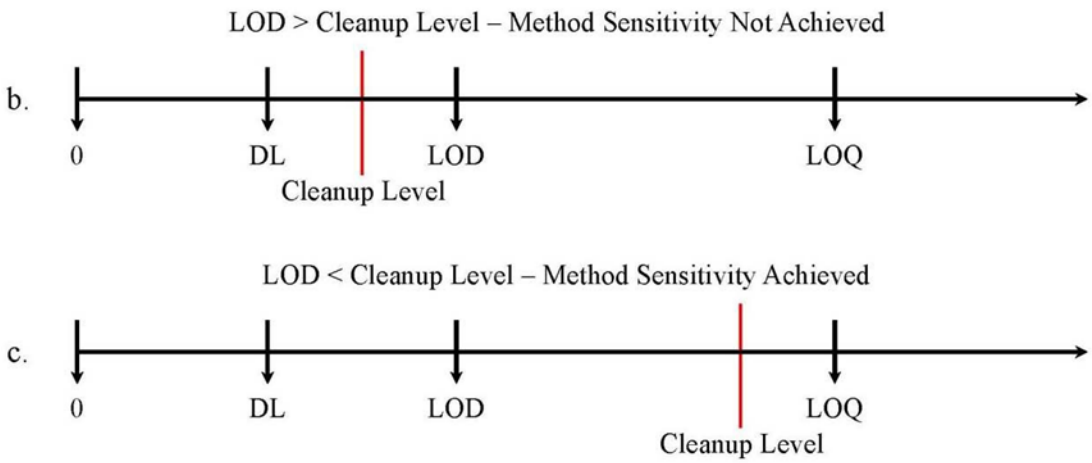
- Method detection limit (MDL): the lowest concentration of an analyte that is distinguishable from the method blank with 99% confidence. (40 CFR Part 136 Appendix B). The MDL is equivalent to the DL as defined by DoD/DOE QSM.
- Reporting limit (RL): the lowest concentration of an analyte that can be detected with known and recorded precision and bias. This value is equivalent to the LOQ as defined by DoD/DOE QSM.

Some laboratory deliverables do not report LOQs, and may report analytical sensitivity limits using the LOQ, practical quantitation limit (PQL), or method reporting limit (MRL). It is important to note the LOQ, PQL and MRL are interchangeable terms and depends on the laboratory for which term is used in reporting the results. For the purposes of this DVPP, the LOQ is referenced.

Shannon & Wilson typically requests inclusion of laboratory qualifiers for detected results reported below the LOQ to denote that the low-level results may be imprecise. Laboratory-added flags are replaced where Shannon & Wilson applies flags to denote directional bias or inaccuracy identified during the data review process.

Exhibit 5-3 provides a summary of laboratory result flags applied to each range and an example of acceptable and unacceptable (elevated) reporting limits.

Exhibit 5-3: Relationship between DL, LOD, LOQ, and Corresponding Laboratory Result Flags and Cleanup Levels.



NOTES:

b. Unacceptable LOD-to-cleanup-level relationship.

c. Acceptable LOD-to-cleanup-level relationship.

Note that these are example scenarios; not all data are compared using the LOD, and therefore this figure does not apply to data received from all laboratories.

DL = detection limit; LOD = limit of detection; LOQ = limit of quantitation.

6 BLANK SAMPLES

Blank samples are analyzed to check for possible contributions to the analytical results from cross-contamination between samples, or from sample-contamination from an outside source. Typically, the following blank samples are reviewed in conjunction with project samples, where appropriate:

- method blanks;
- trip blanks (volatile analytes only);
- field blanks; and
- equipment blanks.

Each of these blanks check for sample-contamination issues at various steps between sample collection and analysis. Detections in one blank can cause related detections in other blank samples. For example, a detection in a method blank can cause detections in corresponding trip blanks or equipment blanks. Therefore, it is important to investigate blank detections to determine at what step sample-contamination was first introduced; data-qualification should proceed beginning at this level.

For the purposes of this DVPP (Level II data review), blank detection evaluation should proceed using the following hierarchy:

1. method blank;
2. trip blank;
3. field blank; and
4. equipment blank

Additional details regarding these types of blanks are provided in sections 6.1 through 6.4 below. Additional blanks collected or analyzed by the lab for method-specific requirements should be evaluated on a case-by-case basis.

Data-qualification procedures are identical between blank types within a given matrix; however, the list of affected project samples vary. Exhibit 6-1 presents data-qualification criteria for samples affected by detections in a blank sample; these criteria are generally consistent with those presented in EM 200-1-10 (USACE 2005).

Exhibit 6-1: Actions for Blank Detections

Analysis	Concentration in corresponding project sample	Action
Marginal Exceedance	**DL < blank < 2x LOQ**	
PFAS	sample is ND	No qualification
	sample < LOQ < 10x blank	**UB at the LOQ**
	LOQ ≤ sample < 10x blank	**UB at the detected result**
	sample ≥ 10x blank	No qualification
All Others[1]	sample is ND	No qualification
	sample < LOQ < 5x blank	**UB at the LOQ**
	LOQ ≤ sample < 5x blank	**UB at the detected result**
	5x blank ≤ sample < 10x blank	**JH**
	sample ≥ 10x blank	No qualification
Gross Exceedance	**blank ≥ 2x LOQ[2]**	
All Analytes	sample is ND	No qualification
	sample is detected	**R**

NOTES:

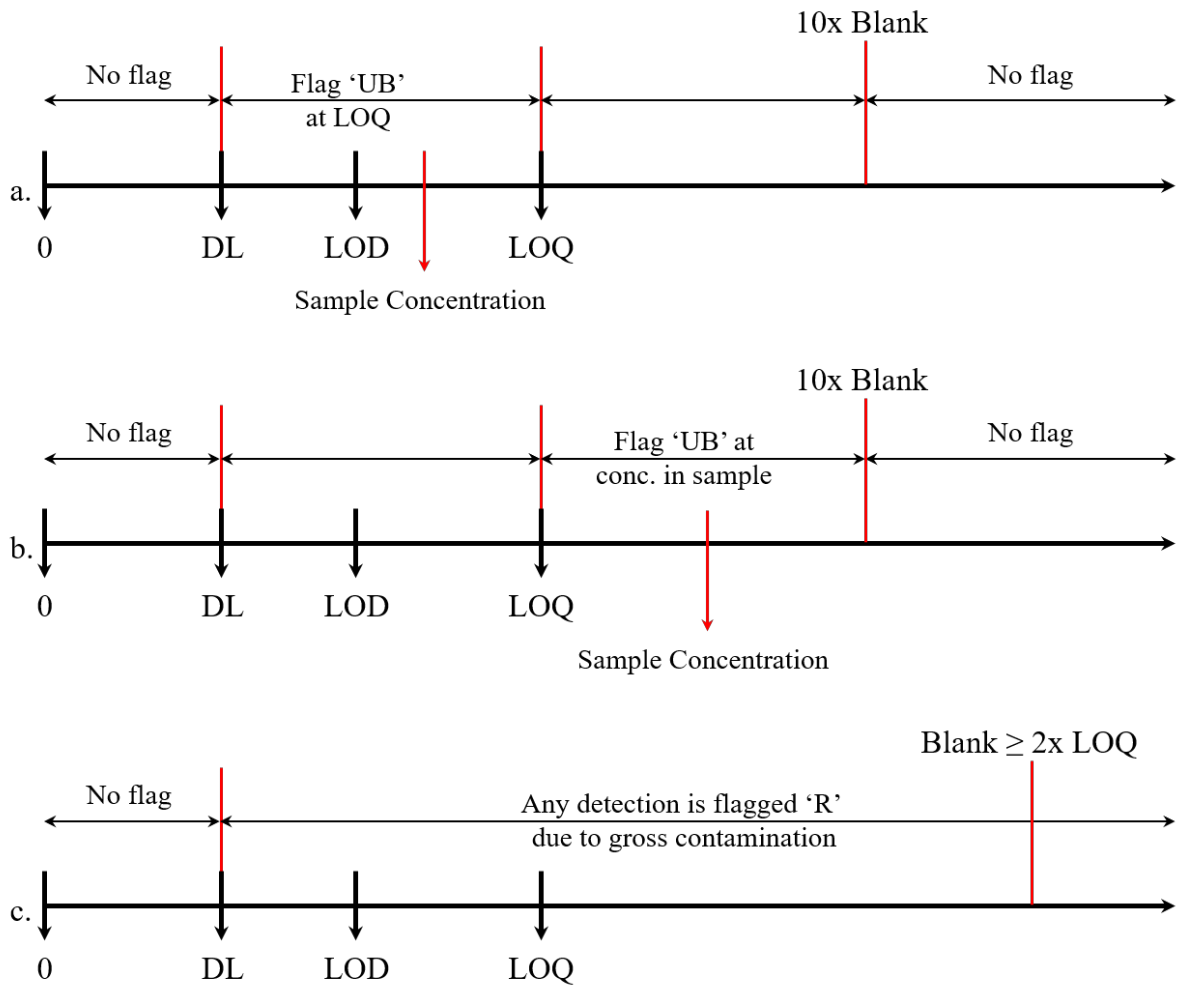
1 Use professional judgment and refer to method-specific requirements for non-standard analyses and matrices.

2 Use professional judgment to assess the reported LOQ. If elevated, reference a typical LOQ for a non-detect result.

DL = detection limit, LOQ = limit of quantitation (also known as PQL or MRL), y = concentration in blank, z = concentration in corresponding sample

Exhibits 6-2 and 6-3 presents a visual example of flagging criteria for a blank detection for PFAS and all other analyses, respectively.

Exhibit 6-2: Example- Qualification Criteria for PFAS Blank Detections



NOTES:

Project-sample results would be qualified as follows:

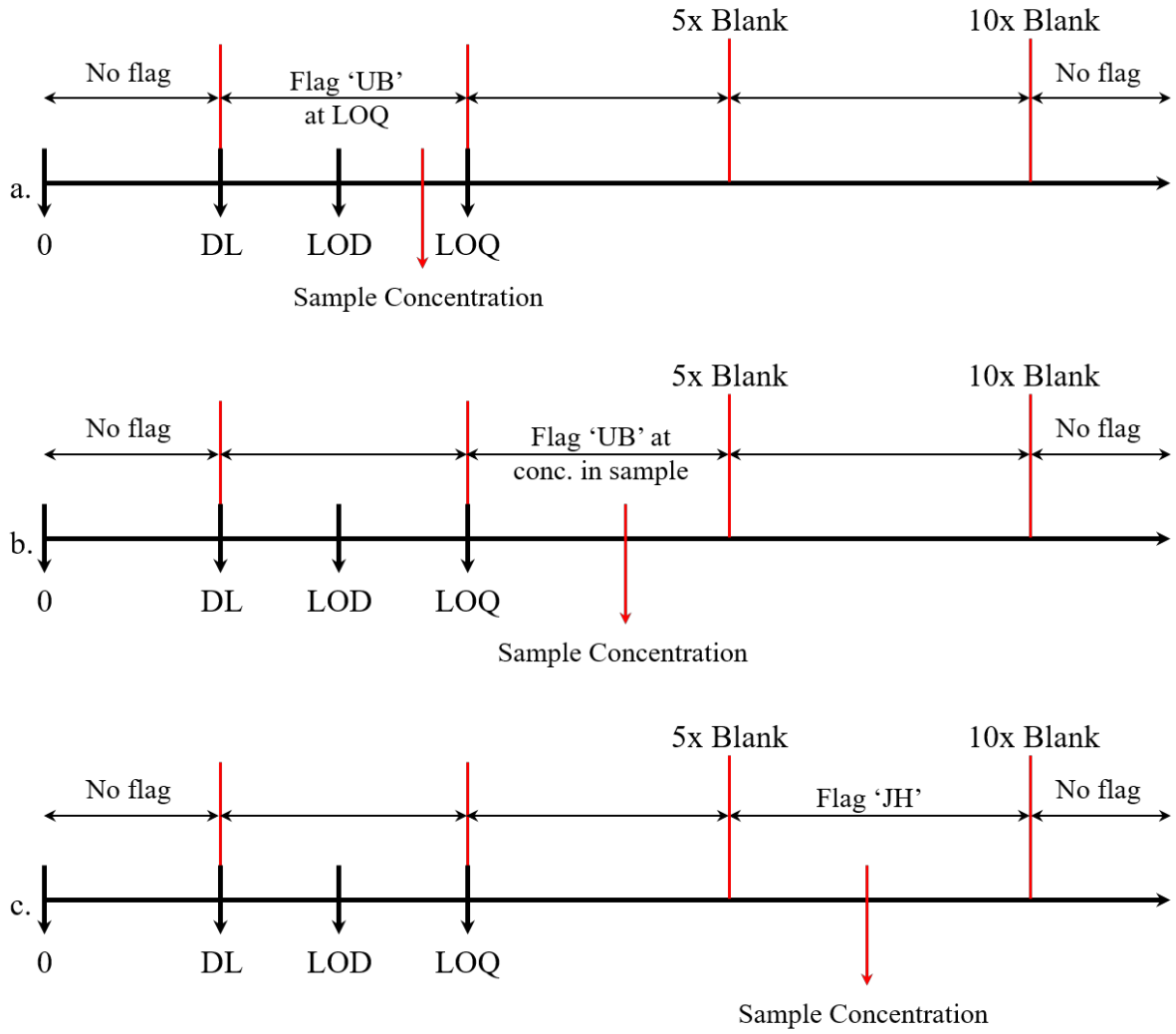
a) Flag 'UB' at the LOQ.

b) Flag 'UB' at the concentration detected in the sample.

c) Flag 'R' for any detection in the sample.

DL = detection limit; LOD = limit of detection; LOQ = limit of quantitation (also known as PQL or MRL).

Exhibit 6-3: Example Qualification Criteria for Non-PFAS Blank Detections



NOTES:

Project-sample results would be qualified as follows:

a) Flag 'UB' at the LOQ.

b) Flag 'UB' at the concentration detected in the sample.

c) Flag 'JH' at the concentration detected in the sample.

DL = detection limit; LOD = limit of detection; LOQ = limit of quantitation (also known as PQL or MRL).

6.1 Method Blanks

Method blank (MB) samples are prepared by the laboratory with every preparatory batch, at a minimum rate of one MB per 20 samples. MBs are samples of clean media (soil, water, etc.) that are subjected to the same procedures as project samples to extract a given analyte(s). MBs are evaluated to determine if the method of extraction, cleanup, or analysis introduces any contamination during the process.

The reviewer will check that MBs were prepared and analyzed by the laboratory at the required frequency, and that no analytes were reported in the MBs. If an analyte is reported in an MB, all samples in the corresponding preparatory batch should be evaluated for that analyte. Data qualifiers should be applied according to Exhibit 6-1, above.

6.2 Trip Blanks

Trip blank (TB) samples are prepared by the laboratory and one TB should always accompany each cooler containing samples for volatile analysis and stay with the samples. A TB is not required for semi-volatile or non-volatile analytes. TBs serve to check for cross-contamination or contamination from an outside source during sample collection, storage, transportation, and processing by the laboratory.

The reviewer will check that TBs were prepared, transported, and analyzed with any samples analyzed for volatile analyses (i.e., VOCs and GRO), and that no analytes were reported in the TB. A minimum of one TB per cooler is required; the cooler containing the TB and samples for VOC analysis should be clearly identified on the COC. If an analyte is reported in a TB, all samples in the corresponding cooler should be evaluated for the detected analyte and, if necessary, qualified based on the criteria presented in Exhibit 6-1, above. If the sampler did not document which cooler contained the TB, and there is more than one cooler containing samples for VOC analysis, all VOC samples in the work order should be considered potentially affected.

6.3 Field Blanks

Field blank (FB) samples are collected in the field by sample personnel. The sampler opens a sample bottle in the same air space as the corresponding project sample and collects the field blank by filling the bottle with laboratory provided deionized water. The FB is used to assess for possible contamination from the sampling site. If an analyte is reported in the FB, the corresponding sample should be evaluated for the detected analytes and, if necessary, qualified based on the criteria presented in Exhibit 6-1, above.

6.4 Equipment Blanks

Equipment blank (EB) samples are collected in the field by the sampling personnel. The EB is used to determine if decontamination of reusable sampling equipment between sampling locations is sufficient. The reviewer will check that EBs were collected at the required frequency, and that no analytes were reported in the EBs. If an analyte is reported in an EB, all samples collected using the same sampling equipment on the same day will be evaluated (determined based on field sampling logs, and if necessary, qualify based on the criteria presented in Exhibit 6-1, above.

7 ACCURACY

Accuracy is evaluated at multiple levels throughout the analytical process, using a variety of techniques. It is assessed at the preparatory batch level using recovery information from LCS and laboratory control sample duplicates (LCSDs), matrix spike samples (MSs) and matrix spike duplicates (MSDs), and surrogates or isotope dilution analytes (IDAs). MS/MSD and surrogate or IDA recovery information are used to determine whether there is interference from the sample matrix that affects the accuracy of the reported results. The following sections discuss these QC samples in association with the preparatory batch. However, note that there are some analytical methods for inorganics that do not require a preparatory batch and the LCS, LCSD, MS, and MSD QC sample are assessed at the analytical-batch level. Accuracy is also assessed at the analytical-batch level using recovery information from initial calibration verification (ICV) and continuing calibration verification (CCV) samples, where information is available in the Level II data deliverable.

7.1 Laboratory Control Samples

LCSs (also referred to as blank spikes) are prepared by the laboratory with every preparatory batch, at a minimum of one LCS per 20 samples, where required. In some cases, analytical protocol requires the laboratory also analyze an LCSD to assess laboratory precision (see Section 8.1 for assessment of laboratory precision). LCSs and LCSDs are prepared using the same extraction method that is applied to the project samples using laboratory-grade, blank-matrix samples spiked with a known concentration of analyte(s). The laboratory reports a percent recovery (%R) of the spiked amount for each analyte added to the blank sample. The laboratory maintains acceptance limits for LCS/LCSD recovery; these limits are reported in the Level II laboratory report for comparison.

The reviewer will check that LCSs were reported at the required frequency, and that LCS/LCSD recoveries are within laboratory control limits. An LCS or LCSD recovery failure affects all corresponding samples in the same preparatory batch for the affected analyte(s).

The following guidelines in Exhibit 7-1 will be used for qualifying sample results associated with LCS/LCSD-recovery failures.

Exhibit 7-1: Actions for LCS/LCSD and MS/MSD Recovery Failures

Analysis	LCS/LCSD or MS/MSD Results	Action	
		Detected Analytes	Analytes Not Detected
PFAS	%R < 10%	JL	R
	10% ≤ %R < LCL	JL	UJ
	%R > UCL[2]	JH	No qualification
All Others[1]	%R < Control Limits[2]	JL	UJ
	%R within Control Limits	No qualification	
	%R > Control Limits[2]	JH	No qualification

NOTES:

1 Use professional judgment and refer to method-specific requirements for non-standard analyses and matrices.

2 If LCS/LCSD recovery is grossly outside control limits (recoveries less than 10% or greater than 250%) the reviewer should use professional judgment when qualifying the data. The reviewer should consider rejecting results for analytes not detected where the recovery was below 10% (USACE 2005).

LCL = lower control limit, %R = percent recovery, UCL = upper control limit

7.2 Matrix Spike Samples

For certain methods, the laboratory analyzes an MS/MSD in addition to the LCS. MS/MSDs are prepared and analyzed on a preparatory batch basis and are analyzed with every 20 samples when used. They consist of project (native) samples spiked with a known concentration of analyte(s) and prepared using the same method that is applied to project samples to extract the analyte(s). The MS and MSD are used to determine the presence of matrix interferences and evaluate the analytical accuracy for a given method and matrix, expressed as a %R of the spiked amount added to the field sample.

The reviewer will check to make sure that MS/MSDs were analyzed at the frequency required by analytical methods or project-specific requirements. Some methods may require the analysis of an MS/MSD pair, but insufficient sample volume may prevent the laboratory from providing these QC samples. The laboratory's standard operating procedures (SOPs) may allow for an LCSD instead of an MS/MSD for these cases.

The reviewer will check that %R for each analyte is within laboratory control limits. If there is a recovery failure, only the field sample utilized for the MS/MSD (the parent sample) is typically considered affected; however, the reviewer should use professional judgment whether other samples in the same preparatory batch have sufficiently similar matrices to be considered affected as well. For example, if an MS/MSD recovery failure is reported for one of two field duplicate samples, it should be assumed there were similar matrix effects in the duplicate, and corresponding results should also be qualified.

Before MS/MSD recovery is evaluated, two important factors must be considered:

1. Verify that the field sample chosen for the MS/MSD is part of the project-sample set currently being reviewed. The laboratory may run samples from other projects in the same preparatory batch and it is possible that the original sample selected for the MS/MSD may not be from the work order reviewed. In this case, it cannot be confirmed that the parent sample matrix is similar to the matrix in the project samples and the recovery failures do not affect data quality for the project-sample set.
2. Verify that the spiking concentration is high relative to the native concentration of the analyte. In accordance with EM 200-1-10 (USACE 2005):

   If the native concentration of a target analyte is high relative to the spiking concentration, then this may contribute a significant uncertainty to the recovery calculations; the MS recovery may not be representative of actual method performance for the matrix. In the absence of other guidance, evaluate the MS recovery when the spiking concentration is at least two times greater than the native analyte concentration (USACE 2005).

If the above criteria are met, then results associated with the failures in the original project sample should be qualified using the criteria listed in Exhibit 7-1.

For metals analysis where MS/MSD recovery failures occur, different criteria are used. For metals analysis using most analytical methods, if a matrix spike recovery failure occurs and the sample concentration is greater than the spike concentration, the laboratory is required to conduct a post-digestion spike. A post-digestion spike is where the original sample is spiked at twice the native concentration so that recovery can be evaluated. In this case, refer to the data-qualification criteria in the spiked sample analysis section in the National Functional Guidelines for Inorganic Methods Data Review (EPA 2017a) under the relevant analytical technique.

7.3 Surrogates and Isotope Dilution Analytes

Surrogates are organic compounds that are similar to the analytes being evaluated by a given method (often a deuterated version of the one of the analytes). They are used to identify matrix interferences and inefficiencies in sample extraction for organic analyses. The surrogates are introduced into a field- or laboratory-QC sample prior to sample preparation and analysis. Accuracy is expressed as a %R of the spiked amount added to the sample.

Some methods require analysis using an isotope-dilution method, which uses IDAs instead of a surrogate, and corrects raw data of the associated analyte concentration based on the recovery of the IDA.

The reviewer will check that surrogates and/or IDAs were analyzed for each sample for each organic analysis (including laboratory QC samples), and that recoveries were reported within laboratory-control limits. If there is a reported recovery failure, it is considered to affect only the analytes associated with the surrogate/IDA (see Appendix C for a surrogate/IDA association list) for the corresponding project with the reported failure. However, there are a few special considerations when qualifying data based on surrogate-recovery failures:

1. Matrix interference: Recovery failures due to matrix interference (coelution of an interfering analyte or other matrix interactions) are considered to affect data quality, and results should be qualified as described in Exhibit 7-2. The laboratory typically documents in the case narrative whether a surrogate/IDA recovery failure was due to matrix interference.
2. Dilution: Recovery failures may be observed due to dilution of the surrogates and are not considered to affect the data (USACE 2005). The laboratory typically documents surrogate failures due to dilution in the case narrative. Refer to number 4 for IDA recovery failure assessments.
3. Surrogate/IDA recovery failures in laboratory QC samples: Surrogate/IDA failures in an LCS, LCSD, MS, or MSD are not considered to affect the project sample data as long as the recovery of individual analytes associated with that surrogate/IDA are within the laboratory control limits for the LCS/LCSD/MS/MSD sample. However, gross or systematic surrogate/IDA recovery failures should be considered along with all other QC information for the preparatory batch and the results evaluated according to professional judgment.
4. IDA recovery in project samples: As part of the analytical procedure for isotope-dilution methods, a given analyte concentration is corrected based on the recovery of the associated IDA. Therefore, recovery inefficiencies are somewhat self-correcting, and one would expect less inaccuracy due to slight matrix effects. However, recovery outside the recovery limits may indicate there are significant matrix effects that the method is unable to adequately correct for. Results should be qualified as described in Exhibit 7-2.

Excluding the exceptions listed above, data affected by surrogate/IDA recovery failures should be qualified using the following criteria listed in Exhibit 7-2.

Exhibit 7-2: Actions for Surrogate or Isotope Dilution Analyte Recovery Failures

Type	Criteria	Action	
		Detected Analytes	Analytes Not Detected
IDA	%R < 10%	J	R
	10% ≤ %R < LCL	J	UJ
	%R < LCL (diluted sample)	Use professional judgement	N/A[1]
	%R > UCL	J	No qualification
	%R within range	No qualification	
Surrogate	%R < range	JL[2]	UJ[3]
	%R within range	No qualification	
	%R > range	JH[2]	No qualification

NOTES:

1 Non-detects should be reported from the undiluted analysis.

2 Use professional judgment when the bias is poorly defined. Only impart a bias to the qualified data if the bias is well defined (i.e., if there is more than one surrogate in the analysis, where recovery failures are in the same direction). Otherwise, it may be more conservative to simply qualify the results as estimated ('J'; USACE 2005).

3 Use professional judgment when evaluating gross recovery failures. The reviewer should consider rejecting the results where analytes are not detected if the associated surrogate recovery is below 20% (USACE 2005).

LCL = lower control limit, %R = percent recovery, UCL = upper control limit

7.4 Calibration Verification Samples

Calibration verification samples are not typically reported in the Level II data reports provided by the laboratory (aside from appearing in the EDD), and review of such samples is outside the scope of this DVPP. The laboratory may have requirements to re-calibrate the instrument if calibration verification fails or other corrective action. However, this is not always possible, and occasionally calibration verification failures occur and are reported in the case narrative of the Level II laboratory report. Calibration verification samples are described briefly below.

ICV samples are clean extraction solvent spiked with a known analyte concentration, using a different source than that of the primary calibration standards, and analyzed immediately following instrument calibration. Similarly, CCV samples are calibration standards that are analyzed at the beginning of each analytical batch and periodically throughout the run.

The laboratory evaluates ICV and CCV recovery information based on their internal acceptance criteria; in some cases, they also evaluate relative percent difference between CCVs to determine if drift is occurring. As stated above, calibration-level data review is beyond the scope of this DVPP and may be conducted as part of a Level IV data-validation, if calibration issues are identified in the case narrative. Professional judgment should dictate whether any samples in an analytical batch with unresolved CCV failures should be

considered preliminary pending further investigation. For these circumstances, contact the laboratory for more direction and ask the Senior Laboratory Analyst to provide justification for using the data and any bias resulting from these QC failures. Request that the laboratory report be revised to include the justification.

8 PRECISION

Precision refers to the repeatability of measurements (USACE 2005). Precision is evaluated using laboratory QA/QC and field-duplicate samples. The following sections describe the duplicate-sample information that is commonly used to assess precision. However, this is not an exhaustive list, and the laboratory may occasionally analyze other duplicate samples that should also be considered. For most analyses, at least one laboratory QC-sample duplicate must be analyzed; this can include a LCSD, MSD, or a laboratory duplicate.

Each type of duplicate is evaluated in the same manner (LCS/LCSD, MS/MSD, laboratory duplicate and field duplicates). A relative percent difference (RPD) is calculated between the duplicate results for a given analyte using the following equation presented in Exhibit 8-1.

Exhibit 8-1: RPD Calculation

Equation	Variable and Definition	
$RPD = \frac{\lvert R_1 - R_2 \rvert}{(R_1 + R_2)/2} \times 100\%$	RPD	Relative Percent Difference
	R1	Primary Result
	R2	Duplicate Result

The resulting RPD is compared to laboratory control limits (for laboratory QC samples), or project or regulatory DQOs for field duplicates. For purposes of this DVPP, the DEC-recommended water-sample DQO of 30% and soil-sample DQO of 50% are used to assess precision of field-duplicate samples.

The guidelines presented in Exhibit 8-2 will be used for qualifying sample results associated with duplicate-sample RPD failures. The treatment of a failure is the same across types of duplicate samples, but the samples that are affected vary. Refer to the following sections for details.

Exhibit 8-2: Actions for Duplicate-Sample RPD Failures

Criteria	Action	
	Detected Analytes	Analytes Not Detected
RPD ≤ Control Limit or DQO	No qualification	
RPD > Control Limit or DQO	J	UJ

DQO = data quality objective, RPD = relative percent difference

8.1 Laboratory Control Sample Duplicates

Precision can be evaluated between LCS and LCSD results for a given analyte. The laboratory calculates the RPD using the equation presented in Exhibit 8-1 for each analyte. The reviewer will check that each RPD is within the laboratory control limits. RPD failures for specific analytes in the LCS/LCSD are considered to affect the precision of that analyte in each corresponding project sample in the same preparatory batch. Affected results should be flagged according to the criteria presented in Exhibit 8-2.

8.2 Matrix Spike Duplicates

Precision can be evaluated between the MS and the MSD results for a given analyte. The laboratory calculates the RPD for each analyte. The reviewer will check that each RPD is within the laboratory control limits. RPD failures for specific analytes in the MS/MSD are considered to affect the precision of that analyte in the parent sample spiked for the MS/MSD. Professional judgment should be used to determine whether additional samples should be qualified (based on similarity of sample matrix).

RPD failures should be considered to affect the data regardless of the concentration spiked, as long as the laboratory calculates the RPD based on the total analyte concentration quantified in the MS/MSD. If the laboratory calculates the RPD based only on what was recovered of the spike, it should be treated as for MS/MSD recovery, with failures only considered to affect data quality if the spiking concentration is at least double the native concentration of the analyte. Affected results should be flagged according to the criteria presented in Exhibit 8-2.

8.3 Laboratory Duplicates

For select analyses, or when insufficient volume is submitted for analysis of an MS and MSD, the laboratory may analyze a project sample twice (referred to as a laboratory duplicate). The laboratory calculates an RPD between the original result and the duplicate-sample result for each analyte. The reviewer will check that each RPD is within the laboratory control limits. As with MS/MSDs, laboratory duplicate RPD failures are considered to affect the precision of the affected analyte only in the parent sample used for the duplicate analysis. Affected results should be flagged according to the criteria presented in Exhibit 8-2.

8.4 Field-Duplicate Samples

Field-duplicate samples are duplicate samples collected from the same location and submitted to the laboratory performing the requested analysis. The duplicate sample will

have a "dummy" sample number and submitted to the laboratory as a regular sample (i.e., the duplicate is submitted "blind"). These field duplicates are used to determine the reproducibility of the sampling technique, as well as the subsequent laboratory analysis. Sample homogeneity is necessary to obtain acceptable values for the RPD and any heterogeneity should be noted during sampling.

For field-duplicate pairs, the reviewer will calculate an RPD using the equation presented in Exhibit 8-1. An RPD will only be calculated if both sample results are detected above the detection limit. The calculated RPD will be compared to the standard DQOs of 30% for water or 50% for soil. Field-duplicate RPD failures are considered to affect only the results of the duplicate pair; affected data will be qualified based on the criteria in Exhibit 8-2.

In the event that one of the results is above the LOQ but the other result is below the detection limit (not detected) and J-flag detections are reported for the project, the reviewer should use professional judgment and consider qualifying the detected and non-detect result as estimated even though an RPD cannot be calculated. This may be evidence of samples having been mislabeled (in the field or the laboratory), sample heterogeneity, or some other issue; further investigation may be warranted.

9 REPRESENTATIVENESS

Representativeness is defined in Chapter One of the EPA SW-846 Update V Revision 2 (EPA 2014) as the degree to which data accurately and precisely represents a characteristic of a population for a sampling point. Representativeness is dependent on proper execution of the approved sampling program, which is agreed upon by the DEC, DOT&PF, and Shannon & Wilson. To assess sample representativeness, sample-log sheets will be reviewed to ensure the samples were collected according to the approved sampling program and the results therefore represent the location and depth sampled. In addition, where possible, the analytical result for each sample will be compared to the historical results to check that the result is consistent with the broader data set for that location.

There are instances where sample collection procedures deviate from the sampling program and may affect the sample representativeness. Professional judgement is used to assess the data usability based on these deviations. Some of these infrequent instances are presented in Exhibit 9-1 along with qualifications to the data.

Exhibit 9-1: Actions for Deviations from Sampling Program

Sampling Type	Description of Deviation	Action	
		Detected Analytes	Analytes Not Detected
Monitoring Well/ Residential Sampling	Purging/stabilization criteria not met	J	UJ
Residential Sampling – Organic Analyses	Sample collected post treatment (especially for collection post carbon filter)	JL	UJ[1]
Residential Sampling – Inorganic Analyses	Sample collected post treatment (especially iron analyses collected post sediment filter)	JL	UJ

NOTES:

1 Use professional judgment. The reviewer should consider rejecting the results where organic analytes are not detected and samples were collected post carbon filter. At minimum, the non-detect results should be considered estimated and flagged 'UJ' to identify the sample collection discrepancy.

10 LABORATORY APPLIED FLAGS

The laboratory is required to qualify data that does not meet laboratory QC standards. The data qualifiers, flagging criteria, and flagging procedures are detailed in the laboratory's SOPs. The lab does not interpret the impact of an applied flag on the data, rather the flags are meant to draw the attention of the reviewer to an area where laboratory QC criteria is not met. When data is reviewed and validated, the information the laboratory reported is taken and evaluated to determine the effect of the QC deficiency on the data and apply appropriate flags as defined in this document.

In some cases, laboratory applied flags are not needed and may be removed for reporting. For example:

> When an MS and/or MSD sample has a %R failure, but the spiking concertation is not high relative to the native parent sample concentration, then the %R failure is not applicable. The flag the lab applies to the data is therefore not necessary and is removed the analytical reporting table.

In some cases, laboratory applied flags are overwritten by flags applied by Shannon & Wilson. For example:

> When a sample result exceeds the calibration range, the lab may flag the affected data with an 'E'. Calibration exceedances are flagged with a 'J' in the analytical reporting table overwriting the 'E' flag.

In either case listed above, laboratory applied flags are maintained in the laboratory report for reference.

See Exhibit 10-1 for common laboratory applied flags that are either overwritten by a S&W applied flag or are removed from the analytical reporting tables because they are deemed unnecessary after the data-validation process. The flags remain in the laboratory report for reference.

Exhibit 10-1: Actions for Common Laboratory Applied Flags

Laboratory Applied Flag[1]	Flag Description	Shannon & Wilson Applied Flag
I	Value is the estimated maximum possible concentration. Case Narrative flag description: The "I" qualifier means the transition mass ratio for the indicated analyte was outside of the established ratio limits. The qualitative identification of the analyte has some degree of uncertainty. However, analyst judgement was used to positively identify the analyte.	J
E	Result exceeded calibration range.	J
B	Compound was found in the blank sample	See Exhibit 6-1 for flagging criteria
*	LCS or LCSD is outside acceptance limits.	See Exhibit 7-1 for flagging criteria
*	Isotope dilution analyte is outside acceptance limits	See Exhibit 7-2 for flagging criteria
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.	See Exhibit 7-2 for flagging criteria
F1	MS and/or MSD recovery is outside acceptance limits.	See Exhibit 7-2 for flagging criteria
F2	MS/MSD RPD exceeds control limits	See Exhibit 8-2 for flagging criteria

NOTES:

1 This is not meant to be a comprehensive list of flags applied by the laboratory, but rather a list of the most encountered laboratory flags that are often not applicable after data-validation. Labs do not always use identical flags for the same QC failure; therefore, this information will be extrapolated to address the specific flags used by each laboratory and applied to each data set on a case-by-case basis.

LCS = laboratory control sample, LCSD = laboratory control sample duplicate, MS = matrix spike, MSD = matrix spike duplicate, RPD = relative percent difference.

11 COMPARABILITY

Chapter One of the EPA SW-846 Update V Revision 2 (EPA 2014) defines comparability as the expression of the degree of confidence with which one data set can be compared to another. Per the EPA SW-846 Update V Revision 2, a measurement is considered to be valid if they are unqualified or qualified as estimated data during validation. The reviewer and data users should qualitatively assess the comparability between historical and current data sets and use caution in combining data sets if the quality of the data is uncertain. For

example, current analytical methods may not be comparable to historical methods where the MRL was elevated.

12 COMPLETENESS

Chapter One of the EPA SW-846 Update V Revision 2 (EPA 2014) defines completeness as the measure of valid data collected compared to the amount planned. The SW-846 defines a valid datum as a measurement that is "unqualified or qualified as estimated [biased high, low, or no direction] during (data) validation." The overall data set from a sampling event will be evaluated to determine if the completeness goal of 85-percent useable data was achieved. Completeness is calculated by comparing the amount of useable (valid) data to the overall number of samples planned. A completeness value below 85- percent may be cause for collecting additional analytical samples.

13 DATA-VALIDATION PLAN UPDATES

This DVPP will be reviewed upon request of DOT&PF or as needed based on changes in the laboratory reporting process.

Exhibit 13-1: Summary of DVPP Updates

Document Version	Date	Personnel
V.0	May 2020	AMJ,MXJ,KRF
V.1	March 2022	RLW, AMJ, MXJ, KRF

14 REFERENCES

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APPENDIX A: GLOSSARY

Appendix A

Glossary

APPENDIX A: GLOSSARY

GLOSSARY

The glossary of terms is adapted from Chapter 1 of EPA's Project Quality Assurance and Quality Control EPA SW-846 Update V Revision 2 (EPA 2014)

- Accuracy: a measure of how close a value is to the true value and is measured by percent recovery.
- Analytical batch: a group samples that does not require processing (e.g., digestion or extraction) or has been prepared and analyzed with the same reagents, calibration curve and quality control samples.
- Analytical sensitivity: the amount of analyte necessary to produce a detector response that can be reliably detected or quantified.
- Bias: a distortion in the sampling, measuring, or data evaluation process that results in error.
- Chain of custody: a record of individuals collecting, shipping, and receiving each sample.
- Comparability: the expression of the degree of confidence with which one data set can be compared to another.
- Completeness: the measure of valid data collected compared to the amount planned.
- Continuing calibration verification (CCV) sample: a quality control sample analyzed at the beginning of each analytical batch and periodically throughout the run made from calibration standards.
- Data review: the initial data quality assessment completed upon receipt of the laboratory electronic data deliverables that discuss the sample handling, condition, preservation, hold times, accuracy and precision of quality control samples and project samples, representativeness, comparability, and completeness.
- Data validation: the final review completed by staff members to validate the initial data review process.
- Detection limit (DL): the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate (Type I error) is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific analyte in a specific matrix with a specific method with 99% confidence.*
- Electronic Data Deliverable (EDD): a document provided by the lab to summarize project and quality control sample results.
- Equipment blank (EB): a sample collected in the field used to determine if decontamination of reusable sampling equipment between sampling locations is sufficient.

- Field blank (FB): a sample of laboratory-provided deionized water collected in the same air space as the corresponding project sample used to assess for possible contamination from the sampling site.
- Hold Time: a specified amount of time in which project samples should be extracted and analyzed, as determined by the laboratory or analytical method.
- Initial Calibration Verification (ICV) sample: a quality control sample analyzed immediately following instrument calibration that consist of clean extraction solvent spiked with a known analyte concentration, using a different source than that of the primary calibration standards.
- Isotope dilution Analyte (IDA): Isotopically labeled analogs of analytes of interest added to all project and quality control samples for isotope dilution analyses.* The isotopically labeled analog is used to assess method performance (recoverability) and quantification based on signal ratios.
- Laboratory Control Sample: a sample included in the preparatory batch that is prepared using the same extraction method that is applied to the project samples with laboratory-grade, blank-matrix samples spiked with a known concentration of analyte(s).
- Laboratory Level II Report: a summary of laboratory results that includes a case narrative, surrogate recoveries, chain of custody, method blank, laboratory control samples and matrix spike samples summary, and additional duplicate samples.
- Laboratory Level IV Report: a summary of laboratory results that includes elements of a Level II Report in addition to the following: GC/MS tune, initial calibration, continuing calibration verification (CCV), and raw data logs (i.e., instruments logs, data sheets, spectra, extraction logs, etc.)
- Limit of detection (LOD): the smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate (Type II error) is 1%. A LOD may be used as the lowest concentration for reliably reporting non-detect of a specific analyte in a specific matrix with a specific method at 99% confidence.*
- Limit of quantification (LOQ): the smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.*
- Matrix Spike Sample: a representative, randomly chose project sample that is "spiked" with laboratory-provided concentrations of analytes.
- Method blank (MB): analyte-free water used to assess background interference or contamination in the laboratory that may result in a false positive.
- Precision: a measure of analytical reproducibility and is measured by relative percent differences or relative standard deviation.

APPENDIX A: GLOSSARY

- Preparatory batch: a group of samples processed as an entire group with the same reagents, equipment, and laboratory personnel within a 24-hour period.
- Quality assurance (QA): the process to show relevant parties that quality control standards are being met throughout the review and validation process.
- Quality control (QC): a process to verify the acceptability an accuracy of analytical results.
- Qualifiers: a denotation to a data result to call out specific QC issues. Qualifiers are also known as flags and can be applied to the laboratory or during the data review process.
- Reporting limit (RL): a general term used to describe the lowest concentration of an analyte that produces result with known precision and bias.
- Representativeness: as the degree to which data accurately and precisely represents a characteristic of a population for a sampling point or environmental condition.
- Sample receipt form (SRF): the laboratory's documentation of sample condition and QC non-conformance issues during sample handling.
- Surrogate: an organic compound that is similar to the target analytes added to quality control samples and project samples to assess matrix effects and instrument performance for project samples.
- Trip blank: a sample free of volatile analytes that accompanies volatile between the laboratory and field sampling site, to account for contamination related to shipping and field handling.

* denotes the definition is provided by DoD/DOE QSM 5.3

APPENDIX B: BOTTLE GUIDE

Appendix B

Bottle Guide

APPENDIX B: BOTTLE GUIDE

EUROFINS TESTAMERICA BOTTLES

Method	Media	Container and Sample Volume	Preservation	Holding Time
EPA 537.1	drinking water	2 x 250-ml HDPE bottle	Trizma®	14 days
	Groundwater, surface water, wastewater	2 x 250-ml HDPE bottle	None	14 days
	soil	1 x 4-oz HDPE soil jar	none	14 days

SGS North America Inc. - Alaska Division

Sample Guide: Methods, Bottles, Preservatives & Hold Times

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
1,4-Dioxane	SW 8270	water	2x250 ml amber glass	0-6° C	7 days	(Ref Lab)
1,4-Dioxane	EPA 522	DW	?	?	28 days	(Ref Lab)
1,4-Dioxane	SW 8260C SIM	water	3x40 ml VOA vials	HCl; 0-6° C	14 days	
1,4-Dioxane	SW 8260C SIM	soil	1x4 oz prewt'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; 0-6° C	14 days	
Acidity as CaCO3	SM 2310B	water	1x250 ml HDPE	0-6° C	14 days	should be analyzed in the field
Acute Whole Effluent Toxicity (AWET)	*(depends on permit)*	water	1x2-8 gallon plastic (see permit)	0-6° C	**24 hrs**	(Ref Lab) need permit #/etc.
Alcohols: see Glycols or Alcohols						
Alkalinity as CaCO3 (Total or Full)	SM 2320B	water	1x250 ml HDPE	0-6° C	14 days	should be analyzed in the field
Ammonia	SM 4500-NH3-G modified	soil	1x4 oz glass	4° C	28 days	
Ammonia	SM 4500NH3-G	water	1x125 ml HDPE	H2SO4; 0-6° C	28 days	
Anion/Cation Balance	SM 1030E	water	1x60 ml Nalgene for NO2+NO3 1x250 ml HDPE for metals 1x500 ml HDPE for other analyses	H2SO4 HNO3 unpreserved	ASAP	field-filter for dissolved metals; other container unpreserved for alkalinity and anion analyses.
Asbestos	PCM or TEM	air	cartridge	none	n/s	(Ref Lab)
Asbestos	PLM or TEM	solids	any	none	n/s	(Ref Lab)
Asbestos	TEM	DW	2x1 L amber glass	0-6° C	48 hrs or ozonate	(Ref Lab) leave 20% headspace
Biochemical Oxygen Demand (BOD)	SM 5210B	water	1x1 L HDPE (depending on matrix)	0-6° C	**48 hrs**	
Bromate	EPA 300.1	water	125 ml HDPE (special order)	1.25 ml 5% EDA 0-6° C	28 days	(Ref Lab)
Bromide	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6° C	28 days	
Bromide	EPA 300.0/SW 9056A	water	1x60 ml Nalgene	0-6° C	28 days	
BTEX	SW 8021B/8260C	soil	1x4 oz prewt'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; 0-6° C	28 days for AK101 (14 days for BTEX)	field-preservation required; use 50 g soil & 25 ml MeOH (can combo with GRO) TB required
BTEX	SW 8021B/8260C	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	(can combo with GRO) allow no headspace; TB required
CAN (Total Coliform, Arsenic, Nitrate)	SM 9223B, EPA 200.8, SM 4500NO3	DW	sterile 120 ml container for coli 1x120 mL Nalgene for metals 60 ml Nalgene for NO2+NO3	Na2S2O3 for coli; HNO3 for metals; H2SO4 for NOx; chill recommended	**30 hrs for coli**	
CAN (Total Coliform, Arsenic, Nitrate)	SM 9223B, EPA 200.8, SM 4500NO4	DW with PWSID	sterile 120 ml container for coli 1x120 mL Nalgene for metals 60 ml Nalgene for NO2+NO4	Na2S2O3 for coli; HNO3 for metals; H2SO4 for NOx; 2-6°C	**30 hrs for coli**	
Carbamates	EPA 531.1	DW	3x40 ml amber VOA vials w/ septa (special order)	Na2S2O3; Monochloroacetic Acid; 0-6° C	7 days	(Ref Lab)
Carbamates	EPA 531.1	DW with PWSID	3x40 ml amber VOA vials w/ septa (special order)	Na2S2O3; Monochloroacetic Acid; 2-6° C	7 days	(Ref Lab)
Chemical Oxygen Demand (COD)	EPA 410.4	water	1x125 ml HDPE	H2SO4; 0-6° C	28 days	
Chlorate	EPA 300.1	water	1x125 ml HDPE (special order)	1.25 ml 5% EDA 0-6° C	28 days	(Ref Lab)
Chloride	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6° C	28 days	
Chloride	EPA 300.0/SW 9056A	water	1x60 ml Nalgene	0-6° C	28 days	

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
Chlorite	EPA 300.1	water	1x125 ml HDPE (special order)	1.25 ml 5% EDA 0-6° C	14 days	(Ref Lab)
Chlorophyll a	SM 10200H	water	1x1 L amber glass (special order filters)	freeze filter ASAP	21 days	(Ref Lab) use 4.25 cm GF-B filter; field-filter & freeze
Chromium, Hexavalent	SM 3500Cr or SW 7196	water	1x125 ml HDPE	0-6° C	**24 hrs**	
Chromium, Hexavalent	SW 7196	soil	1x4 oz amber glass	0-6° C	28 days	(Ref Lab)
Chronic Whole Effluent Toxicity (CWET)	(depends on permit)	water	1x2-8 gallon plastic (see permit)	0-6° C	**24 hrs**	(Ref Lab) need permit specs
Coliform, Fecal (MF)	SM 9222D	water	sterile 120 ml container filled to 100 ml mark	Na2S203; 0-8° C	**8 hrs**	
Coliform, Total (MF)	SM 9222B	water	sterile 120 ml container filled to 100 ml mark	Na2S203; chill recommended	**30 hrs**	(Ref Lab) for quantification of Total coliform colonies, use method 9223B Quantitray
Coliform, Total (P/A or Quantitray)	SM 9223B	DW, DW with PWSID, water	sterile 120 ml container filled to 100 ml mark	Na2SO3; chill recommended	**30 hrs**	(Contact SGS PM to make arrangements if hold time is other than 30 hours.)
E. coli (LT2 Quantitray)	SM 9223B	DW, DW with PWSID	sterile 120 ml container filled to 100 ml mark	Na2S203; <10˚ C	**30 hrs**	(Contact SGS PM to make arrangements if hold time is other than 30 hours.)
Color, True or Apparent	SM 2120B	water	1x250 ml HDPE	0-6° C	**48 hrs**	
Conductivity	SM 2510B	water	1x250 ml HDPE	0-6° C	28 days	
Corrosivity (see pH)						
Crpytosporidia	EPA 1623	water	1x10 L cubitainer	0-6° C	**24 hrs**	(Ref Lab) (can combo with Giardia)
Cyanide, Total	SM 4500CN-C,E	DW/W	1x125ml amber HDPE	(Sodium Arsenite if chlorinated) NaOH; 0-6° C	14 days	
Cyanide, Total	SM 4500CN-C,E	DW with PWSID	1x125ml amber HDPE	(Sodium Arsenite if chlorinated) NaOH; 2-6° C	14 days	
Cyanide, Weak Acid Dissociable	SM 4500CN-I	water	1x125ml amber HDPE	NaOH; 0-6° C	14 days	
Diesel Range Organics (DRO)	AK102	oil	1x20 ml scintillation vial	none	n/s	can combo with RRO
Diesel Range Organics (DRO)	AK102/8015C	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	can combo with RRO
Diesel Range Organics (DRO)	AK102/8015C	water	2x1 L amber glass	HCl; 0-6° C	14/40 days (*)	can combo with RRO
Diesel Range Organics (DRO)-Low Vol.	AK102/8015C	water	2x250 ml amber glass	HCl; 0-6° C	14/40 days (*)	
Dioxins	EPA 1613	DW	2x1 L amber glass	Na2S203; 0-6° C	28 days	(Ref Lab)
Dioxins	EPA 1613	DW with PWSID	2x1 L amber glass	Na2S203; 2-6° C	28 days	(Ref Lab)
Dioxins	SW 8280B or 8290A	soil	1x4 oz amber	0-6° C	n/s	(Ref Lab)
Dioxins	SW 8280B or 8290A	water	2x1 L amber glass	0-6° C	n/s	(Ref Lab)
Diquat/Paraquat	EPA 549.2	DW	1x1 Liter amber poly	Na2S203; 0-6° C	7 days	(Ref Lab)
Diquat/Paraquat	EPA 549.2	DW with PWSID	1x1 Liter amber poly	Na2S203; 2-6° C	7 days	(Ref Lab)
Dissolved Metals (see Metals, Dissolved)						
Dissolved Organic Carbon (DOC)	SM 5310B	water	1x125 ml amber glass	HCl; 0-6° C	28 days	field-filter; unpres. if lab-filtered (should be field-filtered)
Dissolved Oxygen	SM 4500O2-G	water	BOD bottle w/ stopper	0-6° C	15 minutes (ASAP)	should be analyzed in the field; allow no headspace
EDB/DBCP/1,2,3-TCP	SW 8260C SIM	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	TB required, allow no headspace
EDB/DBCP/1,2,3-TCP	SW 8260C SIM	soil	1x4 oz prewt'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; 0-6° C	14 days	TB required
EDB/DBCP/1,2,3-TCP	EPA 504.1	DW	3x40 ml amber VOA vials w/ septa	0-6° C	14 days	(Ref Lab) TB required allow no headspace
EDB/DBCP/1,2,3-TCP	EPA 504.1	DW with PWSID	3x40 ml amber VOA vials w/ septa	2-6° C	14 days	(Ref Lab) TB required allow no headspace

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
EDB/DBCP/1,2,3-TCP	SW 8011	soil	1x4 oz amber	0-6° C	14 days	(Ref Lab) allow no headspace
EDB/DBCP/1,2,3-TCP	SW 8011	water	3x40 ml amber VOA vials w/ septa	0-6° C	14 days	(Ref Lab) TB required allow no headspace
Endothall	EPA 548.1	DW	1x125 ml amber glass	Na2S203; 0-6° C	7 days	(Ref Lab)
Endothall	EPA 548.1	DW with PWSID	1x125 ml amber glass	Na2S203; 2-6° C	7 days	(Ref Lab)
Enterococci	Enterolert	water	sterile 120 ml container filled to 100 ml mark	Na2S203; 0-6° C	**8 hrs**	
EPH	NW-EPH	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	(Ref Lab)
EPH	NW-EPH	water	2x500 ml amber (special order)	HCl; 0-6° C	7/40 days (*)	(Ref Lab)
Explosives	SW 8330A	soil	1x4 oz amber glass	0-6° C	7 days	(Ref Lab)
Explosives	SW 8330A	water	2x1 L amber glass	0-6° C	7 days	(Ref Lab)
Fluoride	EPA 300.0/SW 9056A	water	1x60 ml Nalgene	0-6° C	28 days	
Fluoride	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6° C	28 days	
Gasoline Range Organics (GRO)	AK101/8015C	oil	1x20 ml scintillation vial	none	n/s	(can combo with BTEX)
Gasoline Range Organics (GRO)	AK101/8015C	soil	1x4 oz prewt'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; chill recommended	28 days for AK101 (14 days for BTEX)	field-preservation required; use 50 g soil & 25 ml MeOH (can combo with BTEX) TB required
Gasoline Range Organics (GRO)	AK101/8015C	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	(can combo with BTEX) allow no headspace; TB required
Giardia	EPA 1623	water	1x10 L cubitainer	0-6° C	**24 hrs**	(Ref Lab) (can combo with Crypto)
Glycols or Alcohols	SW 8015 modified	water	3x40 ml VOA vials	HCl; 0-6° C	14 days	(Ref Lab) specify each compound
Glycols or Alcohols	SW 8015 modified	liquid	1x120 ml amber glass	HCl; 0-6° C	14 days	(Ref Lab) specify each compound
Glycols or Alcohols	SW 8015 modified	solid	1x4 oz glass	HCl; 0-6° C	14 days	(Ref Lab) specify each compound
Glyphosate	EPA 547	DW	1x125 ml amber glass	Na2S203; 0-6° C	7 days	(Ref Lab)
Glyphosate	EPA 547	DW with PWSID	1x125 ml amber glass	Na2S203; 2-6° C	7 days	(Ref Lab)
Gross Alpha &/or Gross Beta	EPA 900	water	1x1 L HDPE	HNO3 (preserved at lab)	none	(Ref Lab)
Gross Heating Value	ASTM D 240	oil	1x20 ml scintillation vial	none	n/s	
Haloacetic Acids Formation Potential	SM 5710/6251B	DW/W	2x1 Liter	0-6° C	ASAP/14 days	(Ref Lab)
Haloacetic Acids Formation Potential	SM 5710/6251B	DW/W with PWSID	2x1 Liter	2-6° C	ASAP/14 days	(Ref Lab)
Haloacetic Acids	EPA 552.3	DW/W	1 x 250 ml narrow mouth amber glass	NH4Cl; 0-6° C	14 days	(Ref Lab)
Haloacetic Acids	EPA 552.3	DW/W with PWSID	1 x 250 ml narrow mouth amber glass	NH4Cl; 2-6° C	14 days	(Ref Lab)
Hardness	SM 2340B	water	1x250 ml HDPE	HNO3	180 days	
Herbicides	EPA 515.4	DW	2x125 ml amber glass	Sodium Sulfite; 0-6° C	14 days	(Ref Lab)
Herbicides	EPA 515.4	DW with PWSID	2x125 ml amber glass	Sodium Sulfite; 2-6° C	14 days	(Ref Lab)
Herbicides	EPA 555	DW	2x1 L amber glass	Na2S203; 0-6° C	7/40 days (*)	(Ref Lab)
Herbicides	EPA 555	DW with PWSID	2x1 L amber glass	Na2S203; 2-6° C	7/40 days (*)	(Ref Lab)
Herbicides	SW 8151A	soil	1x4 oz amber	0-6° C	14/40 days (*)	(Ref Lab)
Herbicides	SW 8151A	water	2x250 ml amber glass	0-6° C	7/40 days (*)	(Ref Lab)
Heterotrophic Plate Count (Pour Plate)	SM 9215B	water	sterile 120 ml container filled to 100 ml mark	Na2S203; chill recommended	**30 hrs for Pool/Spa** **8 hrs for Drinking** **& Reagent Water**	(Contact SGS PM to make arrangements if hold time is other than 30 hours.)
Ignitability, Seta Flash	SW 1020B	oil	1x4 oz glass	none	n/s	
Inorganic Contaminants, Primary	EPA 200.8 and 300.0, SM 4500CN-C,E, 4500NO3-F	DW	1x250 ml HDPE for metals; 1x120 ml Nalgene for cyanide; 1x60 ml Nalgene for NO2+NO3; 1x60 ml Nalgene for anions	HNO3 for metals; NaOH for CN; H2SO4 for NOx; none for F; 0-6° C	28/180 days; 14 days; 28 days; 28 days	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
Inorganic Contaminants, Primary	EPA 200.8 and 300.0, SM 4500CN-C,E, 4500NO3-F	DW with PWSID	1x250 ml HDPE for metals; 1x120 ml Nalgene for cyanide; 1x60 ml Nalgene for NO2+NO3; 1x60 ml Nalgene for anions	HNO3 for metals; NaOH for CN; H2SO4 for NOx; none for F; 2-6° C	28/180 days; 14 days; 28 days; 28 days	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Karl Fisher Water Content	ASTM D 1744	oil	1x20 ml scintillation vial	none	n/s	
Kjeldahl Nitrogen: see Total Kjeldahl N						
Langlier Index	SM 2330B	DW	1x250 ml HDPE for metals 1x500 ml HDPE for other analyses	HNO3 for metals; 0-6° C for others	ASAP	(req's pH, TDS, Alkalinity & Hardness)
Langlier Index	SM 2330B	DW with PWSID	1x250 ml HDPE for metals 1x500 ml HDPE for other analyses	HNO3 for metals; 2-6° C for others	ASAP	(req's pH, TDS, Alkalinity & Hardness)
Lead in Paint	SW 6020A	solid	any	none	6 months	
Lead/Copper Rule	EPA 200.8	DW	1x1 L HDPE (No substitution)	HNO3	6 months	*"First Draw" collection required If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling*
MBAS: see Surfactants						
Mercury, Dissolved	EPA 200.8/245.1 or SW 6020A/7470A	Water	1x250 mL HDPE	HNO3	28 days	field-filter; unpres. if lab-filtered (should be field-filtered) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Mercury, Methyl-	EPA 1630	Water	1x250 ml Teflon (special order)	HCl	90 days	(Ref Lab)
Mercury, Total	EPA 200.8/245.1 or SW 6020A/7470A	Water	1x250 mL HDPE	HNO3	28 days	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Mercury, Total	SW 6020A/7470A/7471B	soil	1x4 oz glass	none; 0-6° C	28 days	
Mercury, Trace by CVAF (Low Level)	EPA 1631E	water	1x500 ml FLPE, Teflon or amber glass	HCl	90 days	TB recommended
Metals, Dissolved (other than Hex.Cr)	EPA 200.8	water	1x250 ml HDPE	HNO3	28 days for Hg 180 days for metals	field-filter; unpres. if lab-filtered (should be field-filtered) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Metals, Dissolved (other than Hex.Cr)	SW 6020A	water	1x250 ml HDPE	HNO3	28 days for Hg 180 days for metals	field-filter; unpres. if lab-filtered(should be field-filtered) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Metals, Total (other than Hex.Cr)	EPA 200.8	water	1x250 ml HDPE	HNO3	28 days for Hg 180 days for metals	
Metals, Total (other than Hex.Cr)	SW 6020A	soil	1x4 oz glass	0-6° C	28 days for Hg 180 days for metals	
Metals, Total (other than Hex.Cr)	SW 6020A	oil	1x20 ml scintillation vial	n/a	28 days for Hg 180 days for metals	
Metals, Wipes	SW 6020A	wipes	premoistened "Ghost Wipe"	n/a	28 days for Hg 180 days for metals	wipe 10x10 cm area
Methane/Light Gases	RSK 175	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	(Ref Lab) allow no headspace
Nitrate+Nitrite, Total	SM 4500NO3-F	DW/W	1x60 ml Nalgene	H2SO4; chill recommended	28 days	
Nitrate+Nitrite, Total	SM 4500NO3-F	DW with PWSID	1x60 ml Nalgene	H2SO4;0-6°C	28 days	Samples received < 24 hours from collection need to be in the process of cooling.
Nitrate	EPA 300.0/SW 9056A	DW	1x60 ml Nalgene	0-6° C	**48 hrs**	Samples received < 24 hours from collection need to be in the process of cooling.

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
Nitrate	EPA 300.0/SW 9056A	DW with PWSID	1x60 ml Nalgene	0-6°C	48 hrs	Samples received < 24 hours from collection need to be in the process of cooling.
Nitrate	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6°C	28 days	
Nitrite	EPA 300.0/SW 9056A	DW	1x60 ml Nalgene	0-6°C	48 hrs	Samples received < 24 hours from collection need to be in the process of cooling.
Nitrite	EPA 300.0/SW 9056A	DW with PWSID	1x60 ml Nalgene	0-6°C	48 hrs	Samples received < 24 hours from collection need to be in the process of cooling.
Nitrite	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6°C	28 days	
Odor	SM 2150B	DW	1x1L amber glass	0-6°C	48 hrs	(Ref Lab)
Odor	SM 2150B	DW with PWSID	1x1L amber glass	0-6°C	24 hrs	(Ref Lab)
Oil & Grease, HEM	EPA 1664A	water	2x1L amber glass	HCl; 0-6°C	28 days	
Oil Burn Specs (OBS)	40 CFR 279.11 (PCBs, As, Cd, Cr, Pb, Total Halogens & Ignitablity)	oil	1x4 oz glass	none	n/s	
Ortho-Phosphate	SM4500P-E	water	1x60 ml Nalgene	0-6° C	48 hrs	
PAH	EPA 525.2	DW	2x1 L amber glass	Sodium Sulfite; HCl; 0-6° C	14 days	(Ref Lab * verify cmpd list *)
PAH	EPA 525.2	DW with PWSID	2x1 L amber glass	Sodium Sulfite; HCl; 2-6° C	14 days	(Ref Lab * verify cmpd list *)
PAH	EPA 625M-SIM; SW 8270D-SIM	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	
PAH	EPA 625M-SIM; SW 8270D-SIM	water	2x250 ml amber glass	0-6° C	7/40 days (*)	
PAH Trace	EPA 625M-SIM; SW 8270D-SIM	water	2x1 L amber glass	0-6° C	7/40 days (*)	
PCB Wipes	SW 8082A	wipes	1 gauze wipe w/ 4 oz glass (septa lid)	Hexane	n/s	wipe 10x10 cm area
PCBs	EPA 508	DW	2x1 L amber glass	Na2S203; 0-6° C	1 year (*)	(Ref Lab; can combo with Pest)
PCBs	EPA 508	DW with PWSID	2x1 L amber glass	Na2S203; 2-6° C	1 year (*)	(Ref Lab; can combo with Pest)
PCBs	EPA 608	water	2x1 L amber glass	0-6° C	1 year (*)	(Ref Lab; can combo with Pest)
PCBs	SW 8082A	oil	1x20 ml scintillation vial	none	n/s	
PCBs	SW 8082A	soil	1x4 oz glass	0-6° C	n/s	
PCBs	SW 8082A	water	2x1 L amber glass	0-6° C	n/s	
PCBs in Transformer Oil	SW 8082A	oil	1x20 ml scintillation vial	none	n/s	
Percent Solids (Moisture Content)	SM 2540G (modified)	soil	1x4 oz amber glass	0-6° C	14 days	
Pesticides	EPA 508	DW	2x1 L amber glass	Na2S203; 0-6° C	7/40 days (*)	(Ref Lab; can combo with PCBs)
Pesticides	EPA 508	DW with PWSID	2x1 L amber glass	Na2S203; 2-6° C	7/40 days (*)	(Ref Lab; can combo with PCBs)
Pesticides	EPA 608	water	2x1 L amber glass	0-6° C	7/40 days (*)	(Ref Lab; can combo with PCBs)
Pesticides	SW 8270D-SIM	oil	1x20 ml scintillation vial	none	n/s	
Pesticides	SW 8270D-SIM	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	
Pesticides	SW 8270D-SIM	water	2x1 L amber glass	0-6° C	7/40 days (*)	
PFAs (Polyfluorochemicals)	PFAs	water	1x1 L polycarbonate (special order)	0-6° C w/Trizma	28 days	(Ref Lab) should include temp blank in same type bottle
PFAs (Polyfluorochemicals)	537	DW	2x250 ml polycarbonate (special order)	0-6° C w/Trizma	14 days	(Ref Lab) should include temp blank in same type bottle
PFAs (Polyfluorochemicals)	PFAs	Soil	1 x 4 oz polycarbonate (special order)	0-6° C	28 days	(Ref Lab) should include temp blank in same type bottle
PFAs (Polyfluorochemicals)	PFAs	Product	2x250 ml polycarbonate (special order)	0-6° C	N/A	(Ref Lab) should include temp blank in same type bottle
pH	SM 4500H-B	water	1x250 ml Nalgene	0-6° C	ASAP/7 days	should be field analyzed
pH Corrosivity	SW 9040C	liquid	1x4 oz glass	none	ASAP/7 days	
pH Corrosivity	SW 9045D	solid	1x4 oz glass	none	ASAP/7 days	

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
Phase II Inorganics	EPA 200.8; EPA 300.0	DW	1x250 ml HDPE for metals; 1x60 ml Nalgene for anions	HNO3 for metals, unpreserved for fluoride; 0-6° C	6 months; 28 days	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Phase II Inorganics	EPA 200.8; EPA 300.0	DW with PWSID	1x250 ml HDPE for metals; 1x60 ml Nalgene for anions	HNO3 for metals, unpreserved for fluoride; 2-6° C	6 months; 28 days	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Phase V Inorganics	EPA 200.8; SM 4500CN-C,E	DW	1x250 ml HDPE for metals; 1x125 ml Nalgene for cyanide	HNO3 for metals, NaOH for CN; 0-6° C	6 months; 14 days	(dechlorinate before collecting for cyanide if applicable) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Phase V Inorganics	EPA 200.8; SM 4500CN-C,E	DW with PWSID	1x250 ml HDPE for metals; 1x125 ml Nalgene for cyanide	HNO3 for metals, NaOH for CN; 2-6° C	6 months; 14 days	(dechlorinate before collecting for cyanide if applicable) If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Phenols	EPA 420.1 or SW9065	water	1 x 500 ml HDPE	H2SO4; 0-6° C	28 days	(Ref Lab)
Phosphorus, Total	SM4500P-B,E	water	1x125 ml HDPE	H2SO4; 0-6° C	28 days	
PIWA (Private Individual Water Analysis)	SM 9223B, 2320B, 2510B, 2540C, 4500-H B, EPA 200.8, 300.0	water	sterile 120 ml container for coli 60 ml Nalgene for NO2+NO3 1x120 mL Nalgene for metals 1x500 ml HDPE for other analyses	Na2S2O3 for coli; HNO3 for metals; H2SO4 for NOx; chill recommended	**30 hrs for coli**	
Radiological Test Bank (i.e., Gross Alpha, Radium 226/228, Uranium)	EPA 900 EPA 903.1/904 EPA 200.8	DW	8x1 L HDPE (Note: Collect 2x1-L each quarter, then composite at the end of the year.)	HNO3 (preserved at lab)	180 days	(Ref Lab)
Radium 226/228	EPA 903.1/904	water	3x1 L HDPE	HNO3 (preserved at lab)	6 months	(Ref Lab)
Radon in DW	EPA 913 or SM 7500	water	3x40 ml amber VOA with septa	0-6° C	**72 hrs**	(Ref Lab)
Residual Chlorine, Free	SM 4500CL-F	water	1x60 ml Nalgene	0-6° C	**15 minutes**	should be field analyzed
Residual Chlorine, Total	SM 4500CL-G	water	1x60 ml Nalgene	0-6° C	**15 minutes**	should be field analyzed
Residual Range Organics (RRO)	AK103	oil	1x20 ml scintillation vial	none	n/s	(can combo with DRO)
Residual Range Organics (RRO)	AK103	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	(can combo with DRO)
Residual Range Organics (RRO)	AK103	water	2x1 L amber glass	HCl; 0-6° C	14/40 days (*)	(can combo with DRO)
Residue, Filterable (TDS)	SM 2540C	water	1x125 mL HDPE	0-6° C	7 days	
Residue, Non-Filterable (TSS)	SM 2540D	water	1x1 L HDPE (entire volume required)	0-6° C	7 days	requires 1 full Liter
Residue, Settleable (SS or SM)	SM 2540F	water	2x1 L HDPE (entire volume required)	0-6° C	**48 hrs**	requires 2 full Liter
Residue, Suspended Volatile (SVS)	SM 2540E	water	1x1 L HDPE (entire volume required)	0-6° C	7 days	requires 1 full Liter
Residue, Total (TS)	SM 2540B	water	1x125 ml HDPE	0-6° C	7 days	
Residue, Total Volatile (TVS)	SM 2540E	water	1x125 ml HDPE	0-6° C	7 days	
Resistivity	SM 2510B	water	1x125 ml HDPE	0-6° C	28 days	
Salinity by Chloride	EPA 300.0	water	1x60 ml Nalgene	0-6° C	28 days	
Secondary Inorganic Contaminants	EPA 200.8, 300, SM 4500H-B, 2120B, 2330B, 2320B, 2540C	DW	1x250 mL HDPE for metals; 1x1 L HDPE for other analyses	HNO3 for metals; none for others; 0-6° C	**48 hrs for anions, pH, Alkalinity, etc.**	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Secondary Inorganic Contaminants	EPA 200.8, 300, SM 4500H-B, 2120B, 2330B, 2320B, 2540C	DW with PWSID	1x250 mL HDPE for metals; 1x1 L HDPE for other analyses	HNO3 for metals; none for others; 2-6° C	**48 hrs for anions, pH, Alkalinity, etc.**	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Semivolatile Organic Cmpds (SVOC)	EPA 525.2	DW	2x1 L amber glass	Sodium Sulfite; HCl; 0-6° C	14/40 days (*)	(Ref Lab * verify cmpd list *)
Semivolatile Organic Cmpds (SVOC)	EPA 525.2	DW with PWSID	2x1 L amber glass	Sodium Sulfite; HCl; 2-6° C	14/40 days (*)	(Ref Lab * verify cmpd list *)
Semivolatile Organic Cmpds (SVOC)	EPA 625	water	2x1 L amber glass	0-6° C	7/40 days (*)	

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
Semivolatile Organic Cmpds (SVOC)	SW 8270D	soil	1x4 oz amber glass	0-6° C	14/40 days (*)	
Semivolatile Organic Cmpds (SVOC)	SW 8270D	water	2x1 L amber glass	0-6° C	7/40 days (*)	
Settleable Matter (SS or SM): see Residue, Settleable						
Solids, Total (TS): see Residue, Total						
Solids, Volatile (VS): see Residue, Volatile						
Specific Gravity	Lab SOP	liquid	1x125 ml amber glass	none	n/s	
SPLP … (see TCLP methods)	SW 1312…					
Sulfate	EPA 300.0/SW 9056A	soil	1x4 oz glass	0-6° C	28 days	
Sulfate	EPA 300.0/SW 9056A	water	1x60 ml Nalgene	0-6° C	28 days	
Sulfide, Total	SM 4500S-D	water	1x125 mL HDPE	NaOH+ZnAc; 0-6° C	7 days	
Sulfite	EPA 377.1	water	1x500 ml HDPE	5ml 2.5% EDTA	15 minutes	(Ref Lab)
Sulfolane	EPA 1625/SW8270D	soil	1x8 oz amber glass	0-6° C	14/40 days (*)	
Sulfolane	EPA 1625/SW8270D	water	2x1 L amber glass	0-6° C	7/40 days (*)	
Sulfur, Total	ASTM D 2622	oil	1x120 ml amber glass	none	n/s	(Ref Lab)
Surfactants (MBAS)	SM 5540C	water	1x500 mL amber glass	0-6° C	**48 hrs**	(Ref Lab)
Suspended Solids (SS or SM): see Residue, Settleable						
TAH	EPA 602 by 624/SW 8260B	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	allow no headspace
TAqH	EPA 625M-SIM; SW 8270D-SIM	water	2x250 ml amber glass	0-6° C	7/40 days (*)	
TAqH Trace	EPA 625M-SIM; SW 8270D-SIM	water	2x1 L amber glass	0-6° C	7/40 days (*)	
Tannin/Lignin	HACH	water	1x250 ml amber glass	0-6° C	28 days	(Ref Lab)
TCLP Herbicides	SW 1311/8151A	water	1x1 L amber glass	none	14/7/40 days	(Ref Lab)
TCLP Herbicides	SW 1311/8151A	oil	1x20 ml scintillation vial	none	14/7/40 days	(Ref Lab)
TCLP Herbicides	SW 1311/8151A	solid	1x8 oz amber glass	none	14/7/40 days	(Ref Lab)
TCLP Metals	SW 1311/6000/7000	water	1x500 mL or 1Liter HDPE	none	28 days (for Hg) 180 days (other)	
TCLP Metals	SW 1311/6000/7000	oil	1x20 ml scintillation vial	none	28 days (for Hg) 180 days (other)	
TCLP Metals	SW 1311/6000/7000	solid	1x8 oz amber glass	none	28 days (for Hg) 180 days (other)	
TCLP Pesticides	SW 1311/8270D-SIM	water	1x1 L amber glass	none	14/7/40 days	
TCLP Pesticides	SW 1311/8270D-SIM	oil	1x20 ml scintillation vial	none	14/7/40 days	
TCLP Pesticides	SW 1311/8270D-SIM	solid	1x8 oz amber glass	none	14/7/40 days	
TCLP Semivolatiles	SW 1311/8270D	water	1x1 L amber glass	none	14/7/40 days	
TCLP Semivolatiles	SW 1311/8270D	oil	1x20 ml scintillation vial	none	14/7/40 days	
TCLP Semivolatiles	SW 1311/8270D	solid	1x8 oz amber glass	none	14/7/40 days	
TCLP Volatiles	SW 1311/8260C	water	3x40 ml amber VOA vial w/ septa	none	14/14 days	
TCLP Volatiles	SW 1311/8260C	oil	1x20 ml scintillation vial	none	14/14 days	
TCLP Volatiles	SW 1311/8260C	solid	1x4 oz amber glass	none	14/14 days	
Thiocyanate	SM4500CN-M	water	1x125ml HDPE	HNO3; 0-6° C	28 days	(Ref Lab) Clean aqueous matrix only
Total Dissolved Solids (TDS): see Residue, Filterable						
Total Halogens	SW 5050/9056A	oil	1x60 ml amber glass	none	n/s	
Total Kjeldahl Nitrogen (TKN)	EPA 4500N-D	water	1x125 mL HDPE	H2SO4; 0-6° C	28 days	
Total Nitrogen (see: NO2/NO3, TKN and Ammonia)						

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
Total Organic Carbon (TOC)	TOC-SGS SOP	soil	1x4 oz amber	0-6° C	28 days	HT extended if frozen
Total Organic Carbon (TOC)	SM 5310B/SW 9060A	water	1x125 ml amber glass	HCl; 0-6° C	28 days	
Total Organic Halides (TOX)	SW 9020	soil	1x4 oz amber	0-6° C	28 days	(Ref Lab)
Total Organic Halides (TOX)	SW 9020	water	2x40 ml VOA or larger bottle	0-6° C	28 days	(Ref Lab)
Total Petroleum Hydrocarbons, HEM-SG	EPA 1664 SG	water	2x1 L amber glass	HCl; 0-6° C	28 days	
Total Solids: see Residue, Total						
Total Suspended Solids: see Residue, Non-Filterable						
Toxicity, SPP (for drilling mud)	40 CFR …	solid	1 Liter	0-6° C	90 days	(Ref Lab)
TPH by 8015B: See GRO or DRO						
Trihalomethane Formation Potential	SM 5710/EPA 551.1	DW/W	1 Liter	0-6° C	ASAP/14 days	(Ref Lab)
Trihalomethane Formation Potential	SM 5710/EPA 551.1	DW with PWSID	1 Liter	2-6° C	ASAP/14 days	(Ref Lab)
Trihalomethanes (TTHM)	EPA 524.2	DW/W	3x40 ml amber VOA vials w/ septa	Ascorbic Acid/ HCl; 0-6° C	14 days	allow no headspace; TB required
Trihalomethanes (TTHM)	EPA 524.2	DW with PWSID	3x40 ml amber VOA vials w/ septa	Ascorbic Acid/ HCl; 2-6° C	14 days	allow no headspace; TB required
Turbidity	SM 2130B	water	1x60 ml Nalgene	0-6° C	**48 hrs**	
Turbidity	SM 2130B	DW with PWSID	1x60 ml Nalgene	2-6° C	**48 hrs**	
Uranium, Total	EPA 200.8	DW	1x250 ml HDPE	0-6° C	6 months	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
Uranium, Total	EPA 200.8	DW with PWSID	1x250 ml HDPE	2-6° C	6 months	If samples for metals are not acid preserved they must be received by the lab within 14 days of sampling
UV 254	SM 5910B	DW	1x250 mL amber glass	0-6° C	48 hrs	(Ref Lab)
UV 254	SM 5910B	DW with PWSID	1x250 mL amber glass	2-6° C	48 hrs	(Ref Lab)
VOC: Volatile Organic Compounds	EPA 524.2	DW	3x40 ml amber VOA vials w/ septa	(Ascorbic Acid if chlorinated) HCl; 0-6° C	14 days	allow no headspace; TB required
VOC: Volatile Organic Compounds	EPA 524.2	DW with PWSID	3x40 ml amber VOA vials w/ septa	(Ascorbic Acid if chlorinated) HCl; 2-6° C	14 days	allow no headspace; TB required
VOC: Volatile Organic Compounds	EPA 624	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	allow no headspace; TB required
VOC: Volatile Organic Compounds	SW 8260C	oil	1x20 vial or 1x40 ml VOA w/ septa	0-6° C	14 days	allow no headspace
VOC: Volatile Organic Compounds - Low Level Halogens	SW 8260C	soil	1x4 oz prewt'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; 0-6° C	14 days	field-preservation required; use 50 g soil & 25 ml MeOH (can combo with BTEX) TB required
VOC: Volatile Organic Compounds	SW 8260C	soil	1x4 oz prewt'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; 0-6° C	14 days	field-preservation required; use 50 g soil & 25 ml MeOH (can combo with BTEX) TB required
VOC: Volatile Organic Compounds	SW 8260C	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	allow no headspace; TB required
VOC: Volatile Organic Compounds Low Level (5035A FROZEN)	SW 8260C Low Level	soil	2x40 ml VOA w/ septa; 5-ml DI water & stir bar (also provide jars for medium level VOC and % solids)	freeze w/in 48 hrs: -7 to -20° C	14 days	field-preservation required; 5 g soil in 5 ml DI water & freeze on side immediately. TB required

Parameter	Method	Matrix	Recommended Container/Size	Preservative	Holding Time *	Other Notes
VPH	NW-VPH	soil	1x4 oz prewt'd amber (2nd 4 oz unpreserve % solids jar if no other analyses)	MeOH+BFB; 0-6° C	14 days	(Ref Lab) TB required; field-preservation required; use 50 g soil & 25 ml MeOH
VPH	NW-VPH	water	3x40 ml amber VOA vials w/ septa	HCl; 0-6° C	14 days	(Ref Lab) TB required; allow no headspace

** - Methods requiring semivolatile extraction by SW 3520/3550 have a hold time for extraction followed by a hold time for analysis of the extract.*

APPENDIX C: SURROGATE AND ISOTOPE DILUTION ANALYTE ASSOCIATIONS

Appendix C

Surrogate and Isotope Dilution Analyte Associations

Table 1 - Surrogate and Isotope Dilution Analyte Associations

Analytical Method	Surrogate/ Isotope Dilution Analyte	Analyte	CAS
AK101	4-Bromofluorobenzene <surr>	Gasoline Range Organics	GRO
AK102	5a Androstane <surr>	Diesel Range Organics	DRO
AK103	n-Triacontane-d62 <surr>	Residual Range Organics	RRO
SW8260D (VOC)	1,2-Dichloroethane-D4 <surr>	1,1,1-Trichloroethane	71-55-6
		1,1-Dichloroethane	75-34-3
		1,1-Dichloroethene	75-35-4
		1,1-Dichloropropene	563-58-6
		1,2-Dichloroethane	107-06-2
		1,2-Dichloropropane	78-87-5
		2,2-Dichloropropane	594-20-7
		2-Butanone (MEK)	78-93-3
		4-Methyl-2-pentanone (MIBK)	108-10-1
		Benzene	71-43-2
		Bromochloromethane	74-97-5
		Bromodichloromethane	75-27-4
		Bromomethane	74-83-9
		Carbon disulfide	75-15-0
		Carbon tetrachloride	56-23-5
		Chloroethane	75-00-3
		Chloroform	67-66-3
		Chloromethane	74-87-3
		cis-1,2-Dichloroethene	156-59-2
		cis-1,3-Dichloropropene	10061-01-5
		Dibromomethane	74-95-3
		Dichlorodifluoromethane	75-71-8
		Methylene chloride	75-09-2
		Methyl-t-butyl ether	1634-04-4
		trans-1,2-Dichloroethene	156-60-5
		Trichloroethene	79-01-6
		Trichlorofluoromethane	75-69-4
		Vinyl chloride	75-01-4
	4-Bromofluorobenzene <surr>	1,1,2,2-Tetrachloroethane	79-34-5
		1,2,3-Trichlorobenzene	87-61-6
		1,2,3-Trichloropropane	96-18-4
		1,2,4-Trimethylbenzene	95-63-6
		1,2-Dibromo-3-chloropropane	96-12-8
		1,2-Dichlorobenzene	95-50-1
		1,3,5-Trimethylbenzene	108-67-8
		1,3-Dichlorobenzene	541-73-1
		1,4-Dichlorobenzene	106-46-7
		2-Chlorotoluene	95-49-8
		4-Chlorotoluene	106-43-4

Table 1 - Surrogate and Isotope Dilution Analyte Associations

Analytical Method	Surrogate/ Isotope Dilution Analayte	Analyte	CAS
SW8260D (VOC)	4-Bromofluorobenzene <surr>	4-Isopropyltoluene	99-87-6
		Bromobenzene	108-86-1
		Hexachlorobutadiene	87-68-3
		Naphthalene	91-20-3
		n-Butylbenzene	104-51-8
		n-Propylbenzene	103-65-1
		sec-Butylbenzene	135-98-8
		tert-Butylbenzene	98-06-6
	Toluene-d8 <surr>	1,1,1,2-Tetrachloroethane	630-20-6
		1,1,2-Trichloroethane	79-00-5
		1,2-Dibromoethane	106-93-4
		1,3-Dichloropropane	142-28-9
		2-Hexanone	591-78-6
		Bromoform	75-25-2
		Chlorobenzene	108-90-7
		Dibromochloromethane	124-48-1
		Ethylbenzene	100-41-4
		Isopropylbenzene (Cumene)	98-82-8
		o-Xylene	95-47-6
		P & M -Xylene	P & M - Xylene
		Styrene	100-42-5
		Tetrachloroethene	127-18-4
		Toluene	108-88-3
		trans-1,3-Dichloropropene	10061-02-6
		Toluene	108-88-3
		Xylenes (total)	1330-20-7
SW8260D SIM (LL VOC)	4-Bromofluorobenzene <surr>	1,2,3-Trichloropropane	96-18-4
		1,2-Dibromo-3-chloropropane	96-12-8
	Toluene-d8 <surr>	1,2-Dibromoethane	106-93-4
8270D SIMS (PAH)	2-Methylnaphthalene-d10 <surr>	1-Methylnaphthalene	90-12-0
		2-Methylnaphthalene	91-57-6
		Acenaphthene	83-32-9
		Acenaphthylene	208-96-8
		Anthracene	120-12-7
		Fluorene	86-73-7
		Naphthalene	91-20-3
		Phenanthrene	85-01-8
	Fluoranthene-d10 <surr>	Benzo(a)Anthracene	56-55-3
		Benzo[a]pyrene	50-32-8
		Benzo[b]Fluoranthene	205-99-2
		Benzo[g,h,i]perylene	191-24-2
		Benzo[k]fluoranthene	207-08-9

Table 1 - Surrogate and Isotope Dilution Analyte Associations

Analytical Method	Surrogate/ Isotope Dilution Analyte	Analyte	CAS
8270D SIMS (PAH)	Fluoranthene-d10 <surr>	Chrysene	218-01-9
		Dibenzo[a,h]anthracene	53-70-3
		Fluoranthene	206-44-0
		Indeno[1,2,3-c,d] pyrene	193-39-5
		Pyrene	129-00-0
EPA 537.1 Mod (PFAS)	18O2-PFHxS	Perfluorohexansulfonic acid (PFHxS)	355-46-4
	13C2-PFHxA	Perfluorohexanoic acid (PFHxA)	307-24-4
	13C4-PFHpA	Perfluoroheptanoic acid (PFHpA)	375-85-9
	13C5-PFNA	Perfluorononanoic acid (PFNA)	375-95-1
	13C3-PFBS	Perfluorobutanesulfonic acid (PFBS)	375-73-5
	13C2-PFDA	Perfluorodecanoic acid (PFDA)	335-76-2
	13C2-PFUdA	Perfluoroundecanoic acid (PFUnA)	2058-94-8
	13C2-PFDoA	Perfluorododecanoic acid (PFDoA)	307-55-1
		Perfluorotridecanoic acid (PFTrDA)	72629-94-8
	13C2-PFTeDA	Perfluorotetradecanoic acid (PFTeA)	376-06-7
	13C3-HFPO-DA	Hexafluoropropylene oxide dimer acid (HFPO-DA)	13252-13-6
	13C4-PFOS	Perfluorooctanesulfonic acid (PFOS)	1763-23-1
		4,8-Dioxa-3H-perfluorononanoic acid (DONA)	919005-14-4
		9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	756426-58-1
		11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	83329-89-9
	d3-MeFOSAA	N-Methyl perfluorooctane sulfonamidoacetic acid (N-MeFOSAA)	2355-31-9
	d5-EtFOSAA	N-Ethyl perfluorooctane sulfonamidoacetic acid (N-EtFOSAA)	2991-50-6
	13C4-PFOA	Perfluorooctanoic acid (PFOA)	335-67-1

NOTES:

Surrogate associations for GRO, DRO, RRO, VOCs, and PAHs are based on information received February 2022 from SGS North America, Inc. and may not be representative of all laboratories.

Surrogate associations for PFAS are based on information received February 2022 from Eurofins TestAmerica, Inc. and may not be representative of all laborat PFAS analytes are associated with isotope dilution standards.

CAS No. = Chemical Abstract Service Number; DRO = diesel range organics; GRO = gasoline range organics; PAH = polynuclear aromatic hydrocarbons; PFAS = per- and poly-fluorinated alkyl substances; RRO = residual range organics; VOC = volatile organic compounds

IMPORTANT INFORMATION

Important Information

About Your Data-Validation Program Plan

IMPORTANT INFORMATION

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

IMPORTANT INFORMATION

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge

from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland