

**WASTE TREATMENT AND IMMOBILIZATION PLANT
APPENDIX A
SAMPLING AND ANALYSIS PLAN FOR CLOSURE OF WTP FACILITY
CHANGE CONTROL LOG**

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The “**Modification Number**” represents Ecology’s method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number
05/23/2016	8C.2016.Q1

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APPENDIX A
SAMPLING AND ANALYSIS PLAN FOR CLOSURE OF WTP FACILITY

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ACRONYMS

BNI	Bechtel National, Inc.
CFR	Code of Federal Regulations
°C	degree Celsius
CL	control limit
COC	constituent of concern
CVAA	cold vapor atomic absorption
DOE	US Department of Energy
DQO	data quality objective
DRO	diesel range organics
DWMU	dangerous waste management unit
Ecology	State of Washington, Department of Ecology
EPA	US Environmental Protection Agency
GC	gas chromatography
GC/MS	GC/mass spectrometry
GC-ECD	GC-electron capture detector
GFAA	graphite furnace atomic absorption spectrometry
GRO	gasoline range organics
HCl	hydrochloric acid
HLW	high-level waste
HPLC	high-performance liquid chromatography
HRGC/HRMS	high-resolution GC/high-resolution MS
ICP-AES	inductively coupled plasma-atomic emission spectrometry
ICP-MS	inductively coupled plasma-mass spectrometry
L	liter
LAW	low-activity waste
LOQ	level of quantitation
mL	milliliter
MS	mass spectrometry
MS/MSD	matrix spike/matrix spike duplicate
MTCA	Model Toxics Control Act
ORP	Office of River Protection
oz	ounce
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PTFE	polytetrafluoroethylene

QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
SAP	sampling and analysis plan
SIM	selective ion monitoring
SOP	standard operating procedure
SVOC	semi-volatile organic compound
TPH	total petroleum hydrocarbons
TPH-DRO	total petroleum hydrocarbons-diesel range organics
TPH-GRO	total petroleum hydrocarbons-gasoline range organics
US	United States
VOA	volatile organic analyte
VOC	volatile organic compound
WAC	Washington Administrative Code
WTP	Hanford Tank Waste Treatment and Immobilization Plant

1 **A.1 PURPOSE OF SAMPLING AND ANALYSIS FOR CLOSURE OF WTP**

2 This sampling and analysis plan (SAP) describes the sampling, analysis, and quality assurance (QA) and
3 quality control (QC) procedures to be used during closure of the Hanford Tank Waste Treatment and
4 Immobilization Plant (WTP) permitted dangerous waste management units (DWMUs). The DWMUs
5 include container storage areas, containment buildings, tanks, and miscellaneous unit systems with the
6 associated ancillary equipment and secondary containment. The DWMUs may include areas of suspected
7 releases of dangerous wastes, such as concrete floors and underlying soil, when evidence is found
8 indicating apparent failure of secondary containment systems.

9 This SAP presents closure activities in accordance with US Environmental Protection Agency (EPA)
10 guides *EPA Requirements for Quality Assurance Project Plans*, EPA/240/B-01/003, EPA QA/R-5
11 (EPA 2001), *EPA Guidance for Quality Assurance Project Plans*, EPA/240/R-02/009, EPA QA/G-5
12 (EPA 2002a) and Washington Administrative Code (WAC)173-303, *Dangerous Waste Regulations*,
13 closure regulations. The elements of this SAP present the activities, organization, and QA/QC protocols
14 to achieve the data quality objectives (DQOs) of the sampling and analysis effort.

15 This SAP will be updated as necessary in accordance with WAC 173-303-610 and the *Hanford Facility*
16 *Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion, Revision 8C, for the*
17 *Treatment, Storage, and Disposal of Dangerous Waste, Part III, Operating Unit Group 10 (Waste*
18 *Treatment and Immobilization Plant)*, WA7890008967 (Ecology 2007), Permit Condition III.10.C.8, and
19 will serve as the governing document for all activities conducted in support of closure, decontamination,
20 and post-decontamination sampling of WTP.

21 Clean closure is the goal for the DWMUs. Clean closure requires decontamination or removal and
22 disposal of dangerous/mixed waste, waste residues, and contaminated equipment, soil, or other material,
23 in accordance with the clean closure performance standards of WAC 173-303-610. As presented in
24 Section H.2.0 of the closure plan, the use of a “clean debris surface” standard is proposed as the clean
25 closure performance standard for the WTP metal structures and equipment and concrete structures that
26 will remain after closure, as well as DWP equipment used for waste management. If the clean debris
27 surface standard cannot be achieved or verified visually (e.g., interior surfaces of a pipe, pump, or tank),
28 the equipment, structure, or portions thereof, may be washed and flushed with decontamination solutions.
29 The post-decontamination solution or rinsate will be sampled and analyzed to determine whether the
30 criteria defined in WAC 173-303-610(2)(b) have been achieved, which indicates successful
31 decontamination and attainment of the clean closure performance standard (referred to as the rinsate
32 “designation limit standard” in Section H.2.0 of the closure plan).

33 Due to the level of secondary containment provided at the WTP, releases of dangerous wastes to the
34 environment are not anticipated. However, when evidence is found indicating apparent failure of
35 secondary containment systems (e.g., stainless steel liners and coated concrete surfaces), potential soil
36 contamination will be investigated. When contaminated soil is removed, soil samples will be collected
37 and analyzed to verify compliance with risk-based concentration limits (referred to as the “soil cleanup
38 standard” in Section H.2.0 of the closure plan).

39 The overall purposes of the sampling and analysis activities during closure of the DWMUs are to:

- 40 • Confirm that dangerous wastes (i.e., either characterized by toxicity or by corrosivity as defined
41 in WAC 173-303-070 and 40 Code of Federal Regulations [CFR] 261, *Identification and Listing*
42 *of Hazardous Waste*) are not left in any of the DWMUs.
- 43 • For a DWMU where the clean debris surface standard cannot be achieved or verified visually,
44 confirm that the DWMU was successfully decontaminated and can be declared to have achieved
45 clean closure by collecting post-decontamination rinsate samples and demonstrating that the
46 analytical data are below the rinsate designation limit standard.

- For releases of dangerous wastes to soil, confirm that contaminated soil have been successfully removed and the DWMU can be declared to have achieved clean closure by collecting samples of the remaining soil and demonstrating that the analytical data are below the soil cleanup standard.

A.2 SAMPLING OBJECTIVES

Sampling will be conducted to verify the decontamination of equipment and structures and removal of contaminated soil at the DWMUs. Media anticipated to be sampled during closure of the DWMUs include decontamination rinsates and soil at suspected release locations.

Investigation of potential soil contamination may involve coring and sampling of the concrete floor when evidence indicates apparent failure of secondary containment systems. Concrete, if it is left in place, may also be sampled by collecting wipe or chip samples to determine if it is a clean and acceptable risk to remain. Sampling may be conducted following decontamination of the interior surfaces of the permitted secondary containment areas. If there is required sampling under the secondary containment structures, it will be conducted in a manner that minimizes disturbance of underlying soil.

Sampling and analysis tasks in which clean closure demonstrations may be needed are as follows:

- Collect samples from select biased, or *focused*, sample locations, based on reviews of the DWMU operating record; stainless steel liner breach investigations and underlying concrete decontamination work and evaluations; or based on interior inspection data (e.g., from video, closed circuit television, or radiation surveys) for container storage areas, containment buildings, tanks, piping, or other ancillary equipment.
- Collect rinsate, soil, concrete wipe or chip samples from select biased sample locations, focusing on the locations of apparent highest concentrations. For tanks, piping, or other permitted equipment, the locations to be sampled will include apparent or likely waste accumulations in crevices, connections, or other rough or restricted flow locations such as inlets or outlets. The rinsate sample will be taken from the first rinse, obtained within a reasonably short time after the completion of decontamination efforts. For concrete, wipe or chip samples will be collected from locations immediately adjacent to or below stainless steel liner breaches. For soil, samples will be collected from locations immediately adjacent to or below cladding breaches or cracked or deteriorated concrete. The sample locations may expand extensively, as necessary, to determine the areal and vertical boundaries of contaminated soil at concentrations above the soil cleanup standard.
- Conduct analyses of samples.

A list of indicator constituents will be developed based on the media, potential constituents of concern (COCs) and clean closure performance standard (rinsate designation limit standard or soil cleanup standard) for the DWMUs. Collected samples (rinsate, soil, concrete wipe, or chip) will be analyzed for these indicator constituents. In addition, the analytical results will be compiled, evaluated, and summarized in the following manner:

- Review the QC data of the sample handling and analyses to assess the reliability of the analytical data. Examine sample results for comparison with clean closure performance standard on an indicator constituent by indicator constituent basis.
- Conduct the statistical evaluation of the analytical data reported for the indicator constituents.
- Prepare summary statistics of the analytical data reported for indicator constituents.
- For each indicator constituent, compare the statistical results with the selected clean closure performance standard (rinsate designation limit standard or soil cleanup standard) and, for soil, with the established background levels. Sample concentrations below the background level, but above the clean closure performance standard, may be proposed as adequate demonstrations of clean closure, pending State of Washington, Department of Ecology (Ecology) approval.

- 1 • Prepare a report that includes data analysis and assessments that evaluate whether the levels of
2 various indicator constituents present a health or environmental concern, and whether they meet
3 the clean closure performance standards. The report will include sample locations, number of
4 samples, specific methods used for sample collection and analyses, data quality assessment, and
5 differences in procedures or sample locations from those provided in the revised closure plan and
6 the SAP, as applicable. The report will provide clean closure evaluations.
- 7 • A DWMU may require several sampling campaigns and therefore iterative reports, while other
8 units may require no sampling and single short letter reports.

9 **A.3 PROJECT MANAGEMENT**

10 **A.3.1 Project/Task Organization**

11 A generalized organizational chart for the implementation of this SAP during closure is included as
12 Figure A-1.

13 The WTP Closure Manager will be responsible for the activities associated with the closure, and will
14 report directly to the WTP Project Director. His staff will be responsible for the collection and analyses
15 of sampling data of known quality, representative of actual site conditions, and are adequate and
16 appropriate for making informed environmental decisions regarding closure of DWMUs at WTP.

17 The WTP Environmental Protection Manager and WTP Safety and Health Manager will report directly to
18 the WTP Project Director. Their staff will provide environmental permitting, regulatory compliance,
19 waste management, and safety support to the WTP Closure Manager's staff. The WTP Environmental
20 Protection Manager (or his designee) is responsible for revising and updating this SAP.

21 The WTP QA Manager will report directly to the WTP Project Director, and his staff will provide
22 independent QA oversight to ensure that onsite and subcontracted sampling and analytical laboratory
23 activities are performed in accordance with this SAP, WTP QA Manual and other applicable project QA
24 procedures. The WTP QA Manager (or his designee) is responsible for reviewing revisions and updates
25 to this SAP.

26 **A.3.2 Special Training and Certification Requirements**

27 Individuals involved in sampling, analysis, or data review will be trained and qualified to safely
28 implement the activities addressed in this SAP. Training will conform to the training requirements
29 specified in the WAC 173-303-330 (Personnel Training), WTP QA Manual, and Chapter 8.0 of the
30 *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion,*
31 *Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste, Part III, Operating Unit*
32 *Group 10 (Waste Treatment and Immobilization Plant), WA7890008967. Training records will be*
33 *maintained in accordance with Section A.8 of this document.*

34 **A.4 DATA QUALITY OBJECTIVES**

35 The DQOs are qualitative and quantitative statements that define data quality requirements based on
36 identified end uses. The DQOs define the performance criteria that limit the probability of making
37 decision errors by considering the purpose of collecting data, defining the appropriate types of data
38 needed, and specifying acceptable probabilities of making decision errors. The EPA's seven-step process
39 for DQO development is presented below to communicate the quality objectives for closure sampling at
40 WTP (*EPA Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA/240/B-
41 06/001, QA/G-4 [EPA 2006]). These steps may be reviewed and refined for each DWMU before its
42 closure commences.

43 **A.4.1 Step 1: State the Problem**

44 The problem is sampling data are needed to confirm that the clean closure performance standards (discussed
45 in Section A.1 of this SAP and Section H.2.0 of the closure plan) have been met to demonstrate clean

1 closure of the DWMUs. To accomplish this, five primary activities have to be conducted during Step 1.
2 These are:

- 3 • Identify DWMUs to be closed at WTP.
- 4 • Identify potential sample locations at each DWMU based on review of operating records (e.g.,
5 spills and releases to the environment).
- 6 • Identify the list of COCs for each DWMU based on review of operating records (e.g., types and
7 quantities of wastes received and stored in vessels, tanks, miscellaneous equipment, and ancillary
8 equipment during operations).
- 9 • Identify the list of indicator constituents to be analyzed based on the media to be sampled and
10 COCs for each DWMU.
- 11 • Identify the key decision-makers involved in the closure of the DWMU.

12 Identify the resources and organization/management issues needing resolution to successfully implement
13 the sampling and analysis activities

14 **A.4.2 Step 2: Identify the Goals of the Study**

15 The primary goal is to verify that the clean closure performance standards have been met. Possible logic
16 decisions are as follows:

- 17 • DWMU will be administratively closed with no sampling, decontamination or remediation
18 needed based on review of operating records and consideration of the future use of the DWMU.
- 19 • DWMU will be sampled to confirm that clean closure performance standards have already been
20 met without the need of decontamination or remediation.
- 21 • DWMU will be decontaminated or remediated and sampled until clean closure performance
22 standards have been achieved.

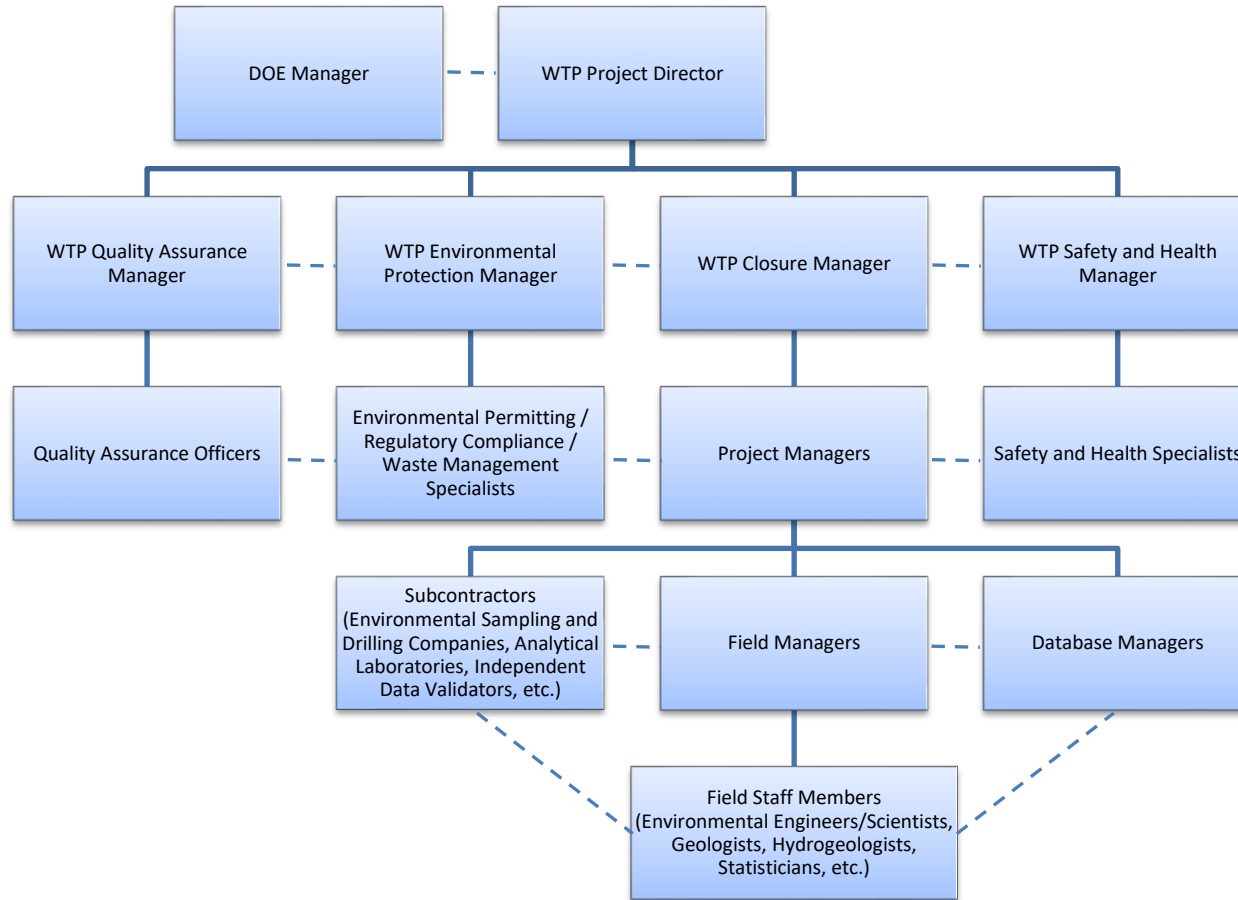
23 **A.4.3 Step 3: Identify Information Inputs**

24 The inputs to the decision include dangerous waste generation and disposal practices, hazardous
25 substances associated with the DWMU operating records, physical attributes of the unit, anticipated
26 variability of the COCs, and critical sample locations that can be identified prior to sampling design
27 consideration. The WTP Closure Plan identifies the COCs and clean closure performance standards.

28 **A.4.4 Step 4: Define the Boundaries of the Study**

29 The boundaries include the physical characteristics of the DWMU planned for closure, spatial boundaries
30 (the specific locations, depths, and media to be sampled), temporal boundaries (the operations to be
31 assessed and the sampling and analysis time frame), and project constraints (the items that may impede or
32 prevent the sampling and analysis activities from being implemented successfully).
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Figure Error! No text of specified style in document.–1Generalized WTP Closure Organizational Chart¹

Notes:
Solid line = line of authority
Dashed line = line of communication

¹ As stated in the closure plan, the design life of the WTP is 40 years after the initiation of waste treatment operations. The actual operating life of the plant may change depending on expansion in treatment capacity, improvements in treatment technology, or many other factors. Consequently, implementation of this SAP may not occur for at least 40 years. The organizational chart will be completed and finalized with specific names and titles in the revised closure plan SAP to be submitted 180 days before closure at WTP commences (Permit Condition III.10.C.8, *Hanford Facility Resource Conservation and Recovery Act [RCRA] Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste, Part III, Operating Unit Group 10 [Waste Treatment and Immobilization Plant], WA7890008967*).

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1 **A.4.5 Step 5: Develop a Decision Rule**

2 The general decision-making is the comparison of the sampling dataset for the indicator constituents to
3 the clean closure performance standards, which will be negotiated with Ecology before closure of the
4 DWMU commences. After achieving agreements on the closure performance standards, specific decision
5 rules for the DWMU will be developed. In general, if the sampling dataset for an indicator constituent is
6 less than or equal to the closure performance standard, the closure performance standard is achieved. If
7 the sampling dataset is greater than the closure performance standard, Ecology will be notified and
8 interim measures will be discussed which may include resampling, decontamination activities, interim
9 corrective action measures, and/or performance of an incremental human-health risk assessment.

10 **A.4.6 Step 6: Specify Performance or Acceptance Criteria**

11 Before closure of the DWMU, the project will decide whether statistical hypothesis tests will be applied
12 to the collected sampling dataset to determine if the clean closure performance standards have been
13 achieved. For example, for a DWMU planned for closure, statistical tests of the analytical results
14 reported for concrete wipe samples or soil samples collected from multiple locations may be performed to
15 determine if the closure performance standards have been met. However, a sample taken from the first
16 rinse of a decontaminated tank may only require a direct comparison of the analytical results to the
17 closure performance standards without performing statistical tests.

18 Due to the inherent uncertainty associated with all sample datasets (EPA 2002a), the result of any
19 statistical hypothesis test performed on a dataset carries some uncertainty and risk whether the correct
20 decision will be made. Quantification of the probabilities of making decision errors will be performed
21 based on the DWMU to be closed, media sampled, and closure performance standards. For statistical
22 hypothesis tests applied to the sampling dataset for each indicator constituent of a DWMU, there are two
23 types of decision errors associated with the determination whether the closure performance standards
24 have been met: Type I (false rejection of the null hypothesis) and Type II (false acceptance of the null
25 hypothesis) (Myers 1997).

- 26 • Type I, False Rejection – This error is the belief that the sample result is less than or equal to the
27 closure performance standard, when in reality it is not. The consequence of this type of error is
28 that an unacceptable concentration of a COC is still present at the DWMU (i.e., the unit was
29 concluded to be clean, when in reality it remains contaminated).
- 30 • Type II, False Acceptance – This error is the belief that the sample result exceeds the closure
31 performance standard, when in reality it meets the closure performance standard. The
32 consequence of this type of error is that resources will be spent unnecessarily to decontaminate or
33 perform removals/remediations at the DWMU (i.e., the unit was concluded to be contaminated,
34 when in reality it is clean).

35 The consequences of such errors depend upon the null hypothesis used when assessing the DWMU in
36 question. The primary purpose for sampling (i.e., the working hypothesis) is to determine if the sampling
37 dataset exceed the closure performance standards. Table A-1 shows how these errors relate to unbiased
38 level of confidence and power related to the sample dataset.

39

Table Error! No text of specified style in document.–1Summary of Potential Decision Errors

Reality	Decision/Conclusion		Result of Decision Error
	Site Is Contaminated	Site Is Not Contaminated	
Site Is Contaminated	Correct Decision Probability $\geq 1 - \alpha =$ Level of Confidence	Type I Error False Rejection Probability $< \alpha$	Failure to decontaminate or perform removals/remediations and unacceptable contamination remains at the DWMU
Site Is Clean	Type II Error False Acceptance Probability $< \beta$	Correct Decision Probability $\geq 1 - \beta =$ Power	Unnecessary allocations of resources to decontaminate or perform removals/remediations at the DWMU

1 There are no prescriptive limits on decision errors; the EPA has no set policy that encourages the use of
 2 any particular decision error limit (EPA 2006). However, some EPA programs (e.g., Superfund) may
 3 provide alternative guidance on starting points for setting decision error limits. For example, the EPA
 4 guidance document, *Soil Screening Guidance: User's Guide*, EPA/540/R-96/018 (EPA 1996),
 5 recommends starting values of 5% for the Type I error rate (α) and 20% for the Type II error rate (β). For
 6 WTP, the specific Type I error and Type II error for each DWMU will be defined based on the specific
 7 characteristics of the problem being investigated.

8 **A.4.6.1 Impact of Decision Errors on Sample Size**

9 Statistical methods generally are used to calculate the minimum number of samples needed to estimate
 10 the population parameters based on predefined values for the Type I and Type II decision errors and other
 11 factors. The null hypothesis is set up so that the consequences of a Type I error are more serious than a
 12 Type II error because the consequences of the Type I error are that actions are not taken when they should
 13 (i.e., the DWMU is concluded to be clean, when in reality it remains contaminated). Therefore, more
 14 stringent limits are placed on the Type I error rate (α), while less stringent limits are placed on the Type II
 15 error rate (β). The probabilistic targeting approach establishes the grid size according to the Type I/Type
 16 II error constraints. The number of samples then becomes a function of the size of the unit. In general,
 17 the more stringent the limits (i.e., the lower the limits) placed on the probability of making a Type I error,
 18 the larger the number of samples required to be collected.

19 **A.4.6.2 Derivation of Sampling Size Requirements**

20 The number of samples to be collected per unit is computed in accordance with the DQO process using
 21 either statistical methods or professional judgment. In general, statistical methods will be used to
 22 determine the appropriate number of samples. However, a number of DWMUs are quite small or are
 23 associated with tanks or miscellaneous units. For these DWMUs, statistical methods provide impractical
 24 large estimates for the number of samples, especially when the limits of decision errors are stringent. In
 25 these cases, professional judgment after reviewing operating records will be used to identify sample
 26 locations (e.g., where leaks/spills may have occurred and/or previous decontamination work may have
 27 been performed), thereby determining the number of samples needed.

28 **A.4.7 Step 7: Develop and Optimize the Design for Obtaining Data**

29 The first six steps of the DQO process presented above will be revisited for each DWMU to develop and
 30 optimize an appropriate sample collection and analysis design before its closure commences. Groupings
 31 of units with similar characteristics and operational histories may implement the same design based on the
 32 DQO process. Section A.5 provides a general overview of the design for collecting and analyzing
 33 samples.

1 **A.5 SAMPLING MANAGEMENT**

2 **A.5.1 Sampling Process Design**

3 This section describes the general approach that will be followed for sampling and analysis during closure
4 of the DWMUs. The sampling and analysis processes will assist in confirming that decontamination or
5 removal/remediation activities, when implemented, have been successful and the DWMU has attained the
6 clean closure performance standard. Sampling may be employed where the clean debris surface standard
7 cannot be met or verified visually, such as interior pipe, pump, or tank surfaces, or where evidence is
8 found indicating apparent failure of the DWMU secondary containment systems.

9 Sampling of decontamination solutions (rinsate) may be conducted for DWMUs that do not meet or could
10 not be inspected to verify attainment of the clean debris surface standard following the decontamination
11 process. This sampling process will serve to define the extent of remaining contamination or confirm
12 adequate decontamination. The sampling process will be repeated after each subsequent round of
13 decontamination effort until the decontamination effort is either determined to be successful, or is
14 terminated, and the contaminated component is removed and disposed of as dangerous or mixed waste.

15 Concrete found to be contaminated may be decontaminated or removed as part of the closure activities,
16 and concrete wipe or chip sampling will be performed to confirm that levels of dangerous wastes in the
17 remaining concrete do not exceed the clean closure performance standards. Soil found to be
18 contaminated above background levels and clean closure performance standards will be removed as part
19 of the closure activities, and sampling will be performed to confirm that levels of dangerous wastes in the
20 remaining soil do not exceed the clean closure performance standards.

21 This sampling and analysis protocol will also be prepared to evaluate the extent of soil contamination and
22 the effectiveness of decontamination at specific permitted mixed waste management units in the WTP, if
23 needed because of breach in the secondary containment structures. This section discusses the design and
24 outline of the sampling program. Subjects addressed in this section will be detailed in the revised closure
25 plan and the SAP prior to commencement of closure. Additional information concerning investigation
26 tools (e.g., the gamma camera, closed circuit television, and other analytical or survey equipment) will
27 also be included in the final closure plan. The subjects addressed in this section include analytical
28 parameters, sampling activities, and data quality.

29 **A.5.2 Sampling Locations**

30 Surfaces of the DWMUs will be visually inspected, if feasible, to determine if the clean debris surface
31 standard has been attained. When sampling of a DWMU is needed, sample locations will be selected
32 based on reviews of the operating record; stainless steel liner breach investigations and underlying
33 concrete decontamination work and evaluations; or based on interior inspection data (e.g., from video,
34 closed circuit television, or radiation surveys). For areas that do not meet or could not be inspected to
35 verify attainment of the clean debris surface standard, decontamination activities may be performed.
36 Post-decontamination solution or rinsate samples will be collected from select biased sample locations,
37 focusing on the locations of apparent highest concentrations. For pipes, pumps, tanks, or other permitted
38 equipment, the locations to be sampled will include apparent or likely waste accumulations in crevices,
39 connections, or other rough or restricted flow locations such as inlets or outlets. The rinsate sample will
40 be taken from the first rinse, obtained within a reasonably short time after the completion of
41 decontamination efforts. When the analytical data are below the closure performance standards, the
42 DWMU was successfully decontaminated and can be declared to have achieved clean closure.

43 Surfaces of the secondary containment systems (e.g., stainless steel liners, coated concrete floors) will be
44 visually inspected, if feasible, to determine if the clean debris surface standard has been attained. If
45 evidence is found indicating apparent failure of the secondary containment systems, the extent of concrete
46 or soil contamination will be determined by collecting concrete wipe or chip samples or soil samples from
47 locations of apparent highest concentrations. Biased sample locations will be selected by reviews of the

1 operating record; stainless steel liner breach investigations and underlying concrete decontamination work
2 and evaluations; or based on results of previous inspections of cracks or areas where concrete has lost its
3 integrity. After decontamination or removal, the remaining concrete or soil will be sampled to confirm
4 that levels of dangerous wastes in the remaining concrete or soil are below the closure performance
5 standards.

6 In lieu of biased or focused sampling, area-wide sampling may be conducted in larger areas of suspected
7 contamination. The area-wide sampling will be performed in accordance with *Guidance for Clean
8 Closure of Dangerous Waste Units and Facilities* (Ecology 2005).

9 Proposed sample locations, and the number of samples collected at each location, will be chosen ahead of
10 time and described in the revised closure plan and SAP prior to commencement of closure of the DWMU.
11 Since the sample locations may be moved or number of samples may be revised based on actual field
12 conditions during the time of sample collection, final sample locations, and numbers will be documented
13 in the final report as part of the closure record.

14 **A.5.3 Sampling Methods, Containers and Preservation**

15 The appropriate sampling methods, containers, supplies, and preservation will be used, depending on the
16 type of media to be sampled and analytical method to be used by the laboratory. The list of criteria used
17 for determining appropriate sampling methods will be developed using federal and state guidance (e.g.,
18 WAC 173-303-110) and industry codes, standards, practices (e.g., ASTM International), and submitted to
19 Ecology for approval prior to initiating sampling activities during closure. Sampling and analysis of
20 samples will be performed in a manner consistent with EPA and Ecology guidelines (EPA 1986 and
21 Ecology 1995).

22 Rinsate samples may be collected from the outlet of a pipe, pump, or tank and transferred directly into
23 laboratory-supplied sample containers. Concrete samples may be collected by breaking small chips using
24 a rock hammer and placed into laboratory-supplied sample containers. Alternatively, a small cylindrical
25 section of the concrete can be removed using a concrete corer and sent to the analytical laboratory, where
26 chip samples can be collected. Wipe samples may be collected using a uniform sample template and
27 wipes pre-wetted with preservatives supplied by the analytical laboratory. Soil samples may be collected
28 using soil probes, augers, or core samplers. Since closure activities and implementation of this SAP may
29 not occur for at least 40 years, sample collection methods and equipment will be specified in the revised
30 closure plan and SAP prior to the start of closure activities to incorporate future advances in sampling
31 technology.

32 The analytical laboratory will furnish new sample containers with required preservatives. Sample
33 containers will be selected based on their compatibility with the waste sampled, types of analyses to be
34 performed, resistance to leaking or breakage, ability to seal tightly, and the required volume for an
35 optimum sample, in accordance with protocols described in *Test Methods for Evaluating Solid Waste,
36 Physical/Chemical Methods (EPA SW-846)* (EPA 1986). Sample containers and preservations are listed
37 in Table A-2.

38 Any deviations will be proposed in cases where compliance is impractical or would conflict with other
39 requirements (e.g., *As Low as Reasonably Achievable* requirements). Deviations from this SAP will be
40 proposed in the revised closure plan and SAP to be submitted to Ecology prior to the start of closure
41 activities. Deviations made in the field during sampling and analysis activities will be recorded in a field
42 logbook and discussed in the final report.

43

1
Table Error! No text of specified style in document.--2Sample Containers, Preservation and Holding Times

Analyte	Method ¹	Sample Containers ²	Preservation	Holding Time
Solid Samples³				
Glycols	SW8015	4 oz amber glass jar with PTFE-lined lid	Cool, ≤6°C	14 days
VOCs	SW8260	EnCore™ or equivalent	Cool ≤6°C, freeze at lab within 48 hours	14 days
		1 x 5-25 ^{1,2} grams collected using coring device and extruded into 40 milliliter (mL) VOA vial with PTFE-lined septum cap	Cool ≤6°C, methanol preserved within 48 hours	14 days
TPH-GRO	NWTPH-Gx	EnCore™ or equivalent	Cool, ≤6°C, freeze at lab within 48 hours	14 days
		1 x 5-25 ⁴ grams collected using coring device and extruded into 40 mL VOA vial with PTFE-lined septum cap	Cool, ≤6°C, methanol preserved within 48 hours	14 days
		40 mL VOA vial with PTFE-lined septum cap	Cool, ≤6°C	14 days
TPH-DRO	NWTPH-Dx	8 oz amber glass jar with PTFE-lined lid	Cool, ≤6°C	14 days until extraction; 40 days after extraction
SVOCs	SW8270, SW8270 SIM	8 oz amber glass jar with PTFE-lined lid	Cool, ≤6°C	14 days until extraction; 40 days after extraction
Dioxins/Furans	SW8290	8 oz amber glass jar with PTFE-lined lid	Cool, ≤6°C	30 days until extraction; 45 days after extraction
PCBs	SW8082	8 oz amber glass jar with PTFE-lined lid	Cool, ≤6°C	14 days until extraction; 40 days after extraction
PCB Congeners	EPA1668	8 oz amber glass jar with PTFE-lined lid	Cool, ≤6°C	1 year until extraction; 1 year after extraction ⁵
Explosives	SW8095, SW8330, SW8332	8 oz amber glass jar with PTFE-lined lid	Cool, ≤6°C	14 days until extraction; 40 days after extraction
Metals	SW6010, SW6020	8 oz glass or plastic (high density polyethylene) jar ⁶	Cool, ≤6°C	180 days
	SW7471		Cool, ≤6°C	28 days
Wipe Samples				
VOCs	SW8260	4 oz amber glass jar with PTFE-lined lid containing pre-wetted wipe	Cool, ≤6°C	14 days
Glycols	SW8015	4 oz amber glass jar with PTFE-lined lid containing pre-wetted wipe	Cool, ≤6°C	14 days
SVOCs	SW8270, SW8270 SIM	4 oz amber glass jar with PTFE-lined lid containing pre-wetted wipe	Cool, ≤6°C	14 days until extraction; 40 days after extraction
Dioxins/Furans	SW8290	1 L amber glass bottle with PTFE-lined lid	Cool, ≤6°C	30 days until extraction; 45 days after extraction
PCBs	SW8082	2 x 1 L amber glass bottle with PTFE-lined lid	Cool, ≤6°C	7 days until extraction; 40 days after extraction
PCB Congeners	EPA1668	1 L amber glass bottle with PTFE-lined lid	Cool, ≤6°C	1 year until extraction; 1 year after extraction ⁵
Explosives	SW8095, SW8330, SW8332	4 oz amber glass jar with PTFE-lined lid containing pre-wetted wipe	Cool, ≤6°C	14 days until extraction; 40 days after extraction

Table Error! No text of specified style in document.--2Sample Containers, Preservation and Holding Times

Analyte	Method ¹	Sample Containers ²	Preservation	Holding Time
Metals	SW6010, SW6020	4 oz amber glass jar with PTFE-lined lid containing pre-wetted wipe	Cool, ≤6°C	180 days
	SW7471	4 oz amber glass jar with PTFE-lined lid containing pre-wetted wipe	Cool, ≤6°C	28 days
Aqueous Samples				
VOCs	SW8260	3 x 40 mL VOA vial with PTFE-lined septum cap	HCl to pH<2, Cool, ≤6°C, no headspace	14 days
Glycols	SW8015	1 L amber glass bottle with PTFE-lined lid	Cool, ≤6°C	7 days until extraction; 40 days after extraction
TPH-GRO	NWTPH-Gx	3 x 40 mL VOA vial with PTFE-lined septum cap	HCl to pH<2, Cool, ≤6°C, no headspace	14 days
TPH-DRO	NWTPH-Dx	1 L amber glass bottle with PTFE-lined lid	HCl to pH<2, Cool, ≤6°C	14 days; 7 days for unpreserved water
SVOCs	SW8270, SW8270 SIM	2 x 1 L amber glass bottle with PTFE-lined lid	Cool, ≤6°C	7 days until extraction; 40 days after extraction
Dioxins/Furans	SW8290	1 L amber glass bottle with PTFE-lined lid	Cool, ≤6°C	30 days until extraction; 45 days after extraction
PCBs	SW8082	2 x 1 L amber glass bottle with PTFE-lined lid	Cool, ≤6°C	7 days until extraction; 40 days after extraction
PCB Congeners	EPA1668	1 L amber glass bottle with PTFE-lined lid	Cool, ≤6°C	1 year until extraction; 1 year after extraction ⁵
Explosives	SW8095, SW8330, SW8332	1 L amber glass bottle with PTFE-lined lid	Cool, ≤6°C	7 days until extraction; 40 days after extraction
Metals	SW6010, SW6020	1 L plastic (high density polyethylene) bottle	HNO ₃ to pH<2, Cool, ≤6°C	180 days
	SW7470		HNO ₃ to pH<2, Cool, ≤6°C	28 days
Acronyms:				
°C	degree Celsius	SIM	selective ion monitoring	
HCl	hydrochloric acid	SVOC	semi-volatile organic compound	
L	liter	TPH-DRO	total petroleum hydrocarbons-diesel range organics	
mL	milliliter	TPH-GRO	total petroleum hydrocarbons-gasoline range organics	
oz	ounce	VOA	volatile organic analyte	
PCB	polychlorinated biphenyl	VOC	volatile organic compound	
PTFE	polytetrafluoroethylene			
Notes:				
¹ Alternate analytical methods may be acceptable. The laboratory must submit any changes to the analytical methods listed, along with proposed QC acceptance criteria, prior to substitution.				
² Alternate numbers and sizes of containers may be used to provide adequate sample volume required by the laboratory.				
³ Solid samples may include soil, concrete chip or other solid material.				
⁴ If 25 grams of sample are collected, additional methanol will be required.				
⁵ Extended holding times only apply when samples and extracts are stored in the dark at less than -10°C at the laboratory.				
⁶ High density polyethylene containers are preferred where boron is a COC.				

1 A.5.4 Sample Handling and Custody

2 All samples will be uniquely identified, labeled, and documented in the field at the time of collection. A
3 sample label will be completed and securely affixed to each container. Sample labels convey information
4 unique to each sample and thus serve to prevent misidentification of samples. Labels may be adhesive or
5 tags, made of weatherproof paper or plastic with gummed backs. Labels will be completed with indelible
6 ink before or at the time of collection and protected from water with clear tape. Information will be
7 completed as close as possible to the time of collection. Each label will contain at least the following
8 information:

- 9 • Project identification and sample location

- 1 • Unique sample identification number
- 2 • Sample collection date and time, using a 24-hour clock notation
- 3 • Site contractor
- 4 • Name or initials of field sampler (not preprinted)
- 5 • Analysis to be performed and required sample preservation (if applicable)

6 In accordance with the chain-of-custody protocols, signed and dated custody seals will be affixed on the
7 sample containers and on the sample shipment coolers to prevent or detect tampering with the samples
8 between the time of collection and the beginning of analysis. Seals will be applied to the sample
9 containers and coolers before leaving the sample location. The seals will be attached in such a manner
10 that the seal will be broken to open the container or cooler.

11 Samples collected in the field will be transported to the laboratory as expeditiously as possible. When
12 cooling to a temperature of less than or equal to 6 degrees Celsius (°C) immediately after sample
13 collection is required, the samples will be packed in ice to keep them cool during collection and
14 transportation. A temperature blank will be included in every cooler and used to determine the internal
15 temperature of the cooler upon receipt of the cooler at the laboratory. If the temperature of the samples
16 upon receipt exceeds the temperature requirements, the exceedance will be recorded on laboratory
17 records. The decision regarding the potentially affected samples will also be documented in laboratory
18 records.

19 Chain-of-custody forms will be used to document the integrity of all samples and to physically trace
20 sample possession from the time of collection to ultimate disposition. To maintain a record of sample
21 collection, transfer of samples between personnel, shipment of samples and receipt of samples at the
22 laboratory, chain-of-custody forms will be completed. At a minimum, information recorded on the form
23 will include:

- 24 • Project identification and sample location
- 25 • Unique sample identification number for each container
- 26 • Sample collection date and time, using a 24-hour clock notation
- 27 • Site contractor
- 28 • Name or initials of field sampler
- 29 • Type of sample (e.g., solid, wipe, aqueous)
- 30 • Designation of matrix spike / matrix spike duplicate (if predetermined)
- 31 • Analysis to be performed and required sample preservation (if applicable)
- 32 • Serial numbers of custody seals and shipment coolers (if any)
- 33 • Custody transfer signatures as well as dates and times of sample transfers from the field to
34 transporters and to the laboratory
- 35 • Bill of lading or transporter tracking number (if applicable)

36 The chain-of-custody forms will be signed as relinquished or received each time the sample changes
37 possession. A sample is in the custody of a field sampler, shipping agent, or analytical laboratory
38 employee/sample custodian if:

- 39 • In a person's physical possession.
- 40 • In view, after having been in a person's physical possession.
- 41 • Secured and locked so that it cannot be tampered with, after having been in a person's physical
42 custody.
- 43 • Placed in a designated secure area restricted to authorized personnel.

1 Samples will be shipped to the laboratory via overnight air courier. Bills of lading will be used as
2 custody documentation during this time and will be retained as part of the permanent sample custody
3 documentation. In some cases, samples may be hand delivered to the laboratory; hand delivery will be
4 noted on the chain-of-custody form. The laboratory is responsible for sample custody once samples are
5 received.

6 In the event that multiple analytical laboratories are used, a separate chain-of-custody form will be
7 completed for each laboratory. Each form will indicate the number of sample containers and coolers
8 transmitted to that particular laboratory. A copy of the form shall be placed in the cooler and accompany
9 the sample containers to the laboratory.

10 Once the samples are accepted by the laboratory, they will be checked against information on the chain-
11 of-custody form for anomalies. The condition, temperature, and appropriate preservation of samples will
12 be checked and documented. Checking an aliquot of the sample using pH paper or meter is an acceptable
13 procedure except for volatile organic compounds where an additional sample is required to check
14 preservation. The occurrence of any anomalies in the received samples and their resolutions will be
15 documented in laboratory records. All sample information will then be entered into a laboratory
16 information management tracking system and unique analytical sample identifiers will be assigned by the
17 laboratory.

18 Samples will be stored in limited- or controlled-access, temperature-controlled areas while in the
19 laboratory. Refrigerators, coolers, and freezers will be monitored for temperature seven days a week.
20 Acceptance criterion for the temperatures of the refrigerators and coolers for all samples will be 6°C.
21 Acceptance criterion for the temperatures of the freezers will be less than or equal to 7°C. All of the cold
22 storage areas will be monitored by thermometers calibrated with a National Institute of Standards and
23 Technology traceable thermometer. Records of refrigerator, cooler and freezer temperatures will be
24 maintained. These records will include acceptance criteria. Samples for volatile organic analysis will be
25 stored separately from other samples, standards, and sample extracts.

26 Sample holding time tracking begins with the collection of samples and continues until the analysis is
27 completed. Samples will not be held in excess of specified analytical holding times listed in Table A-2.
28 Procedures ensuring internal laboratory sample control and custody will be implemented and documented
29 by the laboratory. Specific instructions concerning the analysis specified for each sample on the chain-of-
30 custody form will be communicated to the analysts. Preparation batches will be created and laboratory
31 QC samples will be introduced into each batch. Samples will be stored after analysis until disposed of in
32 accordance with applicable local, state, and federal regulations. Disposal records will be maintained by
33 the laboratory.

34 **A.5.5 Field Quality Control**

35 Sample QC procedures will be followed, including proper implementation of the sample collection,
36 labeling, handling, and chain-of-custody form completion described in the preceding sections. Field QC
37 sampling described in this section will also be followed.

38 Field QC will be accomplished through the collection and analysis of trip blanks, field duplicates,
39 equipment rinsate blanks, and field blanks. Definitions of each type of field QC samples are listed below.

40 ***Trip blanks.*** These samples are used to verify that no contamination has occurred during sampling and
41 shipping of VOC samples due to environmental conditions. They consist of a series of cleaned sample
42 containers filled with analyte-free water and precertified by analysis at the laboratory as clean. The trip
43 blanks are prepared by the laboratory in sample containers identical to those used in the actual sampling
44 activities. Trip blanks will be included for each sample cooler containing samples for VOC analysis. The
45 trip blanks will be analyzed for VOCs only.

1 **Field duplicates.** These samples are used to evaluate sampling quality and to check the precision and
2 accuracy of the sampling technique for collecting samples. A field duplicate sample is one of two
3 samples collected at a single sample location in the field during a single act of sampling. Field duplicate
4 samples are collected in a manner identical to that of routine samples, transferred to separate sample
5 containers, and analyzed for the same parameters. One field duplicate will be collected for every 10
6 aqueous samples or each sampling event when less than 10 samples were collected. Due to soil
7 heterogeneity, soil duplicates will not be collected. The variability between soil samples nullifies the
8 ability of duplicate samples to confirm analytical results.

9 **Equipment rinsate blanks.** These samples are used to verify that samples collected in the field were not
10 contaminated by the equipment. They will be prepared by passing deionized or distilled water through
11 decontaminated, non-dedicated sampling equipment. The water is collected, transferred to a sample
12 container, and handled in the same manner as other samples. Equipment rinsate blanks will be collected
13 daily and analyzed for the same analytes as the samples collected that day.

14 **Field blanks.** These samples are used to verify that the water used for decontamination of the equipment
15 was not contaminated. They will be prepared by collecting the deionized or distilled water used for
16 decontamination of sampling equipment into a sample container and handled in the same manner as other
17 samples. Field blanks will be collected daily and analyzed for the same analytes as the samples collected
18 that day.

19 **A.5.6 Field Instrument Calibration and Frequency**

20 Any field instrumentation or monitoring equipment used to support sampling will be calibrated at
21 prescribed intervals and/or as part of daily use in accordance with the manufacturer's specifications to
22 ensure sampling activities obtain the most accurate and precise information possible. Equipment will be
23 calibrated, whenever possible, using reference standards having known relationships to nationally
24 recognized standards or accepted values of physical constants. If national standards do not exist, the basis
25 for calibration will be documented. Calibrations of equipment will be recorded in a field logbook and
26 records will be included in the final report.

27 **A.5.7 Field Instrument/Equipment Testing, Inspection and Preventative Maintenance 28 Procedures and Frequency**

29 All new sample equipment, consumable materials, parts, and supplies of current manufacture that are free
30 from defects affecting performance will be used as required to perform necessary sampling. These items
31 will be inspected for quality by the appropriate sampling personnel before use and stored in a clean,
32 uncontaminated condition throughout the course of the sampling activities. When feasible, disposable
33 and/or dedicated sampling equipment, materials, parts, and supplies will be used to collect samples to
34 avoid the need to decontaminate them after use. Non-disposable and non-dedicated items will be
35 decontaminated and inspected between uses and sample locations in accordance with the manufacturer's
36 specifications and approved project procedures. Inspection and preventive maintenance of field
37 equipment will be conducted in accordance with the manufacturer's specifications. Maintenance of
38 equipment will be recorded in a field logbook and records will be included in the final report.

39 **A.5.8 Inspection/Acceptance of Field Supplies and Consumables**

40 Consumable materials, parts, and supplies will be inspected by the appropriate sampling personnel before
41 use to ensure it is clean, free from defects, and made of materials appropriate for the media being sampled
42 and analytes being analyzed. Inspection and acceptance of these items will be documented or, when
43 certifications are provided by the manufacturer, maintained in project files to ensure availability of these
44 records for review when needed.

1 **A.6 LABORATORY ANALYSIS MANAGEMENT**

2 **A.6.1 Analytical Laboratory**

3 The laboratory chosen for conducting the analyses will have the appropriate level of qualified personnel,
4 appropriate instrumentation, approved QA plans and standard operating procedures (SOPs), approved
5 analytical methods, and appropriate internal procedures and requirements to perform the required
6 analyses. Laboratory accreditations (e.g., National Environmental Laboratory Accreditation Program)
7 will be used for selection of the commercial laboratory that may be retained for sample analyses. When
8 requested, the QA plans and SOPs will be made available for review by WTP project personnel.

9 **A.6.2 Analytical Parameters**

10 Analytical parameters will be based on knowledge of the operations and wastes processed (process
11 knowledge) in the DWMUs. A list of indicator constituents will be developed based on potential COCs
12 and the clean closure performance standard (rinsate designation limit standard or soil cleanup standard)
13 selected for the DWMU. These indicator constituents and their associated analytical methods will be
14 provided in the revised closure plan and SAP prior to the start of closure activities.

15 **A.6.3 Analytical Methods**

16 A listing of analytical and preparation methods that may be used by a future contract laboratory for
17 organic and inorganic analyses can be found in Tables A-2 and A-3. To ensure that data of acceptable
18 quality are obtained, standard EPA laboratory methods described in *Test Methods for Evaluating Solid
19 Waste, Physical/Chemical Methods, (EPA SW-846)* (EPA 1986) or technically appropriate methods for
20 radioanalytical determinations will be used to obtain laboratory data. Sample analysis and laboratory
21 results will be requested only for the indicator constituents specified in the approved closure plan and
22 SAP. Method detection limits, estimated quantitation limits and reporting limits will be established based
23 on the media to be analyzed, selected indicator constituents and analytical methods in conformance with
24 *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (EPA SW-846)* (EPA 1986) or
25 other guidance. Since closure activities and implementation of this SAP may not occur for at least 40
26 years, analytical methods will be specified in the revised closure plan and SAP prior to the start of closure
27 activities to incorporate future advances in analytical testing technology.

28 **A.6.4 Laboratory Quality Control**

29 Laboratory QC is addressed through the analysis of laboratory QC samples, documented internal and
30 external laboratory QC practices, and laboratory audits. Three types of laboratory QC samples will be
31 used: laboratory blank samples, matrix spike/matrix spike duplicate (MS/MSD) samples, and laboratory
32 control samples. Definitions of each type of laboratory QC samples are listed below.

33 **Laboratory blank samples.** These samples are designed to detect contamination of routine samples that
34 occurs in the laboratory. Laboratory blanks verify that method interference caused by contaminants in
35 solvents, reagents, glassware, and other sample processing hardware are known and minimized.
36 Laboratory blanks are deionized water for water samples or a purified solid matrix for soil samples. A
37 minimum of one laboratory blank will be analyzed each day that routine samples are analyzed. The
38 concentration of the target compounds in the laboratory blank sample must be less than or equal to the
39 reporting limit. If the blank is not under the specified limit, the source contamination is to be identified
40 and corrective actions taken.

41

Table Error! No text of specified style in document.–3Analytical and Preparation Methods

Analytical Method ¹	Parameter	Preparation Methods	
		Water/Aqueous	Solid ² /Wipe
GC			
SW8015	Glycols	—	See analytical method
SW8081	Chlorinated Pesticides	SW3510, SW3520, SW3535	SW3540, SW3541, SW3545, SW3550
SW8082	PCBs	SW3510, SW3520, SW3535	SW3540, SW3541, SW3545, SW3550
NWTPH-Gx	TPH-GRO	NWTPH-Gx	NWTPH-Gx
NWTPH-Dx	TPH-DRO	NWTPH-Dx	NWTPH-Dx
GC/MS			
SW8260	VOCs	SW5030	SW5035, SW5035A
SW8270	SVOCs	SW3510, SW3520, SW3535	SW3540, SW3541, SW3545, SW3550
SW8270 SIM	SVOCs/PAHs	SW3510, SW3520, SW3535	SW3540, SW3541, SW3545, SW3550
NWTPH-Gx	TPH-GRO	NWTPH-Gx	NWTPH-Gx
GC/ECD			
SW8095	Explosives	SW3535	See analytical method
HRGC/HRMS			
SW8290	Dioxins/Furans	See analytical method	See analytical method
EPA1668	PCB Congeners	See analytical method	See analytical method
HPLC			
SW8330	Explosives	See analytical method	See analytical method
SW8332	Explosives	See analytical method	See analytical method
ICP-AES/ICP-MS/GFAA/CVAA			
SW6010	Trace metals by ICP-AES	SW3005, SW3010, SW3015, SW3020	SW3050, SW3051
SW6020	Trace metals by ICP-MS	SW3005, SW3010, SW3015, SW3020	SW3050, SW3051
SW7470	Mercury (water)	See analytical method	—
SW7471	Mercury (solid)	—	See analytical method
Acronyms: — not applicable CVAA cold vapor atomic absorption GC gas chromatography GC/MS GC/mass spectrometry GC-ECD GC-electron capture detector GFAA graphite furnace atomic absorption spectrometry HPLC high-performance liquid chromatography HRGC/HRMS high-resolution GC/ high resolution MS ICP-AES inductively coupled plasma-atomic emission spectrometry		ICP-MS inductively coupled plasma-mass spectrometry PAH polycyclic aromatic hydrocarbon PCB polychlorinated biphenyl SIM selective ion monitoring SVOC semi-volatile organic compound TPH-DRO total petroleum hydrocarbons-diesel range organics TPH-GRO total petroleum hydrocarbons-gasoline range organics VOC volatile organic compound	
Notes: ¹ Alternate analytical methods may be acceptable. The laboratory must submit any changes to the analytical methods listed, along with proposed QC acceptance criteria, prior to substitution. ² Solid samples may include soil, concrete chip or other solid material.			

1 **MS/MSD samples.** These samples are designed to check the precision and accuracy of the analytical
2 methods through the analysis of a normal sample with a known amount of analyte added. Soil samples to
3 be used for MS/MSD samples will be collected and identified in the field; water MS/MSD samples will
4 be collected in the same manner as field duplicate samples. In the lab, two portions of the sample are
5 spiked with a standard solution. MS/MSD samples are to be analyzed for the same parameters as the
6 routine samples, and analytical results compared to evaluate the precision and accuracy of the analytical
7 method and effects of the sample matrix. The MS/MSD samples will be collected at one for every 20
8 routine samples for each sample matrix.

9 **Laboratory control samples.** These samples include blank spikes and blank spike duplicates. Blank
10 spike samples are designed to check the accuracy of the analytical method by measuring a known
11 concentration of an analyte in the blank spike samples. Blank spike duplicate samples are designed to
12 check the accuracy and precision of the analytical method by measuring a known concentration of an
13 analyte in the blank spike duplicate sample. Blank spike and blank spike duplicate samples are prepared
14 by the laboratory using clean laboratory matrices spiked with the same spiking compounds used for
15 matrix spikes at levels no greater than 10 times the method detection limit.

16 **A.6.5 Laboratory Instrument Calibration and Frequency**

17 Laboratory equipment and instrumentation will be operated and calibrated according to both the
18 manufacturer's specifications and the analytical method specifications as appropriate to ensure laboratory
19 analysis activities obtain the most accurate and precise information possible. The laboratory QA plan will
20 include requirements for calibrations when specifications are not listed in analytical methods.
21 Calibrations that are typically not called out in analytical methods include ancillary laboratory equipment
22 (e.g., analytical balances, pipettes, and pH meters) and verification of reference standards used for
23 calibration and standard preparation.

24 Analytical methods prescribed must have specifications for equipment checks and instrument calibrations.
25 The laboratory will comply with method-specific calibration requirements for requested parameters. If an
26 instrument calibration or equipment fails, the instrument will be recalibrated and all affected samples will
27 be analyzed using an acceptable calibration.

28 Laboratory equipment and instrumentation will be calibrated at prescribed intervals and/or as part of daily
29 use. Frequency will be based upon the type of equipment, inherent stability, and manufacturer's
30 recommendations. Calibration will be conducted, whenever possible, using reference standards having
31 known relationships to nationally recognized standards or accepted values of physical constants. If
32 national standards do not exist, the basis for calibration will be documented. Laboratory documentation
33 will include calibration techniques and sequential calibration actions, performance tolerances provided by
34 the specific analytical method, and calibration dates and frequency.

35 In addition, records for laboratory-prepared standards will be maintained and provided at an agreed upon
36 time or as requested with each data deliverable. Instrument responses for gas chromatography (GC) /
37 mass spectrometry (MS), GC retention time window definitions, and documentation of calibration check
38 precision for GC and GC/MS systems will be reported in each deliverable. Standard reference materials
39 used to perform calibration checks associated with both inorganic target analytes and radiochemical
40 parameters will be prepared using an independent source for the standard materials from that used to
41 prepare the calibration standards. The results of these calibration checks will be reported with each data
42 deliverable.

43 **A.6.6 Laboratory Instrument/Equipment Testing, Inspection and Preventative** 44 **Maintenance Procedures and Frequency**

45 Laboratory equipment and instrumentation will be tested, inspected, and maintained to a level such that
46 each piece of equipment and instrumentation can meet method-specific QA/QC tolerances and are in
47 proper working order. Testing, inspection, and maintenance will be performed under the supervision of

1 qualified personnel in accordance with the manufacturer's specifications, laboratory QA plan, and
2 procedures and requirements.

3 *EPA Requirements for Quality Assurance Project Plans*, EPA/240/B-01/003, EPA QA/R-5 (EPA 2001)
4 requires that all activities not governed by specific analytical procedures be completed under approved
5 procedures and requirements. If procedures and requirements governing the inspection and maintenance
6 of equipment and instrumentation do not presently exist, they will be developed to ensure that activities
7 are conducted using equipment and instrumentation that are performing within the manufacturer's or
8 design specifications.

9 **A.6.7 Inspection/Acceptance of Laboratory Supplies and Consumables**

10 Laboratory consumable materials, parts, and supplies will be inspected for quality by the appropriate
11 personnel before use to ensure it is clean, free from defects, and made of materials appropriate for the
12 media and analytes being analyzed. Inspection and acceptance of these items will be documented or,
13 when certifications are provided by the manufacturer, maintained in laboratory files to ensure availability
14 of these records for review when needed.

15 **A.6.8 Laboratory Data Reporting Requirements**

16 An important part of the laboratory documentation is the case narrative. The case narrative contains
17 essential information that allows an informed evaluation of data usability. The case narrative will
18 include, but not be limited to, the following:

- 19 • A table summarizing samples received, correlating field sample identification numbers,
20 laboratory sample identification numbers, and laboratory analyses completed.
- 21 • Discussion of sample appearance and integrity issues that may affect data usability (e.g.,
22 temperature, preservation, pH, sample containers, air bubbles, and multi-phases).
- 23 • Samples received but not analyzed and the reason for it.
- 24 • Discussion of holding time excursions for sample preparation and analyses.
- 25 • Discussion on all out-of-control analyses or discrepancies of calibrations, continuing calibrations
26 or QC sample results (e.g., surrogates, laboratory blank samples, laboratory control samples,
27 MS/MSD samples, and post-digestion spikes) and corrective actions taken.
- 28 • Discussion of all qualified data and definition of qualifying flags.
- 29 • Discussion of and recommendations for potential data usability of qualified data.

30 Reporting of analytical results will follow the guidelines listed below:

- 31 • Reported data will identify the concentration units (e.g., milligrams per kilogram, milligrams per
32 liter) and appropriate laboratory qualifiers.
- 33 • Data reported as non-detected will be referenced against a stated method detection limit or
34 instrument detection limit value.
- 35 • Method detection limits and sample results will be reported to one decimal place more than the
36 corresponding level of quantitation (LOQ), unless the appropriate number of significant figures
37 for the measurement dictates otherwise.
- 38 • Soil samples will have results reported on a dry-weight basis.
- 39 • If possible, samples will be analyzed undiluted and non-detects reported to the specified LOQs;
40 LOQs for minority constituents in highly contaminated samples may have to be adjusted for
41 dilutions.

1 **A.6.9 Laboratory Data Review Requirements**

2 All analytical data generated will be verified for completeness and technical accuracy by the laboratory
3 performing the work prior to submittal to WTP. This internal data review process, which is multi-tiered,
4 will include all aspects of data generation, reduction, and QC assessment. In each laboratory analytical
5 section, the analyst performing the tests will review 100% of the definitive data. After the review by the
6 analyst has been completed, 100% of the data will be reviewed independently by a senior analyst or by
7 the supervisor of the respective analytical section using the same criteria.

8 The elements of the laboratory data review at each level will include, but are not limited to:

- 9 • Sample receipt procedures and conditions
- 10 • Sample preparation
- 11 • Accuracy and completeness of analytical results
- 12 • Correct interpretation of all raw data, including all manual integrations
- 13 • Appropriate application of QC samples and compliance with established CLs
- 14 • Verification of data transfers
- 15 • Documentation completeness (e.g., all anomalies in the preparation and analysis have been
16 identified; appropriate corrective actions have been taken and have been documented in the case
17 narratives; associated data have been appropriately qualified; and anomaly forms have been
18 completed)
- 19 • Accuracy and completeness of data deliverables (hardcopy and electronic)

20 **A.6.10 Laboratory Data Deliverable Requirements**

21 The laboratory data package will be prepared after completion of analyses and submitted to WTP. It will
22 contain adequate information for data review and validation. A complete data deliverable will consist of
23 a complete analytical report, chain-of-custody documentation, and electronic deliverable. The following
24 information may be part of the laboratory data package:

- 25 • Cover letter that identifies the project
- 26 • Table of contents
- 27 • Case narrative that summarizes samples and analyses and discusses any issues that may affect
28 data usability
- 29 • Analytical results to include the field sample identification numbers, laboratory sample
30 identification numbers, date sampled, date extracted, date analyzed, dilution factors, extraction
31 and analytical methods, units and sample quantitation limits
- 32 • Laboratory method detection limits, estimated detection limits, and LOQs
- 33 • Laboratory qualifiers
- 34 • Sample management records including original signed chain-of-custody and cooler receipt forms
- 35 • Internal laboratory QA/QC information

36 **A.7 DATA VALIDATION AND REPORTING**

37 The data collection in the field and by the laboratory is the first of several steps in evaluating conditions at
38 a DWMU. After the data are collected, a series of evaluations and data reduction steps must be conducted
39 to ensure that the data are acceptable and that the information is in a form practical for the data users.

40 **A.7.1 Data Review and Reduction**

41 Data review is the in-house examination to ensure that the collected data have been recorded, transmitted,
42 and processed correctly. Data review includes checking for data entry, transcription, calculation,

1 reduction, and transformation errors. It is also a completeness check to determine whether there are any
2 deficiencies such as data missing or integrity lost (e.g., due to corruption or loss in storage or processing).
3 Data reduction is the process of converting raw data or instrument data into a usable form for evaluation
4 by data users. Review and reduction of environmental data will take place at the laboratory and project
5 offices. The data review and reduction activities convert the data into a form more usable for interpretive
6 purposes of environmental risk and verification of clean closure.

7 Field data reduction involves tabulating data obtained in the field and calculating summary statistics (e.g.,
8 average, maximum, minimum) on the data. Laboratory data reduction involves converting the outputs of
9 the analytical instruments into sample and QC results. Laboratory data reduction will be performed as
10 defined in the analytical method. Laboratory deliverables will include raw data and reduced data. This
11 form of laboratory reporting will: (a) ensure complete documentation of all aspects of laboratory analysis,
12 (b) permit independent verification of reported results, (c) provide a form of data that is technically and
13 legally defensible, and (d) ensure that data users can be completely confident in the results they deem
14 usable.

15 Scientists, engineers, and regulators within EPA, Office of River Protection (ORP), and Ecology may
16 review the data to ensure compliance with applicable WACs and DOE closure requirements. Individual
17 regulators will submit their requests to the WTP Closure Manager for any datasets required to evaluate
18 the post-decontamination sampling effort and declaration of clean closure. The WTP Closure Manager
19 will provide requested information to regulators in an agreed upon form.

20 **A.7.2 Data Verification and Validation**

21 The *EPA Guidance on Environmental Data Verification and Data Validation*, EPA/240/R-02/004, EPA
22 QA/G 8 (EPA 2002b) will be used as a guide to perform data verification and validation. Data
23 verification is the process of evaluating the completeness, correctness, and conformance/compliance of a
24 specific dataset against the method, procedural, or contractual requirements. Data verification is
25 performed on analytical results to ensure that they are complete and in order. It involves ensuring that
26 deficiencies are identified, documented, and corrected. Data verification is generally done by the
27 laboratory generating the data or by others independent of the laboratory.

28 Data validation is the comparison of analytical results versus the requirements established by the
29 analytical method. Validation involves evaluation of all sample-specific information generated from
30 sample collection in the field to sample analysis in the laboratory. It involves ensuring that the holding
31 times, precision, accuracy, laboratory blanks, and detection limits are within the acceptance criteria. Data
32 validation is used to determine whether the analytical data are technically and legally defensible and
33 reliable. The applicable analytical method QC guidelines will be used to validate the data with the
34 exception of radioanalytical data. Data validation is one step of the data quality assessment (DQA)
35 process that will be used to determine whether the data meet the DQOs.

36 Data validation is generally performed by others independent of the laboratory performing sample
37 analysis. The analytical data generated by the laboratory will be sent to an independent, third-party
38 company for data validation. The data validation strategy may be 90% Level III and 10% Level IV. The
39 Level III data validation assumes that reported data values are correct as reported by the laboratory. Data
40 quality is assessed by verifying that the requirements have been achieved for each compound class. The
41 Level IV data validation is based on the assessment of laboratory raw data packages, which include all
42 data required for a full review of compound selection, integration, interference assessment, and
43 requantification (e.g., spectra and chromatograms). Supporting records are also included in this package
44 (e.g., calibration standards, instrument sequence files, and dilution factors). If necessary, Level IV data
45 validation includes requantification of reported QC and field sample values using the raw data files. In
46 addition, instrument performance, calibration methods, and calibration standards are reviewed to ensure
47 that the detection limits and data values are accurate and appropriate.

1 The final product of the validation process is the validation report. The validation report communicates
2 the quality and usability of the data to the data users and decision-makers. The validation report will
3 contain an itemized discussion of the validation process and results. The validation report, along with the
4 other data obtained during the sampling and analysis activities, will be reviewed to make a determination
5 whether the overall dataset met the DQOs and the closure performance standards have been attained.

6 **A.7.3 Data Quality Assessment**

7 The sampling and analytical data will be evaluated to determine whether they are of the appropriate type,
8 quality, and quantity to support their intended use. A data quality assessment will be performed on data
9 obtained in the field and by the laboratory in accordance with *EPA Guidance for Data Quality*
10 *Assessment: Practical Methods for Data Analysis*, EPA/600/R-96/084, EPA QA/G-9 (EPA 2000).

11 **A.7.4 Non-Direct Measurements**

12 In addition to the data obtained during sampling and analysis activities, decision-makers will use data
13 obtained from other existing sources such as operating records from project files and databases,
14 photographs taken during operations, information on background soil levels from published scientific
15 literature and environmental investigation reports from other facilities, and cleanup standards from local,
16 state, and federal regulations. These data will be used to assist in designing the sampling and analysis
17 program. For example, operating records will be used to identify potential sample locations and COCs
18 while soil background levels and regulatory cleanup standards will be used to establish clean closure
19 performance standards for the DWMU. In addition, operating records will be reviewed to determine
20 whether the DWMU may be administratively closed with no sampling, decontamination, or remediation.

21 **A.8 DOCUMENTATION AND DATA MANAGEMENT**

22 To ensure all sampling, analysis, and data reporting activities are conducted in accordance with this SAP,
23 WTP QA Manual and all appropriate project procedures, adequate documentation of each event must be
24 completed. Therefore, all field activities related to sample collection and sample custody must be
25 recorded. A designated professional engineer will observe sampling activities and will be given the
26 documentation generated during closure activities that is required to certify closures.

27 The laboratory will perform all functions required for analyses of the samples and reporting of analytical
28 results in accordance with an approved laboratory QA plan. Laboratory activities relating to sample
29 custody, sample preparation, sample analysis, and data reporting must be recorded to ensure that
30 laboratory data can be confidently used by the data users. As designated by the WTP Closure Manager,
31 key project staff may contact the laboratory personnel and obtain a copy of the laboratory QA plan for
32 review and/or visit the facility to ensure laboratory procedures meet the project-specific goals.

33 Records generated to support activities described in this SAP will be legible, identifiable, and retrievable,
34 and will be protected against damage, deterioration, or loss. Requirements and responsibilities for record
35 transmission, distribution, retention, maintenance, and disposal will be established and documented.
36 Personnel that generate or use data in an electronic format are responsible for complying with applicable
37 software quality requirements to ensure that data input (and changes to data input) is complete and
38 accurate, and that security and integrity of the data are maintained.

39 **A.8.1 Field Operations Records**

40 The following subsections provide a summary of requirements for adequate field documentation. All field
41 documentation will be the responsibility of the designated sampling personnel.

42 **A.8.1.1 Sample Container Labels**

43 At the point of sample collection, samples will be collected in pre-labeled containers to obtain sufficient
44 volumes for the required analyses. Each sample may require multiple containers and each sample set of

1 containers from a specific sample location and depth will be assigned a unique identification number to
2 prevent misidentification of samples.

3 At a minimum, the sample location, identification number, collection date and time will be recorded on
4 the sample label, in the field logbook and/or on the chain-of-custody form. Samples will be labeled,
5 recorded, and tracked according to the requirements of this SAP.

6 **A.8.1.2 Field Sampling Logbooks**

7 Field logbooks are legal documents; they are the written record for all field data gathered, field
8 observations, field equipment calibrations, samples collected for laboratory analysis, and sample custody.
9 The logbooks are maintained to ensure that field activities are properly documented. Field logbooks will
10 be bound and will contain consecutively numbered pages. All entries in field logbooks will be made
11 using permanent ink pens or markers. All mistakes made as entries will be amended by drawing a single
12 line through the entry. The person making the correction will initial and date it. At a minimum, the
13 following entries will be made to the field logbook:

- 14 • Identification of project
- 15 • Name of site contractor
- 16 • Identification of all sampling team members
- 17 • References to field methods used to obtain samples, field data, etc.
- 18 • Location, depth and description of each sample location
- 19 • Matrix of samples (e.g., rinsate, soil, concrete wipe, concrete chip)
- 20 • Types, numbers, and volumes of sample containers
- 21 • Unique sample identification numbers
- 22 • Dates and times of sample collection, using a 24-hour clock notation
- 23 • Dates and times of sample shipping or transfer of sample custody
- 24 • Observed weather conditions
- 25 • All field equipment, instruments and measurements
- 26 • Any deviations from this SAP
- 27 • The chain-of-custody form numbers

28 **A.8.1.3 Chain-of-Custody Forms**

29 The ability to demonstrate that samples were collected from the designated sample locations and that they
30 reached the laboratory without alteration is important for the accuracy and integrity of the data resulting
31 from laboratory analysis. Evidence of sample collection, transfers between personnel, shipment, and
32 laboratory receipt will be documented using chain-of-custody forms. The chain-of-custody form will, as
33 a minimum, provide the sample location, identification number, type, collection date and time,
34 preservation, and analyses to be performed.

35 **A.8.2 Laboratory Records**

36 Laboratory records are required to document all activities involved in sample receipt, processing,
37 analysis, and data reporting. The following subsections describe the laboratory records that will be
38 generated for WTP closure activities.

39 **A.8.2.1 Sample Data Records**

40 These records contain the times samples were analyzed to verify the holding times were the same as those
41 prescribed by the analytical methods. Sample data records will include information on the total number
42 of samples analyzed in a given day, location of sample analysis (i.e., instrument identification number),

1 any deviations from analytical procedures and requirements and/or methods, and time and date of
2 analysis. Corrective action steps taken to rectify situations that did not conform to laboratory procedures
3 and requirements and/or analytical methods (including steps taken to seek additional sample material, if
4 required) will also be noted in these records.

5 **A.8.2.2 Sample Management Records**

6 Sample management records document sample receipt, handling and storage, and date of analyses. The
7 records verify that the chain-of-custody was maintained and the sample was properly preserved. The
8 record will reflect any anomalies in the samples (such as receipt of damaged samples), note proper log in
9 of samples into the laboratory, and address procedures used to prioritize received samples to ensure
10 holding time requirements will be met.

11 **A.8.2.3 Test Methods**

12 This documentation describes any deviation from the analytical methods or laboratory procedures and
13 requirements. Items to be documented include sample preparation and analysis, instrument
14 standardization, detection and reporting limits, and test-specific QC criteria. Documentation
15 demonstrating laboratory proficiency with each method used will also be included in this category.

16 **A.8.2.4 Quality Assurance/Quality Control Reports**

17 The QA/QC reports will include general QC records, such as initial demonstration of the capability of
18 individual analysts to conduct specific analyses, instrument calibration, routine monitoring of analytical
19 performance (e.g., control charts), and calibration verification. Project-specific information from the
20 QA/QC checks, such as blanks (e.g., field, reagent, and method), spikes (e.g., MS/MSD and surrogate),
21 calibration check samples (e.g., zero check, span check, and mid-range check), replicates, and splits will
22 be included in the QA/QC reports to facilitate data quality analysis. Specific requirements for the
23 quantity and types of QA/QC monitoring and associated reporting formats will be specified in the
24 analytical SOPs to the laboratory.

25 **A.8.3 Document Control**

26 Document control consists of the clear identification of all project-specific documents in an orderly form,
27 secure storage of all project information, and controlled distribution of all project information. Document
28 control ensures controlled documents of all types related to the project will receive appropriate levels of
29 review, comment, and revision as necessary.

30 Hardcopy and/or electronic data of records generated to support activities described in this SAP will be
31 stored in project files. The laboratory will maintain electronic and hardcopy records sufficient to recreate
32 each analytical event. Records will be stored by the laboratory for the duration of the WTP Project or
33 once closure certification has been completed, whichever is longer, or as dictated by project requirements.
34 Data will be made available for retrieval by authorized WTP personnel upon request. In the event of
35 laboratory closure, all applicable documents and electronic media must be immediately transferred to the
36 WTP facility operator at the time of closure and/or ORP.

37 **A.8.4 Project Data Flow and Transfer**

38 The data flow from the laboratory and field to the project staff/data users will be sufficiently documented
39 to ensure that the data are properly tracked, reviewed, validated for use and retrievable.

40 **A.9 ASSESSMENTS AND CORRECTIVE ACTIONS**

41 Periodic assessments to verify that field sampling and laboratory analytical activities meet the
42 requirements of this SAP, WTP QA Manual, and laboratory QA plan will be conducted. If necessary,
43 corrective action procedures will be implemented whenever field sampling or laboratory analysis results
44 do not meet the required QA/QC standards. Implemented corrective actions will be documented
45 according to approved procedures.

1 **A.10 REPORTS TO MANAGEMENT**

2 Conditions identified as having an adverse effect on quality, the significance of such conditions, and
3 corrective actions will be documented, reported to the appropriate level of management, and resolved
4 according to approved procedures.

5 The assessment reports may include the following items, as appropriate:

- 6 • Deviations from the requirements specified in this SAP, WTP QA Manual, or laboratory QA plan
- 7 • Limitations or constraints on the applicability of the resulting field and analytical data
- 8 • Results of assessments
- 9 • Corrective actions taken

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