AR TARGET SHEET

The following document was too large to scan as one unit, therefore, it has been divided into sections.

EDMC#: 0073164
SECTION: 2 OF 3

DOCUMENT #: 07-AMCP-0198

TITLE: Tanks/Lines/Pits/Boxes/Septic Tank and Drain Fields Waste Group OU Remedial Investigation/Feasibility Study (RI/FS) Work Plan and RCRA TSD Unit Sampling Plan; Includes 200-IS-1 and 200-ST-1 OUs DOE/RL-2002-14 Rev1 Draft B

A2.0 QUALITY ASSURANCE PROJECT PLAN

The QAPjP establishes the quality requirements for environmental data collection, including sampling, field measurements, and laboratory analysis. The QAPjP complies with the requirements of the following:

- DOE O 414.1C, *Quality Assurance*, as amended, "Contractor Requirements Document"
- 10 CFR 830 Subpart A, "Quality Assurance Requirements"
- EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5.

A2.1 PROJECT MANAGEMENT

The following section addresses basic areas of project management. It also identifies project elements including the project task and goals, quality objectives, and required documentation.

A2.1.1 Project/Task Organization

The project organization is described in the subsections that follow and is shown in Figure A-3.

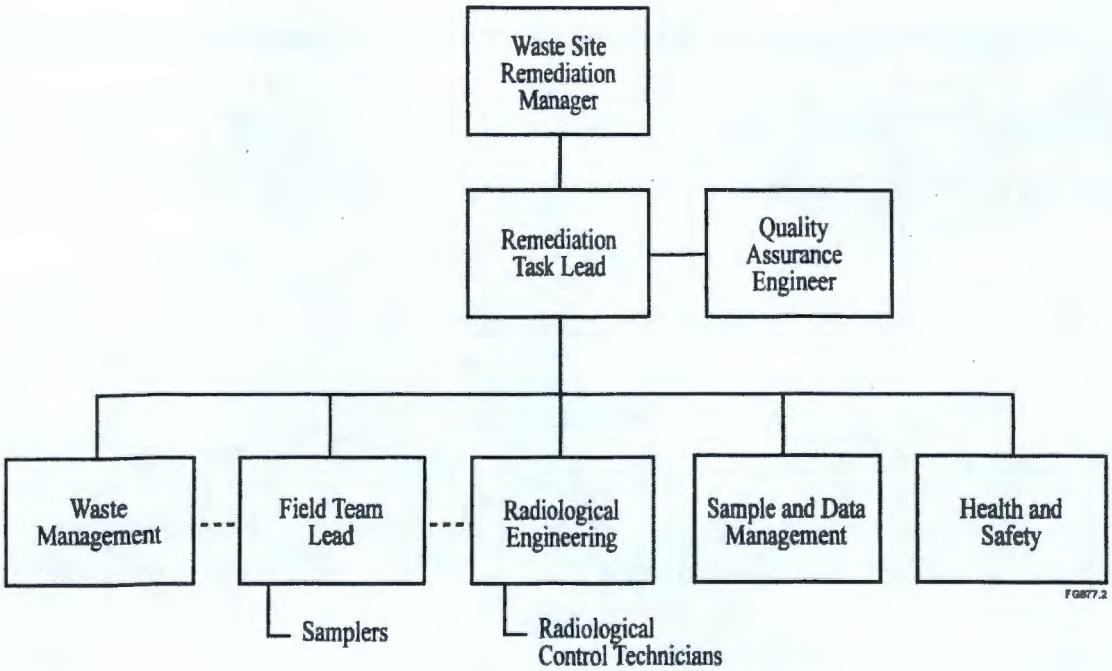
A2.1.1.1 Waste Site Remediation Manager

The Waste Site Remediation Manager provides oversight for all activities and coordinates with the U.S. Department of Energy, Richland Operations Office (RL) and regulators in support of sampling activities. In addition, support is provided to the task lead to ensure that the work is performed safely and cost effectively.

A2.1.1.2 Remediation Task Lead

The Remediation Task Lead is responsible for direct management of sampling documents and requirements, field activities, and subcontracted tasks. The Remediation Task Lead ensures that the Field Team Lead, samplers, and others responsible for implementing this SAP and the QAPjP are provided with current copies of this document and any revisions thereto. The Remediation Task Lead works closely with quality assurance, health and safety, and the Field Team Lead to integrate these and the other lead disciplines in planning and implementing the workscope. The Remediation Task Lead also coordinates with, and reports to, RL, regulators, and the Project Hanford Management Contractor on all sampling activities.

Figure A-3. Project Organization.



A2.1.1.3 Quality Assurance Engineer

The Quality Assurance Engineer is matrixed to the Remediation Task Lead and is responsible for quality assurance issues on the project. Responsibilities include oversight of implementation of the project quality assurance requirements; review of project documents, including SAPs (and the QAPjP); and participation in quality assurance assessments on sample collection and analysis activities, as appropriate.

A2.1.1.4 Waste Management

The Waste Management Lead communicates policies and procedures and ensures project compliance for storage, transportation, disposal, and waste tracking in a safe and cost-effective manner. Other responsibilities include identifying waste management sampling/characterization requirements to ensure regulatory compliance interpretation (e.g., with WAC 173-303, "Dangerous Waste Regulations") of the characterization data to generate waste designations, profiles, and other documents that confirm compliance with Environmental Restoration Disposal Facility waste acceptance criteria specified in BHI-00139, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*.

A2.1.1.5 Field Team Lead

The Field Team Lead has the overall responsibility for planning, coordinating, and executing the field-characterization activities. Specific responsibilities include converting the sampling-design requirements into field task instructions that provide specific direction for field activities.

Responsibilities also include directing training, mock-ups, and practice sessions with field personnel to ensure that the sampling design is understood and can be performed as specified. The Field Team Lead communicates with the Remediation Task Lead to identify field constraints that could affect the sampling design. In addition, the Field Team Lead directs the procurement and installation of materials and equipment needed to support the field work.

The Field Team Lead oversees field-sampling activities that include sample collection, packaging, provision of certified clean sampling bottles/containers, documentation of sampling activities in controlled logbooks, chain-of-custody documentation, and packaging and transportation of samples to the laboratory or shipping center.

The Field Team Leads, samplers, and others responsible for implementation of this SAP and the QAPjP will be provided with current copies of this document and any revisions thereto.

A2.1.1.6 Radiological Engineering

The Radiological Engineering Lead is responsible for the radiological engineering and health physics support on the project. Specific responsibilities include conducting as-low-as-reasonably-achievable (ALARA) reviews, exposure and release modeling, and radiological controls optimization for all work planning. In addition, radiological hazards are identified and appropriate controls are implemented to maintain worker exposures to the hazards ALARA. Radiological Engineering interfaces with the project health and safety representative and plans and directs radiological control technician support for all activities.

A2.1.1.7 Sample and Data Management

The Sample and Data Management organization selects the laboratories that perform the analyses. This organization also ensures that the laboratories conform to Hanford Site internal laboratory quality-assurance requirements, or their equivalent, as approved by RL, the EPA, and the Washington State Department of Ecology (Ecology). Sample and Data Management periodically initiates audits of the laboratories to ensure compliance. Sample and Data Management receives the analytical data from the laboratories, makes the data entry into the *Hanford Environmental Information System* (HEIS) database, and arranges for data validation. Validation will be performed on completed data packages (including quality control [QC] samples) by the Fluor Hanford, Inc. (Fluor Hanford) Environmental Information Services group or by a qualified independent contractor.

A2.1.1.8 Health and Safety

Responsibilities include coordination of industrial safety and health support on the project as carried out through health and safety plans, job-hazard analyses, and other pertinent safety documents required by Federal regulation or by internal Fluor Hanford work requirements. In addition, assistance is provided to project personnel in complying with applicable health and safety standards and requirements. Personal protective clothing requirements are coordinated with Radiological Engineering.

A2.1.2 Background and Problem Definition

The 200-IS-1 OU includes pipelines used to transfer liquid waste containing low to high concentrations of radionuclides and nonradiological constituents. The 200-IS-1 OU DQO summary report (D&D-30262) and the work plan provide additional discussion concerning development of the rationale and use of process-waste characteristics for the assignment of the pipeline bins used in this SAP.

The objective of the DQO process for the pipelines addressed in this SAP was to determine the environmental measurements necessary to support the remedial investigation/feasibility study process and remedial decision making, including refinement of the preliminary conceptual contaminant-distribution models for process-waste pipeline systems. The DQO process supported development of the content presented in this SAP.

Given that the process pipeline systems in the Central Plateau received waste discharges, the task is to determine from process history and/or data collection and analysis whether pipelines and/or surrounding soils contain constituents that are above regulatory and/or risk thresholds.

A2.1.3 Project and Task Description

The field activities described in this Phase 1 SAP include evaluation of both the pipeline interiors and the surrounding soil. For the interior evaluations, the pipelines will be accessed to permit visual inspection, field instrument measurements, and the collection of residual sediment, sludge, or scale. For the soil surrounding the pipelines, geophysical logging, field instrument measurements, soil sampling, and visual inspection will be used to assess whether contamination is present. Sampling requirements for waste-disposal determinations of IDW will be addressed through a waste-designation DQO process before the field characterization activities begin.

At the completion of the field investigation, a field report will be prepared to summarize the activities performed and information collected in the field. The report will include survey coordinates for direct-push locations, the number and types of samples collected and their associated HEIS numbers, inventory of IDW containers, laboratory and field-screening analyses performed, and geophysical-logging results.

A2.1.4 Quality Objectives and Criteria for Measurement Data

EPA 600/R-96/055, *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, was used to support the development of this SAP. The DQO process is a strategic-planning approach that provides a systematic process for defining the criteria that a data-collection design should satisfy. Using the DQO process ensures that the type, quantity, and quality of environmental data used in decision making will be appropriate for the intended application. This section summarizes the key outputs resulting from the implementation of the DQO process.

A2.1.4.1 Contaminants of Concern

The DQO process identifies the need to develop a list of contaminants of potential concern (COPC) for the 200-IS-1 OU process-waste pipeline systems. Development of the COPCs is an essential step toward refining the preliminary conceptual contaminant-distribution models.

Liquid process-waste streams carried through the pipeline systems required disposition decisions that involved either transfer to tanks within waste management areas (WMA) or disposal from facilities operations to cribs, trenches, or other liquid-waste disposal sites. These waste-transfer and -disposal decisions were based on waste composition. Because of known differences in process waste-stream characteristics, separate evaluations were completed to determine the COPC and analytical reporting requirements for pipeline systems associated with (1) waste streams transferred from facilities directly to liquid-disposal waste sites and (2) those process wastes sent to/transferred between or transferred out of tank farms. Refinement of the master list of COPCs as applicable to the facilities or tank-farm process-waste pipelines was completed as part of the DQO process.

Process waste generated in the facilities in the Central Plateau 200 Areas and transferred directly to liquid-waste disposal sites has been the focus of the numerous characterization investigations conducted to date. Previously, a DQO process was conducted in conjunction with each of these waste-site investigations to prepare final COPC lists. For development of the 200-UR-1 OU DQO, all previous DQO COPC lists were compiled, reviewed, and refined into one comprehensive list. The list encompasses all COPCs that would be considered as primary constituents for laboratory analysis associated with the facility process-waste pipeline systems included in pipeline Bins 1-5. As part of the 200-IS-1 DQO process, several additional analytes were included at the request of Ecology. The facility process-waste pipelines COPC list is presented in Table A-3.

Table A-3. Facilities Process-Waste Pipeline-Systems Contaminants of Potential Concern. (3 Pages)

Radioactive Constituents	
Americium-241	Niobium-94[a]
Carbon-14	Plutonium-238
Cesium-137	Plutonium-239/240
Cobalt-60	Strontium-90
Europium-152	Technetium-99
Europium-154	Tritium
Europium-155	Uranium-233/234
Neptunium-237	Uranium-235/236
Nickel-63	Uranium-238
Chemical Constituents – Metals	
Antimony	Lead
Arsenic	Mercury
Barium	Nickel

Table A-3. Facilities Process-Waste Pipeline-Systems Contaminants of Potential Concern. (3 Pages)

Beryllium	Selenium
Cadmium	Silver
Chromium	Uranium
Hexavalent Chromium	Vanadium
Copper	Zinc
Chemical Constituents – Other Inorganics	
Cyanide	Nitrate/Nitrite
Fluoride	Sulfate
Chemical Constituents – Volatile Organics	
Acetone	Halogenated hydrocarbons
Acetonitrile	Hexane
Benzene	Methyl ethyl ketone
n-Butyl benzene	Methyl isobutyl ketone (MIBK)
1-Butanol (n-butyl alcohol)	Perchloroethylene
2-Butanone (MEK)	Tetrahydrofuran
Carbon Tetrachloride	Toluene
Chlorobenzene	1,1,1 Trichloroethane (TCA)
Cis-1,2-dichloroethylene	1,1,2 Trichloroethane
Cyclohexane	Trans-1,2-dichlorotheylene
1,1-dichloroethane	Tetrachloroethylene (PCE)
1,2-dichloroethane	Trichloroethylene (TCE)
1,1-dichloroethylene	Vinyl chloride
Dichloromethane (Methylene Chloride)	Xylene
Ethylbenzene	
Chemical Constituents – Semivolatile Organics[d]	
AMSCO[b] Tributyl phosphate dilutant	Normal paraffin hydrocarbon
Cyclohexanone	Polyaromatic hydrocarbons
Diesel fuel[c]	Paint thinner
Dodecane	Phenol
Hydraulic fluids (greases)	Polychlorinated biphenyls (and associated World Health Organization congeners)
Kerosene	Shell E-2342 (naphthalene and paraffin)
Naphthylamine	Soltrol-170 ($C_{10}H_{22}$ to C_6 to H_{34}; purified kerosene)
Dibutylphosphate*	Tributyl phosphate and derivatives (mono, bi)

Table A-3. Facilities Process-Waste Pipeline-Systems Contaminants of Potential Concern. (3 Pages)

Monobutylphosphate*	Formate*
Oxalate*	Glycolate*

*Added to list as requested by the Washington State Department of Ecology (chelators or extractants used in processes).
[a]Contaminant of potential concern applicable to Plutonium Finishing Plant area only.
[b]Allen Maintenance Supply Company Inc.
[c]Analyzed as total petroleum hydrocarbons-diesel range; other total petroleum hydrocarbon analyses will include gasoline range.
[d]Trademarks and registered trademarks are the property of their respective owners. All product names mentioned are listed for contaminant potential only; such listing does not imply ownership and does not constitute endorsement.

If additional analytes not identified as COPCs are detected by the analytical methods used for laboratory analysis, these detected analytes and their concentrations will be evaluated against regulatory cleanup standards, or risk-based screening levels if toxicity and exposure data are available, and existing process knowledge. All detected analytes will be assessed in support of remedial-action decision making.

A2.1.4.2 Decision Rules

Decision rules (DR) are developed from the results of the principal study questions, decision statements, remedial-action alternatives, data needs, COPC action levels, analytical requirements, and scale of the decisions. The DRs generally are structured as "IF…THEN" statements that indicate the action that will be taken when a prescribed condition is met. The DRs incorporate the parameters of interest (e.g., COPCs), the scale of the decision (e.g., location), the preliminary action levels, and the resulting actions. The decision rules for Phase 1 are summarized in Table A-4. The associated alternative actions specified in the decision rules are presented in Table A-5.

Table A-4. Phase 1 Decision Rules. (2 Pages)

DR #	Constituents/ Media	Decision Rule
1	Nonradiological/ pipeline structures	If the concentration of chemical constituents in the pipelines, pipeline appurtenances, or plugged pipelines (as estimated by the maximum or detected values) is greater than or equal to the preliminary cleanup levels, select an appropriate alternative action (refer to Table A-5). Excludes Alternative Action 1-1b. Otherwise, evaluate the need for additional sampling.
2	Nonradiological/ soil	If the concentration of chemical constituents (as estimated by the maximum or detected values) in vadose zone soils in known leakage areas, suspect leakage areas, and/or unknown leakage areas is greater than or equal to the preliminary cleanup levels, select an appropriate alternative action (refer to Table A-5). Excludes Alternative Action 2-1b. Otherwise, evaluate the need for additional sampling.
3	Radiological/ pipeline structures	If the activity of radionuclides in the pipelines, pipeline appurtenances, or plugged pipelines (as estimated by the maximum or detected values) results in a direct radiological exposure dose greater than or equal to 15 mrem/yr above background or a groundwater radiological dose greater than or equal to 4 mrem/yr above background (based on fate and transport modeling), select an appropriate alternative action (refer to Table A-5). Excludes Alternative Action 3-1b. Otherwise, evaluate the need for additional sampling.

Table A-4. Phase 1 Decision Rules. (2 Pages)

DR #	Constituents/ Media	Decision Rule
4	Radiological/ soil	If the activity of radionuclides (as estimated by the maximum or detected values) in vadose zone soils in known leakage areas, suspect leakage areas, and/or unknown leakage areas results in a direct radiological exposure dose greater than or equal to 15 mrem/yr above background, a groundwater radiological dose greater than or equal to 4 mrem/yr above background (based on fate and transport modeling), or 0.1 rad/d for protection of terrestrial animals select an appropriate alternative action (refer to Table A-5). Excludes Alternative Action 4-1b. Otherwise, evaluate the need for additional sampling.
5	Dangerous waste	If the concentration of chemical constituents in the pipelines, pipeline appurtenances, or plugged pipelines (as estimated by the maximum or detected values) is greater than or equal to the preliminary cleanup levels, select an appropriate alternative action (refer to Table A-5). Excludes Alternative Action 5-1b. Otherwise, evaluate the need for additional sampling.

DR = decision rule.

Table A-5. Alternative Actions. (2 Pages)

PSQ #	AA #	Alternative Actions
1	1-1a	Evaluate the need for remedial-action alternatives in an FS.*
	1-1b	Evaluate the no-action alternative in an FS.*
	1-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to pipeline system decision making, based on field-screening data and/or analytical data, and take appropriate actions.
	1-3	Evaluate the need for additional sampling.
2	2-1a	Evaluate the need for remedial-action alternatives in an FS.*
	2-1b	Evaluate the no-action alternative in an FS.*
	2-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to piping system decision making, based on field screening data and/or analytical data, and take appropriate actions.
	2-3	Evaluate the need for additional sampling.

Table A-5. Alternative Actions. (2 Pages)

PSQ #	AA #	Alternative Actions
3	3-1a	Evaluate the need for remedial-action alternatives in an FS.*
	3-1b	Evaluate the no-action alternative in an FS.*
	3-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to piping system decision making, based on field-screening data and/or analytical data, and take appropriate actions.
	3-3	Evaluate the need for additional sampling.
	3-4	Evaluate the need for remedial-action alternatives that include transuranic contamination in an FS.*
	3-5	Evaluate the need for remedial-action alternatives that include greater than Class C waste concentrations in an FS.*
4	4-1a	Evaluate the need for remedial-action alternatives in an FS.*
	4-1b	Evaluate the no-action alternative in an FS.*
	4-2	Evaluate a streamlined approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD) to piping system decision making, based on field-screening data and/or analytical data, and take appropriate actions.
	4-3	Evaluate the need for additional sampling.
	4-4	Evaluate the need for remedial-action alternatives that include transuranic contamination in an FS.*
	4-5	Evaluate the need for remedial-action alternatives that include greater than Class C waste concentrations in an FS.*
5	5-1a	Evaluate the need for remedial-action alternatives in an FS.*
	5-1b	Evaluate the no-action alternative in an FS.*
	5-2	Evaluate a streamed-line approach (e.g., CERCLA removal actions, interim actions, voluntary actions, plug into an existing ROD, etc.) to piping system decision making, based on field screening data and/or analytical data, and take appropriate actions.
	5-3	Evaluate the need for additional sampling.

*May include innovative decision making approaches (e.g., probabilistic).
AA = alternative action.
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980.*
FS = feasibility study.
PSQ = principal study question.
ROD = record of decision.

A2.1.4.3 Error Tolerance and Decision Consequences

A nonstatistical sampling design was identified as appropriate for Phase 1. For DRs to be resolved using a nonstatistical sampling design, there is no need to define the tolerable limits on decision error, because these only apply to statistical designs. The qualitative consequence of selecting an inadequate sampling design for this activity was considered to range from low to severe. If the sampling design is determined to be inadequate, the waste sites can be accessed readily for resampling/additional sampling during Phase 2. Chapter 5.0 of the main text summarizes the activities that are planned for after the characterization activities described in this SAP are evaluated.

A2.1.4.4 Analytical Quality Objectives

Analytical quality objectives and criteria for laboratory data are presented in Tables A-6 for radiological and A-7 for nonradiological analytes. Following the completion of the DQO report (D&D-30262), RL and Ecology agreed that 12 World Health Organization PCB congeners would be included as COPCs for laboratory analysis. The specific congeners are identified in Table A-7. Laboratory analysis of these PCB congeners will be completed on 20 percent of all samples collected for laboratory analysis of PCB aroclors. Those samples designated for analysis of PCB congeners will be jointly identified by Fluor Hanford, RL, and Ecology.

For all analyses, in the event of a laboratory analytical failure, the laboratory is required to initiate corrective actions with the Sample and Data Management team of the Environmental Information Systems group. As part of the data-package transmittal procedure, a sample disposition record is generated to define the problem and to indicate the agreed-upon solution reached with discussions by the project manager or task lead. As part of the sample-disposition process, quarterly trend reports containing quality statistics are compiled based on the sample-disposition records. This provides an insight into emerging problems and the effectiveness of past responses to problems.

A2.1.4.5 Laboratory Sample Custody

Sample custody during laboratory analysis will be addressed in the applicable laboratory standard operating procedures. Laboratory custody procedures will ensure the maintenance of sample integrity and identification throughout the analytical process.

A2.1.4.6 Quality Assurance Objective

The quality-assurance objective of this plan is to provide implementation guidance that will result in data of known and appropriate quality and adhere to the approved Fluor Hanford QAPjP. Data quality is assessed by representativeness, comparability, accuracy, and precision. The applicable QC guidelines, quantitative target limits, and levels of effort for assessing data quality are dictated by the intended use of the data and the nature of the analytical method. Each of these is addressed in the following subsections.

A2.1.4.6.1 Representativeness

Representativeness is a measure of how closely the results reflect the actual concentration and distribution of the chemical and radiological constituents in the matrix sampled. Sampling-plan design, sampling techniques, and sample-handling protocols (e.g., storage, preservation, transportation) have been developed and are discussed in subsequent sections of this document. The documentation will establish that protocols have been followed and that sample identification and integrity are ensured.

Table A-6. Facilities Process-Waste Pipeline Systems – Radionuclide Analytical Performance Requirements. (2 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (pCi/g)	Target Detection Limits[a] (pCi/g)	Precision Required (%)[b]	Accuracy Required (%)[b]
14596-10-2	Americium-241	Am-241 AEA	31.1	1	±30	70-130
14762-75-5	Carbon-14	C-14 LSC (low level)	4.65	1	±30	70-130
10045-97-3	Cesium-137	Gamma GS	6.2	0.1	±30	70-130
10198-40-0	Cobalt-60	Gamma GS	1.4	0.05	±30	70-130
14683-23-9	Europium-152	Gamma GS	3.3	0.1	±30	70-130
15585-10-1	Europium-154	Gamma GS	3.0	0.1	±30	70-130
14391-16-3	Europium-155	Gamma GS	125	0.1	±30	70-130
13994-20-2	Neptunium-237	Np-237 AEA	2.5	1	±30	70-130
13981-37-8	Nickel-63	Ni-63 LSC	4,026	30	±30	70-130
14681-63-1	Niobium-94[c]	Gamma GS	2.43	1	±30	70-130
13981-16-3	Plutonium-238	AEA	37.4	1	±30	70-130
Pu-239/240	Plutonium-239/240	AEA	33.9	1	±30	70-130
13982-63-3	Radium-226	Gamma GS	7.03	0.2	±30	70-130
Rad-Sr	Strontium-90	Strontium-89,90 - Total Sr – Gas Proportional Counting	4.5	1	±30	70-130
14133-76-7	Technetium-99	Technetium-99 LSC (low level)	1.93	1	±30	70-130
10028-17-8	Tritium	Tritium - H_3 LSC (mid level)	48.2	30	±30	70-130
13966-29-5	Uranium-233/234	Isotopic Uranium AEA	1.1	1	±30	70-130
15117-96-1	Uranium-235		101	1	±30	70-130
U-238	Uranium-238		1.06	1	±30	70-130
N/A	Gross cesium-137 counts	Portable NaI detector		3.1	N/A	N/A
N/A	Gross alpha	Portable contamination detector		100 d/min/ 100 cm^2	N/A	N/A

Table A-6. Facilities Process-Waste Pipeline Systems – Radionuclide Analytical Performance Requirements. (2 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (pCi/g)	Target Detection Limits[a] (pCi/g)	Precision Required (%)[b]	Accuracy Required (%)[b]
N/A	Gross beta/gamma	Portable contamination detector		5,000 d/min/ 100 cm^2	N/A	N/A

[a]Units are in pCi/g (radioisotopes) unless otherwise specified.
[b]Accuracy criteria for associated batch laboratory-control sample percent recoveries. With the exception of gamma energy analysis, additional analysis-specific evaluations also are performed for matrix spikes, tracers, and carriers, as appropriate to the method. Precision criteria are based on batch laboratory replicate sample analyses.
[c]Contaminant of potential concern analysis only applicable to Plutonium Finishing Plant Area.
AEA = alpha energy analysis. GS = gamma spectroscopy. N/A = not applicable.
CUL = cleanup level. LSC = liquid scintillation counter. NaI = sodium iodide.

Table A-7. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (7 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method[a]	Lowest Overall CUL (mg/kg)	Target Detection Limits[b] (mg/kg)	Precision Required (%)[c]	Accuracy Required (%)[c]
Inorganics						
7440-36-0	Antimony	EPA Methods 6010 (trace), 6020, or 200.8 (trace)	5	0.6	±30	70-130
7440-38-2	Arsenic	EPA Methods 6010 (trace), 6020, or 200.8	6.47	1	±30	70-130
7440-39-3	Barium	EPA Methods 6010, 6020, or 200.8	132	20	±30	70-130
7440-41-7	Beryllium	EPA Methods 6010, 6020, or 200.8	10	0.5	±30	70-130
7440-43-9	Cadmium	EPA Methods 6010, 6020, or 200.8	0.81	0.5	±30	70-130
7440-47-3	Chromium (III)/Chromium (total)	EPA Methods 6010, 6020, or 200.8	42	1	±30	70-130

Table A-7. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (7 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method[a]	Lowest Overall CUL (mg/kg)	Target Detection Limits[b] (mg/kg)	Precision Required (%)[c]	Accuracy Required (%)[c]
7440-50-8	Copper	EPA Methods 6010, 6020, or 200.8	50	1	±30	70-130
18540-29-9	Hexavalent chromium	EPA Method 7196	18.4	0.5[d]	±30	70-130
7439-92-1	Lead	EPA Methods 6010, 6020, or 200.8	50	5	±30	70-130
7439-97-6	Mercury	EPA Methods 7471, 6020, or 200.8	0.33	0.2	±30	70-130
7439-98-7	Molybdenum	EPA Methods 6010, 6020, or 200.8	2	2	±30	70-130
7440-02-0	Nickel	EPA Methods 6010, 6020, or 200.8	30	4	±30	70-130
7782-49-2	Selenium	EPA Methods 6010 (trace), 6020, or 200.8	0.78	1[e]	±30	70-130
14808-79-8	Sulfate	IC Anions, EPA Method 300.0	1,000	5	±30	70-130
7440-22-4	Silver	EPA Methods 6010, 6020, or 200.8	2	2	±30	70-130
7440-28-0	Thallium	EPA Methods 6010 (trace), 6020, or 200.8	1	0.5	±30	70-130
7440-61-1	Uranium (total)	Kinetic phosphorescence analysis, or EPA Method 200.8	3.21	0.2	±30	70-130
7440-62-2	Vanadium	EPA Methods 6010, 6020, or 200.8	560	2.5	±30	70-130
7440-66-6	Zinc	EPA Methods 6010, 6020, or 200.8	86	1	±30	70-130
57-12-5	Cyanide	EPA Methods 9010 total cyanide or 335	0.80	0.5	±30	70-130
14797-55-8	Nitrate	IC, EPA Method 300.0	40	2.5	±30	70-130
14797-65-0	Nitrite	IC, EPA Method 300.0	4	2.5	±30	70-130
NO_3/NO_2	Nitrogen in nitrite and nitrate	EPA Method 353	12	0.75	±30	70-130

Table A-7. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (7 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method[a]	Lowest Overall CUL (mg/kg)	Target Detection Limits[b] (mg/kg)	Precision Required (%)[c]	Accuracy Required (%)[c]
Organics						
208-96-8	Acenaphthylene	EPA Method 8270	97.9	0.33	±30	70-130
67-64-1	Acetone	EPA Method 8260	28.9	0.02	±30	70-130
75-05-8	Acetonitrile	EPA Method 8260	0.196	0.1	±30	70-130
71-43-2	Benzene	EPA Method 8260	0.00448	0.0015	±30	70-130
120-12-7	Anthracene	EPA Method 8270	1,140	0.33	±30	70-130
56-55-3	Benzo(a)anthracene	EPA Method 8270	0.856	0.33	±30	70-130
50-32-8	Benzo(a)pyrene	EPA Method 8270	0.137	0.33	±30	70-130
205-99-2	Benzo(b)fluoranthene	EPA Method 8270	1.37	0.33	±30	70-130
191-24-2	Benzo(ghi)perylene	EPA Method 8270	2,400	0.33	±30	70-130
207-08-9	Benzo(k)fluoranthene	EPA Method 8270	13.7	0.33	±30	70-130
100-51-6	Benzyl alcohol	EPA Method 8260/8270	20.7	0.33	±30	70-130
75-27-4	Bromodichloromethane	EPA Method 8260	0.00368	0.005	±30	70-130
71-36-3	n-butyl alcohol (1-butanol)	EPA Method 8015 or 8260	6.62	5	±30	70-130
56-23-5	Carbon tetrachloride	EPA Method 8260	0.00310	0.002	±30	70-130
108-90-7	Chlorobenzene	EPA Method 8260	0.874	0.005	±30	70-130
67-66-3	Chloroform (trichloro-methane)	EPA Method 8260	0.0381	0.005	±30	70-130
218-01-9	Chrysene	EPA Method 8270	95.6	0.33	±30	70-130
156-59-2/ 156-60-5	Cis/Trans-1,2-Dichloro-ethylene	EPA Method 8260	720	0.005	±30	70-130
108-94-1	Cyclohexanone	EPA Method 8270	344	0.5	N/A	N/A
53-70-3	Dibenzo(ah)anthracene	EPA Method 8270	0.137	0.33	±30	70-130
75-34-3	1,1-Dichloroethane	EPA Method 8260	4.37	0.001	±30	70-130

Table A-7. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (7 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method[a]	Lowest Overall CUL (mg/kg)	Target Detection Limits[b] (mg/kg)	Precision Required (%)[c]	Accuracy Required (%)[c]
107-06-2	1,2-Dichloroethane	EPA Method 8260	0.00232	0.002	±30	70-130
75-35-4	1,1-Dichloroethylene	EPA Method 8260	0.000522	0.002	±30	70-130
75-09-2	Dichloromethane (methylene chloride)	EPA Method 8260	0.0218	0.005	±30	70-130
106-46-7	p-Dichlorobenzene	EPA Method 8270	0.03	0.33	±30	70-130
107-66-4	Dibutylphosphate	TBD	--	TBD		
100-41-4	Ethyl benzene	EPA Method 8260	6.05	0.005	±30	70-130
60-29-7	Ethyl ether	EPA Method 8015	6.68	5	±30	70-130
86-73-7	Fluorene	EPA Method 8270	30	0.33	±30	70-130
64-18-6	Formate (formic acid)	EPA Method 300.0	--	10.0	±30	70-130
79-14-1	Glycolate (glycolic acid)	TBD	--	TBD		
110-54-3	Hexane	EPA Method 8260	96.2	TBD	±30	70-130
193-39-5	Indeno(123-cd)pyrene	EPA Method 8270	1.37	0.33	±30	70-130
108-10-1	Methyl isobutyl ketone (MIBK hexone)	EPA Method 8260	2.71	0.01	±30	70-130
78-93-3	Methyl ethyl ketone (MEK)	EPA Method 8260	19.6	0.01	±30	70-130
--	Monobutylphosphate	TBD	--	TBD		
144-62-7	Oxalate (oxalic acid)	EPA Method 300.0	--	TBD		
127-18-4	Perchloroethylene (tetrachloro-ethene, PCE)	EPA Method 8260	0.000859	0.005	±30	70-130
88-01-8	Phenanthrene (ethanedionic acid)	EPA Method 8270	1,140	0.33	±30	70-130
108-95-2	Phenol	EPA Method 8270	22	0.33	±30	70-130
95-63-6	Pseudocumene (1,2,4-trimethyl benzene)	EPA Method 8260	4,000	0.2	±30	70-130

Table A-7. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (7 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method[a]	Lowest Overall CUL (mg/kg)	Target Detection Limits[b] (mg/kg)	Precision Required (%)[c]	Accuracy Required (%)[c]
109-99-9	Tetrahydrofuran	EPA Method 8260	0.05	0.05	±30	70-130
108-88-3	Toluene	EPA Method 8260	4.65	0.005	±30	70-130
71-55-6	1,1,1-Trichloroethane (TCA)	EPA Method 8260	1.58	0.005	±30	70-130
79-00-5	1,1,2-Trichloroethane	EPA Method 8260	0.00427	0.002	±30	70-130
79-01-6	Trichloroethylene (TCE)	EPA Method 8260	0.0263	0.005	±30	70-130
75-01-04	Vinyl chloride	EPA Method 8260	0.000184	0.01	±30	70-130
1330-20-7	Xylenes	EPA Method 8260	14.6	0.01	±30	70-130
126-73-8	Tributyl phosphate	EPA Method 8270	6.18	3.3	±30	70-130
2674-11-2	Aroclor-1016	PCBs, EPA Method 8082	0.65	0.02	±30	70-130
11104-26-2	Aroclor-1221	PCBs, EPA Method 8082	0.092	0.02	±30	70-130
11141-16-5	Aroclor-1232	PCBs, EPA Method 8082	0.092	0.02	±30	70-130
53969-21-9	Aroclor-1242	PCBs, EPA Method 8082	0.394	0.02	±30	70-130
126572-29-6	Aroclor-1248	PCBs, EPA Method 8082	0.386	0.02	±30	70-130
11097-6999-1	Aroclor-1254	PCBs, EPA Method 8082	0.066	0.02	±30	70-130
11096-82-5	Aroclor-1260	PCBs, EPA Method 8082	0.5	0.02	±30	70-130
32598-13-3 (BZ77)	3,3',4,4'-Tetrachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130
70362-50-4 ((BZ81)	3,4,4',5-Tetrachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130
32598-14-4 (BZ105)	2,3,3',4,4'-Pentachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130
74472-37-0 (BZ114)	2,3,4,4',5-Pentachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130
31508-00-6 (BZ118)	2,3',4,4',5-Pentachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130
65510-44-3 (BZ123)	2,3',4,4',5'-Pentachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130
57465-28-8 (BZ126)	3,3',4,4',5-Pentachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130

Table A-7. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (7 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method[a]	Lowest Overall CUL (mg/kg)	Target Detection Limits[b] (mg/kg)	Precision Required (%)[c]	Accuracy Required (%)[c]
38380-08-4 (BZ156)	2,3,3',4,4',5-Hexachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130
69782-90-7 (BZ157)	2,3,3',4,4',5'-Hexachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130
52663-72-6 (BZ167)	2,3',4,4',5,5'-Hexachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130
32774-16-6 (BZ169)	3,3',4,4',5,5'-Hexachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130
39635-31-9 (BZ189)	2,3,3',4,4',5,5'-Heptachlorobiphenyl	PCB congeners, EPA Method 1668	TBD	0.001	±30	70-130
TPH gasoline	Total petroleum hydrocarbon-gasoline range w/benzene	NWTPH gasoline	30	5	±30	70-130
TPH diesel	Total petroleum hydrocarbon-diesel range	NWTPH diesel	200	5	±30	70-130
Oil/grease	Hydraulic fluids (greases)	EPA Method 413.1 oil/grease or 1664A	2,000	200	±30	70-130
8008-20-6, TPH-kerosene	Kerosene, normal paraffins, paint thinner	NWTPH-Dx modified for kerosene range	2,000	5	±30	70-130

[a]For 4-digit EPA methods, see SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-B*, as amended. For EPA Methods 335, 353, and 413.1, see EPA/600/4-79/020, *Methods of Chemical Analysis of Water and Wastes*. For EPA Method 200.8, see EPA/600/R-94/111, *Methods for the Determination of Metals in Environmental Samples, Supplement 1*. For EPA Method 300.0, see EPA/600/R-93/100, *Methods for the Determination of Inorganic Substances in Environmental Samples*. For NWTPH Methods, see Ecology 97-602, *Analytical Methods for Petroleum Hydrocarbons*.

[b]Detection limits are based on optimal conditions in a standard fixed laboratory. Interferences and matrix effects may degrade the values shown.

[c]Accuracy criteria is the minimum for associated batch laboratory control sample percent recoveries. Laboratories must meet statistically based control if more stringent. Additional analyte-specific evaluations also are performed for matrix spikes and surrogates, as appropriate to the method. Precision criteria are based on batch laboratory-replicate matrix-spike analyses.

[d]Target detection limit is less than the inhalation limit of 2 mg/kg.

[e]Special arrangements will be made with the laboratory to achieve the detection limit needed for the ecological action level for selenium.

"–" No information available.

Aroclor is an expired trademark.

(BZ#) = PCB congener number originally assigned by Ballschmiter & Zell ("BZ Number") (Ballschmiter, K., and M. Zell, 1980, "Analysis of Polychlorinated Biphenyls (PCB) by Glass Capillary Gas Chromatography").

Table A-7. Facilities Process-Waste Pipeline Systems – Primary Inorganic and Organic Constituents Analytical Performance Requirements. (7 Pages)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method[a]	Lowest Overall CUL (mg/kg)	Target Detection Limits[b] (mg/kg)	Precision Required (%)[c]	Accuracy Required (%)[c]

CUL = cleanup level.
EPA = U.S. Environmental Protection Agency.
IC = ion chromatography.
N/A = not applicable.
NWTPH = Northwest total petroleum hydrocarbon.
PCB = polychlorinated biphenyl.
TBD = to be determined; method and/or detection limit currently are under evaluation.
TPH = total petroleum hydrocarbon.

A2.1.4.6.2 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using standard procedures and consistent methods and units. Tables A-6 and A-7 list applicable fixed-laboratory methods for analytes and target detection limits. Actual detection limits will depend on the sample matrix and the sample quantity available. Data will be reported as defined for specific samples.

A2.1.4.6.3 Accuracy

Accuracy is an assessment of the closeness of the measured value to the true value. Accuracy of chemical-test results is assessed by spiking samples with known standards and establishing the average recovery. A matrix spike is the addition to a sample of a known amount of a standard compound similar to the compounds being measured. Radionuclide measurements that require chemical separations use this technique to measure method performance. For radionuclide measurements that are analyzed by gamma spectroscopy, laboratories typically compare results of blind audit samples against known standards to establish accuracy. Validity of calibrations are evaluated by comparing results from the measurement of a standard to known values and/or by generation of in-house statistical limits based on three standard deviations (+/- 3 SD). Tables A-6 and A-7 list the accuracy provided for fixed-laboratory analyses for the project.

A2.1.4.6.4 Precision

Precision is a measure of the data spread when more than one measurement has been taken on the same sample. Precision can be expressed as the relative percent difference for duplicate measurements or relative standard deviation for triplicates. Tables A-6 and A-7 list the analytical precision for fixed-laboratory analyses.

A2.1.4.6.5 Completeness

A target value for data completeness was not defined in the DQO process; therefore, no requirement applies to this SAP.

A2.1.4.6.6 Detection Limits

Detection limits are functions of the analytical method used to provide the data and the quantity of the sample available for analyses. Method detection limits for the COPCs are presented on Tables A-6 and A-7.

A2.1.5 Special Training Requirements/Certification

Typical training or certification requirements have been instituted by the Project Hanford Management Contract team to meet training requirements imposed by the Project Hanford Management Contract (DE-AC06-96RL13200, *Contract Between the U.S. Department of Energy, Richland Operations Office, and Fluor Hanford, Inc.*), regulations, U.S. Department of Energy orders, contractor requirements documents, American National Standards Institute/American Society of Mechanical Engineers standards, *Washington Administrative Code*,

etc. For example, training or certification requirements needed by sampling personnel will be in accordance with Site analytical quality requirements.

The environmental health and safety training program provides workers with the knowledge and skills necessary to safely execute assigned duties. Field personnel typically will have completed the following training before starting work:

- Occupational Safety and Health Administration 40-hour hazardous-waste worker training and supervised 24-hour hazardous-waste site experience
- 8-hour hazardous-waste worker refresher training (as required)
- Hanford general-employee radiation training
- Radiological-worker training.

A graded approach is used to ensure that workers receive a level of training that is commensurate with their responsibilities and that complies with applicable U.S. Department of Energy orders and government regulations. Specialized employee training includes prejob briefings, on-the-job training, emergency preparedness, plan-of-the-day activities, and facility/worksite orientations.

A2.1.6 Documents and Records

Planning for sample collection and analysis will be in accordance with the programmatic requirements governing fixed-laboratory sample-collection activities as discussed in the sample team procedures. In the event that specific procedures do not exist for a particular work evolution, or if it is determined that additional guidance to complete certain tasks is needed, a work package will be developed to adequately control the activities, as appropriate. Examples of the sample team requirements include the activities associated with the following:

- Chain of custody/sample-analysis requests
- Project and sample identification for sampling services
- Control of certificates of analysis
- Logbooks, checklists
- Sample packaging and shipping.

Approved work control packages and procedures will be used to document radiological measurements when implementing this SAP. Examples of the types of documentation for field radiological data include the following:

- Instructions regarding the minimum requirements for documenting radiological controls information as discussed in 10 CFR 835, "Occupational Radiation Protection"
- Instructions for managing the identification, creation, review, approval, storage, transfer, and retrieval of Hanford Site radiological records

- The minimum standards and practices necessary for preparing, performing, and retaining radiological-related records
- The indoctrination of personnel on the development and implementation of survey/sample plans
- The requirements associated with preparing and transporting regulated material.

A2.2 DATA GENERATION AND ACQUISITION

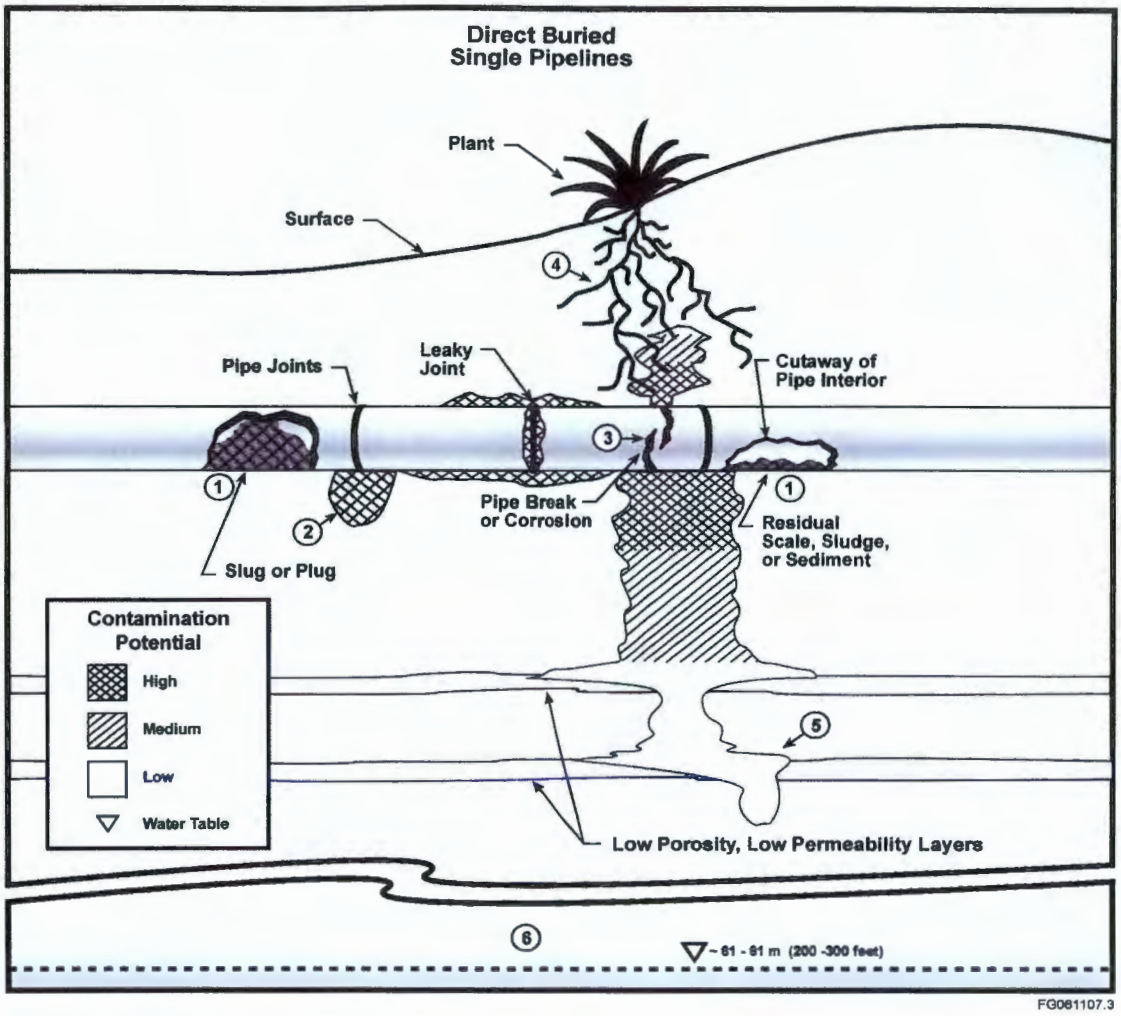
A2.2.1 Sampling Process Design

A nonstatistical sampling design (professional judgment) was used to determine sample locations in the pipelines and surrounding soil. A biased (or focused) sampling approach was selected based on process knowledge, expected behavior of COPCs, pipeline configuration, and the preliminary conceptual contaminant-distribution model developed for the facility process-waste pipeline systems (Figure A-4). Using this approach, sample locations are defined that increase the likelihood of encountering contamination. The total number of samples selected for each pipeline was based on criteria identified during the 200-IS-1 DQO process (D&D-30262). Quality assurance requirements for the data collected were discussed previously in Section A2.1.

For the facility process-waste pipelines, the purpose of the Phase 1 investigation is to determine if hazardous and/or radioactive COPCs are present in the pipelines and/or in the surrounding soil. The conceptual contaminant-distribution model for the facility process-waste pipelines (Figure A-4) suggests that the highest potential for vadose-zone soil contamination should be near potential release locations such as leaky pipe joints and fractures or pipe breaks. The potential for encountering contamination in the soil, if present, would be near the pipe, with decreasing potential for encountering contamination with increasing depth and distance from the pipeline. In the vadose-zone soils, where liquid releases have occurred, low-mobility COPCs, such as plutonium and Cs-137 normally sorb near the point of release. Mobile contaminants, such as nitrate and tritium, migrate with the moisture front to greater depths.

The pipeline structures are buried at depths ranging from several feet to tens of feet below the ground surface. Engineering designs and as-built drawings provide information on the locations of the pipelines and associated structures, construction materials, and pipe diameters. Burial depths can be determined at intermittent locations, based on survey elevation data for the bottoms of the pipelines (i.e., inverts) provided on engineering drawings and surface topographic elevations. Materials used in pipeline construction vary and include CI, CS, SS, VC, CM, polyethylene, polyvinyl chloride, and concrete.

Figure A-4. Preliminary Conceptual Contaminant-Distribution Model for Buried Process-Waste Pipelines.



1. Residual material in the form of scale, sludge, and/or sediment may occur at some locations within pipelines. Extensive buildup may have resulted in formation of plugged areas.
2. Pipe connection locations such as joints and fittings are susceptible to leakage. The releases are characterized as low-volume leaks and most likely are attributed to faulty or degraded seals, joints, or fittings. The effluent and contaminants move according to the permeability of surrounding soils at various points of release. Low-mobility contaminants such as cesium and plutonium sorb near points of release, and concentrations decrease with depth.
3. Fractures, cracks, and breaks are more prevalent in some pipelines such as those constructed of vitrified clay. Pipe breakage may have occurred in some cases as the result of loading and differential settling of surrounding soils. Larger breaks where flow was under pressure may have resulted in releases that extend both above and below the pipe into surrounding soil.
4. Contamination extends above the pipeline to the surface in some places because of uptake by vegetation (or possible animal intrusion).
5. Mobile contaminants such as nitrate and tritium migrate with the moisture front to greater depths.
6. Process fluids and contaminants may or may not impact groundwater, depending on the volume of releases.

A2.2.1.1 Contaminant Distribution Inside Pipelines

Data are not available concerning the concentrations and distribution of contaminants inside the majority of the pipelines. Residual material, if present, may occur as scale, corrosion products, sludge, and/or sediment. The tendency for materials to sorb contaminants is expected to vary with pipe composition. Some pipelines, over time, may tend to accumulate debris and sludge. Depending on the characteristics of the pipe, length of use, and the waste-stream type, debris may accumulate through the pipeline. In general, material such as stainless steel is assumed to be less likely to have sorbed waste-stream constituents than pipeline material such as VC. Many of the disposal sites on the Central Plateau received liquid waste from gravity-flow pipelines. The conceptual model for this type of pipeline would show waste accumulation within the pipe and at pipe bends or low points, if present.

A2.2.1.2 Soil Adjacent to Pipeline Structures

The potential distribution of contaminants in the soil surrounding the pipeline structures is assumed to be variable and to depend on a number factors. The occurrence and magnitude of potential releases would be affected by the integrity of fittings at pipe joints, breaks or fractures in the line related to loading or subsidence, and degradation associated with age and incompatibility of waste streams and pipeline materials. The extent of vertical and/or lateral migration in surrounding soil would be related to factors such as size of the release opening, period of time over which the release occurred, whether the release was under pressure, the soil characteristics (e.g., porosity and permeability), and the total volume of liquid that was discharged.

For pipelines where inadvertent liquid releases to the surrounding soil have occurred, the contaminant distribution may be limited to the shallow-zone soil interval (i.e., the interval from the ground surface to a depth of 4.6 m [15 ft]), but could extend to a deeper depth. Liquid releases at pipeline failure locations may display simple or complex concentration distributions within the impacted soil area. The distribution will depend on the a number of factors, including the chemistry of the liquid waste stream, volume of the release, attributes of the pipe failure, and properties of surrounding soil.

A2.2.1.2.1 Vertical Contaminant Distribution

The specific vertical contaminant distribution in the soil will depend on several influencing factors: volume of the release, time period over which the release occurred, waste stream composition, and mobility of the constituents (e.g., soil-water partition distribution coefficients and porosity/permeability of the sediments).

For small-volume release to surrounding soil associated with minor pipe-joint offsets or small cracks or fractures, it is expected that the vertical contaminant migration will be limited to within several feet of the bottom of the structure. Large-magnitude releases could result in vertical migration (toward the surface or toward the groundwater) of contaminants in the soil to depths of tens of feet.

A2.2.1.2.2 Lateral Contaminant Distribution

Some lateral migration could occur of liquid releases from pipelines in the impacted soils, and the spread of the contamination would depend on site-specific conditions and the volume of the release. For small-volume releases, lateral spreading might be greater than vertical migration, while for large-volume releases, vertical migration might be greater than lateral migration because of the hydraulic head associated with the large-volume release and its preference for vertical migration. However, this also is dependent on the local geologic characteristics in the vicinity of the release.

A2.2.2 Sampling Activities

Information concerning sample-collection techniques, sample locations, and number of samples is presented below.

A2.2.2.1 Investigation Techniques

Field-screening measurements, in addition to the collection of samples for laboratory analysis, will be used to determine occurrence and concentrations of COPCs. Application of these measurements with the selected characterization approach is presented in Chapter A3.0 of this SAP.

A2.2.2.2 Field-Screening Analyses

To support the selection of appropriate field-screening techniques to be used at the pipeline-sampling locations, a review of available radiological and chemical data for each pipeline was completed. This review involved compiling data concerning waste-stream composition including primary constituents identified by waste-stream inventory records, primary chemical components noted in the process operations that generated the waste streams, and laboratory analytical results of soil samples collected from the disposal site connected to the pipeline. A summary of this compilation and the primary radiological and nonradiological constituents that were identified using all three data sources is presented in the Attachment, Table ATT-2. The footnotes to Table ATT-2 describe the systematic process that was followed to review each data source and identify the target constituents for field screening. References used for compiling the lists of chemical constituents provided in Table ATT-2 are presented in the Attachment, Table ATT-3. Selected primary constituents will be used as target constituents for field screening. In some cases, groups of constituents or types of compounds are the targets for screening, such as VOCs, hydrocarbons, PCBs, and polyaromatic hydrocarbons.

The applicable field-screening methods that were identified for this project, and their performance capabilities, are presented in Tables A-8 and A-9. Special care should be taken to prevent cross-contamination of field-screening equipment by properly storing and handling the equipment and performing proper decontamination between sampling events.

Table A-8. Radiological Field-Screening Methods.

Measurement Type	Emission Type	Method/Instrument	Detection Limit
Exposure/dose rate	Beta/gamma	RO-20/RO-03 portable ionization chamber	0.5 mrem/h
Contamination level	Alpha	100 cm^2 Portable alpha meter or equivalent instrument	90 d/min α/100 cm^2 (10 sec static count) 250 d/min α/100 cm^2 (1 in./sec scan speed)
Contamination level	Beta/gamma	100 cm^2 ruggedized scintillation detector or equivalent	500 d/min β–γ/100 cm^2 (20 sec static count @ 13% efficiency) 1,400 d/min β–γ/100 cm^2 (2 in./sec scan speed)
Contamination level	Gamma	2 in. x 2 in. sodium iodide detector (e.g. Ludlum 44-3 or equivalent)	5 pCi/g Cs-137 in soils
Contamination level	Gamma	2 in. x 10 mm sodium iodide low-energy gamma detector (e.g., Eberline PG-2 or equivalent)	20 pCi/g Am-241 in soils
Spectral-gamma logging	Gamma isotopic emissions	High-purity germanium	~25 nCi/g to 50 nCi/g Am-241 and Pu-239 through well casing; ~100 pCi/g for Np-237 through well casing
Gross-gamma logging	Gamma emissions	Bismuth-germanium or sodium iodide detector	~25 nCi/g for Am-241 and Pu-239 through well casing
Spectral-gamma logging	Gamma emissions	Bismuth-germanium or sodium iodide detector	~0.5 pCi/g (100 sec static count time) (5 pCi/g with 10 sec count)
Passive-neutron logging	Neutron emissions	Helium-3 detector	~100 nCi/g for Am-241 and Pu-239 through well casing
Active-neutron logging	Thermal neutron	Helium-3 detector	Less than 1% volume fraction moisture in soil.

Eberline E-600 and SHP380-A/B are trademarks of Eberline Instruments, a subsidiary of Thermo Electron Corporation, Waltham, Massachusetts.
Ludlum is a trademark of Ludlum Measurements, Inc., Sweetwater, Texas.
PG-2, RO-20, and RO-03 are trademarks of Eberline Instruments, a subsidiary of Thermo Electron Corporation, Waltham Massachusetts.

d/min = disintegrations per minute.

Table A-9. Nonradiological Field-Screening Methods. (2 Pages)

Measurement Variable	Measurement Method[a]	Detection Limit
Chromium (VI)	Water extraction and colorimetric analysis	2 to 5 mg/kg
Mercury	Immunoassay or equivalent method	0.5 mg/kg. Results reported within a prespecified range.
Polyaromatic hydrocarbons	Immunoassay or equivalent method	1 to 5 mg/kg. Results reported within a prespecified range.
Polychlorinated biphenyls	Immunoassay equivalent method	0.1 to 0.3 mg/kg. Results reported within a prespecified range.
Nitrate	Colorimetric or Immunoassay	10 to 500 mg/kg. Analyses performed using test strips and reflectometer.
Total petroleum hydrocarbons	Immunoassay or equivalent method	5 to 10 mg/kg. Results reported within a prespecified range. Used for gasoline or diesel products.

Table A-9. Nonradiological Field-Screening Methods. (2 Pages)

Measurement Variable	Measurement Method[a]	Detection Limit
VOCs (vapor screening)	Photoacoustic infrared analyzer (e.g., B&K 1302)[b]	Specific to VOCs of interest.
VOCs (vapor screening)	MIRAN SapphIRe infrared analyzer[c]	Specific to VOCs of interest.
VOCs (vapor screening)	Photoionization detector (e.g., thermoanalytical organic vapor monitor)	1 to 5 mg/kg (isobutylene-equivalent). Specific to VOCs of interest. Limited to photoionizing compounds at 10.6 eV.
VOCs (vapor screening)	Portable gas chromatograph with photoionization detector (e.g., Photovac 10S Plus)[d]	Sub-mL/m^3 levels depending on VOC of interest. Specific to VOCs of interest. Limited to photoionizing compounds at 11.7 eV.

[a]Other methods may be identified and implemented in conjunction with technology development.
[b]B&K is a trademark of Brüel and Kjær, S&V, Nærum, Denmark.
[c]MIRAN and SapphIRe are registered trademarks of Thermo Electron Corporation, Franklin, Massachusetts.
[d]Photovac 10S Plus is a trademark of Photovac, Inc., Waltham, Massachusetts.

VOC = volatile organic compound.

A2.2.2.3 Radiological Field Data

Alpha, gamma, and beta/gamma field data will be used to support the characterization described in this SAP, as appropriate. The following information will be disseminated to personnel performing work in support of this SAP, as appropriate:

- Measuring instructions: Instructions to the radiological control technicians on methods required to measure sample activity and media for gamma, alpha, and/or beta emissions, as appropriate. This will include direction to allow the radiological control technicians to calculate a number of quantities supporting sample analysis

- Geiger-Mueller[2] portable instrument: A physical description of the Geiger-Mueller instrument, radiation and energy response characteristics, calibration/maintenance and performance testing descriptions, and the application/operation of the instrument. The Geiger-Mueller instrument is a commonly used beta/gamma instrument on the Hanford Site when removable surface-contamination measurements and direct measurements of the total surface contamination are performed

- Portable alpha meter: A physical description of the portable alpha meter, radiation and energy response characteristics, calibration/ maintenance and performance-testing descriptions, and the application/operation of the instrument. The portable alpha meter is a commonly used alpha instrument on the Hanford Site when removable surface-contamination measurements and direct measurements of the total surface contamination are performed

[2] Geiger-Mueller is not a trademark.

- Sodium-iodide detector: A physical description of the sodium-iodide detector, radiation and energy response characteristics, calibration/ maintenance and performance testing descriptions, and the application/operation of the instrument. The sodium-iodide detector instrument is a commonly used gamma detector on the Hanford Site when direct measurements are performed

- Hand-held probes: Characteristics associated with the hand-held probes to be used in the performance of direct radiological measurements include a physical description of the probe, the radiation- and energy-response characteristics, calibration/maintenance and performance testing descriptions, and the application/operation of the instrument. Probes appropriate for the type and energy range of radioactivity present in the soils are commonly used on the Hanford Site when removable surface-contamination measurements and direct measurements of the total surface contamination are performed.

A2.2.2.4 Sampling Locations

Table A-10 provides information on the sampling locations selected for each pipeline. The information listed includes the pipeline identification number, pipe material and diameter at the sample location, a physical description of the location, and additional comments concerning aspects of some of the sample-location information. Primary locations identified for sample collection are listed, along with alternate locations that can be used if access to primary locations is restricted. For each bin, alternate internal-pipeline-sample locations and alternate exterior-soil-sample collection locations are identified on Table A-10. An alternate location will be used only if a primary (i.e., preferred) location is not accessible for sample collection. Circumstances such as encountering undocumented buried obstacles and worker health and safety issues could require use of an alternate sampling location. No hierarchy or preference is associated with the use of any of the alternate locations. Temporary sample identification numbers are provided on the table that correspond directly to the sampling locations shown on Figures A-5 through A-21.

The sampling locations (e.g., manholes, pipeline interior, direct-push locations) will be identified in the field before characterization activities are begun. Locations will be staked by the technical lead or field team leader assigned by the project manager. After the locations have been staked, minor adjustments to the location may be made to mitigate unsafe conditions, avoid structural interferences, or bypass utilities. Sample-location identification numbers will be defined during or after sampling. Changes in sample locations that do not affect the DQOs will require approval of the task lead. Changes to sample locations that result in impacts to the DQOs will require concurrence by RL and the lead regulatory agency.

Surface geophysical and radiation surveys will be performed at all sampling locations. The surface geophysical surveys will be conducted using ground-penetrating radar and/or electromagnetic imaging and will aid in verifying the locations of buried pipelines and in selecting soil-probe locations to avoid subsurface obstructions. The surface radiation surveys will identify areas of surface contamination that might affect the field activities and health and safety.

This page intentionally left blank.

Table A-10. Sample Location Summary Information. (4 Pages)

Bin	Associated Waste Site	Pipeline Number(s)	Pipe Material at Sampling Location	Interior Pipe Sampling Locations [Sample Identification Numbers in Brackets]			Exterior Soil Sampling Locations Sample Identification Numbers in Brackets]		Comments
				Pipe Location 1 (P1)	Pipe Location 2 (P2)	Pipe Location 3 (P3)	Soil Locations 1 and 2 (S1/S2)	Soil Locations 3 and 4 (S3/S4)	
1 (B1)	216-A-10	200-E-192-PL:1, 200-E-192-PL:2 (L1)		At an accessible point along the 8-in. SS pipeline east of the 216-A-10 Crib.	At an accessible point along the 8-in. VC pipeline northeast of the 216-A-10 Crib.	At the "Proportional Sampler Pit #4," northeast of the internal PUREX security fence.	At a point on the 8 in. VC pipeline (west of "Proportional Sampler Pit #4" and northeast of the 216-A-10 Crib) where the pipeline changes direction from west to southwest.	At a point on the 8-in. SS pipeline (east of the 216-A-10 Crib) where the pipeline changes direction from south-southwest to west-southwest.	Interior pipe sampling locations P1 and P2 will require a "dig-and-cut" approach for pipeline access, and the exact points for this internal sampling should be determined based upon clearance from nearby pipelines, structures/features, and contamination areas. The P3 interior pipe sampling location will potentially provide access to both the SS pipelines and the VC pipeline.
				[B1L1P1]	[B1L1P2]	[B1L1P3]	[B1L1S1 & B1L1S2]	[B1L1S3 & B1L1S4]	
			SS	8 in.	NA	8 in. (via SP)	N/A	8 in.	
			VC	N/A	8 in.	8 in. (via SP)	8 in.	N/A	
	216-Z-1A	200-W-174-PL (L2)		At an accessible point along the two 2-in. SS pipelines north of the contamination area associated with the 216-Z-1A Tile Field.	At an accessible point along the two 2-in. SS pipelines west of the 241-Z-361 Settling Tank.	At an accessible point along the two 2-in. SS pipelines east of Building 243-Z.	**Alternate:** At an accessible point along the two 2-in. SS pipelines north of the contamination area associated with the 216-Z-1A Tile Field.	**Alternate:** At a point along the two 2-in. SS pipelines (southeast of Building 243-Z and northeast of the 241-Z Tank Pit) where the pipeline changes direction from south-southeast to south.	Marker posts generally are located along the two 2-in. SS pipelines where there are changes in pipe direction. All interior pipe sampling locations will require a "dig-and-cut" approach for pipeline access, and the exact points for this internal sampling should be determined based on clearance from nearby pipelines, structures/features, and contamination areas. This pipeline was selected as an alternate for exterior soil sampling.
				[B1L2P1]	[B1L2P2]	[B1L2P3]	[B1L2S1] (Alt) & [B1L2S2] (Alt)	[B1L2S3] (Alt) & [B1L2S4] (Alt)	
			SS	2 in. (x2)	2 in. (x2)	2 in. (x2)	2 in. (x2)	2 in. (x2)	
	216-B-12	200-E-160-PL, 200-E-162-PL:1, 200-E-162-PL:2 (L3)		**Alternate:** At an accessible point along the 6-in. VC pipeline, preferably at the 45° elbow south of the 216-B-12 Crib.	**Alternate:** At the "Diversion Pit" located east of the 216-B-12 Crib at the connection with the line leading to the 216-B-62 Crib.	**Alternate:** At the "Sampler Pit" located near the origin of this pipeline south of Building 221-B (B Plant).	At the 45° elbow on the 6-in. VC pipeline (Line V219) south of the 216-B-12 Crib.	At a point along the pipeline southeast of the 216-B-12 Crib, where a contamination area occurs that is potentially associated with this pipeline.	A large portion of this pipeline lies within a large "underground radioactive material" area and is surrounded by unrelated pipelines and structures/features. Consequently, few "dig and cut" options are available for interior pipe sampling on the upstream half of this pipeline. The P1 interior pipe sampling location will require a "dig-and-cut" approach for pipeline access, and the exact points for this internal sampling should be determined based upon clearance from nearby pipelines, structures/features, and contamination areas. The section of this pipeline associated with S3/S4 exterior soil sampling locations is constructed of unknown materials. The S3/S4 sampling locations were chosen because of the presence of a contamination area around this section of the pipeline. This pipeline was selected as an alternate for interior pipe sampling.
				[B1L3P1] (Alt)	[B1L3P2] (Alt)	[B1L3P3] (Alt)	[B1L3S1] & [B1L3S2]	[B1L3S3] & [B1L3S4]	
			M35	N/A	N/A	4 in. (via SP)	N/A	N/A	
			VC	6 in.	N/A	N/A	6 in.	N/A	
			FRE	N/A	4 in. (via DP)	N/A	N/A	N/A	
			Unknown					Unknown Diameter	
2 (B2)	216-B-2-2	200-E-112-PL (L1)		At the MH (southwest of the 207-B Retention Basin) where the 24-in. VC pipe changes direction ~45° from north to northeast.	At the MH located directly east of the unrelated 241-B-361 Settling Tank.	At the MH (east of B Plant) where the pipeline converts from 24-in. CI pipe to 24-in. VC pipe and changes direction 90° from east to north.			Many other MHs are located along this pipeline that would be available for interior pipe sampling if necessary. This pipeline was not selected for exterior soil sampling.
				[B2L1P1]	[B2L1P2]	[B2L1P3]			
			CI	N/A	N/A	24 in. (via MH)			
			VC	24 in. (via MH)	24 in. (via MH)	24 in. (via MH)			
	216-A-25	200-E-127-PL (L2)		At MH #1, located near the downstream end of the overall pipeline length, where the pipe size is reduced from 42-in. to 30-in. CM pipe.	At MH #5, located near the midpoint of the overall pipeline length, where the pipe size is reduced from 42-in. to 36-in. CM pipe.	At MH #8, located near the upstream origin of the overall pipeline length, where the pipe size is reduced from 36-in. to 30-in. CM pipe.	At a point along the 36-in. CM pipe (near the midpoint of the overall pipeline length) where a contamination area occurs that is potentially associated with this pipeline and where a diversion point exists.	At a point along the 36-in. CM pipe (near the midpoint of the overall pipeline length, near MH #5) where another contamination area occurs that is potentially associated with this pipeline.	The interior pipe sampling locations will provide access to potential sediment accumulation areas (directly upstream from the MHs) along the pipeline because of the size reductions. Many other MHs are located along this pipeline that would be available for interior pipe sampling if necessary.
				[B2L2P1]	[B2L2P2]	[B2L2P3]	[B2L2S1] & [B2L2S2]	[B2L2S3] & [B2L2S4]	
			CM	30 in. & 42 in. (via MH)	36 in. & 42 in. (via MH)	30 in. & 36 in. (via MH)	36 in.	36 in.	

Table A-10. Sample Location Summary Information. (4 Pages)

Bin	Associated Waste Site	Pipeline Number(s)	Pipe Material at Sampling Location	Interior Pipe Sampling Locations [Sample Identification Numbers in Brackets]			Exterior Soil Sampling Locations Sample Identification Numbers in Brackets]		Comments
				Pipe Location 1 (P1)	Pipe Location 2 (P2)	Pipe Location 3 (P3)	Soil Locations 1 and 2 (S1/S2)	Soil Locations 3 and 4 (S3/S4)	
2 (B2) cont.	216-A-30	200-E-113-PL (L3)		**Alternate:** At an accessible point along the 16-in. Stl. pipeline west of the 216-A-30 Crib and east of the 216-A-42C Valve Box.	**Alternate:** At an accessible point along the 16-in. Stl. pipeline west of the 216-A-6 Crib and east of Canton Avenue.	**Alternate:** At an accessible point along the 16-in. Stl. pipeline at a pipe direction change location west of Canton Avenue.	**Alternate:** At a point along the 16-in. Stl. pipeline west of the 216-A-30 Crib at or near the 216-A-42C Valve Box where a contamination area occurs that is potentially associated with this pipeline.	**Alternate:** At a point along the 16-in. Stl. pipeline (west of the 216-A-42C Valve Box) where another contamination area occurs that is potentially associated with this pipeline.	All interior pipe sampling locations will require a "dig-and-cut" approach for pipeline access, and the exact points for this internal sampling should be determined based on clearance from nearby pipelines, structures/features, and contamination areas. This pipeline was selected as an alternate for both interior and exterior sampling.
				[B2L3P1] (Alt)	[B2L3P2] (Alt)	[B2L3P3] (Alt)	[B2L3S1] (Alt) & [B2L3S2] (Alt)	[B2L3S3] (Alt) & [B2L3S4] (Alt)	
			Stl.	16 in.	16 in.	16 in.	16 in.	16 in.	
	216-T-36	200-W-79-PL (L4)					At a point along the 4-in. VC pipe east of the 200-T-36 Crib where a contamination area occurs that is potentially associated with this pipeline.	At another point (east of S1/S2) along the 4-in. VC pipe east of the 200-T-36 Crib where another contamination area occurs that is potentially associated with this pipeline.	This pipeline was not selected for interior pipe sampling.
							[B2L4S1] & [B2L4S2]	[B2L4S3] & [B2L4S4]	
			VC				4 in.	4 in.	
3 (B3)	216-A-29	200-E-187-PL (L1)		**Alternate:** At the MH located where the newer 15-in. CS pipe changes direction ~45° from east to southeast.	**Alternate:** At the MH located where the older 12-in. VC pipe changes direction 90° from north to east.	**Alternate:** At the MH located where the older 12-in. VC pipe changes direction 90° from east to north.	**Alternate:** At a MH where the newer 15-in. CS pipeline direction changes from east to southeast (same location as P1).	**Alternate:** East of the MH where the older 12-in. VC pipeline changes direction from north to east (east of the MH selected for P2).	Many other MHs are located along this pipeline that would be available for interior pipe sampling if necessary. The three MHs were chosen because of direction changes in the pipeline and for accessibility. This pipeline was selected as an alternate for both interior and exterior sampling.
				[B3L1P1] (Alt)	[B3L1P2] (Alt)	[B3L1P3] (Alt)	[B3L1S1] (Alt) & [B3L1S2] (Alt)	[B3L1S3] (Alt) & [B3L1S4] (Alt)	
			CS	15 in. (via MH)	N/A	N/A	15 in. (at MH)	N/A	
			VC	N/A	12 in. (via MH)	12 in. (via MH)	N/A	12 in.	
	216-S-10	200-W-157-PL (L2)		At the MH located where the 12-in. VC pipe changes direction ~30° from west to west-southwest.	At the MH located where the 12-in. VC pipe changes direction 90° from south to west and where another 8-in. VC pipe joins with the 12-in. VC pipe.	At the MH located where two upstream 8-in. VC pipes connect to a downstream 12-in. VC pipe.	At a point along the 12-in. VC pipeline east-northeast of the now grout-filled MH where the pipeline discharged into the 216-S-10 Ditch.	At a MH where the 12-in. VC pipeline changes direction ~30° from west to west-southwest.	Many other MHs are located along this pipeline closer to the source facility (S Plant) that may be available for sampling if necessary. The three that were chosen were because of either direction changes in the pipeline or for accessibility.
				[B3L2P1]	[B3L2P2]	[B3L2P3]	[B3L2S1] & [B3L2S2]	[B3L2S3] & [B3L2S4]	
			VC	12 in. (via MH)	8 in. & 12 in. (via MH)	8 in. & 12 in. (via MH)	12 in.	12 in. (at MH)	
	216-B-63	200-E-188-PL (L3)		At MH #20, located where the 15-in. VC pipe changes direction ~45° from northeast to north (south of the 207-B Retention Basin).	At MH #19, located at the northeast end of a contamination area that is potentially associated with this pipeline.	At MH #16, located where the 15-in. VC pipe changes direction ~45° from north to northeast.	At a point along the 15-in. VC pipeline where a contamination area occurs that is potentially associated with this pipeline (southwest of MH #20).	At a point along the 15-in. VC pipeline where another contamination area occurs that is potentially associated with this pipeline.	MHs #19 and #20 are both located downstream of "underground radioactive material" areas that may be associated with this pipeline. Many other MHs are located along this pipeline that would be available for sampling if necessary. The three were chosen because of pipeline direction changes and/or proximity to contamination areas that may be associated with the pipeline.
				[B3L3P1]	[B3L3P2]	[B3L3P3]	[B3L3S1] & [B3L3S2]	[B3L3S3] & [B3L3S4]	
			VC	15 in. (via MH)	15 in. (via MH)	15 in. (via MH)	15 in.	15 in.	

Table A-10. Sample Location Summary Information. (4 Pages)

Bin	Associated Waste Site	Pipeline Number(s)	Pipe Material at Sampling Location	Interior Pipe Sampling Locations [Sample Identification Numbers in Brackets]			Exterior Soil Sampling Locations Sample Identification Numbers in Brackets]		Comments
				Pipe Location 1 (P1)	Pipe Location 2 (P2)	Pipe Location 3 (P3)	Soil Locations 1 and 2 (S1/S2)	Soil Locations 3 and 4 (S3/S4)	
4 (B4)	216-T-33	200-W-173-PL (L1)		At a point along the 8-in. VC pipeline east of the entry to the 216-T-33 Crib. Refer to comments for additional information.	At an accessible point along the 8-in. VC pipeline near the midpoint of the overall pipeline length.	At an accessible point along the 8-in. VC pipeline west of where the pipeline changes direction ~45° from southwest to west (south of building 2706-W).	At a point along the 8-in. VC pipeline east of the entry to the 216-T-33 Crib. Refer to comments for additional information.	At an accessible point along the 8-in. VC pipeline near the midpoint of the overall pipeline length.	All interior pipe sampling locations will require a "dig-and-cut" approach for pipeline access, and the exact points for this internal sampling should be determined based upon clearance from nearby pipelines, structures/features, and contamination areas. Sample locations P1 and S1/S2 were selected based on the potential presence of plugged "Y" fittings and a "double hub" fitting on the pipeline, based on an engineering drawing for this pipeline.
				[B4L1P1]	[B4L1P2]	[B4L1P3]	[B4L1S1] & [B4L1S2]	[B4L1S3] & [B4L1S4]	
			VC	8 in.	8 in.	8 in.	8 in.	8 in.	
	216-A-21	200-E-193-PL (L2)		At a point along the 6-in. VC pipeline north-northeast of the entry to the 216-A-21 Crib. Refer to comments for additional information.	At an accessible point along the 6-in. VC pipeline north-northeast of sample locations P1 and S1/S2.	At an accessible point along the 6-in. VC pipeline north-northeast of sample location P2.	At a point along the 6-in. VC pipeline north-northeast of the entry to the 216-A-21 Crib. Refer to comments for additional information.	At a point along the 6-in. VC pipeline south of the pipeline origin (Building 293-A) where the pipeline slightly changes direction from south to south-southwest.	All interior pipe sampling locations will require a "dig-and-cut" approach for pipeline access, and the exact points for this internal sampling should be determined based upon clearance from nearby pipelines, structures/features, and contamination areas. Sample locations P1 and S1/S2 were selected based on the potential presence of plugged "Y" fittings on the pipeline, based on an engineering drawing for this pipeline.
				[B4L2P1]	[B4L2P2]	[B4L2P3]	[B4L2S1] & [B4L2S2]	[B4L2S3] & [B4L2S4]	
			VC	6 in.	6 in.	6 in.	6 in.	6 in.	
	216-A-32	200-E-194-PL (L3)		**Alternate:** At an accessible point along the 6-in. VC pipeline south-southwest of the entry to the 216-A-32 Crib.	**Alternate:** At an accessible point along the 6-in. VC pipeline south-southwest of sample locations P1 and S1/S2.	**Alternate:** At an accessible point along the 6-in. VC pipeline north-northeast of the pipeline origin (PUREX).	**Alternate:** At an accessible point along the 6-in. VC pipeline south-southwest of the entry to the 216-A-32 Crib.	**Alternate:** At an accessible point along the 6-in. VC pipeline north-northeast of the pipeline origin (PUREX).	All interior pipe-sampling locations will require a "dig-and-cut" approach for pipeline access, and the exact points for this internal sampling should be determined based upon clearance from nearby pipelines, structures/features, and contamination areas. This pipeline was selected as an alternate for both interior and exterior sampling.
				[B4L3P1] (Alt)	[B4L3P2] (Alt)	[B4L3P3] (Alt)	[B4L3S1] (Alt) & [B4L3S2] (Alt)	[B4L3S3] (Alt) & [B4L3S4] (Alt)	
			VC	6 in.	6 in.	6 in.	6 in.	6 in.	
5 (B5)	216-T-26	200-W-175-PL (L1)		At an accessible point along the 3-in. Stl. pipeline east of where the pipeline changes direction 90° from south to east and where the pipe size is reduced from 4 in. to 3 in.	At an accessible point along the 4-in. Stl. pipeline just north of where the pipe size is reduced from 4 in. to 3 in. and where the pipeline changes direction 90° from south to east.	At an accessible point along the 3.5-in. Stl. pipeline north-northwest of the S3/S4 alternate exterior soil sampling locations.	**Alternate:** At a point (east of the TY Tank Farm) where the pipe size is reduced from 4 in. to 3 in. and where the pipeline changes direction 90° from south to east.	**Alternate:** At a point along the 3.5-in. pipeline (north of the TY Tank Farm) where the pipeline changes direction ~25° from south-southeast to southeast.	All interior pipe-sampling locations will require a "dig-and-cut" approach for pipeline access, and the exact points for this internal sampling should be determined based upon clearance from nearby pipelines, structures/features, and contamination areas. The pipeline from the TY Tank Farm (associated with sampling locations P2 and S1/S2) was disconnected in 1955. The portion of the pipeline associated with interior pipe sampling location P1 may be a likely area for sediment accumulation due to a pipe size reduction (noted under P1 sample location description). This pipeline was selected as an alternate for exterior sampling.
				[B5L1P1]	[B5L1P2]	[B5L1P3]	[B5L1S1] (Alt) & [B5L1S2] (Alt)	[B5L1S3] (Alt) & [B5L1S4] (Alt)	
			Stl.	3 in.	4 in.	3.5 in.	3 in. & 4 in.	3.5 in.	

Table A-10. Sample Location Summary Information. (4 Pages)

Bin	Associated Waste Site	Pipeline Number(s)	Pipe Material at Sampling Location	Interior Pipe Sampling Locations [Sample Identification Numbers in Brackets]			Exterior Soil Sampling Locations Sample Identification Numbers in Brackets]		Comments
				Pipe Location 1 (P1)	Pipe Location 2 (P2)	Pipe Location 3 (P3)	Soil Locations 1 and 2 (S1/S2)	Soil Locations 3 and 4 (S3/S4)	
5 (B5) cont.	216-B-9	200-E-195-PL (L2)		**Alternate:** At an accessible point along the 3.5-in. SS pipeline just southwest of the riser at the entry to the 216-B-9 Tile Field.	**Alternate:** At an accessible point along the 3.5-in. SS pipeline northeast of the S1/S2 exterior soil sample locations.	**Alternate:** At an accessible point along the 3.5-in. SS pipeline northeast of the Line-204 connection point (north of the unrelated 241-B-361 Settling Tank and west of the unrelated 216-B-5 Injection Well.	At the approximate midpoint of the 3.5-in. SS pipeline.	At a point on the 3.5-in. SS pipeline northeast of the Line-204 connection point where a slight change in the pipeline direction occurs (northwest of the 216-B-5 Injection Well).	All interior pipe-sampling locations will require a "dig-and-cut" approach for pipeline access, and the exact points for this internal sampling should be determined based upon clearance from nearby pipelines, structures/features, and contamination areas. This pipeline was selected as an alternate for interior pipe sampling.
				[B5L2P1] (Alt)	[B5L2P2] (Alt)	[B5L2P3] (Alt)	[B5L2S1] & [B5L2S2]	[B5L2S3] & [B5L2S4]	
			SS	3.5 in.	3.5 in.	3.5 in.	3.5 in.	3.5 in.	
	216-B-46*	200-E-114-PL (L3)		At an accessible point along the two 4-in. CS pipelines north of the B Tank Farms and just southeast of the connection point with the pipeline leading to the 216-B-51 French Drain.	At an accessible point along the two 4-in. CS pipelines east of the B Tank Farms.	At an accessible point along the two 4-in. CS pipelines just north of the BC Cribs.	At the connection point with the pipeline leading to the 216-B-51 French Drain (north of B Tank Farm) where the two 4-in. Stl. pipelines change direction ~45° and where a contamination area occurs that is potentially associated with this pipeline.	At a point (northeast of B Tank Farm) where the two 4-in. Stl. pipelines change direction ~30° and where a contamination area occurs that is potentially associated with this pipeline.	All interior pipe-sampling locations will require a "dig-and-cut" approach for pipeline access, and the exact points for this internal sampling should be determined based upon clearance from nearby pipelines, structures/features, and contamination areas. Sampling locations P1 and S1/S2 are located at or very near to the lowest elevation point of this pipeline. * NOTE: Because of its complex operational history, the 200-E-114-PL Pipeline can be associated with many liquid-waste disposal sites. The 216-B-46 Crib was selected as a disposal site that received the same waste stream as this pipeline.
				[B5L3P1]	[B5L3P2]	[B5L3P3]	[B5L3S1] & [B5L3S2]	[B5L3S3] & [B5L3S4]	
			CS	4 in. (x2)	4 in. (x2)	4 in. (x2)	4 in. (x2)	4 in. (x2)	

Pipe Types:
CI = cast iron.
CM = corrugated metal.
CS = carbon metal.
FRE = fiberglass-reinforced epoxy.
M-35 = carbon steel.
SS = stainless steel.
Stl = steel.

Other Abbreviations:
~ = approximately.
° = degree(s).
DP = diversion pit.
MH = manhole.
N/A = not applicable.
PUREX = Plutonium-Uranium Extraction Plant.
SP = sampler pit.
SST = single-shell tank.
VC = vitrified clay.
x2 = two pipes.

1

Figure A-5. Sample Location Map for the 200-E-192-PL Pipeline.

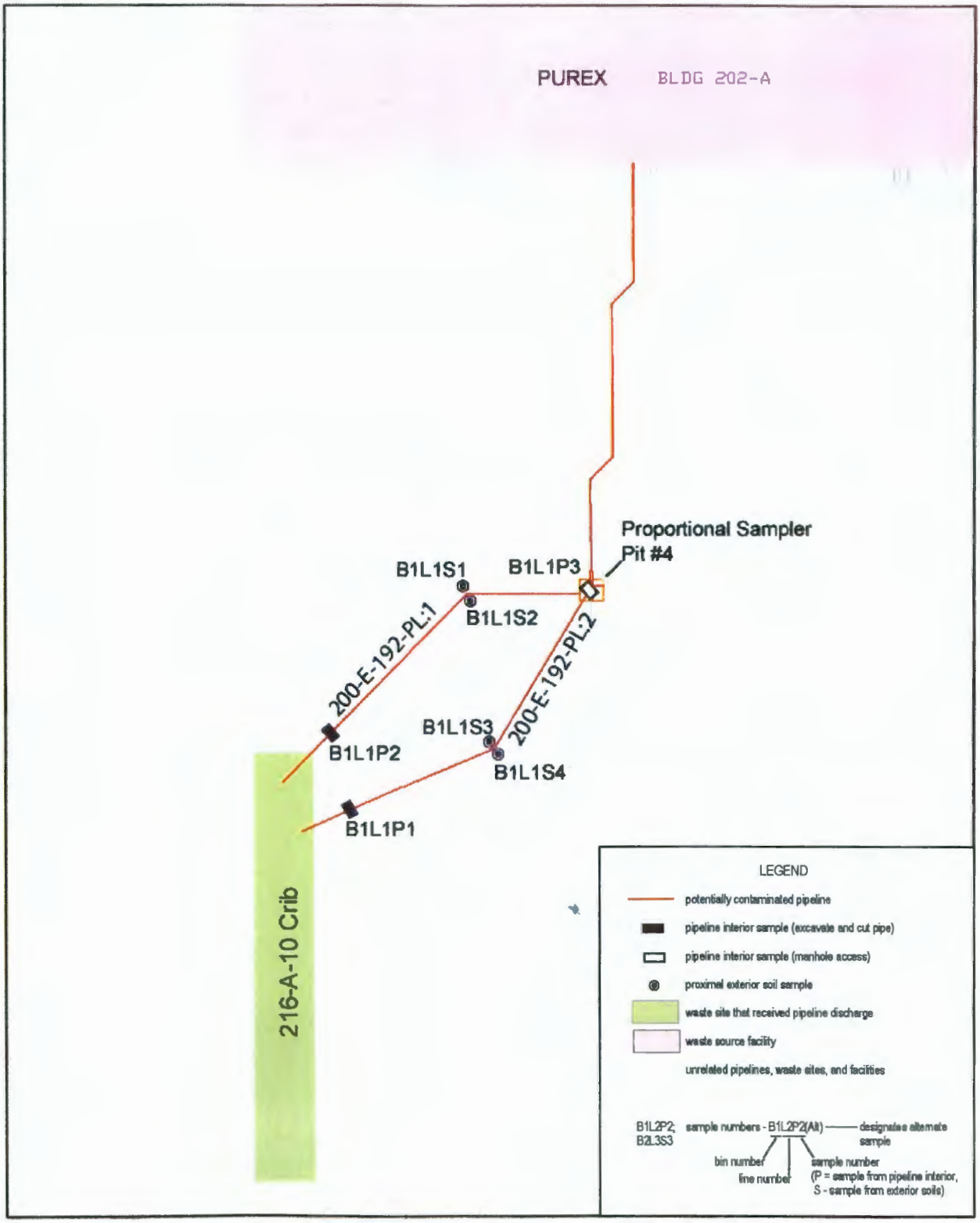


Figure A-6. Sample Location Map for the 200-W-174-PL Pipeline.

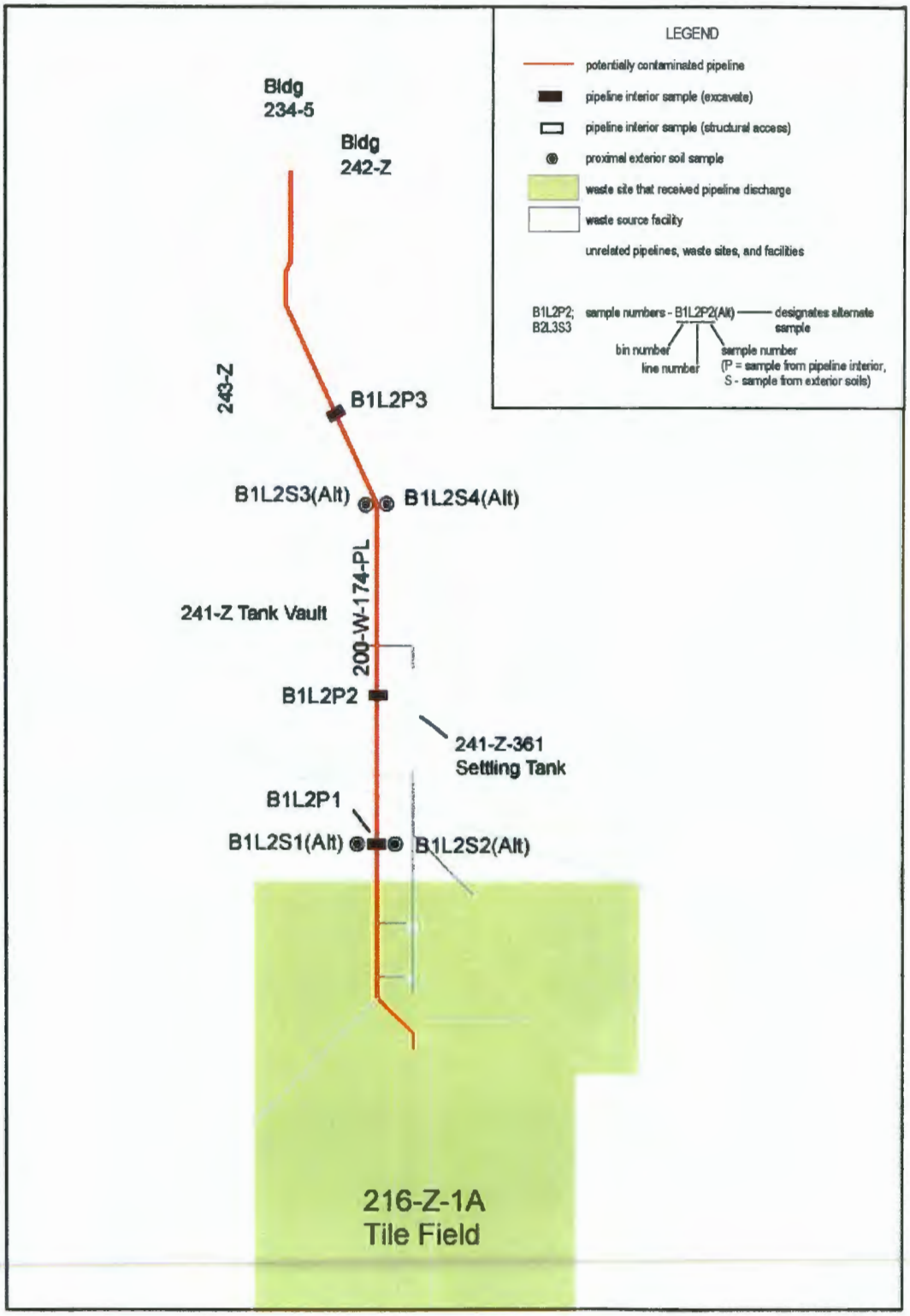


Figure A-7. Sample Location Map for the 200-E-160-PL and 200-E-162-PL Pipelines.

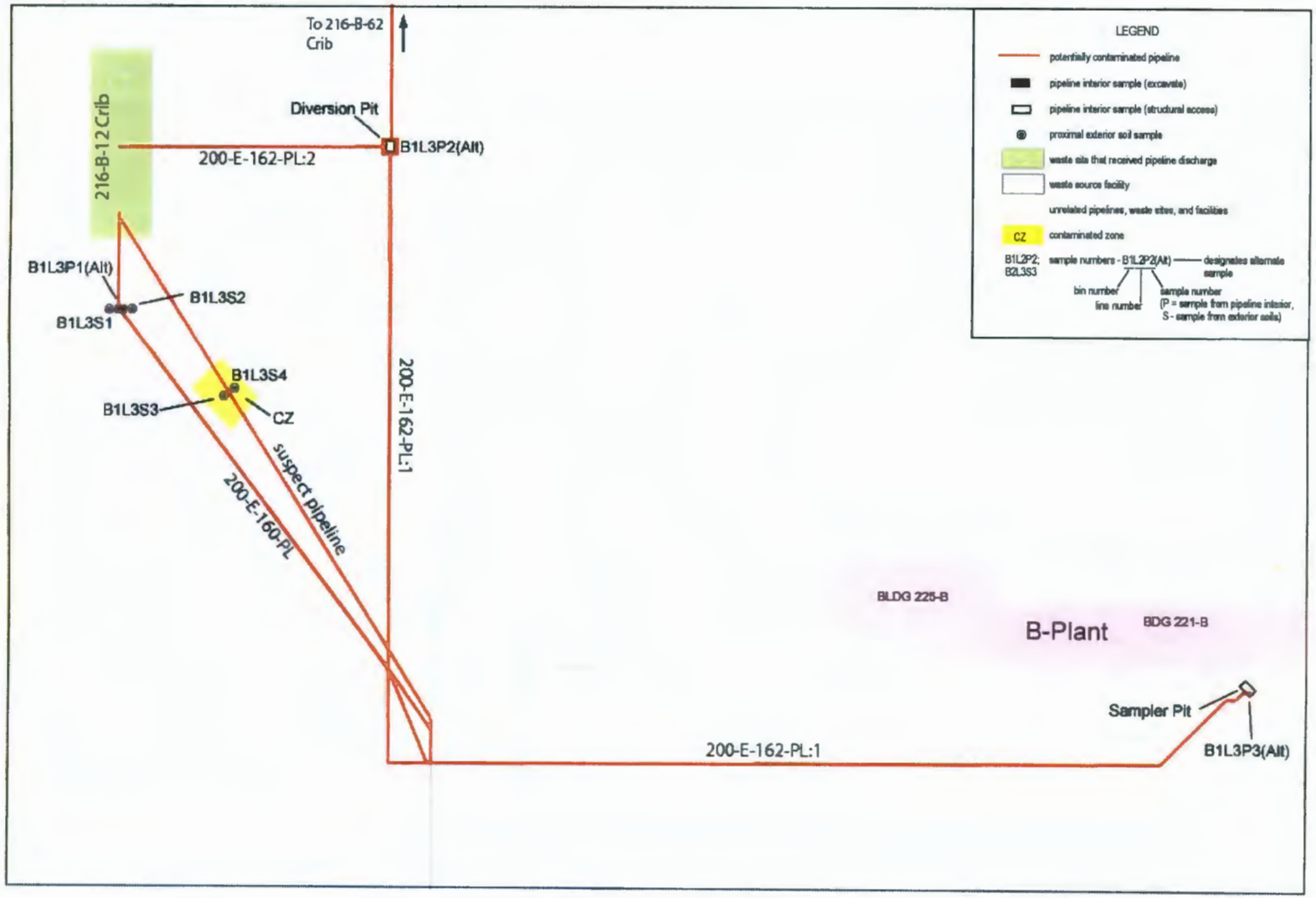


Figure A-8. Sample Location Map for the 200-E-112-PL Pipeline.

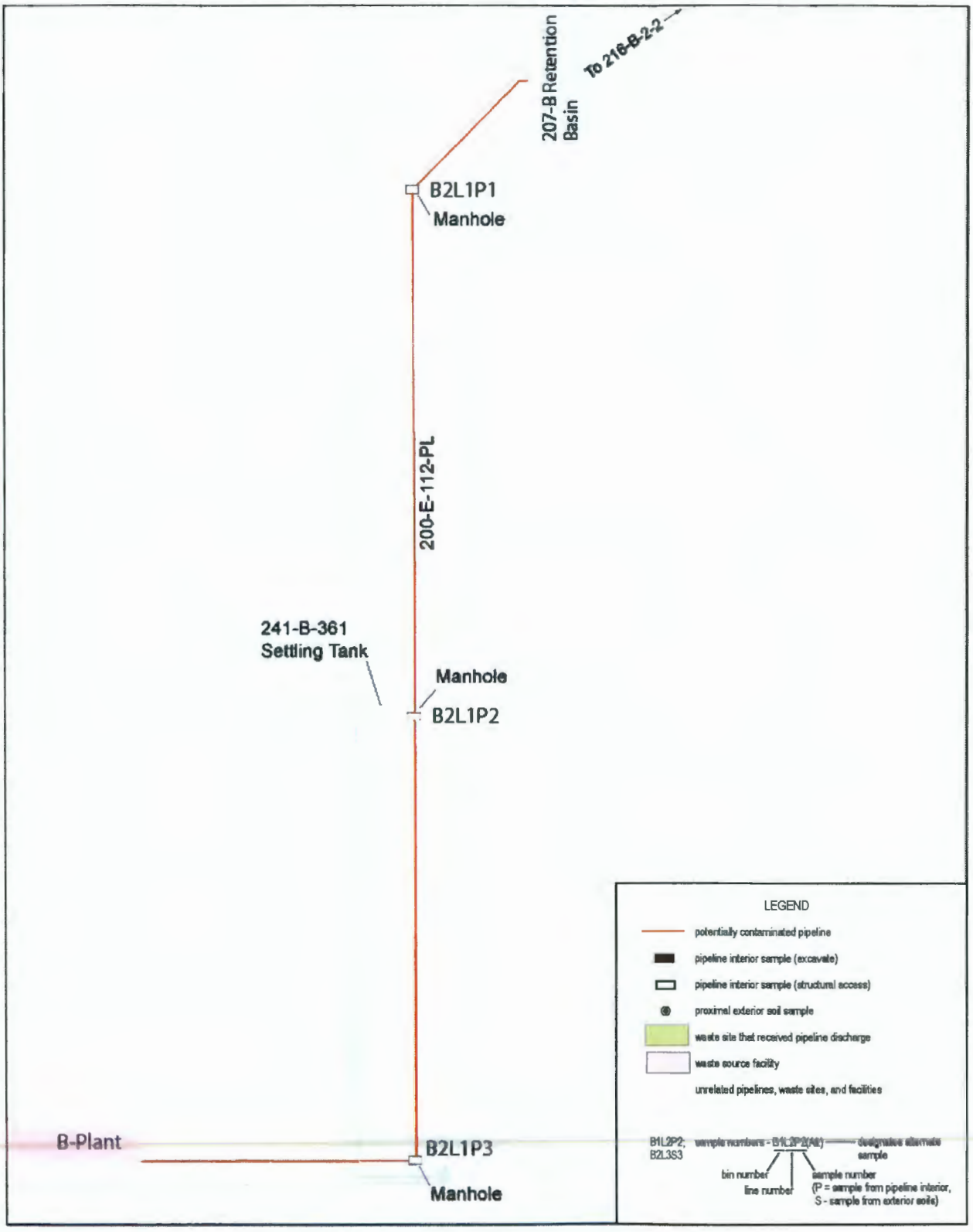


Figure A-9a. Sample Location Map for the 200-E-127-PL Pipeline. (Page 1 of 3)

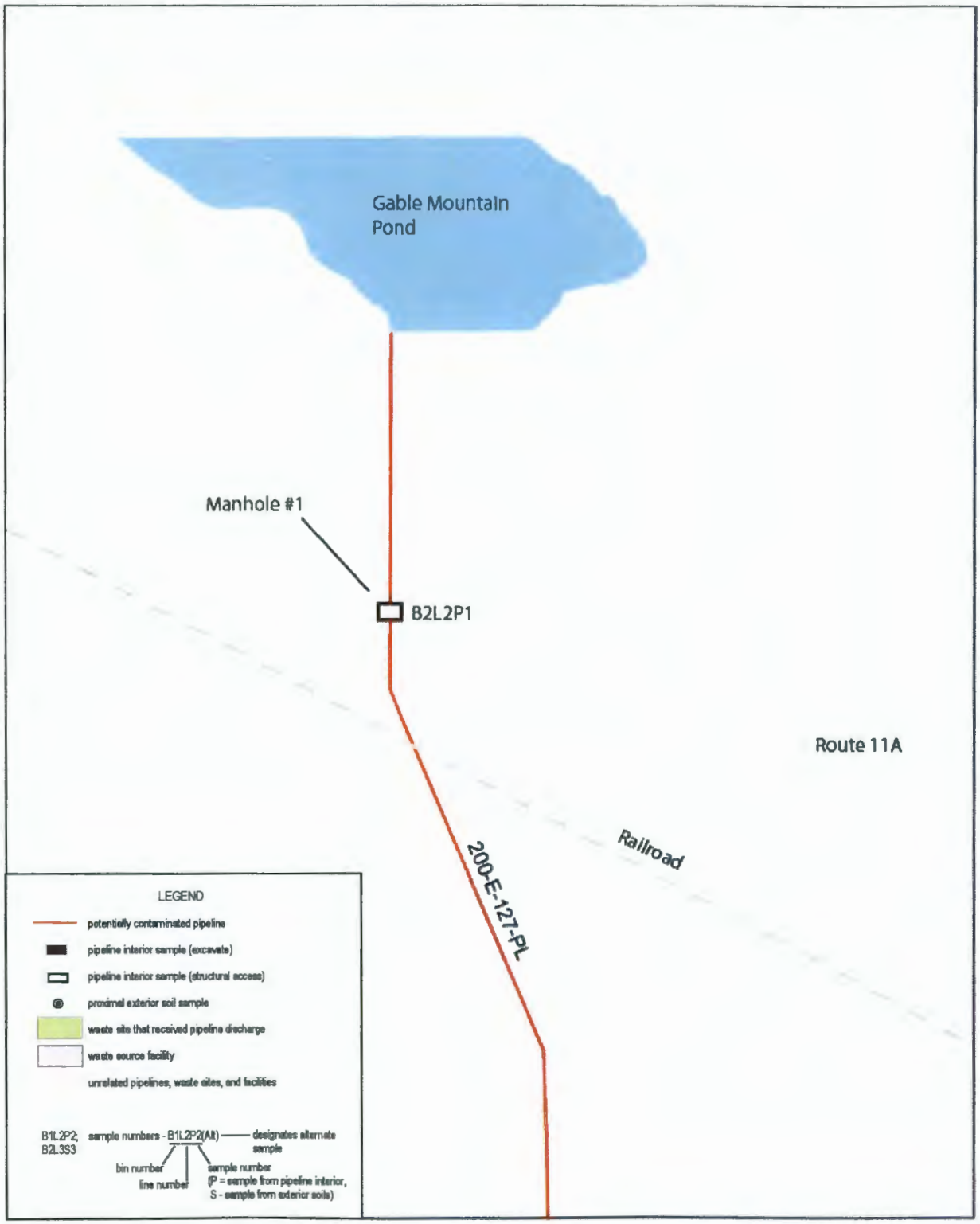


Figure A-9b. Sample Location Map for the 200-E-127-PL Pipeline. (Page 2 of 3)

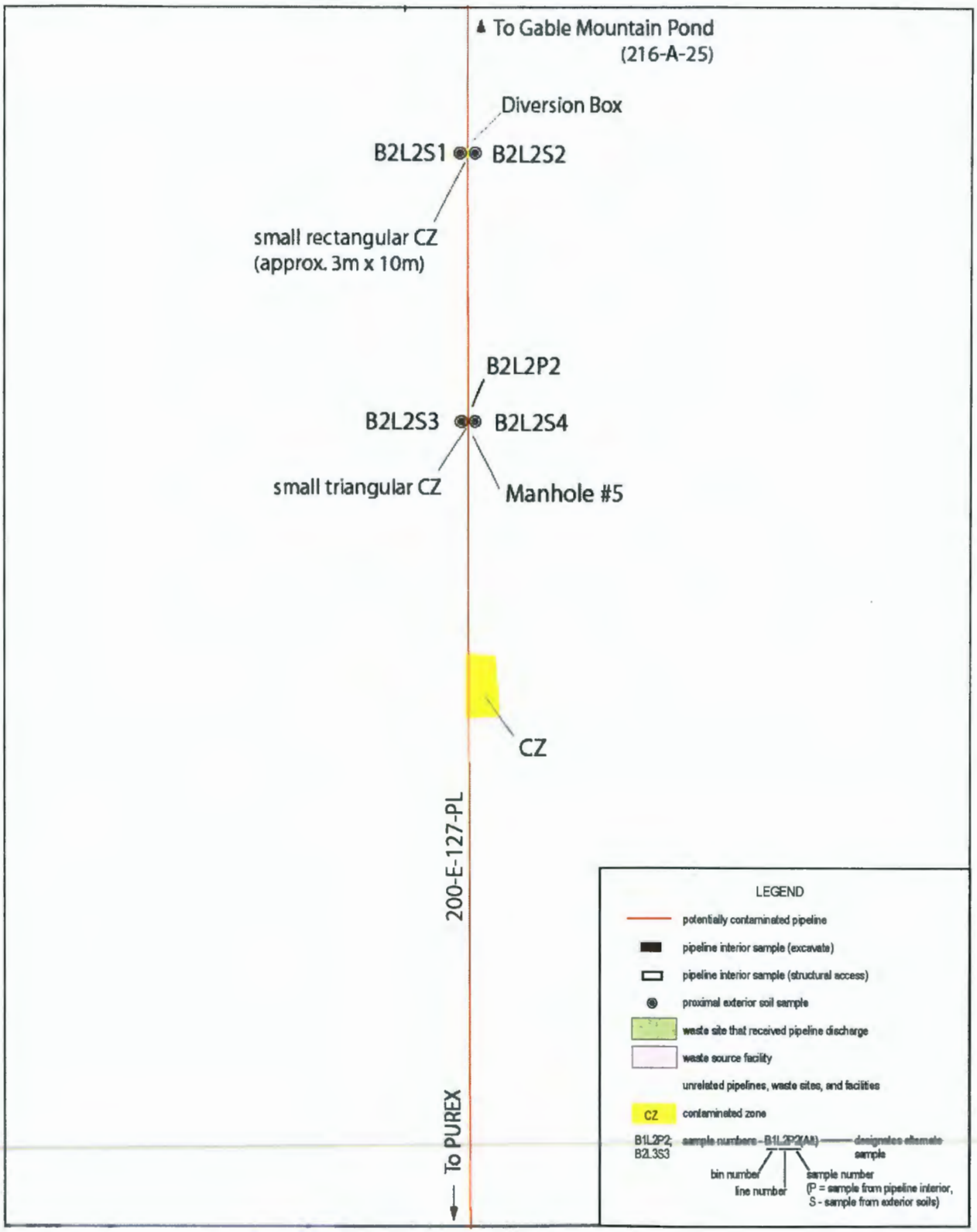


Figure A-9c. Sample Location Map for the 200-E-127-PL Pipeline. (Page 3 of 3)

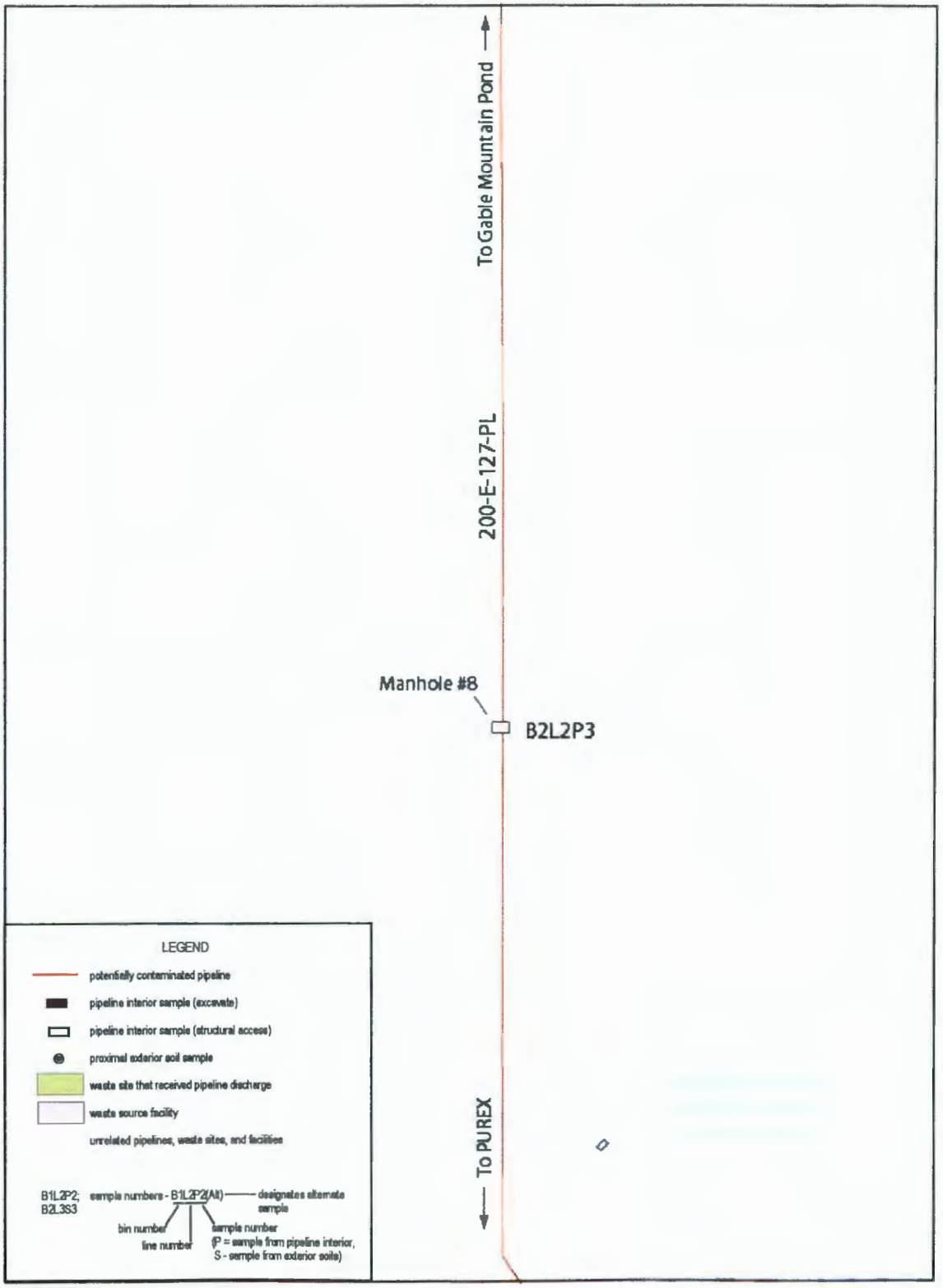


Figure A-10. Sample Location Map for the 200-E-113-PL Pipeline.

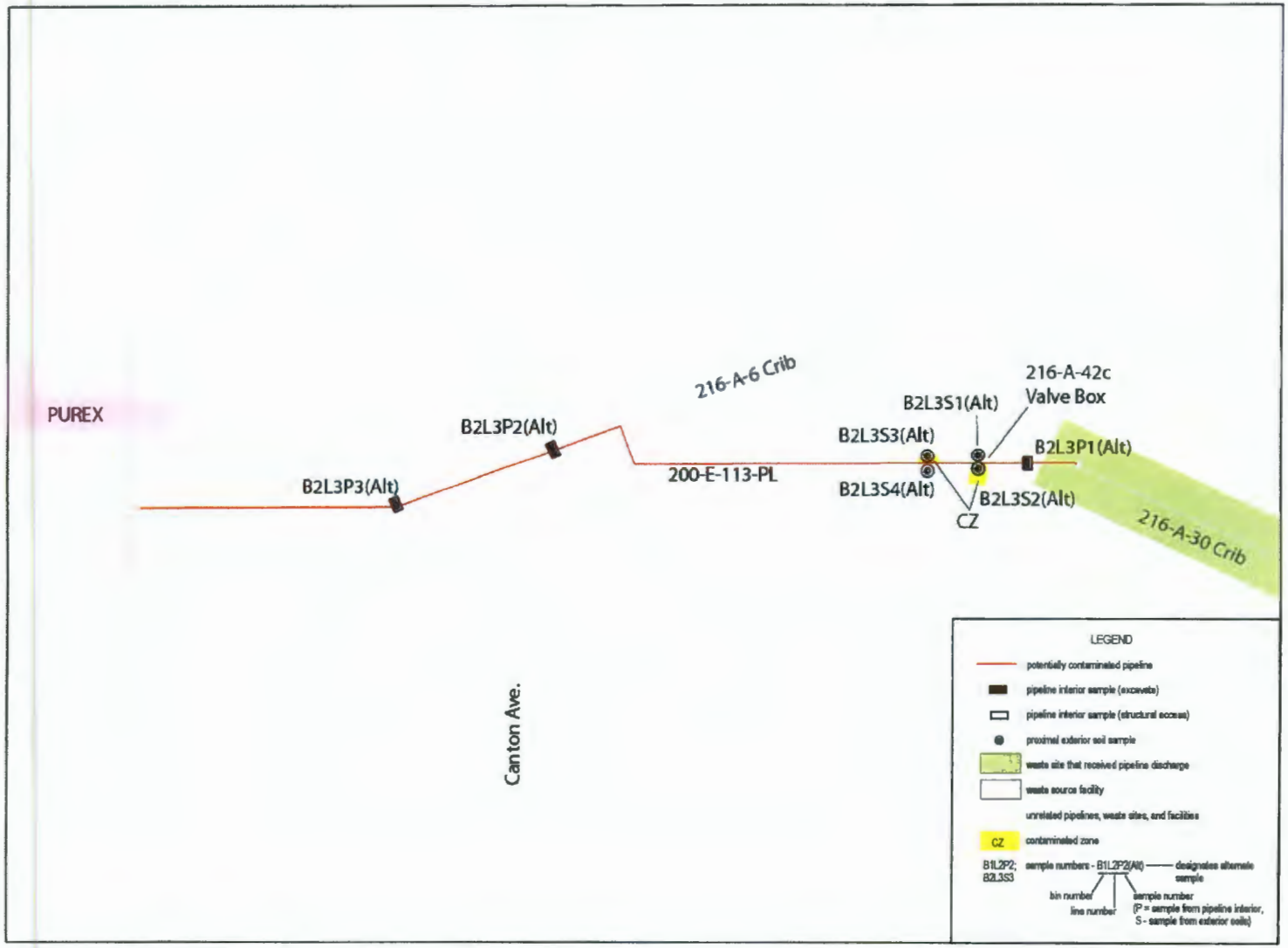


Figure A-11. Sample Location Map for the 200-W-79-PL Pipeline.

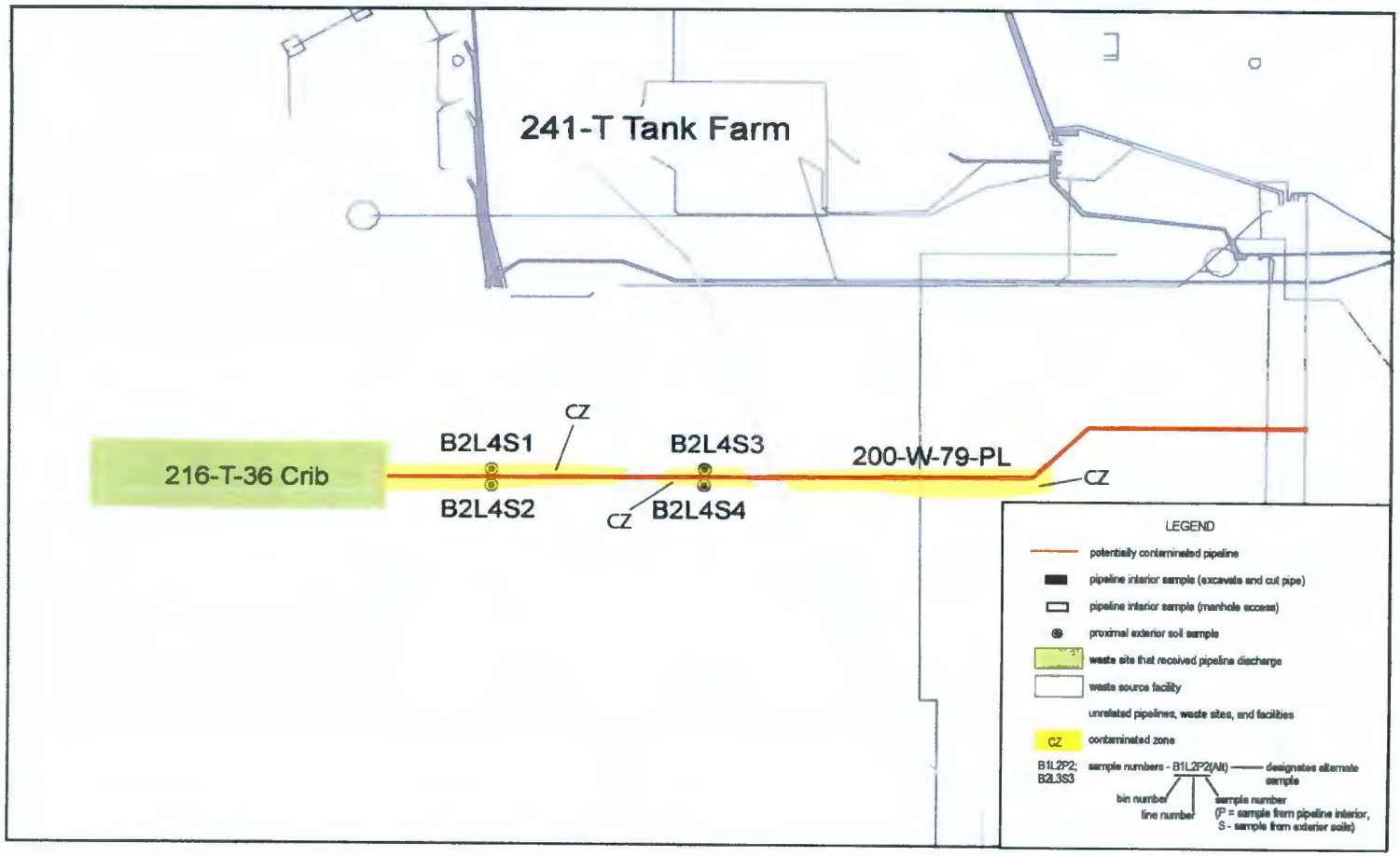


Figure A-12. Sample Location Map for the 200-E-187-PL Pipeline.

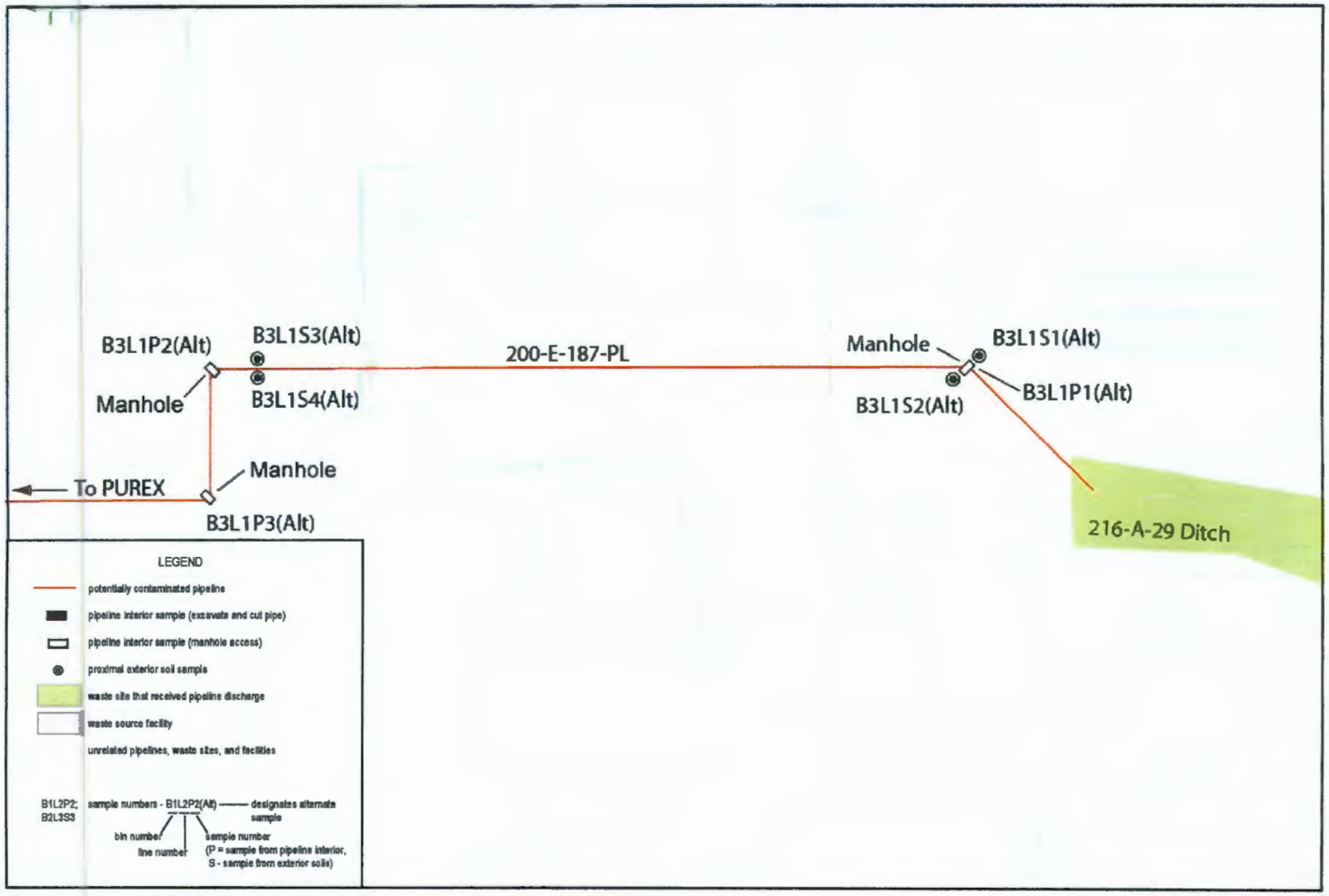


Figure A-13. Sample Location Map for the 200-W-157-PL Pipeline.

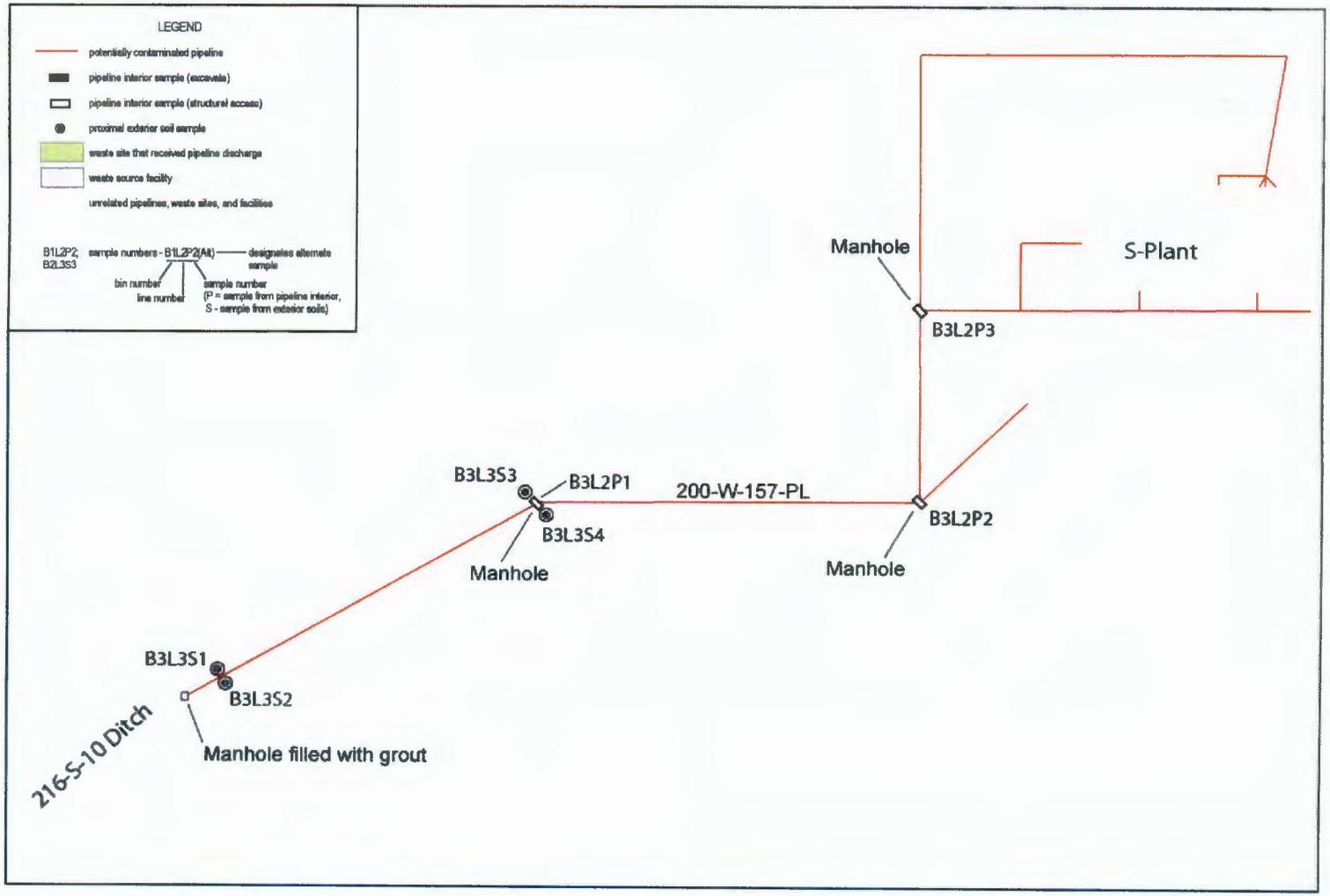


Figure A-14. Sample Location Map for the 200-E-188-PL Pipeline.

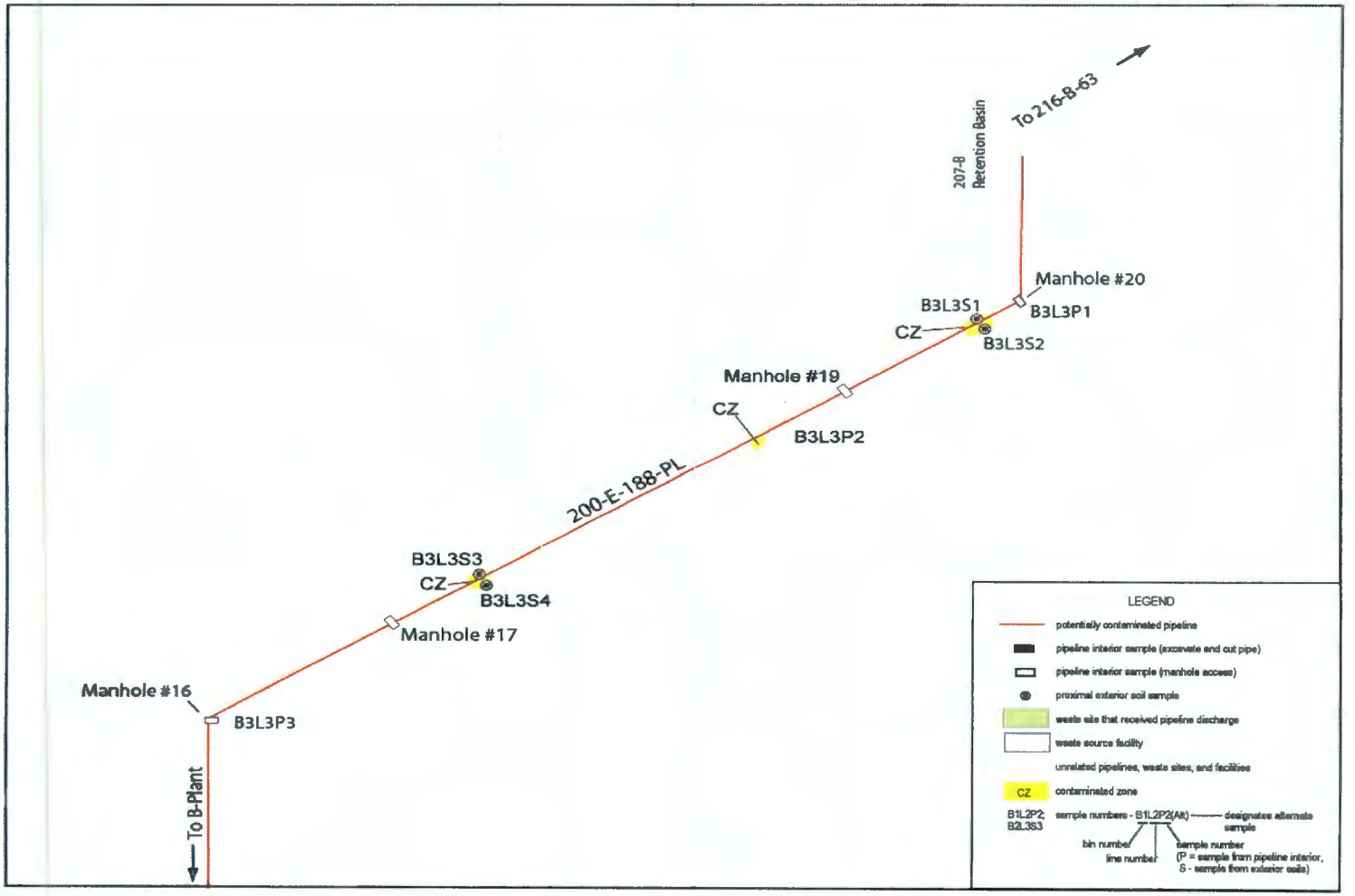


Figure A-15. Sample Location Map for the 200-W-173-PL Pipeline.

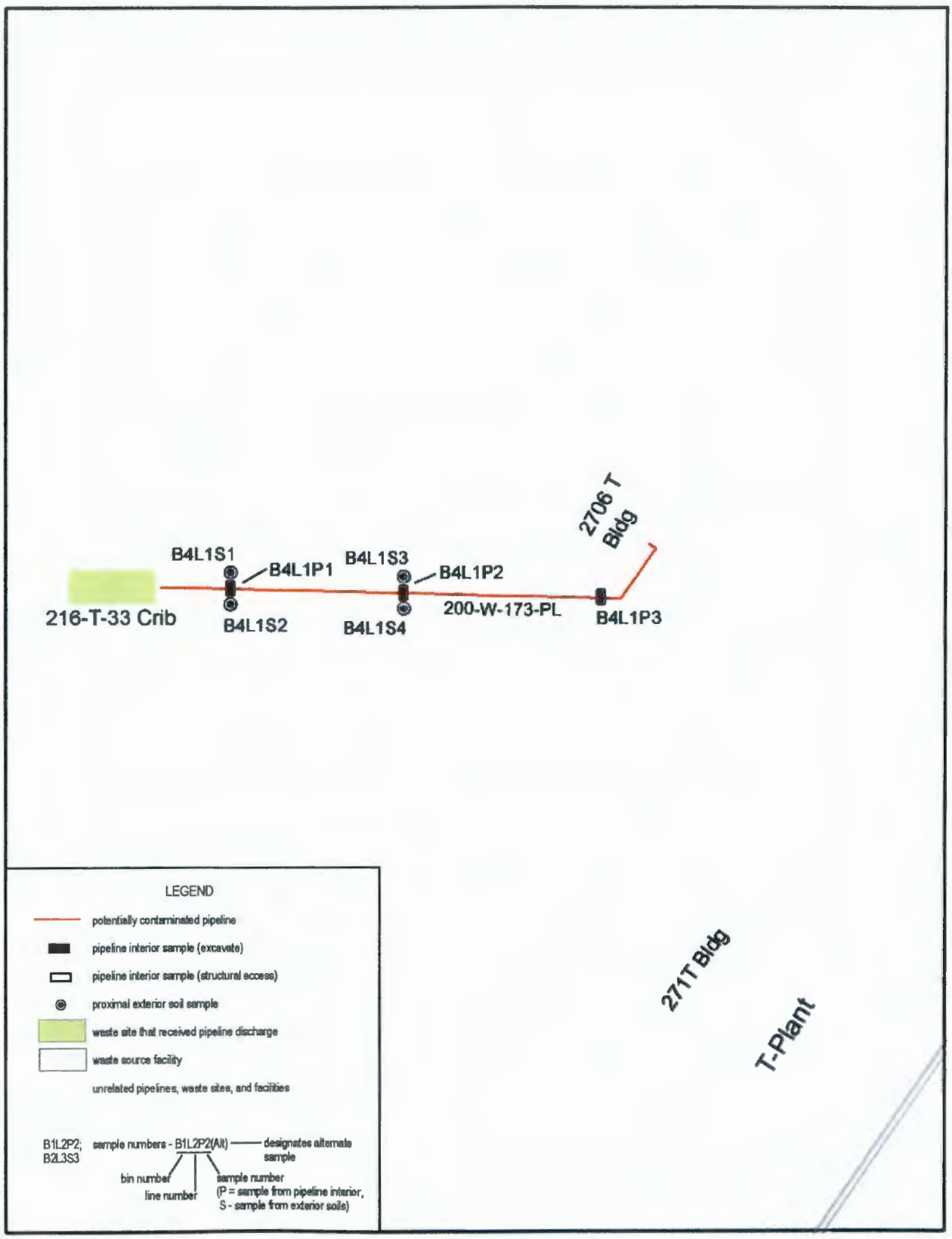


Figure A-16. Sample Location Map for the 200-E-193-PL Pipeline.

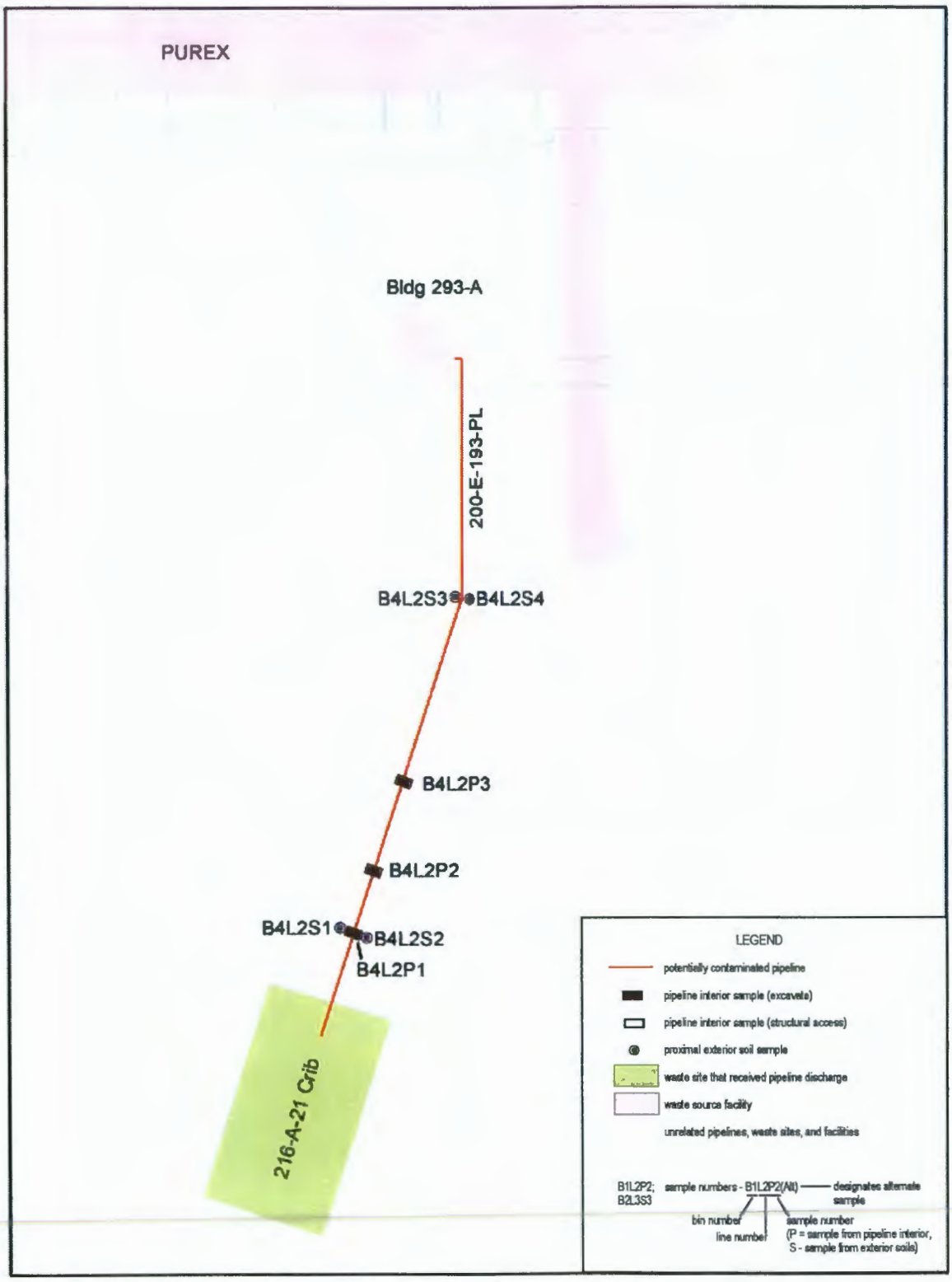


Figure A-17. Sample Location Map for the 200-E-194-PL Pipeline.

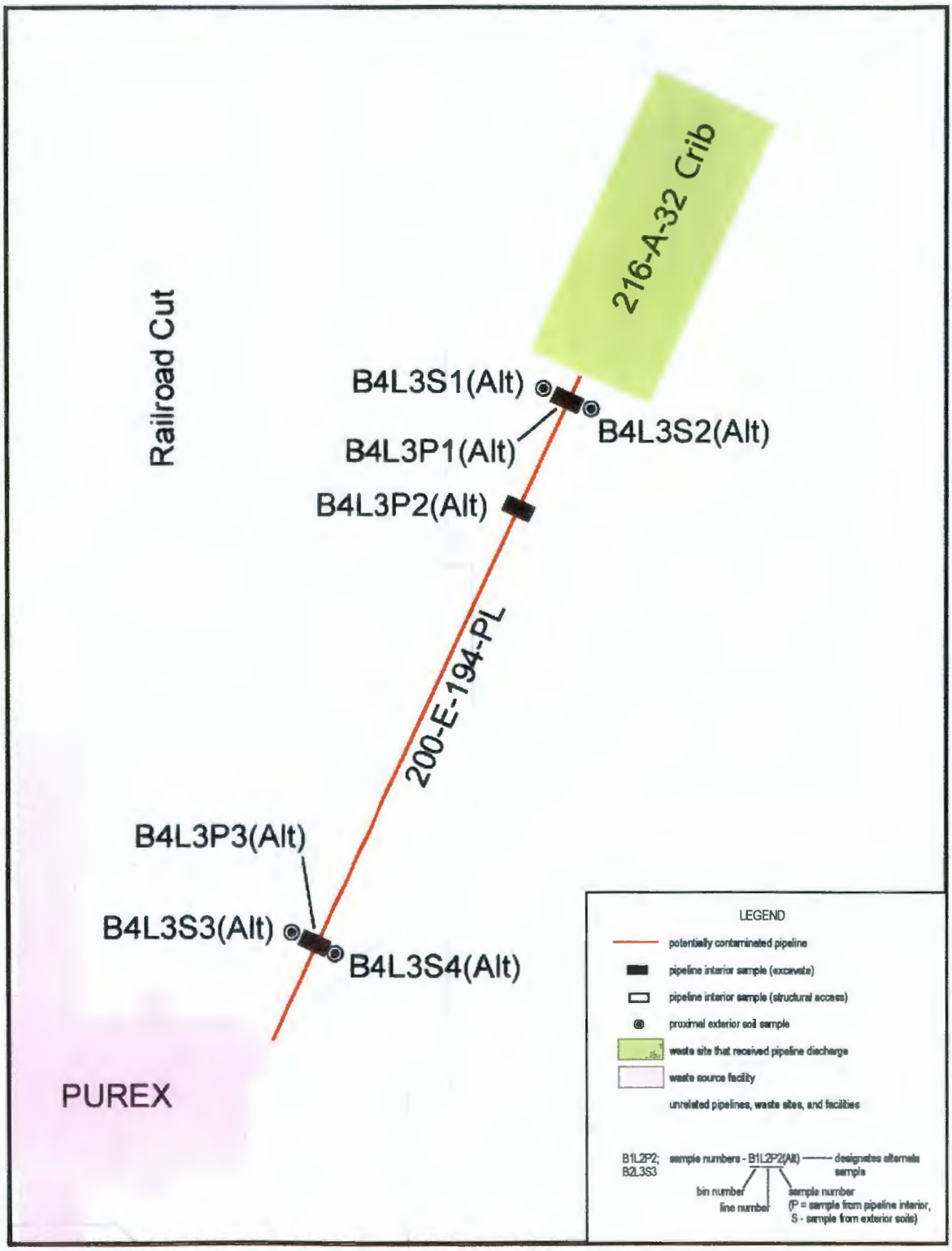


Figure A-18. Sample Location Map for the 200-W-175-PL Pipeline.

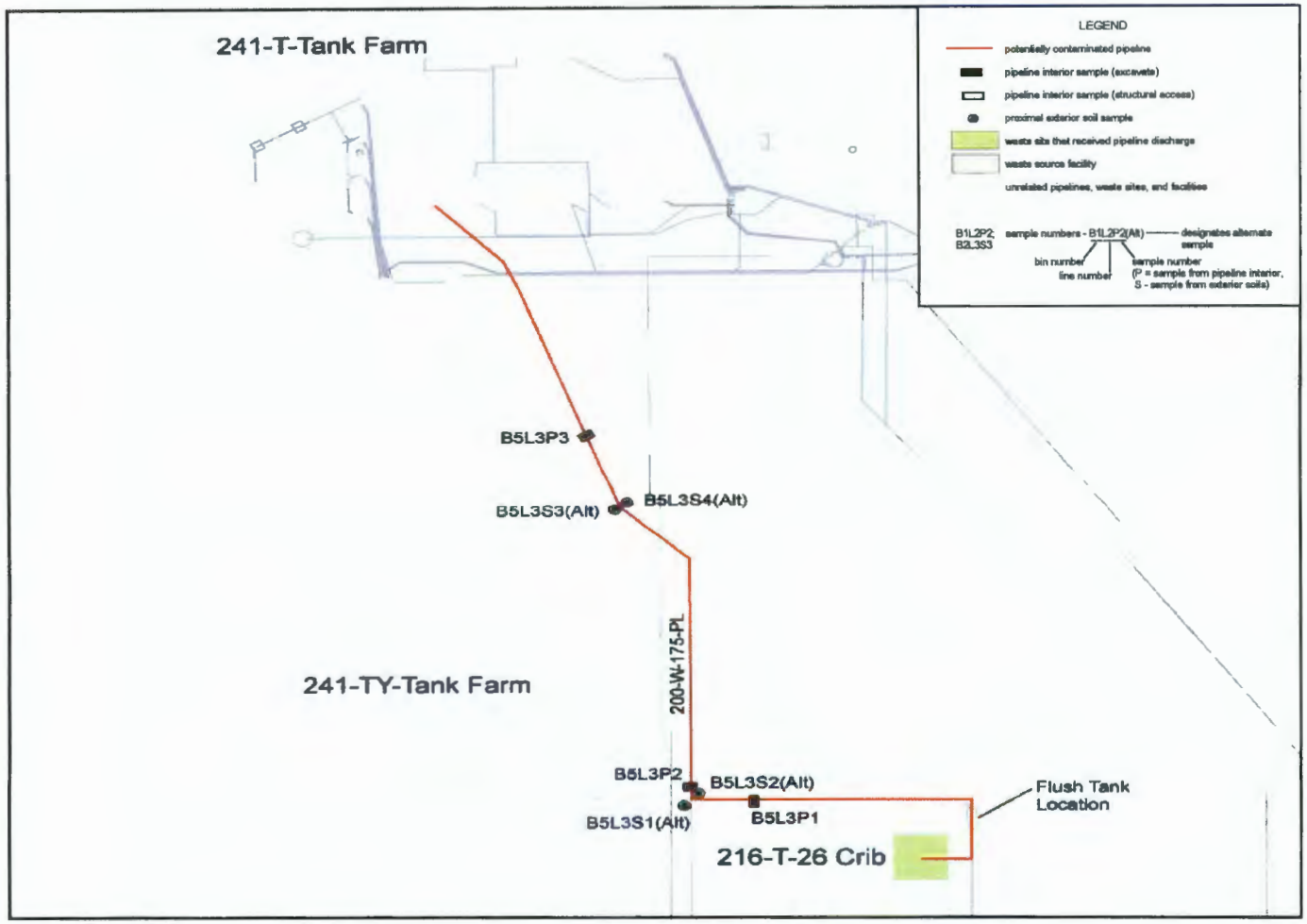


Figure A-19. Sample Location Map for the 200-E-195-PL Pipeline.

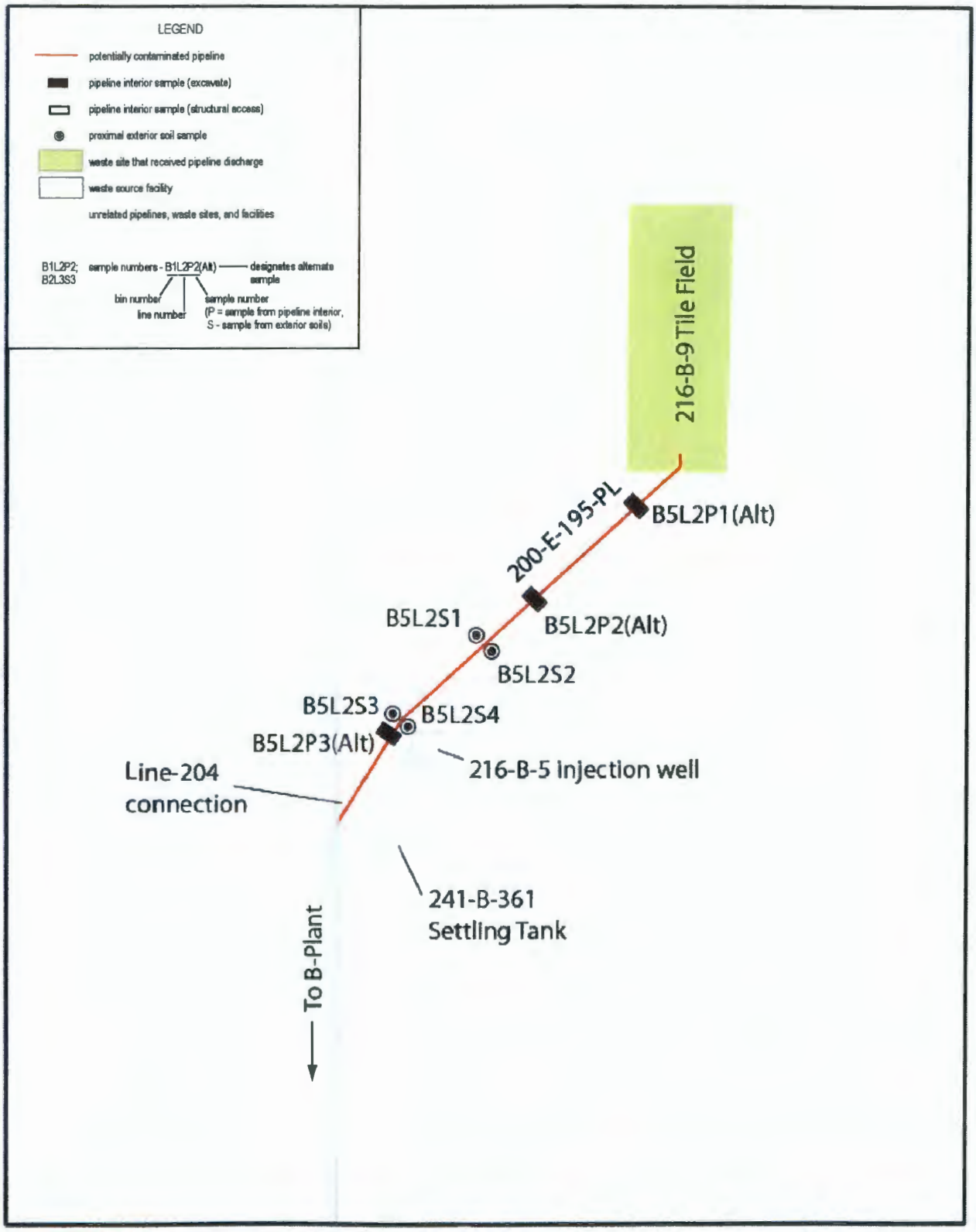


Figure A-20. Sample Location Map for the Northern Portion of the 200-E-114-PL Pipeline.

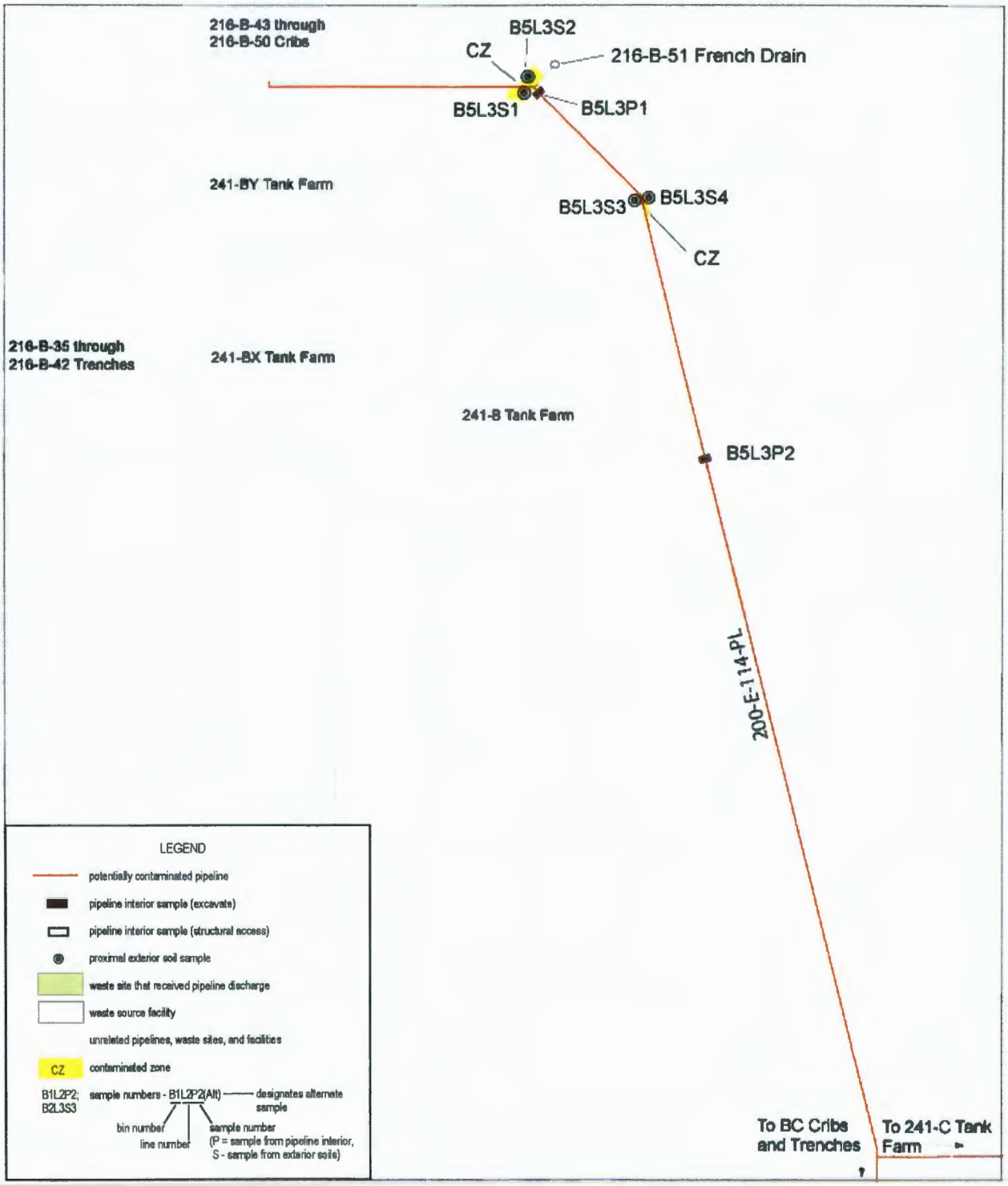
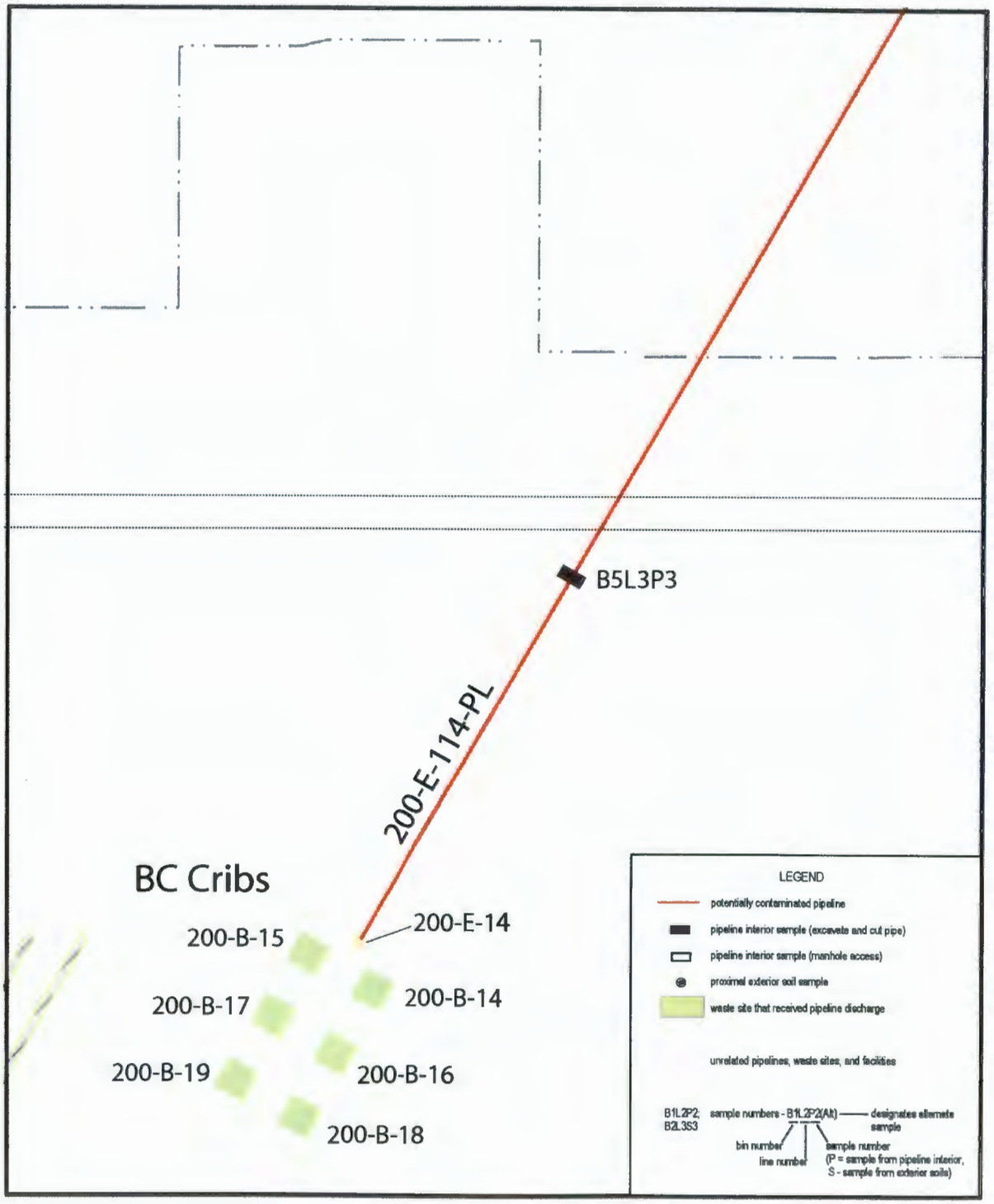


Figure A-21. Sample Location Map for the Southern Portion of the 200-E-114-PL Pipeline.



A2.2.2.5 Summary of Sampling Activities and Sample Numbers

Table A-11 provides a tabulation of all the investigative activities and number of samples to be collected at the primary-pipeline sample locations. Table A-12 lists alternate locations where investigative activities can be completed and samples collected if primary locations are not accessible. The field-screening analyses to be conducted for each pipeline are provided in Table A-13.

A2.2.2.6 Field Quality-Control Sample Requirements

Table A-14 lists the number of field QC samples that will be collected. As noted previously, because of the likely limited quantity of sample material available within the pipelines, these QC specifications may not be attainable.

A2.2.2.7 Sample Identification

The *Sample Data Tracking* database will be used to track the samples from the point of collection through the collection and laboratory-analysis process. The HEIS database is the repository for the laboratory analytical results. The HEIS sample numbers will be issued to the sampling organization for this project in accordance with onsite organizational procedures. Each radiological/nonradiological and physical-properties sample will be identified and labeled with a unique HEIS sample number. The sample location, depth, and corresponding HEIS numbers will be documented in the sampler's field logbook.

Each sample container will be labeled with the following information, using a waterproof marker on firmly affixed water-resistant labels:

- Sampling Authorization Form
- HEIS number
- Sample collection date and time
- Name or initials of person collecting the sample
- Analysis required
- Preservation method (if applicable).

Soil-gas measurements will be assigned a unique HEIS sample number. The HEIS number, collection location, and depth will be documented in the sampler's field logbook.

Table A-11. Summary of Activities at All Pipeline Sample Locations. (3 Pages)

Bin	Waste Site	Pipeline Number(s)	Sampling Location	Pipeline Interior Access Type	Surrounding Soils Sampling	Number of Direct-Push Locations for Radiological Logging[a]	Interior Pipe Sampling Activities			Exterior Soil Sampling Activities		
							Number of Test Pits to Evaluate Pipeline[a]	Number of Field Screening Samples to Evaluate Pipe Interior[a]	Number of Pipeline Interior Samples for Laboratory Analysis[a]	Number of Direct-Push Locations for Soil Sampling[a]	Number of Driven Soil Samples for Field Screening[a]	Number Driven Soil Samples for Laboratory Analysis[a]
1 (B1)	216-A-10	200-E-192-PL:1, 200-E-192-PL:2 (L1)	P1	test pit	--	2	1	1	1	--	--	--
			P2	test pit	--	2	1	1	1	--	--	--
			P3	sampler pit	--	none	none	1	1	--	--	--
			S1	--	X	1	--	--	--	1	4	1
			S2	--	X	1	--	--	--	1	4	1
			S3	--	X	1	--	--	--	1	4	1
			S4	--	X	1	--	--	--	1	4	1
	216-Z-1A	200-W-174-PL (L2)	P1[b]	test pit	--	2	1	1	1	--	--	--
			P2	test pit	--	2	1	1	1	--	--	--
			P3	test pit	--	2	1	1	1	--	--	--
			S1 (Alternate)[b]	--	X	See Table A-12.						
			S2 (Alternate)[b]	--	X							
			S3 (Alternate)	--	X							
			S4 (Alternate)	--	X							
	216-B-12	200-E-160-PL, 200-E-162-PL:1, 200-E-162-PL:2 (L3)	P1 (Alternate)[b]	test pit	--	See Table A-12						
			P2 (Alternate)	diversion pit	--							
			P3 (Alternate)	sampler pit	--							
			S1[b]	--	X	1	--	--	--	1	4	1
			S2[b]	--	X	1	--	--	--	1	4	1
			S3	--	X	1	--	--	--	1	4	1
			S4	--	X	1	--	--	--	1	4	1
2 (B2)	216-B-2-2	200-E-112-PL (L1)	P1	manhole	--	none	none	1	1	--	--	--
			P2	manhole	--	none	none	1	1	--	--	--
			P3	manhole	--	none	none	1	1	--	--	--
	216-A-25	200-E-127-PL (L2)	P1	manhole	--	none	none	1	1	--	--	--
			P2[d]	manhole	--	none	none	1	1	--	--	--
			P3	manhole	--	none	none	1	1	--	--	--
			S1	--	X	1	--	--	--	1	4	1
			S2	--	X	1	--	--	--	1	4	1
			S3[d]	--	X	1	--	--	--	1	4	1
			S4[d]	--	X	1	--	--	--	1	4	1
	216-A-30	200-E-113-PL (L3)	P1 (Alternate)	test pit	--	See Table A-12						
			P2 (Alternate)	test pit	--							
			P3 (Alternate)	test pit	--							
			S1 (Alternate)	--	X							
			S2 (Alternate)	--	X							
			S3 (Alternate)	--	X							
			S4 (Alternate)	--	X							
	216-T-36	200-W-79-PL (L4)	S1	--	X	1	--	--	--	1	4	1
			S2	--	X	1	--	--	--	1	4	1
			S3	--	X	1	--	--	--	1	4	1
			S4	--	X	1	--	--	--	1	4	1

Table A-11. Summary of Activities at All Pipeline Sample Locations. (3 Pages)

Bin	Waste Site	Pipeline Number(s)	Sampling Location	Pipeline Interior Access Type	Surrounding Soils Sampling	Number of Direct-Push Locations for Radiological Logging[a]	Interior Pipe Sampling Activities			Exterior Soil Sampling Activities		
							Number of Test Pits to Evaluate Pipeline[a]	Number of Field Screening Samples to Evaluate Pipe Interior[a]	Number of Pipeline Interior Samples for Laboratory Analysis[a]	Number of Direct-Push Locations for Soil Sampling[a]	Number of Driven Soil Samples for Field Screening[a]	Number Driven Soil Samples for Laboratory Analysis[a]
3 (B3)	216-A-29	200-E-187-PL (L1)	P1 (Alternate)[b]	manhole	--	See Table A-12						
			P2 (Alternate)	manhole	--							
			P3 (Alternate)	manhole	--							
			S1 (Alternate)[b]	--	X							
			S2 (Alternate)[b]	--	X							
			S3 (Alternate)	--	X							
			S4 (Alternate)	--	X							
	216-S-10	200-W-157-PL (L2)	P1[c]	manhole	--	none	none	1	1	--	--	--
			P2	manhole	--	none	none	1	1	--	--	--
			P3	manhole	--	none	none	1	1	--	--	--
			S1	--	X	1	--	--	--	1	4	1
			S2	--	X	1	--	--	--	1	4	1
			S3[c]	--	X	1	--	--	--	1	4	1
			S4[c]	--	X	1	--	--	--	1	4	1
	216-B-63	200-E-188-PL (L3)	P1	manhole	--	none	none	1	1	--	--	--
			P2	manhole	--	none	none	1	1	--	--	--
			P3	manhole	--	none	none	1	1	--	--	--
			S1	--	X	1	--	--	--	1	4	1
			S2	--	X	1	--	--	--	1	4	1
			S3	--	X	1	--	--	--	1	4	1
			S4	--	X	1	--	--	--	1	4	1
4 (B4)	216-T-33	200-W-173-PL (L1)	P1[b]	test pit	--	0[b, f]	1	1	1	--	--	--
			P2[d]	test pit	--	0[d, f]	1	1	1	--	--	--
			P3	test pit	--	2	1	1	1	--	--	--
			S1[b]	--	X	1	--	--	--	1	4	1
			S2[b]	--	X	1	--	--	--	1	4	1
			S3[d]	--	X	1	--	--	--	1	4	1
			S4[d]	--	X	1	--	--	--	1	4	1
	216-A-21	200-E-193-PL (L2)	P1[b]	test pit	--	0[b, f]	1	1	1	--	--	--
			P2	test pit	--	2	1	1	1	--	--	--
			P3	test pit	--	2	1	1	1	--	--	--
			S1[b]	--	X	1	--	--	--	1	4	1
			S2[b]	--	X	1	--	--	--	1	4	1
			S3	--	X	1	--	--	--	1	4	1
			S4	--	X	1	--	--	--	1	4	1
	216-A-32	200-E-194-PL (L3)	P1 (Alternate)[b]	test pit	--	See Table A-12						
			P2 (Alternate)	test pit	--							
			P3 (Alternate)[e]	test pit	--							
			S1 (Alternate)[b]	--	X							
			S2 (Alternate)[b]	--	X							
			S3 (Alternate)[e]	--	X							
			S4 (Alternate)[e]	--	X							

Table A-11. Summary of Activities at All Pipeline Sample Locations. (3 Pages)

Bin	Waste Site	Pipeline Number(s)	Sampling Location	Pipeline Interior Access Type	Surrounding Soils Sampling	Number of Direct-push Locations for Radiological Logging[a]	Interior Pipe Sampling Activities			Exterior Soil Sampling Activities		
							Number of Test Pits to Evaluate Pipeline[a]	Number of Field Screening Samples to Evaluate Pipe Interior[a]	Number of Pipeline Interior Samples for Laboratory Analysis[a]	Number of Direct-Push Locations for Soil Sampling[a]	Number of Driven Soil Samples for Field Screening[a]	Number Driven Soil Samples for Laboratory Analysis[a]
5 (B5)	216-T-26	200-W-175-PL (L1)	P1	test pit	--	2	1	1	1	--	--	--
			P2	test pit	--	2	1	1	1	--	--	--
			P3	test pit	--	2	1	1	1	--	--	--
			S1 (Alternate)	--	X	See Table A-12						
			S2 (Alternate)	--	X							
			S3 (Alternate)	--	X							
			S4 (Alternate)	--	X							
	216-B-9	200-E-195-PL (L2)	P1 (Alternate)	test pit	--	See Table A-12.						
			P2 (Alternate)	test pit	--							
			P3 (Alternate)	test pit	--							
			S1	--	X	1	--	--	--	1	4	1
			S2	--	X	1	--	--	--	1	4	1
			S3	--	X	1	--	--	--	1	4	1
			S4	--	X	1	--	--	--	1	4	1
	216-B-46[g]	200-E-114-PL (L3)	P1	test pit	--	2	1	1	1	--	--	--
			P2	test pit	--	2	1	1	1	--	--	--
			P3	test pit	--	2	1	1	1	--	--	--
			S1	--	X	1	--	--	--	1	4	1
			S2	--	X	1	--	--	--	1	4	1
			S3	--	X	1	--	--	--	1	4	1
			S4	--	X	1	--	--	--	1	4	1
Total Numbers for Primary Sample Sites[a]						68	17	30*	30*	40	160	40

*Note – the number of samples indicated for interior pipeline sample collection is contingent on the amount of sample material available.
[a]Number of samples shown assumes that no alternative locations are selected.
[b]Pipeline sample location P1 is the same location as for soil samples S1 & S2.
[c]Pipeline sample location P1 is the same location as for soil samples S3 & S4.
[d]Pipeline sample location P2 is the same location as for soil samples S3 & S4.
[e]Pipeline sample location P3 is the same location as for soil samples S3 & S4.
[f]The direct-push locations for radiological logging that are associated with this internal pipe sample are the same as for the corresponding external soil sampling at this same general location along the pipeline.
[g]Because of its complex operational history, the 200-E-114-PL Pipeline has been associated with several liquid-waste disposal sites. The 216-B-46 Crib was selected as the best candidate for association with the northern portion of this pipeline being evaluated as part of this investigation.

-- = not applicable.

Table A-12. Summary of Activities for Alternate Sampling Locations. (2 Pages)

Bin	Waste Site	Pipeline Number	Sampling Location	Pipeline Interior Access Type	Surrounding Soils Sampling	Number of Direct-Push Locations for Radiological Logging[a]	Interior Pipe Sampling Activities			Exterior Soil Sampling Activities		
							Number of Test Pits to Evaluate Pipeline[a]	Number of Field Screening Samples to Evaluate Pipe Interior[a]	Number of Pipeline Interior Samples for Laboratory Analysis[a]	Number of Direct-Push Locations for Soil Sampling[a]	Number of Driven Soil Samples for Field Screening[a]	Number Driven Soil Samples for Laboratory Analysis[a]
1 (B1)	216-Z-1A	200-W-174-PL (L2)	S1 (Alternate)[b]	--	X	1	--	--	--	1	4	1
			S2 (Alternate)[b]	--	X	1	--	--	--	1	4	1
			S3 (Alternate)	--	X	1	--	--	--	1	4	1
			S4 (Alternate)	--	X	1	--	--	--	1	4	1
	216-B-12	200-E-160-PL, 200-E-162-PL:1, 200-E-162-PL:2 (L3)	P1 (Alternate)[c]	test pit	--	0[c, d]	1	1	1	--	--	--
			P2 (Alternate)	diversion pit	--	none	none	1	1	--	--	--
			P3 (Alternate)	sampler pit	--	none	none	1	1	--	--	--
2 (B2)	216-A-30	200-E-113-PL (L3)	P1 (Alternate)	test pit	--	2	1	1	1	--	--	--
			P2 (Alternate)	test pit	--	2	1	1	1	--	--	--
			P3 (Alternate)	test pit	--	2	1	1	1	--	--	--
			S1 (Alternate)	--	X	1	--	--	--	1	4	1
			S2 (Alternate)	--	X	1	--	--	--	1	4	1
			S3 (Alternate)	--	X	1	--	--	--	1	4	1
			S4 (Alternate)	--	X	1	--	--	--	1	4	1
3 (B3)	216-A-29	200-E-187-PL (L1)	P1 (Alternate)[e]	manhole	--	none	none	1	1	--	--	--
			P2 (Alternate)	manhole	--	none	none	1	1	--	--	--
			P3 (Alternate)	manhole	--	none	none	1	1	--	--	--
			S1 (Alternate)[e]	--	X	1	--	--	--	1	4	1
			S2 (Alternate)[e]	--	X	1	--	--	--	1	4	1
			S3 (Alternate)	--	X	1	--	--	--	1	4	1
			S4 (Alternate)	--	X	1	--	--	--	1	4	1

Table A-12. Summary of Activities for Alternate Sampling Locations. (2 Pages)

Bin	Waste Site	Pipeline Number	Sampling Location	Pipeline Interior Access Type	Surrounding Soils Sampling	Number of Direct-Push Locations for Radiological Logging[a]	Interior Pipe Sampling Activities			Exterior Soil Sampling Activities		
							Number of Test Pits to Evaluate Pipeline[a]	Number of Field Screening Samples to Evaluate Pipe Interior[a]	Number of Pipeline Interior Samples for Laboratory Analysis[a]	Number of Direct-Push Locations for Soil Sampling[a]	Number of Driven Soil Samples for Field Screening[a]	Number Driven Soil Samples for Laboratory Analysis[a]
4 (B4)	216-A-32	200-E-194-PL (L3)	P1 (Alternate)[c]	test pit	--	0[c,g]	1	1	1	--	--	--
			P2 (Alternate)	test pit	--	2	1	1	1	--	--	--
			P3 (Alternate)[f]	test pit	--	0[f,g]	1	1	1	--	--	--
			S1 (Alternate)[e]	--	X	1	--	--	--	1	4	1
			S2 (Alternate)[e]	--	X	1	--	--	--	1	4	1
			S3 (Alternate)[f]	--	X	1	--	--	--	1	4	1
			S4 (Alternate)[f]	--	X	1	--	--	--	1	4	1
5 (B5)	216-T-26	200-W-175-PL (L1)	S1 (Alternate)	--	X	1	--	--	--	1	4	1
			S2 (Alternate)	--	X	1	--	--	--	1	4	1
			S3 (Alternate)	--	X	1	--	--	--	1	4	1
			S4 (Alternate)	--	X	1	--	--	--	1	4	1
	216-B-9	200-E-195-PL (L2)	P1 (Alternate)	test pit	--	2	1	1	1	--	--	--
			P2 (Alternate)	test pit	--	2	1	1	1	--	--	--
			P3 (Alternate)	test pit	--	2	1	1	1	--	--	--
Total Numbers for Alternative Sample Sites[a]						34	10	15	15	20	80	20

[a]Number of samples shown assumes that all alternative locations are selected.
[b]Pipeline sample location P1 (see Table A-11) is the same location as for alternate soil sample locations S1 & S2.
[c]Alternate pipeline sample location P1 is the same location as for soil sample locations S1 & S2 (see Table A-11).
[d]Number of samples shown assumes that the corresponding soil sample locations (S1 & S2) for this pipeline (see Table A-11) also are selected.
[e]Alternate pipeline sample location P1 is the same location as for alternate soil sample locations S1 & S2.
[f]Alternate pipeline sample location P3 is the same location as for alternate soil sample locations S3 & S4.
[g]Number of samples shown assumes that the corresponding alternative soil sampling locations for this pipeline are also selected.

-- = not applicable.

Table A-13. Summary of Field Screening.

Bin	Associated Waste Site	Pipeline Number(s)	Nonradiological Screening Target Constituents							Radiological Screening Target Constituents		
			Hexavalent Chromium	Mercury	Nitrate (NO_3)	Poly-chlorinated Biphenyls[a]	Polyaromatic Hydro-carbons[b] (SVOCs)	Volatile Organic Compounds	Hydro-carbons[c]	Am-241	Pu-239/ 240	Cs-137
1	216-A-10	200-E-192-PL:1, 200-E-192-PL:2	--	--	--	--	✔	✔	✔	✔	✔	✔
	216-Z-1A	200-W-174-PL	✔	--	✔	--	✔	✔	--	✔	✔	✔
	216-B-12	200-E-160-PL, 200-E-162-PL:1, 200-E-162-PL:2	✔	--	✔	✔	✔	--	--	✔	✔	✔
2	216-B-2-2	200-E-112-PL	--	✔	✔	✔	✔	✔	✔	✔	✔	✔
	216-A-25	200-E-127-PL	✔	--	✔	--	✔	✔	--	✔	✔	✔
	216-A-30	200-E-113-PL	✔	--	✔	--	✔	✔	--	--	✔	✔
	216-T-36	200-W-79-PL	✔	--	✔	--	--	✔	--	--	✔	✔
3	216-A-29	200-E-187-PL	✔	✔	✔	✔	✔	✔	--	✔	✔	✔
	216-S-10	200-W-157-PL	✔	✔	✔	✔	✔	✔	--	✔	✔	✔
	216-B-63	200-E-188-PL	✔	--	✔	✔	--	✔		✔		✔
4	216-T-33	200-W-173-PL	✔	--	✔	✔	--	✔	✔	✔	✔	✔
	216-A-21	200-E-193-PL	--	--	✔	--	✔	✔	--	✔	✔	✔
	216-A-32	200-E-194-PL	✔	--	✔	--	✔	✔	--	✔	✔	✔
5	216-T-26	200-W-175-PL	✔	--	✔	--	✔	✔	--	✔	✔	✔
	216-B-9	200-E-195-PL	✔	--	✔	--	--	✔	--	✔	✔	✔
	216-B-46[d]	200-E-114-PL	✔	--	✔	--	✔	--	--	✔	✔	✔

[a]Method is aroclor specific; Aroclor-1254 is tested for because it was the most frequently detected aroclor. Aroclor is an expired trademark.
[b]A subgroup of SVOCs; includes most of the SVOCs reported in Table ATT-2.
[c]Total petroleum hydrocarbons; results reported in a prespecified range; used for identification of kerosene or diesel products.
[d]Because of its complex operational history, the 200-E-114-PL Pipeline has been associated with many liquid-waste disposal sites. The 216-B-46 Crib was selected as the best candidate for association with the northern portion of this pipeline being evaluated as part of this investigation.

-- = not applicable.
✔ = applicable screening method.
SVOC = semivolatile organic compound.

Table A-14. Summary of Field Quality Control Samples for Laboratory Analysis.

Bin	Associated Pipeline Number(s)	Field Duplicates	Field Splits	Equipment Rinsate Blanks	Field Blanks
1	200-E-192-PL, 200-W-174-PL, 200-E-160-PL, and 200-162-PL	1	1	1	1
2	200-E-112-PL, 200-E-127-PL, 200-E-113-PL, and 200-W-79-PL	1	1	1	1
3	200-E-187-PL, 200-W-157-PL, and 200-E-188-PL	1	1	1	1
4	200-W-173-PL, 200-E-193-PL, and 200-E-194-PL	1	1	1	1
5	200-W-175-PL, 200-E-195-PL, and 200-E-114-PL	1	1	1	1
Totals		5	5	5	5

A2.2.2.8 Field-Sampling Logbook

All information pertinent to field sampling and analysis will be recorded in field checklists and bound logbooks in accordance with existing sample-collection protocols. The sampling team will be responsible for recording all relevant sampling information. Entries made in the logbook will be dated and signed by the individual who made the entry. Program requirements for managing the generation, identification, transfer, protection, storage, retention, retrieval, and disposition of records within the Project Hanford Management Contract will be followed.

A2.2.2.9 Sample Custody

Sample custody will be maintained in accordance with existing Hanford Site protocols. The custody of samples will be maintained from the time the samples are collected until the ultimate disposal of the samples, as appropriate. A chain-of-custody record will be initiated in the field at the time of sampling and will accompany each set of samples shipped to any laboratory. Samples will be sent to the laboratory in accordance with applicable shipping procedures. The analyses requested for each sample will be indicated on the accompanying Chain-of-Custody Form. Custody tape will be used to provide indication of tampering with the samples. The custody tape will be inscribed with the sampler's initials and the date. Chain-of-custody procedures will be followed throughout sample collection, transfer, analysis, and disposal to ensure that sample integrity is maintained. Each time the responsibility changes for the custody of the sample, the new and previous custodians will sign the record and note the date and time. The shipper will make a copy of the signed record before sample shipment and will transmit the copy to Sample and Data Management within 48 hours of shipping.

A2.2.2.10 Sample Containers and Preservatives

Level I EPA pre-cleaned sample containers will be used for soil samples collected for chemical and radiological analysis. Container sizes may vary depending on laboratory-specific volumes/requirements for meeting analytical detection limits. If, however, the dose rate on the outside of a sample jar or the curie content within the sample exceeds levels acceptable by the laboratory, smaller volumes may be sent to the laboratory after consultation with Sample and Data Management to determine the acceptable volumes.

Soil-sample preservation, containers, and holding times for radiological and nonradiological analytes are provided in Table A-15.

1

Table A-15. Sample Preservation, Container, and Holding Time Guidelines. (3 Pages)

Analytes	Matrices	Bottle		Amount Required[a,b,c] (min without lab QC to min including lab QC)	Preser-vation	Packing Require-ments	Holding Time
		Number	Type				
Radionuclides							
Americium-241	Soil/Sludge/Sediment/Scale	1	G/P	1 - 10 g	None	None	6 months
Carbon-14	Soil/Sludge/Sediment/Scale	1	G/P	1 - 10 g	None	None	6 months
Cesium-137	Soil/Sludge/Sediment/Scale	1	G/P	10 - 500 g	None	None	6 months
Cobalt-60	Soil/Sludge/Sediment/Scale						
Europium-152	Soil/Sludge/Sediment/Scale						
Europium-154	Soil/Sludge/Sediment/Scale						
Europium-155	Soil/Sludge/Sediment/Scale						
Niobium-94	Soil/Sludge/Sediment/Scale						
Radium-226	Soil/Sludge/Sediment/Scale						
Neptunium-237	Soil/Sludge/Sediment/Scale	1	G/P	1 – 10 g	None	None	6 months
Nickel-63	Soil/Sludge/Sediment/Scale	1	G/P	1 – 10 g	None	None	6 months
Plutonium-238	Soil/Sludge/Sediment/Scale	1	G/P	1 - 10 g	None	None	6 months
Plutonium-239/240	Soil/Sludge/Sediment/Scale						
Strontium-90	Soil/Sludge/Sediment/Scale	1	G/P	1 - 10 g	None	None	6 months
Technetium-99	Soil/Sludge/Sediment/Scale	1	G/P	5 - 10 g	None	None	6 months
Tritium (H-3)	Soil/Sludge/Sediment/Scale	1	G	25 - 125 g	None	None	6 months
Uranium-233/234	Soil/Sludge/Sediment/Scale	1	G/P	1 - 10 g	None	None	6 months
Uranium-235/236	Soil/Sludge/Sediment/Scale						
Uranium-238	Soil/Sludge/Sediment/Scale						
Chemicals							
IC anions, EPA Method 300.0 for nitrate and nitrite, formate, oxalate	Soil/Sludge/Sediment/Scale	1	G/P	5 - 25 g	None	Cool 4 °C	48 hours
IC anions, EPA Method 353.1 for N in nitrate/nitrite	Soil/Sludge/Sediment/Scale	1	G/P	5 - 25 g	None	Cool 4 °C	28 days
ICP metals, EPA Method 6010C ICP/MS metals, EPA Method 200.8	Soil/Sludge/Sediment/Scale	1	G/P	5 - 25 g	None	None	6 months
Chromium hex, EPA Method 7196	Soil/Sludge/Sediment/Scale	1	G/P	15 – 75 g	None	Cool 4 °C	30 days
Mercury, EPA Method 7471 (CVAA)	Soil/Sludge/Sediment/Scale	1	G	1 - 5 g	None	None	28 days
Total cyanide, EPA Method 9010	Soil/Sludge/Sediment/Scale	1	G	50 – 250 g	None	Cool 4 °C	14 days

Table A-15. Sample Preservation, Container, and Holding Time Guidelines. (3 Pages)

Analytes	Matrices	Bottle		Amount Required[a,b,c] (min without lab QC to min including lab QC)	Preser-vation	Packing Require-ments	Holding Time
		Number	Type				
pH (soil) – 9045	Soil/Sludge/Sediment/Scale	1	G/P	10 - 50 g	None	None	Within 24 h of lab receipt
SVOA – 8270A	Soil/Sludge/Sediment/Scale	1	AG	30 - 150 g	None	Cool 4 °C	14/40 days
VOA – 8260	Soil/Sludge/Sediment/Scale	2 - 8	aG	10 - 40 g	Methanol (high level) Freeze (low level)	Methanol Cool 4 °C; Freeze < - 7 °C and > -20 °C	14 days
Dibutylphosphate	To be determined						
Glycolate (glycolic acid)	To be determined (with IC anions?)						
Monobutyl phosphate	To be determined						
Nonhalogenated VOA, EPA Method 8015M, GC modified for normal paraffin hydrocarbon	Soil/Sludge/Sediment/Scale	1	aG	50 - 250 g	None	Cool 4 °C	14 days
NWTPH – diesel, kerosene	Soil/Sludge/Sediment/Scale	1	G	50 - 250 g	None	Cool 4 °C	14 days
NWTPH – gasoline	Soil/Sludge/Sediment/Scale	1	G	50 - 250 g	None	Cool 4 °C	14 days
Oil & grease	Soil/Sludge/Sediment/Scale	1	G	20 - 100 g	None	Cool 4 °C	28 days
PCB Congeners EPA Method 1668	Soil/Sludge/Sediment/Scale	1	G	10 - 90g	None	Cool 4 °C	14 days
PCBs, EPA Method 8082	Soil/Sludge/Sediment/Scale	1	G	10 - 90g	None	Cool 4 °C	14 days

NOTE: Analytical priority will be based on site-specific conditions.

[a]Optimal volumes, which may be adjusted downward to accommodate the possibility of retrieval of small amount of sample. Minimum sample size will be defined in the Sampling Authorization Form.

[b]Should samples be liquid rather than soils, the following volumes need to be collected:
Radionuclides – 4 L for all radionuclides (except C-14, tritium, and Tc-99, which require approximately 500 mL for each sample).
Chemicals – All liquid samples require the amount listed for soil samples. Preservation and holding times also are affected if liquid samples are collected. Consult Sample and Data Management staff for details.

[c]Mixed soil samples may be obtained and submitted to the analytical laboratory for analyses for specific analytes, including the following:
Radionuclides – 100 g of soil for all radionuclides (except C-14, tritium, and Tc-99, which require approximately 10 g for each sample).
Chemicals – A 10 g soil sample is required for all ICP analyses, 10 g soil sample for IC anion analysis, 5 g soil sample for hexavalent chromium analysis, 10 g soil sample for 9010 analysis, 10 g soil sample for 8015 analysis, and 125 g soil samples each for 8270 and TOC analysis.

For 4-digit EPA methods, see SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-B*, as amended.

For EPA Methods 300.0 and 353.1, see EPA/600/4-79/020, *Methods of Chemical Analysis of Water and Wastes*.

For EPA Method 200.8, see EPA/600/R-94/111, *Methods for the Determination of Metals in Environmental Samples, Supplement I*.

For NWTPH Methods, see Ecology 97-602, *Analytical Methods for Petroleum Hydrocarbons*.

Table A-15. Sample Preservation, Container, and Holding Time Guidelines. (3 Pages)

Analytes	Matrices	Bottle		Amount Required[a,b,c] (min without lab QC to min including lab QC)	Preser-vation	Packing Require-ments	Holding Time
		Number	Type				

aG = amber glass.
CVAA = cold vapor atomic absorption.
EPA = U.S. Environmental Protection Agency.
G = glass.
GC = gas chromatography.
IC = ion chromatography.
ICP = inductively coupled plasma.
ICP/MS = inductively coupled plasma/mass spectrometer.
NWTPH = Northwest total petroleum hydrocarbon.
P = plastic.
PCB = polychlorinated biphenyl.
SVOA = semivolatile organic analyte.
VOA = volatile organic analyte.

A2.2.2.11 Sample Shipping

The radiological control technician will measure the contamination levels on the outside of each sample jar and the dose rates on each sample jar. The radiological control technician also will measure the radiological activity on the outside of the sample container (through the container) and will document the highest contact radiological reading in millirem per hour. This information, along with other data, will be used to select proper packaging, marking, labeling, and shipping paperwork in accordance with U.S. Department of Transportation regulations (49 CFR, "Transportation") and to verify that the sample can be received by the analytical laboratory in accordance with the laboratory's acceptance criteria. Copies of the shipping documentation will be provided to Sample and Data Management within 48 hours of sample shipment. Based on the measured radiological activity, the samples will be shipped to the appropriate Hanford-approved laboratory.

A2.2.3 Analytical Methods

Tables A-6 and A-7 list applicable fixed-laboratory methods for analytes and target detection limits.

A2.2.4 Quality Control

Specifications for field and laboratory quality-control sample types are provided in the following sections.

A2.2.4.1 Field Quality Control

Field QC samples will be collected to evaluate the potential for cross-contamination and laboratory performance. Field QC for sampling in the 200-IS-1 OU process-waste pipeline systems will require the collection of field duplicates and equipment rinsate-blank and field-blank samples. If sufficient sample material is available, field duplicates should be collected from contaminated areas so that valid comparisons can be made between the samples. However, the samples should not be collected from zones that are expected to contain high levels of transuranic-contaminated soils because of the high cost and added handling requirements

associated with transuranic materials. Limited sample material is anticipated to be available in pipeline interiors. Because of this limitation, sufficient sample quantity may not be available for the collection of field QC samples, and the percentage frequency goals specified for each type of field QC sample may not be achievable. Available sample material always will be prioritized for use in the analysis of the primary analytical samples. The field QC sample types and the frequency goals for collection are described in the following subsections.

A2.2.4.1.1 Field Duplicates

Each field duplicate will be retrieved from the sample interval or location using the same equipment (e.g., collected from same split-spoon or sample mixing bowl) and sampling technique as the original sample. Field duplicates for soil are collected and homogenized before being divided into two samples in the field. If volatile organic analyte (VOA) samples are required, they should be collected before homogenization. The duplicate samples will be sent to the primary laboratory in the same manner as the routine site samples. Field duplicates provide information regarding the homogeneity of the sample matrix and can be used to evaluate the precision of the analysis process.

At least 5 percent of the total collected soil samples will be duplicated (one field duplicate will be collected for every 20 samples). At least one field duplicate will be collected from the samples taken for each of the pipeline bins investigated. The duplicate samples will be suitable for analysis by an offsite laboratory and will be analyzed for all of the COPCs listed in Tables A-6 and A-7.

A2.2.4.1.2 Field Splits

Field split samples will be collected at the same frequency as field duplicate samples. Each split sample will be retrieved from the same sample interval or location using the same equipment (e.g., collected from same one split-spoon or sample mixing bowl) and sampling technique as the original sample. Samples will be homogenized, split into two separate aliquots in the field, and sent to two independent laboratories. If VOA samples are required, they should be collected before homogenization. The splits will be used to verify the performance of the primary laboratory.

The split samples will be obtained from a sample medium that is expected to have some contamination and that is suitable for analysis in an offsite laboratory, and they will be analyzed for all of the COPCs listed in Tables A-6 and A-7.

A2.2.4.1.3 Equipment Rinsate Blanks

Equipment rinsate blanks are used to verify the adequacy of sampling-equipment decontamination procedures and will be collected for each sampling method or from each type of nondisposable equipment used. An equipment rinsate blank will be taken from each type of decontaminated sampling equipment used for the collection of samples. Rinsate blanks need only be collected from equipment that undergoes decontamination and is used for repeated sample collection. The field team lead can request that additional equipment blanks be taken. Equipment blanks will consist of deionized water washed through decontaminated sampling equipment and placed in containers identified in the Sampling Authorization Forms. Note that

the bottle and preservation requirements for water may differ from the requirements for soil. Equipment rinsate blanks will be analyzed for the following:

- Gross alpha
- Gross beta
- Metals (excluding hexavalent chromium and mercury)
- Anions (except cyanide)
- VOAs of interest.
- Semivolatile organic analytes (SVOA) of interest.

These analytes are considered the best indicators of decontamination effectiveness.

A2.2.4.1.4 Field Blanks

The volatile organic field blanks will constitute approximately 5 percent of all VOC samples. If applicable, at least one field blank will be collected for each of the pipeline bins. Field blanks will consist of laboratory-grade deionized water added to a clean sample container in the field during the time frame that the characterization samples are being collected. The field blanks will travel to the field with the associated bottle sets and will be returned to the laboratory with the samples. They will remain closed during subsequent transport and handling. Field blanks are prepared as a check for possible contamination originating from ambient conditions at the site during sample collection. The field blank will be analyzed for VOCs only.

A2.2.4.1.5 Prevention of Cross-Contamination

Special care should be taken to prevent cross-contamination of soil samples. Particular care will be exercised to avoid the following common ways in which cross-contamination or background contamination may compromise the samples:

- Improperly storing or transporting sampling equipment and sample containers
- Contaminating the equipment or sample bottles by setting them on or near potential contamination sources, such as uncovered ground
- Handling bottles or equipment with dirty hands
- Improperly decontaminating equipment before sampling or between sampling events.

A2.2.4.2 Laboratory Quality Control

The laboratory method blanks, duplicates, laboratory control sample/blank spike, and matrix spikes are defined in Chapter 1 of SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-B*, as amended, and will be run at the frequency specified in Chapter 1 of SW-846. Because of anticipated limited sample quantity being available within the pipelines, sufficient material may not be available to perform both method analysis and associated laboratory QC. Available sample quantity always will be prioritized and allocated for completion of the method analysis. If insufficient sample is available for completion of laboratory QC analyses, the laboratory will be make note of the

condition in the data-package narrative, and the associated data results will have laboratory qualifiers added as appropriate.

A2.2.5 Instrument and Equipment Testing, Inspection, and Maintenance

Measurement and testing equipment used in the field or in the laboratory that directly affects the quality of analytical data will be subject to preventive-maintenance measures to ensure minimization of measurement system downtime. Laboratories and onsite measurement organizations must maintain and calibrate or verify calibration of their equipment per manufacturer or other applicable guidelines. Maintenance requirements (such as parts lists and documentation of routine maintenance) will be included in the individual laboratory and the onsite organization quality assurance plan or operating procedures (as appropriate).

A2.2.6 Instrument and Equipment Calibration and Frequency

Calibration of laboratory instruments will be performed in a manner consistent with SW-846 or with auditable U.S. Department of Energy, Hanford Site-wide, and contractual requirements. Calibration of radiological field instruments will be performed as indicated in the discussion concerning radiological field-instrumentation data. Nonradiological field screening instrumentation will be calibrated (or calibration verified) in accordance with manufacturer's specifications and other approved procedures. Results of all calibrations will be recorded.

A2.2.7 Inspection and Acceptance of Supplies and Consumables

Supplies and consumables used in support of sampling and analysis activities are procured in accordance with internal work requirements and processes that describe the acquisition system and the responsibilities and interfaces necessary to ensure that structures, systems, and components, or other items and services procured/acquired, meet the specific technical and quality requirements. The procurement process ensures that purchased items and services comply with applicable procurement specifications. Supplies and consumables are checked and accepted by users before use. Supplies and consumables obtained by the analytical laboratories are procured, checked, and used in accordance with the laboratory's quality-assurance plan.

A2.2.8 Nondirect Measurements

Data obtained from existing (1) process-waste inventory records and (2) analytical results for disposal sites associated with the pipelines being evaluated in this SAP were used to identify target constituents appropriate for field screening. From an investigation of historical sources, including process documents, logbooks, original plant technical manuals, and interviews of plant operators, a master list of potential contaminants was identified during the DQO process and was used in determining the analytical requirements.

A2.2.9 Data Management

Data generated as a result of sampling and data analysis activities will follow requirements outlined in this SAP and will be managed and stored in accordance with applicable programmatic requirements governing data-management procedures. At the direction of the task lead, all analytical data packages will be subject to final technical review by qualified personnel before the results are submitted to the regulatory agencies or included in reports. Electronic data access, when appropriate, will be via a database (e.g., HEIS, project-specific database). Where electronic data are not available, hard copies will be provided in accordance with Section 9.6 of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989).

Data will be cross-referenced between laboratory analytical data and radiation measurements to facilitate interpreting the investigation results. Errors reported by the laboratories are reported to the Sample and Data Management Project coordinator, who initiates a Sample Disposition Record in accordance with Project Hanford Management Contractor procedures. This process is used to document analytical errors and to establish their resolution with the project task lead. In addition, the Project Hanford Management Contractor quality-assurance engineer receives quarterly reports that provide narrative summaries and summary statistics of the analytical errors.

A2.3 ASSESSMENT AND OVERSIGHT

Routine evaluation of the data quality described for this project will be documented and filed along with the data in the project file.

A2.3.1 Assessments and Response Action

The Fluor Hanford Compliance and Quality Programs group may conduct random surveillance and assessments to verify compliance with the requirements outlined in this SAP, project work packages, the project quality management plan, procedures, and regulatory requirements.

Deficiencies identified by these assessments will be reported in accordance with existing programmatic requirements. The central quality-assurance group coordinates the corrective actions/deficiencies in accordance with the Project Hanford Management Contractor Quality Assurance Program. When appropriate, corrective actions will be taken by the task lead.

A2.3.2 Reports to Management

Management will be made aware of all deficiencies identified by self-assessments. Identified deficiencies will be reported to the Project Waste Site Remediation Manager, as appropriate.

A2.3.3 Changes in Workscope

Changes to the workscope detailed in the SAP may be required because of unexpected field conditions, new information, health and safety concerns, or other anomalies. Minor changes that have no adverse effect on the DQOs or project schedule can be made in the field with the

approval of the project manager or assigned task lead and then documented in the daily field logbook and/or field summary reports. Changes that affect the DQOs will require concurrence by RL and the lead regulatory agency and can be documented through unit managers' meetings. Alternatively, if substantial changes are required, this SAP can be revised and reissued, requiring RL and regulator approval.

A2.4 DATA VALIDATION AND USABILITY

A2.4.1 Data Review, Verification, and Validation

Data review and verification activities include checking completeness of laboratory analytical data packages (e.g., laboratory QC documentation is complete, all data results are present, data narrative summary is complete, all report pages are present). Verification will consist of confirming that the required deliverables have been provided, comparing requested versus reported analyses, and identifying any transcription errors. Validation will include the evaluation and qualification of results based on holding time, method blanks, matrix spikes, laboratory control samples, laboratory duplicates, and chemical and tracer recoveries, as appropriate to the methods used. No other validation or calculation checks will be performed.

A2.4.2 Verification and Validation Methods

Verification activities will be completed by qualified Soil and Groundwater Remediation Project Sample and Data Management personnel. Validation will be performed on completed data packages by qualified Soil and Groundwater Remediation Project Sample and Data Management personnel or by a qualified independent contractor. At least 5 percent of all data will be validated. Validation requirements will be consistent with Level C validation. No validation will be performed for physical data.

A2.4.3 Reconciliation with User Requirements

The data quality-assessment process compares completed field-sampling activities to those proposed in corresponding sampling documents, and provides an evaluation of the resulting data. The purpose of the data evaluation is to determine if quantitative data are of the correct type and are of adequate quality and quantity to meet the project DQOs. EPA/240/B-06/002, *Data Quality Assessment: A Reviewers Guide*, EPA QA/G-9R, identifies five steps for evaluating the data generated from this project, as summarized below.

Step 1. Review DQOs and Sampling Design. This step requires a comprehensive review of the sampling and analytical requirements outlined in the project-specific DQO workbook and SAP.

Step 2. Conduct a Preliminary Data Review. In this step, a comparison is made between the actual quality assurance/QC achieved (e.g., detection limits, precision, accuracy) and the requirements determined during the DQO. Any significant deviations will be documented.

Basic statistics will be calculated from the analytical data at this point, including an evaluation of the distribution of the data.

Step 3. Select the Statistical Test. Using the data evaluated in Step 2, select an appropriate statistical hypothesis test and justify the selection of this test.

Step 4. Verify the Assumptions. Assess the validity of the data analyses by determining if the data support the underlying assumptions necessary for the analyses or if the data set must be modified (e.g., transposed, augmented with additional data) before further analysis. If one or more assumptions are questioned, return to Step 3.

Step 5. Draw Conclusions from the Data. The statistical test is applied in this step (if applicable to the sample design), and the results either reject the null hypothesis or fail to reject the null hypothesis. If the latter is true, the data should be analyzed further. If the null hypothesis is rejected, the overall performance of the sampling design should be evaluated by performing a statistical power calculation to assess the adequacy of the sampling design.

A3.0 FIELD-SAMPLING PLAN

A3.1 SAMPLING OBJECTIVES

The primary objective of the field-sampling plan is to identify and describe sampling- and field-measurement activities that will be conducted to resolve the DRs (identified in Chapter A2.0). The field-sampling plan describes pertinent elements of the sampling program. Sample methods, procedures, locations, and frequencies are identified in this section.

This plan specifies a variety of field-sampling methods. The combination of methods that will be used are specified for both the interior of the pipelines and the surrounding soil. Initially, surface radiological surveys and surface geophysical surveys will be conducted at any location where an intrusive activity will performed. Surface geophysical surveys will be performed to identify subsurface anomalies, locate underground piping, and assist in determining the exact locations for subsurface sampling.

Installation of small-diameter casing using direct-push equipment will be used for vadose-zone investigations to facilitate in situ radiological-logging measurements and for collection of discrete soil samples. Down-hole logging for gamma-emitting radionuclides, plutonium, and moisture content will be performed before soil samples are collected. Soil samples will be collected in a separate direct-push hole at specified depths from the vadose zone for field screening (Table A-13) and full-suite laboratory analysis (Tables A-6 and A-7). A split-spoon sampler or soil liner will be the primary sampling device used to collect soil samples. The following subsections describe the specific methodologies used at each location included in this SAP. The planned sampling locations are shown in Figures A-5 through A-20. Sampling design features are discussed in Chapter A2.0 and summarized in Table A-10.

Problems with accessing the interior of pipelines, direct-push installations, sample collection, sample custody, or data acquisition that affect the quality of data or impair the ability to acquire data because of failure to meet contract requirements, or failure to follow procedures, will be documented. When a problem is encountered with performing field measurements or conducting sampling, cognizant field personnel will communicate the problem to the task lead for evaluation and resolution.

A3.2 CHARACTERIZATION APPROACH

The following discussion outlines the approach that will be used to optimize data collection and determine which samples will be selected for laboratory analyses. The investigation of the pipelines and collection of data will completed using a systematic sequence of steps. Data results will be reviewed at selected points in the process to determine the subsequent actions to be taken. Integration of the activities associated with collection of data and samples in the interior of the pipelines and in the surrounding soil is included in this approach. Following this overview of the characterization approach, descriptions of the various data-collection activities is provided in subsequent sections. A description of the data-collection steps is presented below.

Site Investigation Steps

1. Conduct surface geophysical surveys at the proposed pipeline-investigation location if needed to verify the position and burial depth of the pipeline and documented buried utilities. These surveys also will determine whether undocumented buried utilities or subsurface geophysical anomalies are present in the immediate area. Approximate sample locations are shown in Figures A-5 through A-20 and described in Table A-10.

2. Identify and stake the locations adjacent to the buried pipeline where the direct-push installations will occur. All pipeline locations where intrusive activities will be conducted will have two direct-push installations completed. The direct-push locations will be positioned as close to the pipeline as possible, with a lateral distance not to exceed 3.0 m (10 ft) away from each side of the pipeline. Specific conditions such as interfering buried utilities or high-exposure hazards may warrant adjusting locations in some instances.

3. Geophysical logging will be conducted at each direct-push location. The logging suite will consist of gross gamma, spectral gamma, passive neutron, and active neutron. Logging results should be reviewed any subsequent activities are initiated. Radiological-logging data will be used for several purposes depending on the location:

    - At pipeline locations requiring excavation to gain access for interior pipe sampling, logging results should be reviewed before excavating soil and exposing pipelines for collection of interior samples. Dose and radiological levels determined by logging will be reviewed to determine potential worker level of protection, site controls, and waste-handling requirements. Alternate sampling locations can be used if existing site conditions restrict proposed subsequent activities

    - At pipeline locations identified for soil sampling, logging results will provide information on the vertical distribution of radionuclide activity and concentration data for major gamma-emitter radionuclides (e.g., Cs-137) within proposed sample intervals. These results will be used in determining the sample interval to be selected for laboratory analysis. Dose and radiological levels obtained by logging will be reviewed to determine potential worker level of protection, site controls, and waste-handling requirements. Alternate sampling locations can be used if existing site conditions restrict proposed subsequent activities.

4. Conduct soil sampling at designated locations along the pipeline. A direct-push dual-tube sampling system will be used to collect samples from designated intervals. Soil sample material will be used primarily to conduct field-screening analyses. Target constituents or classes of compounds (e.g., nitrate, mercury, polyaromatic hydrocarbons, PCBs, hydrocarbons, VOCs) identified for field screening are based on available process information and analytical results (if available) for the pipeline and the disposal site connected to the pipeline. All designated sample intervals will have samples analyzed by field-screening techniques. At a minimum, one sample per sampling location will be used for laboratory analyses. Field-screening results will be used to select the sample

interval for laboratory analysis. The sample interval with the overall largest number of positive detections by field screening at the highest levels will be used for laboratory analysis of COPCs. Based on the results of field screening and as directed by the remediation task lead or designated field personnel, additional samples may be obtained for laboratory analysis.

5. Perform interior-pipeline sample collection at locations that do not require excavation for access. Initially, locations with easier access, such as manholes and sampler pits, will be evaluated. Limited sampling material (sediment, sludge, or scale) may be available. If sufficient material is available for using field-screening test kits and laboratory analysis, both will be performed. If not, only instrument screening will be conducted (i.e., radiological meters and organic vapor analyzers). If radiological-screening levels (gamma, beta, and/or alpha) are greater than three times background, available sample material will be allocated to radiological constituents. In the second tier of screening assessment, if VOC screening results are greater than 1 ppm, as measured with a hand-held organic vapor anaylzer, additional material will be used for analysis of organic constituents (VOCs, SVOCs, and other organics). If VOC levels are less than 1 ppm, available sample material will be used for inorganic analysis (e.g., metals, nitrates).

6. Pipelines requiring excavation to gain access for interior sample collection will be investigated last. These locations potentially pose the greatest logistical concerns. Test-pit excavations to expose the pipe section may involve using sloping, shoring, or trench boxes. The specific configuration of pipe location and anticipated hazards will be considered in the selected technique. Excavated soil will be field screened with radiological instrumentation and an organic vapor analyzer during the removal process to determine if contamination is present. Additional field screening analyses may be performed (e.g., using test kits) based on results of instrument screening and visual observations (e.g., soil discoloration or staining).

7. Initially, exposed pipelines may be screened remotely to determine radiological activity, with instrumentation attached to equipment and configured in a manner to limit worker exposure. Liquid waste could be present inside pipelines at some locations selected for sampling. An opening in the top of the exposed pipe will be completed to assess whether liquid is present before the pipe sections are removed. A plan for handling released liquids, including a notification to regulatory authorities within 24 hours, will be developed before the field program is implemented. Pipe sampling may need to be conducted outside of the excavation to limit worker risks during this operation. A section or sections of pipe, not to exceed a total length of approximately 3.0 m (10 ft), will be removed from the excavation and accessed to acquire sample material. This sample-collection process will be modified as needed to accommodate logistical or hazard restrictions and to ensure the safety of personnel involved with the task. When limited sample material is available, the process described in Step 5 will be followed.

A3.3 FIELD INVESTIGATIONS

Planned field investigations include both surface and subsurface evaluations. Surface measurements will include radiation and geophysical surveys. Subsurface investigations include using direct-push installations to conduct geophysical logging and soil-sample collection. Test-pit excavations will be completed to expose buried pipelines. A description of these activities is provided below.

A3.3.1 Surface Measurements

Surface measurements include surface radiation surveys and surface geophysical surveys.

A3.3.1.1 Surface Radiation Surveys

A surface radiation survey will be performed at each pipeline location to be investigated to document existing surface conditions. This information will be used in preparing the supporting health and safety documents and in finalizing sample-point locations. The surface radiation surveys will be conducted by qualified radiological control technicians in accordance with applicable procedures. A survey report will be prepared for each site. Surveys will be performed in accordance with applicable approved procedures. A survey will be performed at the conclusion of field work at each sampling site to ensure that sampling activities have not contributed to surface contamination.

A3.3.1.2 Surface Geophysical Surveys

Surface geophysical surveys will be used to verify the location of pipelines, other underground utilities, and subsurface anomalies. The survey results also will be used to determine the exact location for direct-push logging and soil sampling. Subsurface anomalies indicative of liquid releases will be delineated. Two different geophysical-survey techniques will be used: ground-penetrating radar and electromagnetic induction.

A3.3.2 Subsurface Measurements – Direct-Push Logging

Direct-push single-wall casing will be installed using the GeoProbe 5400[3] hydraulic ram system (or other comparable equipment) at selected locations to provide access for geophysical logging probes. Small-diameter gross-gamma, spectral-gamma, passive-neutron, and active-neutron logging probes (Table A-8) will be used to detect the presence of radiological contamination and support development of radiological-contamination profiles. Decontamination of the sampling equipment will be performed between each soil-probe location logging. Decontamination procedures will be conducted in accordance with current Hanford Site field operating procedures. Vertical casing will be installed up to 25 ft below ground surface (bgs). Soil

[3] GeoProbe is a registered trademark of GeoProbe Systems, Salina, Kansas.

conditions may limit the ability of the direct push to reach the desired depth. Several attempts will be made to drive the casing to the target depth by relocating to adjacent locations in the immediate area. If unsuccessful, one of the designated alternate locations will be used (see Tables A-10 and A-12). Detectors will be lowered to the total depth of the push rods to measure in situ levels of potential radioactive contaminants including detection of elevated neutron activity, characteristic of the presence of alpha constituents (e.g., transuranic radionuclides). Radiological contaminant profiles will be plotted for each location and used to determine regions of potential contamination. The radiological data also will support the selection of sample intervals for laboratory analyses.

A3.3.3 Direct-Push Soil Sampling

A duel tube sampling system (GeoProbe 5400 hydraulic ram equipment or other comparable equipment) will be used to facilitate (provide access for) sample collection with small-diameter, split-spoon, or soil-liner samplers. The dual-tube system permits driving the outer casing rods to a specified depth and collecting a discrete sample interval. Four sample intervals are designated for collection of sample material. Soil samples will be collected from the following intervals: 1.5 to 3.0 m (5 to 10 ft) bgs, 3.0 to 4.6 m (10 to 15 ft) bgs, 4.6 to 6.1 m (15 to 20 ft) bgs, and 6.1 to 7.6 m (20 to 25 ft) bgs. The sampling intervals were selected to encompass potential leak locations directly above, lateral to, and below the pipeline. Most pipelines have a burial depth of approximately 4.6 to 6.1 m (15 to 20 ft) bgs. A 1.5 m (5-ft) sample interval should provide sufficient material for the analyses. If engineering drawings and/or geophysical data indicate that a pipeline being investigated is buried deeper than 6.1 m (20 ft), the sample intervals will be shifted downward so that sample material is collected above, lateral to, and below the pipeline.

The soil samples will be collected in a split-spoon or soil-liner sampler. The outer casing will be driven to the top of the desired depth interval with the solid drive tip in place. The drive tip then will be removed and the sampler will be driven to the bottom of the interval to obtain the sample material. Depending on the sampler length, multiple pushes may be needed to complete the collection of soil in each 1.5 m (5-ft) interval. If poor recovery occurs and additional material is required for analysis of COPCs from the selected depth interval, installation of an adjacent drive probe may be required. If sufficient sampling material cannot be obtained at the location, one of the designated alternate sampling locations will be used. Decontaminated sampling equipment will be used for each soil-probe location.

Except for the VOC samples, soil will be transferred to a decontaminated, stainless-steel mixing bowl, homogenized, then containerized as required in the sampling procedure. Material obtained for use in laboratory analyses of VOCs will be collected as a discrete sample. This sample material will be taken from the middle of each sample interval. The analytes of interest for the Phase 1 sampling are presented in Tables A-6 and A-7.

The IDW generated during this activity will be handled according to the procedures listed in Chapter A5.0 and the waste control plan (to be prepared/approved before the start of field activities).

A3.3.4 Soil Field Screening

Field screening will be performed on all soil samples. Screening techniques include using handheld radiological instruments to measure dose and count rates. Screening for alpha, beta/gamma, and gamma levels will be conducted. Potential radiological-screening instruments are listed in Table A-8 with their respective detection limits. Gamma measurements can be converted to equivalent concentrations of Cs-137 when spectral data are collected (using a multichannel analyzer). Soil-vapor measurements will be taken with an organic vapor analyzer to measure concentrations of VOCs. A simple headspace analysis will be performed by placing sample material in a sealed mason jar (approximately ½ full) for approximately 30 minutes and allowed to reach room temperature (or higher). The top of the jar will be covered with a sheet of aluminum foil and a lid. To make the measurement, gases in the headspace will be withdrawn and analyzed using an organic vapor analyzer, and the VOC levels will be recorded. Immunoassay and/or colorimetric tests can be performed for a number of constituents. Nonradiological field-screening tests are listed in Table A-9. Table A-13 indicates those field-screening analyses to be performed at each pipeline sampling location.

The radiological control technician or other qualified personnel will field screen all soil samples and cuttings from the samplers for evidence of radioactive contamination. The radiological control technician will record all field measurements, noting the depth of the sample and the instrument reading.

Before driving casing or excavating, a local-area background reading will be taken using the field-screening instruments at a site to be selected in the field. Field screening will be used to provide real-time information on contaminant levels and assist in selecting samples for laboratory analysis. Field-screening data also will be used in determining sample shipping requirements and to support worker health and safety monitoring.

Field-screening instruments will be used, maintained, decontaminated (if applicable), and calibrated (or calibration verified) in accordance with the manufacturer's specifications and other approved procedures. Specific instrumentation information and field-screening results are recorded by the radiological control technician or other qualified personnel. The field geologist also will record field-screening results on the Field Activity Report form. Results are documented in the waste-site characterization summary report prepared by the field geologist.

A3.3.5 Test-Pit Excavations

The test-pit excavations will be used to expose and gain access to buried pipelines at selected locations. Test-pit excavations will be completed in a manner that minimizes dust generation. To minimize dust during backhoe operations, water will be sprayed on the site before and during the activity. This contamination-control measure is necessary to prevent the release of contamination to the air and to stabilized areas within the site boundary. If visible emissions cannot be controlled, the activity will be postponed. Waste generated during this activity will be handled according to procedures described for the use of test pits and in the waste control plan (to be prepared).

A3.3.6 Preshipment Sample Screening

A representative portion of each sample will be shipped to the Waste Sampling and Characterization Facility or other suitable onsite laboratory for total-activity analysis before it is shipped. Total radiological activities or other analysis as required by the shipping subject-matter expert will be used for sample-shipping characterization. Samples that slightly exceed the offsite laboratory criterion may be reduced in volume to reduce total activity and allow offsite shipment. Onsite and offsite laboratories will be identified before field activities are initiated and will be mutually acceptable to the Fluor Hanford Sample and Data Management organization and the task lead.

A3.4 SURVEYING

The location of all direct-push installations and interior-pipeline sampling locations will be surveyed after sampling and site-reclamation activities are completed. Data will be recorded in NAVD88, *North American Vertical Datum of 1988*, and the Washington State Plane (South Zone) NAD83, *North American Datum of 1983*, with the 1991 adjustment for horizontal coordinates. All survey data will be recorded in meters and feet. Global Positioning System survey instrumentation will be used.

A3.5 WASTE-MANAGEMENT SAMPLING

A waste-designation DQO process will be performed immediately before the characterization activities, to ensure that the proper information is collected during the field sampling to support the designation of all project IDW. Any additional sampling requirements or analytes needed to support waste-designation activities will be identified and implemented through the waste-designation DQO summary report that will be prepared at that time.

This page intentionally left blank.

A4.0 HEALTH AND SAFETY

All field operations will be performed in accordance with health and safety requirements and procedures. In addition, documentation will be prepared that will further control site operations. This documentation will consist of an activity hazard analysis, a site-specific health and safety plan, and applicable work permits. Work will be performed in accordance with these site-specific health and safety plans and applicable work permits. The sampling procedures and associated activities will take into consideration exposure-reduction and contamination-control techniques that will minimize the sampling team's exposure.

This page intentionally left blank.

A5.0 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

The IDW generated by characterization activities will be managed in accordance with existing approved Fluor Hanford waste-management documents that identify the requirements and responsibilities for containment, labeling, and tracking of IDW. Procedures have been prepared to implement the requirements found in Ecology et al. 1995, "Strategy for Management of Investigation Derived Waste." Management of IDW, minimization practices, and the waste types applicable to 200-IS-1 OU waste control will be described in the waste control plan.

Unused samples and associated laboratory waste from offsite laboratory analysis will be dispositioned in accordance with the laboratory contract, which in most cases will allow the laboratory to dispose of this material. Unused sample material from onsite laboratories will be returned to the project for disposal.

A waste-designation DQO process will be completed before characterization activities are initiated, to ensure that information necessary to support designation of all project IDW is collected during the field activities. During the IDW DQO activities, any listed waste issues will be resolved. Additional sampling or analysis required to support designation activities will be identified in the waste-designation DQO summary report.

This page intentionally left blank.

A6.0 REFERENCES

10 CFR 830 Subpart A, "Quality Assurance Requirements," Title 10, *Code of Federal Regulations*, Part 830, Subpart A, as amended.

10 CFR 835, "Occupational Radiation Protection," Title 10, *Code of Federal Regulations*, Part 835, as amended.

49 CFR, "Transportation," Title 49, *Code of Federal Regulations*, as amended.

Ballschmiter, K., and M. Zell, 1980, "Analysis of Polychlorinated Biphenyls (PCB) by Glass Capillary Gas Chromatography," *Fresenius Z. Anal. Chem.* 302:20-31.

BHI-00139, 2002, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, Rev. 4, Bechtel Hanford, Inc., Richland, Washington.

BHI-00178, 1995, *PUREX Plant Aggregate Area Management Study Technical Baseline Report*, Rev. 00, Bechtel Hanford, Inc., Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq.

D&D-30262, 2007, *Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

DE-AC06-96RL13200, 1996, *Contract Between the U.S. Department of Energy, Richland Operations Office, and Fluor Hanford, Inc.*, U.S. Department of Energy, Richland Operations Office, Richland, Washington, as amended.

DOE O 414.1C, *Quality Assurance*, as amended, "Contractor Requirements Document," U.S. Department of Energy, Washington, D.C.

DOE/EIS-0222-F, 1999, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, U.S. Department of Energy, Washington, D.C.

DOE/RL-2000-35, 2001, *200-CW-1 Operable Unit Remedial Investigation Report*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2002-42, 2003, *Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Units (Includes the 200-PW-5 Operable Unit)*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2004-17, 2004, *Remedial Investigation Report for the 200-CS-1 Chemical Sewer Group Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2004-25, 2004, *Remedial Investigation Report for the 200-PW-2 Uranium-Rich Process Waste Group and 200-PW-4 General Process Condensate Group Operable Units*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2005-62, 2006, *Remedial Investigation Report for the 200-MW-1 Miscellaneous Waste Group Operable Unit*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2006-51, 2006, *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology 97-602, 1997, *Analytical Methods for Petroleum Hydrocarbons*, Washington State Department of Ecology, Olympia, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington, as amended.

Ecology, EPA, and DOE, 1995, "Strategy for Management of Investigation-Derived Waste," (letter from R. Stanley, Washington State Department of Ecology; D. R. Sherwood, U.S. Environmental Protection Agency; and K. M. Thompson, U.S. Department of Energy, Richland Operations Office), Richland, Washington, July 26.

EPA/240/B-01/003, 2001, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, U.S. Environmental Protection Agency, Quality Assurance Division, Washington, D.C.

EPA/240/B-06/002, 2006, *Data Quality Assessment: A Reviewers Guide*, EPA QA/G-9R, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/4-79/020, 1983, *Methods of Chemical Analysis of Water and Wastes*, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

EPA/600/R-93/100, 1993, *Methods for the Determination of Inorganic Substances in Environmental Samples,* Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

EPA/600/R-94/111, 1994, *Methods for the Determination of Metals in Environmental Samples, Supplement 1*, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/R-96/055, 2000, *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, as amended, U.S. Environmental Protection Agency, Washington, D.C.

Hanford Environmental Information System, Hanford Site database.

NAD83, 1991, *North American Datum of 1983*, National Geodetic Survey, Federal Geodetic Control Committee, Silver Spring, Maryland, as revised.

NAVD88, 1988, *North American Vertical Datum of 1988*, National Geodetic Survey, Federal Geodetic Control Committee, Silver Spring, Maryland.

Radiation Survey Reports:

- SS248978, 1998, *Survey of Underground Transfer Lines*, Westinghouse Hanford Company, Richland, Washington, October 18.
- SS253960, 2000, *Survey of B Plant Transfer Line*, prepared by DynCorp for Fluor Hanford, Inc., Richland, Washington, February 17.
- SS255613, 2000, *Survey of Transfer Line Northeast of B Plant to 207-B*, prepared by DynCorp for Fluor Hanford, Inc., Richland, Washington, August 2.
- SS256115, 2000, *Vegetation Growth Above Posted Pipeline Associated with 216-A-42C and 216-A-30 Crib*, prepared by DynCorp for Fluor Hanford, Inc., Richland, Washington, October 16.
- SS256142, 2000, *Vegetation Growth in Posted CA Associated with UPR-200-E-144*, prepared by DynCorp for Fluor Hanford, Inc., Richland, Washington, October 26.
- SS261107, 2002, *Assessment Survey in a Posted CA South of 12th Street*, Fluor Hanford, Inc., Richland, Washington, May 7.

RHO-CD-1010, 1980, *B Plant Chemical Sewer System Upgrade*, Rockwell Hanford Operations, Richland, Washington.

Sample Data Tracking database, Hanford Site database.

SW-846, 2005, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-B*, as amended, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available on the Internet at www.epa.gov/SW-846/main.htm .

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

Waste Information Data System, Hanford Site database.

WHC-EP-0342, 1990, Addendum 6, *B Plant Chemical Sewer Stream-Specific Report*, Westinghouse Hanford Company, Richland, Washington.

1

This page intentionally left blank.

APPENDIX A

ATTACHMENT

SUPPORTING INFORMATION

1

This page intentionally left blank.

APPENDIX A

ATTACHMENT

SUPPORTING INFORMATION

Table ATT-1. Engineering Drawing References for Pipelines. (3 Pages)

Bin	Waste Site	Pipeline Number	Drawing Number	Sheet(s)
1	216-Z-1A Tile Field	200-E-192-PL	H-2-24924	1, 2
			H-2-26093	1
	216-A-10 Crib	200-W-174-PL	H-2-44501	48
			H-2-53093	
			H-2-55099	
			H-2-55576	
			H-2-56045	
			H-2-56049	
			H-2-56050	
			H-2-56057	
	216-B-12 Crib	200-E-160-PL and 200-E-162-PL	H-2-34524	
			H-2-36574	1, 2
			H-2-43029	
			H-2-43079	
			H-2-44501	86, 97, 98
			H-2-60330	
			H-2-60332	
			H-2-71678	
			H-13-000199	2, 3
2	216-B-2-2 Ditch	200-E-112-PL	H-2-2021	1, 2
			H-2-32262	
			H-2-32266	
			H-2-33115	
			H-2-33119	
			H-2-44500	5
			H-2-44501	96, 97, 107, 117, 118, 128, 129
			M-2904-E-28	
			W-73636	
	216-A-25 Gale Mountain Pond	200-E-127-PL	H-2-3325	1
			H-2-3326	1
			H-2-3327	1
			H-2-3328	1
			H-2-3329	1
			H-2-3330	1
			H-2-3331	1
			H-2-3332	1

Table ATT-1. Engineering Drawing References for Pipelines. (3 Pages)

Bin	Waste Site	Pipeline Number	Drawing Number	Sheet(s)
			H-2-3333	1
			H-2-36494	1, 2
			H-2-55900	
			H-2-56014	1
			H-2-66018	1
			H-6-450	1
	216-A-30 Crib	200-E-113-PL	no drawings available	
	216-T-36 Crib	200-W-79-PL	H-2-3019	
			H-2-33472	
			H-2-44511	126
			H-13-000273	2
			SK-2-21661	
3	216-A-29 Ditch	200-E-187-PL	H-2-44501	48, 57, 58, 59
			H-2-46778	
			H-2-55057	
			H-2-55074	
			H-2-55075	
			H-2-55547	
			H-2-55900	
			H-2-70301	
			H-2-75597	
			H-2-827316	
			H-2-827317	1
			H-2-90437	1
			H-2-90438	4
	216-B-63 Ditch	200-E-188-PL	H-2-33115	
			H-2-33119	
			H-2-35495	1
			H-2-44500	5, 6
			H-2-44501	85, 86, 96, 97, 107, 117, 118, 127, 128
			H-2-66430	
			H-2-94130	
			H-13-000270	1, 2
	216-S-10 Ditch	200-W-157-PL	H-2-44510	7
			H-2-44511	6, 7, 13, 14, 20, 21, 22, 28, 29
			H-2-5307	1, 2
			H-2-5962	
			H-2-72904	
			H-2-82714	
			H-2-82715	

Table ATT-1. Engineering Drawing References for Pipelines. (3 Pages)

Bin	Waste Site	Pipeline Number	Drawing Number	Sheet(s)
			H-2-82722	1
			H-2-82723	1
			H-2-95217	
			H-6-466	7, 18
4	216-T-33 Crib	200-W-173-PL	H-2-32096	
			H-2-44511	140
	216-A-21 Crib	200-E-193-PL	H-2-44501	37
			H-2-57042	
	216-A-32 Crib	200-E-194-PL	H-2-44501	47
			H-2-57110	
5	216-T-26 Crib	200-W-175-PL	H-2-2670	
			H-2-2733	
			H-2-2735	
			H-2-3019	
			H-2-3020	
			H-2-44511	118, 126, 134
	216-B-9 Crib	200-E-195-PL	H-2-432	
			H-2-1031	
			H-2-44501	96, 107
			W-72902	
	216-B-46 Crib*	200-E-114-PL	H-2-2900	
			H-2-2901	
			H-2-2902	
			H-2-2903	
			H-2-2904	
			H-2-2905	
			H-2-2906	
			H-2-2908	
			H-2-2909	

*Because of its complex operational history and its multibranched layout, the 200-E-114-PL Pipeline can be associated with many liquid waste disposal sites. The 216-B-46 Crib was selected as a disposal waste site that would have received the same process waste stream that the northern portion of this pipeline received.

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
1	200 W/ PFP	200-W-174	216-Z-1A	Am-241	3885			Am-241	2,590,000	Am-241
				Pu-240	957			Pu-239/240	38,200,000	Pu-239/240
				Pu-239	3,188					
				Pu-241	14,379					
				U-238	0					
				Cs-137	1			Cs-137	23	Cs-137
				Sr-90	<1					
				H-3	0					
				U total	<1					
				chromium	93		chromium	chromium	22	Hex Cr
				Hg	140,891			Hg	ND or <background	
				nitrate	1,319,897	nitrates		nitrate	250	nitrates
				ammonia	170	ammonia				
				PCBs	NR		PCBs			
				TBP	31,693	TBP				
				other SVOCs	NR			SVOCs (phenol)	<1	PAHs
				carbon tet	306,501	carbon tet		carbon tet	7	VOCs
				other VOCs	NR		VOCs (including acetone, butanol, chloroform, cis-1,2-dichloroethylene, DCA, methylene chloride, toluene, trichloroethane, trichloroethylene, and xylene)	VOCs (chloroform, methylene chloride; DCA, cis-1,2-dichlorothylene, MEK, MIBK, trichloroethylene, tetrachloroethylene, toluene, xylenes; others)	chloroform 3.6, methylene chloride 20; others ND to <1	
1	200 E/ PUREX	200-E-192-PL1, 200-E-192-PL2	216-A-10	Am-241	75			Am-241	1,320	Am-241
				Pu-238	3			Pu-238	316	
				Pu-240	13			Pu-239/240	7,110	Pu-239/240
				Pu-239	56					
				U-238	<1			U-238	1	
				Cs-137	28			Cs-137	2,950	Cs-137
				Sr-90	18			Sr-90	45	

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
1	200 E/ PUREX (cont)	200-E-192-PL1, 200-E-192-PL2 (cont)	216-A-10 (cont)	H-3	57,768			H-3	835	
				U total	358			U total	ND or <background	
				chromium	0			chromium	ND or <background	
				nitrate	1,918,945	nitrates		nitrate	ND or <background	
				ammonia	0	ammonia		ammonia	ND or <background	
				PCBs	NR			PCBs	ND	
				O/G	NR			O/G	59,400	HC
				TBP	0	TBP		TBP	2,000	PAHs
				other SVOCs	NR		SVOCs(including benzo(a)anthracene, benzo(a)pyrene, and benzo(ghi)perylene)	other SVOCs	ND	
				carbon tet	0			carbon tet	ND	VOCs
				other VOCs	NR		VOCs (including butanol, MEK, MIBK, TCA, trichloroethane, and tetrachloroethylene)	VOCs (MEK, acetone, toluene; others)	ND to <1	
1	200 E/ B Plant	200-E-160, 200-E-162-PL1, 200-E-162-PL2	216-B-12	Am-241	<1			Am-241	2	Am-241
				Pu-240	<1			Pu-239/240	4	Pu-239/240
				Pu-239	<1					
				U-238	5			U-238	12	
				Cs-137	326			Cs-137	61,900	Cs-137
				Sr-90	120			Sr-90	12,700	
				H-3	2,340			H-3	8	
				U total	15,112			U - total	28	
				chromium	561	chromium		chromium	30	Hex Cr
				nitrate	2,860,615	nitrates		nitrate as N	165	nitrates
				ammonia	54	ammonia		ammonia	404	
				PCBs	NR			Aroclor-1254	<1	PCBs
				NPH	17	NPH (kerosene)		NPH	ND	

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
1	200 E/ B Plant (cont)	200-E-160; 200-E-162-PL1; 200-E-162-PL2 (cont)	216-B-12 (cont)	TBP	0			TBP	2	PAHs
				carbon tet	0			carbon tet	ND	
				other VOCs	NR		VOCs (including acetone, benzene, MEK, MIBK, and trichloroethane)	other VOCs	ND	
2	200 E/ PUREX	200-E-127	216-A-25	Am-241	3			Am-241	<1	Am-241
				Pu-240	9			Pu-239/240	<1	Pu-239/240
				Pu-239	29					
				U-238	4			U-238	ND or <background	
				Cs-137	7,263			Cs-137	7,180	Cs-137
				Sr-90	183			Sr-90	59	
				H-3	875			H-3	ND or <background	
				U total	12,193			U total	ND or <background	
				chromium	5	chromium		chromium	24	Hex Cr
				nitrate	163,958	nitrates		nitrate	500	nitrates
				ammonia	5	ammonia		ammonia as N	77	
				PCBs	NR			PCBs	ND	
				TBP	0	TBP				
				other SVOCs	NR		SVOCs (including benzo(a)anthracene, benzo(a)pyrene, and benzo(ghi)perylene)	other SVOCs (bis(2-ethylhexyl)phthalate, dibutyl-benzlphthalate, chloromethane, diethylphthalate, and di-n-butylphthalate)	ND to 1.8	PAHs
				carbon tet	2,199					
				other VOCs	NR		VOCs (including acetone, benzene, butanol, MEK, MIBK, TCA, trichloroethane, and tetrachloroethylene)	VOCs (including acetone, 2-butanone, chloromethane, methylene chloride, toluene, xylenes, and 1,1,2-trichlorethane)	ND to <1	VOCs

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
2	200 E/ B Plant	200-E-112	216-B-2-2	Am-241	12			Am-241	1	Am-241
				Pu-240	5			Pu-239/240	<1	Pu-239/240
				Pu-239	19					
				U-238	2,788			U-238	ND or <background	
				Cs-137	402			Cs-137	721	Cs-137
				Sr-90	134			Sr-90	12,100	
				H-3	99			H-3	ND or <background	
				U total	20,132			U total	ND or <background	
				chromium	1,409	chromium		chromium	ND or <background	
				Hg	279	Hg		Hg	<1	Hg
				nitrate	293,537	nitrates		nitrate	330	nitrates
				ammonia	75	ammonia		ammonia	ND or <background	
				PCBs	NR			Aroclor-1260	9	PCBs
				NPH	37,548	NPH (kerosene)				HC[h]
				TBP	0			TBP	ND	
				other SVOCs	NR			SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(ghi)perylene, benzo(b)fluoranthene, benzo(k)perylene; others)	ND to 2	PAHs
				carbon tet	4,676					
				other VOCs	NR		VOCs (including acetone, benzene, MEK, MIBK, and trichloroethane)	VOCs (acetone methylene chloride)	ND to <1	VOCs

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
2	200 E/ PUREX	200-E-113	216-A-30	Am-241	0			no data	no data	
				Pu-240	11					Pu-239/240
				Pu-239	31					
				U-238	656					
				Cs-137	3					Cs-137
				Sr-90	1					
				H-3	<1					
				U total	<1					
				chromium	6,045					Hex Cr
				nitrate	208,226	nitrates				nitrates
				ammonia	<1	ammonia				
				PCBs	NR					
				TBP	0	TBP				
				other SVOCs	NR		SVOCs (including benzo(a)anthracene, benzo(a)pyrene, and benzo(ghi)perylene)			PAHs
				carbon tet	0					
				other VOCs	NR		VOCs (including butanol, MEK, MIBK, TCA, trichloroethane, and tetrachloroethylene)			VOCs
2	200 W/ T Plant	200-W-79	216-T-36	Am-241	0			no data	no data	
				Pu-240	6					Pu-239/240
				Pu-239	17					
				U-238	172					
				Cs-137	<1					Cs-137
				Sr-90	<1					
				H-3	0					
				U total	0					
				chromium	212	chromium				Hex Cr
				nitrate	4,953	nitrates				nitrates
				ammonia	0	ammonia				

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
				PCBs	NR					
				TBP	0					
				carbon tet	0					
				other VOCs	NR		VOCs (including acetone, benzene, butanol, MEK, MIBK, methylene chloride, toluene, and trichloroethane)			VOCs
3	200 E/ PUREX	200-E-187	216-A-29	Am-241	no data			Am-241	145	Am-241
				Pu-240				Pu-239/240	667	Pu-239/240
				Pu-239						
				U-238				U-238	ND or <background	
				Cs-137				Cs-137	98	Cs-137
				Sr-90				Sr-90	<1	
				H-3				H-3	7	
				U total				U total	ND or <background	
				chromium				chromium	37	Hex Cr
				Cr^{+6}				Cr^{+6}	9	
				Hg				Hg	5	Hg
				nitrate		nitrates		nitrate as N	210	nitrates
				ammonia		ammonia		ammonia	34	
				PCBs				Aroclor-1254	9	PCBs
				TBP		TBP		TBP	<1	
				other SVOCs			SVOCs (including benzo(a)anthracene, benzo(a)pyrene, and benzo(ghi)perylene)	SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene; others)	ND to <1	PAHs
				carbon tet				carbon tet	ND	
				other VOCs			VOCs (including butanol, MEK, MIBK, TCA, trichloroethane, and tetrachloroethylene)	VOCs (tetrachloroethylene; others)	trichloroethylene <1; others[e]	VOCs

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
3	200 E/ B Plant	200-E-188	216-B-63	Am-241	<1			Am-241	<1	Am-241
				Pu-240	0					
				Pu-239	<1					
				U-238	<1			U-238[e]	ND or <background	
				Cs-137	<1			Cs-137	4	Cs-137
				Sr-90	<1			Sr-90	30	
				H-3	130					
				U total	178			U total	ND or <background	
				chromium	14	chromium		chromium	22	Hex Cr
				nitrate	3,137	nitrates		nitrate as N	188	nitrates
				ammonia	0	ammonia		ammonia	ND	
				PCBs	NR			Aroclor-1254	<1	PCBs
				NPH	387	NPH (kerosene)		NPH	ND	
				TBP	0			TBP	ND	
				carbon tet	0			carbon tet	ND	
				other VOCs	NR		VOCs (including acetone, benzene, MEK, MIBK, and trichloroethane)	VOCs (acetone, benzene, methylene chloride, toluene; others)	ND to <1	VOCs

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
3	200 W/ S Plant	200-W-157	216-S-10	Am-241	53			Am-241	<1	Am-241
				Pu-240	5			Pu-239/240	3	Pu-239/240
				Pu-239	15					
				U-238	512			U-238	ND or <background	
				Cs-137	35			Cs-137	9	Cs-137
				Sr-90	<1			Sr-90	<1	
				H-3	3					
				U total	1			U total	ND or <background	
				chromium	2,981	chromates		chromium	815	Hex Cr
				Cr^{+6}	NR			Cr^{+6}	14	
				Hg	120		Hg	Hg	4	Hg
				nitrate	45,361	nitrates		Nitrate as N	18.2	nitrates
				ammonia	<1	ammonia		ammonia	ND or <background	
				PCBs	NR			Aroclor-1254	4	PCBs
				TBP	0		TBP	TBP	ND	
				other SVOCs	NR			SVOCs (acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene; benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, fluorene, di benz[a,h]anthracene, phenanthrene; others)	ND to <1	PAHs
				carbon tet	0			carbon tet	ND	
				other VOCs	NR		VOCs(including benzene and trichloroethane)	VOCs (acetone, methylene chloride; others)	ND to <1	VOCs

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
4	200 W/ T Plant	200-W-173	216-T-33	Am-241	<1			Am-241	2	Am-241
				Pu-240	<1			Pu-239/240	63	Pu-239/240
				Pu-239	2					
				U-238	60			U-238	ND or <background	
				Cs-137	<1			Cs-137	33	Cs-137
				Sr-90	<1			Sr-90	49	
				H-3	<1			H-3	< 1	
				U total	<1			U total	ND or <background	
				chromium	22	chromium		chromium	34	Hex Cr
				nitrate	1,267	nitrate		nitrate	254	nitrates
				ammonia	<1	ammonia		ammonia	ND or <background	
				PCBs	NR			Aroclor-1254, -1260	9, 4	PCBs
				O/G	NR			O/G	842	HC
				TBP	0			TBP	ND	
				carbon tet	0			carbon tet	ND	
				other VOCs	NR		VOCs (including acetone, benzene, MEK, MIBK, and trichloroethane)	VOCs (acetone)	<1	VOCs
4	200 E/ PUREX	200-E-194	216-A-32	Am-241	<1			no data	no data	Am-241
				Pu-240	<1					Pu-239/240
				Pu-239	<1					
				U-238	<1					
				Cs-137	<1					Cs-137
				Sr-90	<1					
				H-3	<1					
				U total	<1					
				chromium	<1					Hex Cr
				nitrate	1	nitrate				nitrates
				ammonia	<1	ammonia				
				PCBs	NR					

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
4 (cont)	200 E/ PUREX (cont)	200-E-194 (cont)	216-A-32 (cont)	TBP	0	TBP				
				other SVOCs	NR		SVOCs (including benzo(a)anthracene, benzo(a)pyrene, and benzo(ghi)perylene)			PAHs
				carbon tet	0					
				other VOCs	NR		VOCs (including butanol, MEK, MIBK, phenol, TCA, tetrachloroethene and trichloroethane)			VOCs
4	200 E/ PUREX		216-A 21	Am-241	5			no data	no data	Am-241
				Pu-240	1					Pu-239/240
				Pu-239	5					
				U-238	195					
				Cs-137	60					Cs-137
				Sr-90	6					
				H-3	0					
				U total	49					
				chromium	0					
				nitrate	320,299	nitrate				nitrates
				ammonia	66,324	ammonia				
				PCBs	NR					
				TBP	0	TBP				
				other SVOCs	NR		SVOCs (including benzo(a)anthracene, benzo(a)pyrene, and benzo(ghi)perylene)			PAHs
				carbon tet	0					
				other VOCs	NR		VOCs (including butanol, MEK, MIBK, phenol, TCA, tetrachloroethene and trichloroethane)			VOCs

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
5	200 W/ T Plant	200-W-175	216-T-26	Am-241	1	no data	no data	Am-241	227	Am-241
				Pu-240	3			Pu-239/240	6,320	Pu-239/240
				Pu-239	37					
				U-238	<1			U-238	21	
				Cs-137	481			Cs-137	47,900	Cs-137
				Sr-90	454			Sr-90	49,100	
				H-3	3			H-3	2,650	
				U total	633			U total	61	
				chromium	1,157			chromium	94	Hex Cr
				Cr^{+6}	NR			Cr^{+6}	4	
				nitrate	375,263			nitrate as N	693	nitrates
				ammonia	<1			ammonia	95	
				fluoride	48,187			fluoride	168	
				PCBs	NR					
				TBP	0			TBP	91	PAHs
				carbon tet	0			carbon tet	ND	
				other VOCs	NR			VOCs (acetone, xylenes; others)	ND to <1	VOCs
5	200 E/ B Plant	200-E-114	216-B-46[g]	Am-241	11	no data	no data			Am-241[h]
				Pu-240	<1			Pu-239/240	227[g]	Pu-239/240
				Pu-239	5					
				U-238	<1			U-238	6.94	
				Cs-137	235			Cs-137	364,000[g]	Cs-137
				Sr-90	897			Sr-90	353,000[g]	
				H-3	42			H-3	53[g]	
				U total	208			U total	44[g]	
				chromium	1,152			chromium	30[g]	Hex Cr
				nitrate	1,330,702			nitrate and N/N as N	5,470[g]	nitrates
				ammonia	<1					

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	
5	200 E/ B Plant (cont)	200-E-114 (cont)	216-B-46 (cont)	PCBs	NR					
				TBP	0			TBP	19[g]	PAHs
				carbon tet	0					
				Other VOCs	NR					
5	200 E/ B Plant	200-E-195	216-B-9	Am-241	<1			no data	no data	Am-241
				Pu-240	<1					Pu-239/240
				Pu-239	8					
				U-238	12					
				Cs-137	12					Cs-137
				Sr-90	11					
				H-3	<1					
				U total	0					
				chromium	641	chromium				Hex Cr
				nitrate	170,505	nitrates				nitrates
				ammonia	0	ammonia				
				PCBs	NR					
				TBP	0					
				carbon tet	0					
				Other VOCs	NR		VOCs (including acetone, benzene, MEK, MIBK, and trichloroethane)			VOCs

Aroclor is an expired trademark.

[a]RPP-26744, *Soil Inventory Model, Rev. 1.*
[b]Sources summarized in Table ATT-3.
[c]Except as specifically footnoted, references for these columns are as follows:
- for 216-Z-1A, DOE/RL-2006-51, Draft A, *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units.*
- for 216-A-10 and 216-B-12, DOE/RL-2004-25, *Remedial Investigation Report for the 200-PW-2 Uranium-Rich Process Waste Group and the 200-PW-4 General Process Condensate Group Operable Units.*
- for 216-A-25 and 216-B-2-2, DOE/RL-2000-35, *200-CW-1 Operable Unit Remedial Investigation Report.*
- for 216-A-29, 216-B-63, and 216-S-10, DOE/RL-2004-17, Draft A, *Remedial Investigation Report for the 200-CS-1 Chemical Sewer Group Operable Unit.*
- for 216-T-33, 216-A-21, and 216-A-32, DOE/RL-2005-62, Draft A, *Remedial Investigation Report for the 200-MW-1 Miscellaneous Waste Group Operable Unit.*
- for 216-T-26, DOE/RL-2002-42, Draft A, *Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Units.*

[d]See "Description of criteria used for presentation of data shown in Table ATT-2" below for explanation of selection process.

Table ATT-2. Summary of Data Indicating Primary Constituents for Field Screening. (13 Pages)

Bin	Area/ Associated Facility	Pipeline Number (PL)	Associated Waste Site Number	Primary Inventory Constituents Sent to Waste Site (SIMS Data)[a]		Primary Chemical Constituents in Waste Stream (Based on Point-of-Origin Process Operations)[b]		Primary Constituents Detected in Samples Collected at Liquid Waste Disposal Site (Remedial Investigation or Other Data)[c]		Target Constituents for Field Screening[d]
				Constituent	kg or Ci	Verified[e]	Suspected[f]	Constituent	mg/kg or pCi/g	

[e]Verified chemicals are directly referenced in a technical manual, process flow diagram, or other facility document.
[f]Suspected chemicals are referenced in a generic document (documents are listed in Table ATT-3).
[a]Sample results reported are for 216-B-46 (DOE/RL-2002-42, above). Because of its complex operational history, the 200-E-114-PL Pipeline has been associated with many liquid-waste disposal sites. The 216-B-46 Crib was selected for review of waste-site information associated with this pipeline.
[b]The sample analysis did not include this constituent, but because it was reported in the site inventory, it is selected for field screening.

Description of criteria used for presentation of data shown in Table ATT-2:

1. Table includes information for pipelines to be sampled, including alternate pipelines.
2. The constituents shown are a subset of those constituents reported in the Soil Inventory Model (SIM) (RPP-26744), process operational records, and disposal site analytical results. Constituents were selected as follows:
   a. Radionuclides, total uranium, nitrate, chromium, and ammonia because of their contamination potential and their generally high SIM inventory levels.
   b. Tritium (H-3) because of its groundwater contamination potential.
   c. PCBs, carbon tetrachloride, and TBP because of their contamination potential. Because carbon tetrachloride and TBP were the only EPA Method 8260/8270 constituents (SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-B*, as amended) reported in SIM, they are listed apart from the other SVOCs and VOCs.
   d. Other SVOC or VOC not included in SIM, if process operations information reported them to be present and they are listed in Table A-7 (identified for analysis using EPA Method 8260 for VOCs, or EPA Method 8270 for SVOCs).
   e. Fluorine, Pu-241, NPH, and mercury (Hg) for individual waste site(s) when their inventory value was high.
   f. Other constituents reported with a relatively high maximum concentration in a remedial investigation report (i.e., Pu-238 and O/G for 216-A-10 and hexavalent chromium for 216-A-29).
3. For "Primary Chemical Constituents" information:
   a. Does do not include information for radionuclides
   b. "Primary Chemical Constituents" list was compared to the chemicals in the "Primary Inventory" column. For non-SVOCs/VOCs, those constituents that matched were included as either 'verified' or 'suspected,' where
      i. "Verified" chemicals are directly referenced in a technical manual, process flow diagram, or other facility document
      ii. "Suspected" chemicals are referenced in a generic document
   c. Those EPA Method 8270/8260 SVOCs/VOCs constituents that were identified as 'suspected' are listed in parentheses.
4. "Primary [Sample] Constituents" data:
   a. Primary [Sample] Constituents list was compared to the chemicals in the "Primary Inventory" column. For non-SVOCs/VOCs, those constituents that matched were included.
   b. Those constituents reported using EPA Method 8270(SVOCs)/8260(VOCs) are listed in parentheses.
5. "Target Constituents for Field Screening" selection was based on the presence or absence of a constituent, as noted in the three data sources, and on field-screening capabilities. For those constituents for which field-screening capabilities are available (Am-241, Pu-239/240, Cs-137, hexavalent chromium, mercury, nitrate, PCB, SVOC [PAH], VOC, and HC), the constituent was selected as a target if it was detected at a concentration above background in the sampling analytical data. If no sampling data were available, the constituent was selected if it was reported as being present in the waste stream in SIM or it was identified in point-of-origin process operations documentation.

List of Constituents:

DCA = 1,1- or 1,2-dichloroethane.
HC = total petroleum hydrocarbons.
MEK = methyl ethyl ketone.
MIBK = methyl iso butyl ketone.
N/N = nitrate/nitrite.
NPH = normal paraffin hydrocarbon (kerosene).
PAH = polyaromatic hydrocarbon(specific SVOCs).
O/G = oil & grease.
PCB = polychlorinated biphenyl.
SVOC = semivolatile organic compound.
TBP = tributyl phosphate.
TCA = 1,1,1-trichloroethane.
VOC = volatile organic compound.

Other Abbreviations:

NR = no data reported for this constituent.
PFP = Plutonium Finishing Plant.
PUREX = Plutonium-Uranium Extraction Plant.
SIMS = Soil inventory model (see footnote "a" above).

Table ATT-3. List of References Used in Point of Origin Process Operations Information for Chemical Constituents. (3 Pages)

Facility/ Area	Referenced Documents
B Plant	ARH-564, 1968, *B Plant Recovery of Cesium from Current Acid Wastes by Phosphotungstate Precipitation*, Atlantic Richfield Hanford Company.
	BHI-00179, 1995, *B Plant Aggregate Area Management Study Technical Baseline Report*, Bechtel Hanford, Inc.
	BNWL-B-102, 1971, *Engineering Scale Development of a Process for Strontium Fluoride Production*, Battelle Northwest Laboratories.
	BNWL-B-142, 1971, *Cesium Chloride Flowsheet Development Studies for the Waste Packaging Program*, Battelle Northwest Laboratories.
	HW-10475, *Hanford Engineer Works Technical Manual (T/B Plants)*, DuPont
	HW-23043, 1951, *Flow Sheets & Flow Diagrams of Precipitation Separations Process*, General Electric
	HW-69011, 1961, Project Number *CGC-897 Title 1 Design Fission Product Storage in B Plant*, General Electric
	ISO-986, 1967, *B-Plant Phase III Flowsheets*, ISOCHEM
C Plant	HW-22956-PT2, 1952, *Hot Semiworks Manual Part II REDOX Operating Procedure [for the REDOX Separation Process]*, General Electric
	HW-27886, 1953, *Design Scope Conversion of Hot Semiworks to PUREX Process*, General Electric
	HW-44776, 1956, *Semi Works Operation of the RECUPLEX Facility*, 2 vols., General Electric
	HW-71089, 1961, *Process Engineering for Additional Storage, Loadout and Waste Facilities Hot Semiworks*, General Electric
	HW-72666, 1963, *Hot Semiworks Strontium-90 Recovery Program*, General Electric
	WHC-SD-EN-ES-019, 1992, *Semiworks Aggregate Area Management Study Technical Baseline Report*, Westinghouse Hanford Company
Z Plant	DOE/RL-91-58, 1992, *Z Plant Source Aggregate Area Management Study Report*, DOE-RL
	HNF-EP-0924, 1997, *History & Stabilization of the Plutonium Finishing Plant (PFP) Complex Hanford Site*, Fluor Daniel
	HNF-SD-CP-OCD-044, 1997, *Basis Document for PFP Plutonium Nitrate Ion Exchange Process in Room 228A*, Babcock & Wilcox Hanford Co.
	HW-22604, 1951, *RECUPLEX Process Chemical Flowsheets RECUPLEX HW #1 and HW #2*, General Electric
	HW-23344, 1952, *The RECUPLEX Process*, General Electric
	HW-23633, 1952, *Flow Sheet - Preliminary RM Task 1 on PU IV] Oxalate*, General Electric
	HW-33964, 1954, *RECUPLEX Preliminary Flowsheets*, General Electric
	HW-35030, 1955, *RECUPLEX Operating Manual*, General Electric
	HW-40617, 1955, *Flowsheet for RECUPLEX Operation*, General Electric

Table ATT-3. List of References Used in Point of Origin Process Operations Information for Chemical Constituents. (3 Pages)

Facility/ Area	Referenced Documents
	HW-47655, 1957, *RMC Line Flowsheet - Tasks I, II, and III*, General Electric
	HW-57288, 1958, *Plutonium Recovery from Contaminated Materials [PROJECT CGC-813] Process Design*, General Electric
	HW-64851, 1960, *Solvent Extraction Flowsheet for New Plutonium Reclamation Facility*, General Electric
	HW-65727, 1960, *Removal of Plutonium from 234-5 Sump Wastes and from RECUPLEX Extraction Wastes*, General Electric
	HW-66916, 1960, *Design Scope of the Z Plant Plutonium Reclamation Facility Project CAC-880*, General Electric
	HW-67010, 1960, *Design Scope of the Waste Treatment Facility, Z Plant Project CGC-912*, General Electric
	HW-75675, 1962, *Flowsheet and Bases for Equipment Specifications New Leach Hood*, General Electric
A Plant	ARH-2127, 1977, *PUREX Process Operation and Performance 1970 THORIA Campaign*, Atlantic Richfield Hanford Company
	BHI-00178, 1995, *PUREX Plant Aggregate Area Management Study Technical Baseline Report*, Bechtel Hanford, Inc.
	H-2-65013, 1976, *Figure 12 PUREX Flowsheet Neptunium Purification*, Atlantic Richfield Hanford Company
	H-2-65483, 1983, *Process Flow Diagram*, Vitro Engineering Corporation
	H-2-75643, 1983, *Process Flow Diagram*, [PUREX Oxide Conversion Facility] Kaiser Hanford Company
	H-2-98743, 1991, *Process Flow Diagram*, [Neptunium Oxide Glove Box] ICF Kaiser Hanford Company
	HW-31000, 1955, *PUREX Technical Manual*, General Electric
	RL-SEP-267 PT1, 1965, *Engineering Study Thorium Processing - PUREX Part II- Flowsheet*, General Electric
	SK-2-23947, 1995, *Figure 1 PUREX Flowsheet 6 Percent Plutonium 240 1st Decontamination & Partition Cycle & 2nd Uranium Cycle*, Westinghouse Hanford Company
	SK-2-23948, 1995, *Figure 2 PUREX Flowsheet 6 Percent Plutonium 240 1st Decontamination & Partition Cycle & 2nd Uranium Cycle*, Westinghouse Hanford Company
	SK-2-23949, 1995, *Figure 3 PUREX Flowsheet 6 Percent Plutonium 240 Backcycle Waste Concentration & 2nd Neptunium Cycle Phase 1*, Westinghouse Hanford Company
	SK-2-23950, 1995, *Figure 4 PUREX Flowsheet 6 Percent Plutonium 240 Waste Concentration & Acid Recovery*, Westinghouse Hanford Company
	SK-2-23951, 2002, *Figure 5 PUREX Flowsheet* Solvent Treatment, Rockwell Hanford Corporation
	SK-2-52421, 1970, *Thorium Process Flow Sketch 1970 Campaign*, Atlantic Richfield Hanford Company
	SK-2-56348, 1995, *Figure 3A PUREX Flowsheet 6 Percent Plutonium 240 Backcycle Waste Concentration & 2nd Neptunium Cycles Phases II & III*, Westinghouse Hanford Company

Table ATT-3. List of References Used in Point of Origin Process Operations Information for Chemical Constituents. (3 Pages)

Facility/ Area	Referenced Documents
S Plant	BHI-01142, 1998, *REDOX Facility Safety Analysis Report*, Bechtel Hanford, Inc.
	DOE/RL-91-60, 1993, *S Plant Aggregate Area Management Study Report*, Westinghouse Hanford Company, DOE-RL
	HW-10733, 1948, *REDOX Process Waste Streams Approximate Quantities & Compositions*, General Electric
	HW-18700, 1951, *REDOX Technical Manual*, General Electric
	HW-34163, 1954, *REDOX E Cell Oxonization*, General Electric
	HW-68730, 1961, *REDOX Plutonium Ozonator Information Manual*, General Electric
	ISO-335, 1966, *REDOX Chemical Flowsheet HW Number 9*, Isochem
Generic Reference	DOE/RL-96-82, 1996, *Hanford Facility Dangerous Waste Closure Plan for 241Z Treatment & Storage Tanks*, U.S. Department of Energy, Richland Operations Office
	DOE/RL-99-36 Rev. 1, 1999, *Phase 1 RCRA Facility Investigation Corrective Measures Study Work Plan for SST Waste Management Areas*
	HNF-8735, 2001, *241Z361 Tank Characterization Report*, Fluor Hanford
	LA-UR-96-3860, 1997, *Hanford Tank Chemical & Radionuclide Inventories of HDW Model Rev 4*, Lockheed Martin Hanford Corporation, Los Alamos National Laboratory
	RHO-ST-44, 1982, *216Z12 Transuranic Crib Characterization*, Rockwell Hanford Operations
	RPP-7455, Rev. 0, 2001, *Data Quality objectives Report for Waste Management Areas T & TX-TY*, CH2M HILL Hanford Group, Inc.
	WHC-EP-0172, Rev. 1, 1988, *Inventory of Chemicals Used at Hanford Production Plants & Support Operations 1944-1980*, CH2M HILL Hanford Group, Inc.
	WHC-MR-0517, Rev. 0, 1996, *Listed Waste History at Hanford Facility TSD Units*, Westinghouse Hanford Company
	WHC-SD-EN-TI-248, 1994, *1994 Conceptual Model of Carbon Tetrachloride in the 200W Area at Hanford Site*, Westinghouse Hanford Company

1

This page intentionally left blank.

APPENDIX B

PHASE 1 SAMPLING AND ANALYSIS PLAN FOR 200-IS-1 OPERABLE UNIT TANK FARM PIPELINES (PUBLISHED SEPARATELY AS RPP-PLAN-31715 BY CH2M HILL HANFORD GROUP, INC.)

1

This page intentionally left blank.

PHASE 1 SAMPLING AND ANALYSIS PLAN FOR 200-IS-1 OPERABLE UNIT TANK FARM PIPELINES

D. M. Nguyen
CH2M HILL Hanford Group, Inc.
Richland, WA 99352
U.S. Department of Energy Contract DE-AC27-99RL14047

EDT/ECN:	N/A	UC:	N/A
Cost Center:	7G410	Charge Code:	502927
B&R Code:	N/A	Total Pages:	52

Key Words: 200-IS-1, phase 1, operable unit, sampling and analysis, sampling, analysis, tank farm, pipeline, soil

Abstract: Requirements for sampling and analysis of a number of tank farm pipelines and surrounding soil within the 200-IS-1 operable unit are specified. Data obtained based upon this sampling and analysis plan will be used to support development of the Remedial Investigation/Feasibility Study for the operable unit.

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

Printed in the United States of America. To obtain copies of this document, contact: Document Control Services, P.O. Box 950, Mailstop H6-08, Richland WA 99352, Phone (509) 372-2420; Fax (509) 376-4989.

MAY 23 2007
DATE:
STA: 15
HANFORD RELEASE
ID: 65

Janis Aardal 05/23/07
Release Approval Date

Release Stamp

Approved For Public Release

RPP-PLAN-31715
Revision 0

PHASE 1 SAMPLING AND ANALYSIS PLAN FOR 200-IS-1 OPERABLE UNIT TANK FARM PIPELINES

D. M. Nguyen
CH2M HILL Hanford Group, Inc.

Date Published
May 2007

CH2MHILL
Hanford Group, Inc.

Prepared for the U.S. Department of Energy
Office of River Protection

TABLE OF CONTENTS

1.0 SAMPLING AND ANALYSIS OBJECTIVES 6

2.0 BACKGROUND 6

3.0 SCOPE 6

4.0 SAMPLING REQUIREMENTS 7
- 4.1 SAMPLING AND ANALYSIS APPROACH 7
- 4.2 SAMPLING METHODS 15
  - 4.2.1 Pipeline Sampling 15
  - 4.2.2 Soil Sampling and Survey Methods 16
  - 4.2.3 Surface Geophysical Techniques for Pipeline Evaluations 16
- 4.3 SAMPLE CUSTODY 18

5.0 LABORATORY ANALYSIS REQUIREMENTS 19
- 5.1 SAMPLE HANDLING REQUIREMENTS 19
- 5.2 METHODS AND REQUIREMENTS FOR ANALYSIS 19

6.0 QUALITY ASSURANCE AND QUALITY CONTROL 25
- 6.1 FIELD QUALITY CONTROL 25
- 6.2 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS FOR LABORATORY ANALYSIS 27
  - 6.2.1 Quality Control Requirements 27
  - 6.2.2 Target Detection Limits 29

7.0 DATA REPORTING 35

8.0 CHANGE CONTROL 35

9.0 REFERENCES 36

A-1.0 PROJECT MANAGEMENT 38
- A-1.1 PROJECT/TASK ORGANIZATION 38
- A-1.2 PROBLEM DEFINITION/BACKGROUND 40
- A-1.3 PROJECT/TASK DESCRIPTION 41
- A-1.4 QUALITY OBJECTIVES AND CRITERIA 41
- A-1.5 SPECIAL TRAINING/CERTIFICATION 41
- A-1.6 DOCUMENTS AND RECORDS 41

A-2.0 DATA GENERATION AND ACQUISITION 42
- A-2.1 SAMPLING PROCESS DESIGN 42
- A-2.2 SAMPLING METHODS 42
- A-2.3 SAMPLE HANDLING AND CUSTODY 42
- A-2.4 ANALYTICAL METHODS 42
- A-2.5 QUALITY CONTROL 42

A-2.5.1 Quality Assurance Objective 42
A-2.5.3 Sample Preservation, Containers, and Holding Times 43
A-2.5.4 Sample Collection Requirements 45
A-2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE46
A-2.6 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY 46
A-2.7 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES 47
A-2.8 NON-DIRECT MEASUREMENTS 47
A-2.9 DATA MANAGEMENT 47

A-3.0 ASSESSMENT AND OVERSIGHT 48
A-3.1 ASSESSMENT AND RESPONSE ACTIONS 48
A-3.2 REPORTS TO MANAGEMENT 48

A-4.0 DATA VALIDATION AND USABILITY 49
A-4.1 DATA REVIEW, VERIFICATION, AND VALIDATION 49
A-4.2 VERIFICATION AND VALIDATION METHOD 49
A-4.3 RECONCILIATION WITH USER REQUIREMENTS 49

A-5.0 QUALITY ASSURANCE PROJECT PLAN REFERENCES 50

LIST OF TABLES

Table 4-1. Pipeline and Sample Location Attributes 11

Table 5-1. Chemical, Radiological, and Physical Analytical Requirements for Samples 21

Table 5-2. Primary Organic Analytes 24

Table 6-1. Quality Control Parameters for Primary Analytes 28

Table 6-2. Target Detection Limits for Primary Radionuclides 29

Table 6-3. Target Detection Limits for Primary Chemicals 31

Table A-1. Sample Preservation, Container, and Holding Time Guidelines 44

LIST OF FIGURES

Figure 4-1. Phase 1 Tank Farm Pipeline Sample Locations 10

Figure 4-2. Conceptualization of Residual Waste in Process Pipelines 14

Figure A-1. Project Organization 39

LIST OF TERMS

CH2M HILL	CH2M HILL Hanford Group, Inc.
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DQO	data quality objective
Ecology	Washington State Department of Ecology
EMI	electromagnetic induction
EPA	U.S. Environmental Protection Agency
GPR	ground penetrating radar
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
IC	ion chromatography
ICP/AES	inductively coupled plasma/atomic emissions spectroscopy
OU	operable unit
PCB	polychlorinated biphenyl
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPP	River Protection Project
SAP	sampling and analysis plan
SST	single-shell tank
SVOA	semivolatile organic analysis
SVOC	semivolatile organic compound
TIC	tentatively identified compound
PSAP	Pipeline sampling and analysis plan
VOA	volatile organic analysis
VOC	volatile organic compound
WIDS	Waste Information Data System
WMA	Waste Management Area

1.0 SAMPLING AND ANALYSIS OBJECTIVES

The primary objective for sampling and analysis of the pipelines and contaminated soil in the 200-IS-1 Tanks/Lines/Pits/Waste Group Operable Unit (OU) is to provide characterization data for remedial investigation/feasibility study and remediation decision-making.

Sampling and analysis requirements were defined using a data quality objective (DQO) process. The Washington State Department of Ecology (Ecology), the U.S. Department of Energy (DOE) and its contractors participated in the DQO process. Results of the DQO process are documented in the *Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances* (D&D-30262).

This sampling and analysis plan (SAP) summarizes the DQO requirements and provides additional direction and clarification for field screening, sampling, laboratory analysis, and data reporting for meeting the requirements. Specifically, the SAP covers the DQO requirements for chemical and radiological characterization. Operational sampling and analysis requirements will be documented in pipeline and associated soil sampling and analysis plans (PSAPs). A PSAP will be prepared for an individual pipeline (or a group of pipelines) and associated areas of contaminated soil in accordance with approved CH2M HILL Hanford Group, Inc. (CH2M HILL) procedures. The PSAPs will meet requirements in this SAP.

2.0 BACKGROUND

The 200-IS-1 OU consists of *Resource Conservation and Recovery Act* (RCRA) (EPA 1976) past-practice waste sites and treatment, storage, and disposal units. The OU designation and waste site assignments are defined in DOE/RL-96-81, *Waste Site Grouping for 200 Areas Soil Investigations*, and DOE/RL-98-28, *200 Areas Remediation Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program*. The OU includes an extensive network of pipelines, diversion boxes, catch tanks, valve pits, related infrastructures, and associated unplanned releases. The systems were used to transport waste or process materials from separation facilities to the single-shell and double-shell tanks and to control or divert flow to disposal waste sites that received liquid waste streams. The process-waste pipeline systems are located primarily within the industrial 200 Areas of the Hanford's Central Plateau.

3.0 SCOPE

The scope of this SAP is limited to the 200-IS-1 OU pipelines and contaminated soil. Sampling and analysis of other equipment in the OU will be addressed at a later date. Also, this SAP is applicable only to the approximately 300 individual pipelines that are being managed by CH2M HILL for the U. S. Department of Energy. These pipelines are located outside tank farms (e.g., facility to diversion box, tank farm to tank farm, etc.). They do not include those located within tank farm fences. Identification of pipelines has been performed by examining drawings and

other documentations. Pertinent information for these pipelines are entered into the Waste Information Data System (WIDS) (Fluor 2007). Additional pipelines may be identified by future field walk-downs or excavations. A separate SAP is used to address characterization needs for facility process pipelines within the 200-IS-1 OU that are managed by Fluor Hanford, Inc.

In accordance with the DQO (D&D-30262), characterization of the pipelines will be performed in two phases. In Phase 1, data will be collected for piping and soil where existing knowledge indicates contamination is likely present. The goal of Phase 1 sampling is to determine whether or not contamination is above preliminary cleanup levels. In addition, data will be collected in Phase 2 to support remediation decision making including a no-action decision. It is expected that Phase 2 would require a much larger data set. This SAP only addresses Phase 1 sampling. Additional Phase 1 sampling may be required after reviewing the results for the sampling outlined in this SAP prior to moving to Phase 2.

4.0 SAMPLING REQUIREMENTS

4.1 SAMPLING AND ANALYSIS APPROACH

The approximately 300 tank farm pipelines comprise of over 400,000 ft of pipes. Levels of contamination are expected to be different among individual pipelines and could vary significantly within a pipeline. Therefore, direct characterization of the 400,000 ft of piping is not practical. A sampling approach has been developed to take maximum advantage of existing knowledge and waste sample data to optimize pipeline sampling.

The pipelines were used to transfer waste or process materials from facilities such as the Plutonium-Uranium Extraction Plant (PUREX), Reduction-Oxidation Plant (REDOX), B Plant, T Plant, U Plant, tank farm evaporators (242-B, 242-T, 241-S, and 242-A), processing vaults (244-AR, 244-BXR, 244-CR, etc.) and Hot Semiworks. Wastes generating from many of these facilities are well known based on knowledge of facility operations. The wastes were transferred for storage primarily in the Hanford tank farms. Wastes stored in the tank farms are relatively well characterized by extensive sampling and thorough review of waste generating and transfer history. However, little or no sampling has been performed on the residual waste that may be present in the transfer lines. Also, a review of existing documentation to develop process knowledge for the pipelines is still ongoing. Presently, little is known about past duties (i.e., what wastes was transferred through which pipelines) of many pipelines.

Therefore, characterization of contamination in the pipelines will be needed to support RI/FS and remediation decision-making. As discussed previously, the primary objective of Phase 1 sampling is to determine whether or not contamination in a pipeline and in surrounding soil is above preliminary cleanup level. Secondary objectives include:

- Evaluate and demonstrate sampling and field measurement methods and technologies.
- Evaluate process history associated with these pipelines.
- Refine current conceptualization of waste associated with the pipelines, associated encasements, and soils.
- Collect data that may be used to develop sampling approach for Phase 2.

To achieve the above objectives, it is desirable that pipelines selected for Phase 1 sampling have the following attributes:

1. The pipelines experienced failures such as leaking or plugging. Contamination in the pipe or surrounding soil likely exceeds preliminary cleanup levels.
2. The selected pipelines represent both direct-bury pipelines and encased pipelines. These conditions present different challenges for sampling. Selection of these pipelines will allow demonstration of sampling methods for different conditions.
3. The pipelines were constructed from pipes made of different material (e.g., a stainless steel pipe welded to a carbon steel pipe). The mismatch of construction increases the likelihood that a leak may have occurred and, therefore, the pipe and surrounding soil may have elevated levels of contamination.
4. The pipelines were used to transfer waste known to have high level of contamination. This increases the likelihood that contamination in the pipe exceeds cleanup levels.
5. The pipelines represent a group of lines used to transfer the same waste. Because composition of the waste transferred through a group of lines generally can be developed based on process knowledge and existing tank sample data, sample data obtained for one or two pipelines in a group will provide information regarding contamination in the other pipelines. This information may be used to guide additional Phase 1 sampling or to optimize Phase 2 sampling.

Each pipeline selected for Phase 1 will be sampled at a minimum of three locations. Both pipe and surrounding soil will be sampled at the selected locations. Contamination measurements at three different locations in a pipeline will provide information on the distribution of contamination along the length of a pipeline.

In addition to the pipelines having the attributes discussed above, the lines will be sampled at locations where contamination is most likely to accumulate. Examples of these types of location are listed below:

1. Low point in the line,
2. At the end of a long run with low slope,
3. Point where a leak occurred,
4. A transition point (e.g., bend, elbow, etc.), and
5. Point where there is a mismatch of pipe-construction materials.

Also, many of the pipelines can be accessed for sampling only by significant excavation; therefore, it is desirable that multiple pipelines be accessible at an excavation location. Each sample location will have one or more of the attributes.

Two pipelines that satisfy the above desired attributes are selected for Phase 1 sampling: V108/812 and V108/8653/8618. Pipeline V108/812 is a 3-inch diameter, carbon steel, direct buried transfer line. Pipeline V108/8653/8618 is a 3-inch diameter, stainless steel, encased line. The lines are 1420 and 6840 ft long, respectively. V108/812 was used to transfer primarily PUREX supernatant or PUREX sludge supernatant from the 244-AR Vault to the 241-C-151 diversion box. V108/8653/8618 was used to transfer PUREX acid sludge from the 244-CR Vault to the 221-B Plant. A leak was known to occur in 1971, likely near where the lines are welded together. Additional details on the pipelines can be found in the Waste Information Data System (WIDS), Site Codes 200-E-153-PL and 200-E-111-PL, respectively.

Sample locations for these two pipelines are shown in Figure 4-1. Note that samples to be taken at location 1 will be used for both pipelines. The desired attributes associated with each sample location are shown in Table 4-1. The selected sample locations may not be accessible because of unexpected radiation level or equipment configuration encountered in the field. In that event, alternate sample locations will be selected after a discussion with Ecology personnel. Changes to the sample locations will be documented in the appropriate PSAP.

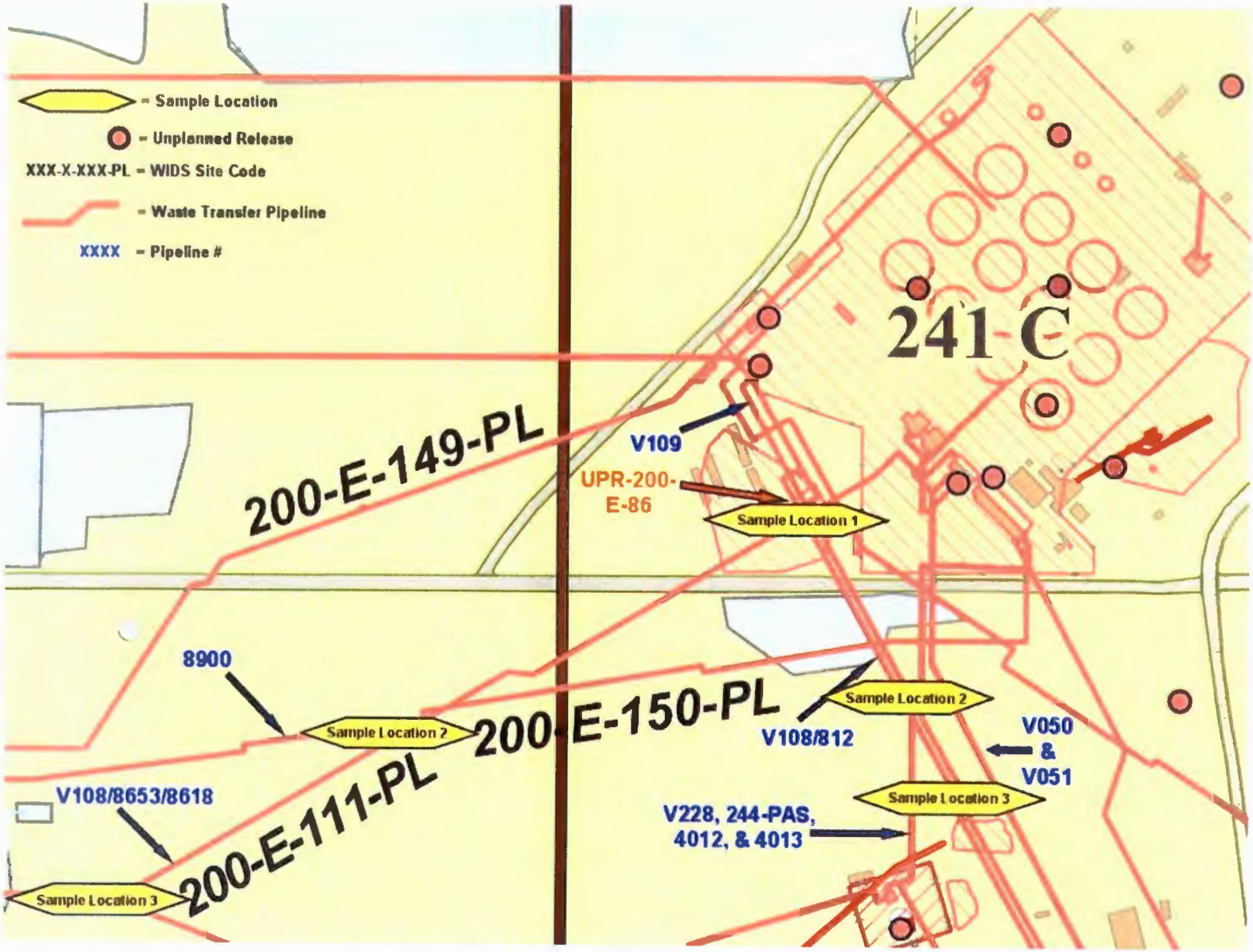


Figure 4-1. Phase 1 Tank Farm Pipeline Sample Locations

Table 4-1. Pipeline and Sample Location Attributes

Pipeline - Sample Location	Attributes									
	Known Leak	Low Point in Line	End of Long Run with Low Slope	One of a Number of Pipelines Used to Transfer the Same Waste[1]	At a Transition Point in Pipeline (e.g., Bend, Elbow)	Direct Buried Line	Encased Line	Construction Material Mismatch	Access to Multiple Lines at One Sample Location	Carried Waste Known to Have High Level of Contamination
V108/812 and V108/8653/8618 Sample Location 1	X	X	X	X	X	X	X	X	X	X
V108/812 Sample Location 2		X		X		X			X	X
V108/812 Sample Location 3		X		X		X			X	X
V108/8653/8618 Sample Location 2		X		X			X		X	X
V108/8653/8618 Sample Location 3		X		X			X		X	X

[1]V108/812 was used to transfer PUREX supernatant. Other pipelines that carried the same waste include V109, V130, 8902, and 4012. V108/8653/8618 was used to transfer PUREX acid sludge. Other pipelines that carried the same waste include V228 and 8901/8649/244.

Sampling at each location will be based on a conceptualization of residual waste in the pipelines. The conceptualizations of residual waste for intact and failed, direct-buried pipelines, encased pipelines, and encasements are shown in Figures 4-2. In general, contamination in the residual waste is likely a result of solids settled out on the bottom of the pipelines and insoluble constituents deposited on the pipe wall during operation. Contaminants in the residual waste are most likely insoluble metal cations (such as silver, bismuth, aluminum, iron, manganese, chromium, mercury, lead, silicon, and zirconium), insoluble radionuclides (such as strontium-90, uranium isotopes, actinides, and cobalt-60), soluble salts (such as sodium and potassium), and soluble radionuclides (such as cesium-137, iodine-129, and technetium-99). In cases where pipelines failed due to plugging, contaminants include both soluble and insoluble constituents of the waste that was transferred when plugging occurred.

Soil at each sample location will be characterized. Soil sampling is expected to be simpler than pipeline sampling. Therefore, soil will be collected by grab sampling at multiple depths and sent to a laboratory for analyses (see Section 5.0 for analytical requirements). One or more of the soil sampling methods described in Section 4.2.2 may be used. The number of grab samples and the location and depth of each grab will be based on field screening (e.g., surface radiation survey, ground penetration radar, etc.) and depth of the pipeline. Location and depth of soil grab samples will be specified in the appropriate PSAP.

Pipeline sampling poses significant difficulties and exposure to the workers. Therefore, the approach for pipeline sampling and analysis is somewhat different from soil sampling. At the first sample location for each pipeline, a section of pipe will be removed and sent to the laboratory for analysis of residue. Total length of the section of pipe removed is limited to 10 ft or less, based on a desire to limit excavation and for As Low As Reasonably Achievable (ALARA) concerns. Actual length of piping removed will be based on field survey results. The pipe section may be cut into smaller sub-sections for ease of shipping and handling.

Residual waste on the interior of the pipe (and between the primary and secondary pipe, if the pipe is encased and the primary pipe failed) will be removed and analyzed as required in Section 5.0. Liquids, if present in the pipeline, will be collected in sample jar(s) and shipped to a laboratory for analysis. If the amount of the sample material is insufficient for analysis of all constituents listed in Table 5-1, then only the constituents most likely to be present, as discussed above, will be analyzed. If the amount is insufficient even for these analytes, then DOE and Ecology will evaluate additional changes to the list of analyses. Changes to the analyses will be documented in the appropriate PSAP.

At the other sample locations for a pipeline, either field-deployed measurements or laboratory non-destructive assay (NDA) of a short section of pipe will be used to obtain limited data. These data may be used directly to confirm whether or not contamination in the pipeline exceeds cleanup levels. For example, if gamma energy data obtained with a field instrument or NDA indicates cesium-137 exceeds its cleanup level, then no further evaluation is necessary. This is a possible scenario for V108/812 because this pipeline was used to transfer PUREX supernatant, which is known to have high level of this radionuclide.

Field measurement or NDA data may be used indirectly also. If cesium-137 concentration is below its cleanup level, then concentration of other COPCs at these locations may be estimated by the use of scaling factors (concentration ratios of other constituents to cesium-137). First, a scaling factor is developed for each constituent using sample results from the first sample location. Second, obtain cesium-137 concentration of the residual waste in a pipe by using field gamma measurements or NDA. Third, estimate concentration of the other COPCs by scaling the measured cesium-137 concentration at each location. This is a possible scenario for V108/8653/8618 because this pipeline carried PUREX acid sludge, which has a relatively low level of cesium-137 but high levels of actinides and strontium-90.

After completion of sampling, the pipeline and the surrounding soil will be placed in a state that is protective of the worker and environment. Activities to achieve the end state will depend on sample location and sampling methods used. Guidance for achieving the end state after sampling will be provided in the PSAP.

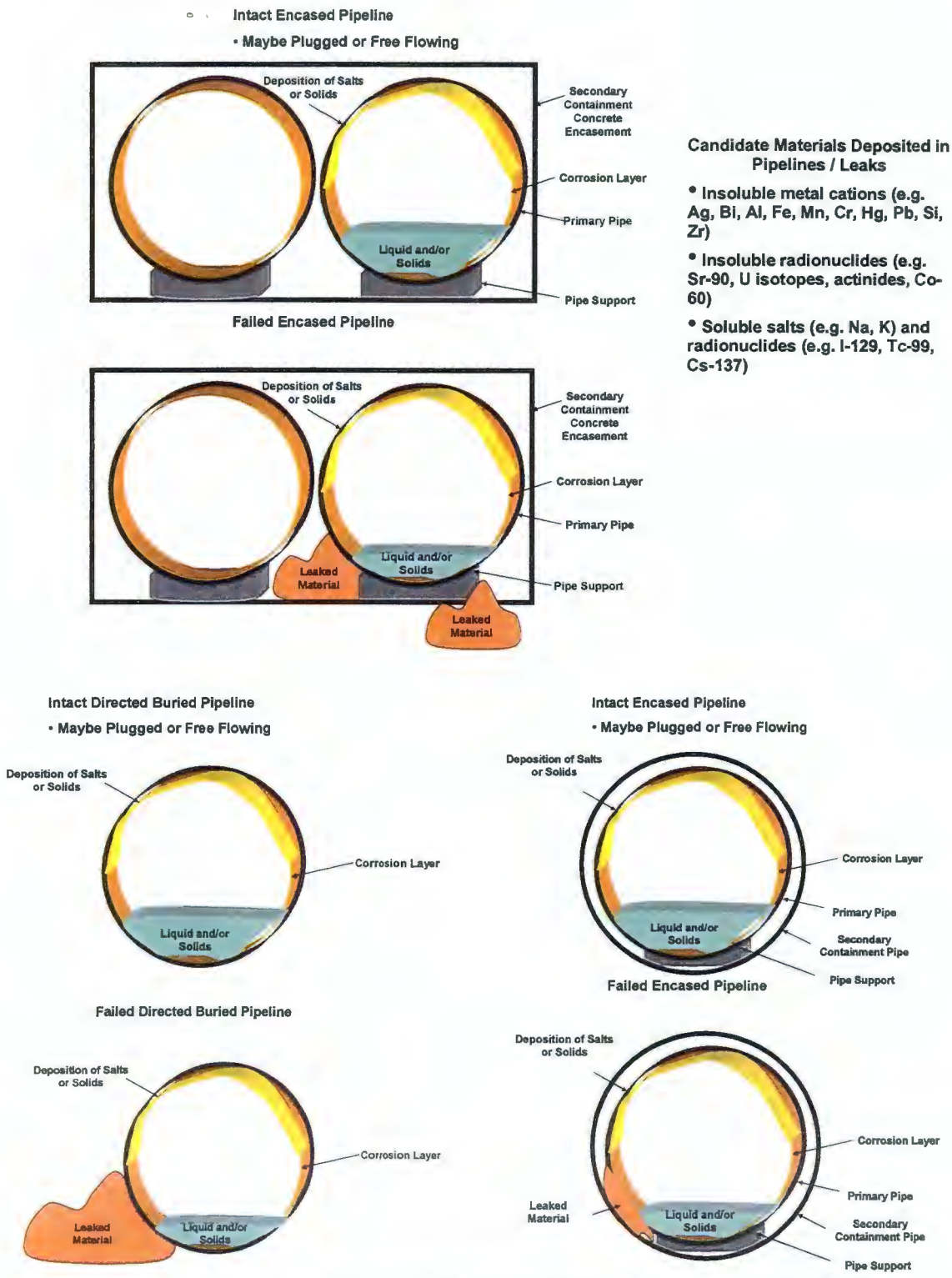


Figure 4-2. Conceptualization of Residual Waste in Process Pipelines

4.2 SAMPLING METHODS

Characterization activities include evaluation of the interior of pipelines and adjacent vadose zone soil. Within the interior of pipelines, samples of residual solids in the form of sediment, sludge or scale and liquid, if present, will be collected. For soil, sampling and geophysical logging using spectral and gross gamma, passive neutron, and active neutron (moisture) detectors will be performed. Direct-push technology (e.g., Geoprobe or equivalent equipment) will be used for vadoze soil sampling and geophysical logging. The sampling strategy is designed to provide focused evaluations on potentially contaminated locations and media inside the pipelines, and in adjacent subsurface soils where leakage may have occurred. Selection of samples in soils used for laboratory analysis will be guided by field screening results. Field screening results will assist in identifying the sample depths where the most extensive contamination occurs.

Prior to implementing intrusive activities, surface geophysical and radiation surveys will be conducted at all sample locations. The surface geophysical surveys will be conducted using ground-penetrating radar and/or electromagnetic induction and will aid in verifying buried pipeline locations, other buried utilizes, and subsurface anomalies. Surface radiation surveys will identify areas of surface contamination that might impact the intrusive activities and health and safety requirements.

Sampling and field-deployed measurement methods that may be used are described in Sections 4.2.1 and 4.2.2 for piping and soil, respectively. The specific methods to be used at a sample location will be identified in the appropriate PSAP. The PSAP also will provide additional guidance for excavation and preparation of the samples for shipping to and receiving at the laboratory.

4.2.1 Pipeline Sampling

Handheld and Deployed Instrument Radiological Surveys:

Radiological surveys of pipeline interiors will be used to provide information concerning the presence or absence of residual radiological contamination. A number of deployment systems are available; some include a configuration with camera survey equipment. Alpha, beta, and gamma radiation detectors can be used with some systems. Equipment and survey specifications will be presented in the PSAP(s). Alternatively, a short section of pipe may be removed for NDA at a laboratory.

Sampling Pipe Scale/Sediment Sludge for Laboratory Analyses:

Residual build-up of sediment, slug, or scale may be present in the interiors of pipelines. Liquid may also be present in some pipelines. These materials will be sampled at one location per pipeline. A section of pipe, up to maximum of 10ft long, will be removed and sent to a laboratory for analysis. As discussed earlier, the pipe section may be cut into smaller sub-

sections for ease of handling. Liquid, if present, will be collected in sample jar(s) and shipped to a laboratory for analysis.

A hydraulic-type cutting tool, similar to the "jaws of life" has been used to cut piping jumpers at tank farm underground valve pits, as well as at the Hanford 100K Area, to remove piping. This hydraulic shear is capable of cutting a pipe with a diameter up to 6 inches. Additionally, there are commercially available tools that mount on the outside of piping. These tools not only can cut the pipe pneumatically but also prepare the ends for handling. This could significantly reduce worker exposure.

4.2.2 Soil Sampling and Survey Methods

Investigations for the presence of contaminants in the soils surrounding pipelines will be conducted using both indirect and direct evaluation techniques. Subsurface investigations will include geophysical logging and soil sampling. One or more of the following sampling and survey methods may be used to characterize soil contamination:

Direct-Push Investigative Techniques:

Subsurface investigations using direct-push technology will be employed as part of the assessment for soil surrounding selected pipeline locations. This technology can be used to install casing and collect samples with minimal to no excess waste soil generated. Installations will be used to obtain information relating to a number of in situ soil characteristics including gamma radiological levels and soil moisture. Discrete sample intervals will have soil collected for field screening and laboratory analyses. This technology will work well in the unconsolidated sediments and fill material adjacent to buried pipelines.

Geophysical Logging Through Direct-Push Casing

Radioactivity levels will be measured in soils using geophysical logging instrumentation. Radioactive contamination is generally expected to be primary represented by gamma emitters (e.g., cesium-137). Driven small-diameter casing will be installed and used for down-hole logging with gamma-logging tools. The depth of a driven casing will be limited by the subsurface conditions (i.e., cobbles or gravel). Gross gamma and passive neutron logging probes will be used to determine areas of potentially high americium-241 and plutonium-239/240 concentrations. The small-diameter gross gamma and passive neutron probe system uses bismuth-germanium detector instrumentation for gross counting of the gamma-emitting radionuclides in the soil as a function of depth. The passive neutron logging instrument with a nHe-3 detector can be configured to detect the neutron flux present in the below-ground soil environment. Active neutron logging will be used to determine soil moisture content. Soil moisture will be reported as a percent volume fraction.

4.2.3 Surface Geophysical Techniques for Pipeline Evaluations

Several geophysical techniques are available and will be used as needed to gather information on buried pipelines. Additional discussion on surface geophysical techniques is provided in EPA/625/R-92/007, *Use of Airborne, Surface, and Borehole Geophysical Techniques at Contaminated Sites: A Reference Guide.*

Magnetometry

Magnetometers permit rapid, non-contact surveys to locate buried metallic objects or features. This technique is applicable for use with buried metal pipelines. Portable (one-person) field units can be used virtually anywhere that a person can walk, although they can be sensitive to local interferences, such as fences and overhead wires. Field-portable magnetometers may be single- or dual-sensor. Dual-sensor magnetometers are called gradiometers; they measure gradient of the magnetic field; single-sensor magnetometers measure total field. Magnetic surveys typically are run with two separate magnetometers. One magnetometer is used as the base station to record the earth's primary field. The other magnetometer is used as the rover to measure the spatial variation of the earth's field. The rover magnetometer is moved along a predetermined linear grid laid out at the site.

Ground-Penetrating Radar and Electromagnetic Induction

Surface geophysical surveys using ground-penetrating radar (GPR) and electromagnetic induction (EMI) techniques will be used to verify the locations of pipelines as needed. GPR uses a transducer to transmit frequency module electromagnetic energy into the ground. Interfaces in the ground, defined by contrasts in dielectric constants, magnetic susceptibility, and, to some extent, electrical conductivity, reflect the transmitted energy. The GPR system measures the travel time between transmitted pulses and the arrival of reflected energy. The reflected energy provides the means for mapping subsurface features of interest. The display and interpretation of GPR data are similar to those used for seismic reflection data. When numerous adjacent profiles are collected, often in two orthogonal directions, a plan view map showing the location and depth of underground features can be generated.

The EMI technique is a non-invasive method of detecting, locating, and/or mapping shallow subsurface features. It complements GPR because of its response to metallic subsurface anomalies and because it provides reconnaissance-level information over large areas to help focus GPR activities. The EMI techniques are used to determine the electrical conductivity of the subsurface and generally are used for shallow investigations. The method is based on a transmitting coil radiating an electromagnetic field that induces eddy currents in the earth. A resulting secondary electromagnetic field is measured at a receiving coil as a voltage that is linearly related to the subsurface conductivity.

Surface Geophysical Exploration

Surface geophysical exploration can be used to extend the current level of understanding associated with subsurface contamination by providing spatial distributions that can be correlated with other characterization data. Resistivity data are sensitive to salts such as sodium nitrate, one of the major constituents in tank waste.

Electrical geophysical methods apply an electrical current to the ground and measure the voltage potential at another location. By using multiple electrodes at different locations, regions of lower resistivity can be mapped and subsequently interpreted as possible waste plumes. Because of concerns over possible interference from tanks, piping, and other infrastructure, different combinations of resistivity data may need to be collected such as surface lines, wells (including drywells), and a combination of well-to-surface lines. In addition several geophysical methods should be used to identify the presence and location of buried infrastructure as a prerequisite to

collecting the resistivity data. Infrastructure mapping should use a variety of methods including magnetic gradiometry, electromagnetic induction, and ground-penetrating radar. The infrastructure map will be used during the analysis and interpretation of the resistivity data to differentiate between the effects of buried infrastructure from the effects of subsurface contamination. See RPP-RPT-28955, *Surface Geophysical Exploration of T Tank Farm at the Hanford Site* for additional information.

4.3 SAMPLE CUSTODY

A chain-of-custody form shall be used for each sample and will accompany each sample from sampling through analysis. At a minimum, the following sampling information shall be included on the chain-of-custody form:

- Project name
- Signature of the collector
- Date and time of collection
- Sample type (e.g., pipe, soil, etc.)
- Requested analysis or provide a reference for sample analysis
- Signatures of persons involved in the chain of possession
- Date and time of possession
- Unique sample identification number assigned to the sample
- Location from which the sample was obtained
- A notation of pertinent sampling information including unusual characteristics or sampling problems
- A brief description of the sample matrix such as color or consistency if possible.

Each sample will be shipped to the laboratories in an approved shipping container per approved procedure. A custody seal will be affixed to the lid of each sample container.

The information documented on the chain-of-custody forms should match the instructions within the PSAP. Sampling activities are documented in the work package(s), and any deviations from the PSAP instructions, and the justification for the deviations, will be captured in the work package. Sample integrity and traceability are maintained via the chain-of-custody forms, which are included in the Format V laboratory report. The Format V laboratory report includes a narrative section that documents known deviations from the PSAP requirements. A description

of the Format V report is provided in Section 7.0.

5.0 LABORATORY ANALYSIS REQUIREMENTS

This section specifies requirements for laboratory analysis of pipe and soil samples. Because many of the samples are expected to be radioactive, analysis of the samples will be performed at DOE laboratories. The laboratories shall maintain a quality program that meets the requirements in Section 6.0. Sample handling requirements are provided in Section 5.1. Analytical requirements are specified in Section 5.2.

5.1 SAMPLE HANDLING REQUIREMENTS

The laboratory shall remove sample material from each section of pipe or soil jar as necessary and place it in an individual empty jar (i.e., material from individual samples shall be stored separately). Solids removal methods that may alter chemical characteristics of the sample material (e.g., rinsing) shall not be used. Liquid samples may be kept in the same jars as received. Each sample shall be weighed and the approximate net weight recorded. Close-up photographs of materials in each jar shall be taken. The photographs should show, as clearly as possible, the physical characteristics of the sample.

The laboratory will observe and record the following sample characteristics:

- Color and consistency of solid samples
- Color and clarity of liquid samples (if present)
- Suspended or settled solids in liquid samples, if present (volume of solids will be estimated as a percentage of the sample total volume).

5.2 METHODS AND REQUIREMENTS FOR ANALYSIS

Analytical requirements for pipeline and soil samples are summarized in Table 5-1. Pipe residue (liquid and solids) and soil samples will be analyzed for major constituent categories (VOCs, SVOCs, inorganics, and radionuclides) using specified analytical methods. Waste analyses will be performed utilizing the methods outlined in SW-846, where applicable. However, SW-846 methods may require some deviation to address radiological concerns and unique matrix conditions. All attempts will be made to meet the DQO requirements.

Constituents measured by the specified analytical methods are divided into primary and secondary analytes. Primary analytes are identified in Table 5-1 (and Table 5-2 for organic analytes) and categorized as such if they are included in any of the following:

- The SST Part A Permit (Part A) tank waste inventory
- Underlying hazardous constituents listed in WAC 173-303-610, "Closure and post-closure"; or Title 40, *Code of Federal Regulations*, Part 268, "Land Disposal Restrictions" (40 CFR 258) (40 CFR 268.48, "Universal treatment standards")
- Radionuclides from 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste" (10 CFR 61.55, "Waste classification")

Primary constituents will be analyzed to the quality control (QC) requirements specified in the DQO. Secondary constituents are measured by the same analytical methods but are not required to meet the specified QC requirements.

Some constituents may be measured by more than one method. In these cases, the selection of the method may depend on the action levels required for a decision, the expectation that the constituent is present, or the detection limit that can be achieved for each method.

Hexavalent chromium concentration will be estimated by total chromium measurements. If total chromium concentration measurements exceed applicable threshold for hexavalent chromium, then analysis of hexavalent chromium will be performed.

For organic analyses, tentatively identified compounds (TICs) will be identified using the Reconstructed Ion Chromatogram. The Reconstructed Ion Chromatogram is evaluated for TICs by identifying peaks that have not already been identified as target compounds according to the following criteria. The criteria discussed below are from the proposed language for revision three of Volume 4 of DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents*.

The library match for a TIC should be higher than 75% before this detailed evaluation is initiated. The method-specified tune criteria should be met. Special attention to the tune at low masses should be taken when evaluating volatile compounds. The concentration of a TIC should be greater than 10% of the nearest internal standard or estimated 5 nanogram on column injection, whichever is smaller. Early (injection peak) and late eluting peaks (column bleed and coeluting compounds) should have adequate background subtraction to permit use of these TIC criteria. If isotopic patterns are present, the mass ratios should agree with the reference spectrum within 10%. The base mass peak for the sample should be the same as the reference spectrum. If a molecular ion is present in the reference spectrum, the sample should also have a molecular ion mass. Reference spectrum ions greater than 20% should be in the sample spectrum. Sample ions greater than 20% that are not in the reference spectrum need to be evaluated. Major sample ions (greater than 20%) should match relative intensities to the base peak to those same ratios for the reference spectrum within 10-30%.

The TIC evaluation is limited to the 30 largest TICs for the volatile organic analysis and the 30 largest for the semivolatile organic analysis meeting the criteria discussed above.

Table 5-1. Chemical, Radiological, and Physical Analytical Requirements for Samples. (3 sheets)

Instrument	Analyte	EPA Analytical Method	Prep method for solids (a/d/f/w/e/dist)	Quality control					
				Duplicate per Pipeline	Matrix spike	Matrix spike DUP	Blank	LCS	Units (for liquids or solids as appro-priate)
Gravimetric	Bulk density or SpG[1]	Not available	d	One pipe and one soil samples	NA	NA	NA	ea AB	g/mL or unitless
Thermogravimetric	Wt% H_20	Not available	d	One pipe and one soil samples	NA	NA	NA	ea AB	wt%
ICP/AES	Primary inorganics (Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Pb, Mn, Ni, Sb, Se, Sr, Tl, U, V, Zn)	EPA Method 6010B	f or a	One pipe and one soil samples	ea PB or AB[2]	NR	ea PB or AB	ea PB or AB	µg/g or µg/mL
ICP/MS[3]	^{237}Np, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U, ^{230}Th, ^{232}Th	EPA Method 6020	f or a	One pipe and one soil samples	ea PB or AB	NR	ea PB or AB	ea PB or AB	µg/g or µg/mL
Distillation/ISE	S^{2-}	EPA Method 9030B/9215	d	One pipe and one soil samples	ea AB	NR	ea AB	ea AB	µg/g or µg/mL
Liquid scintillation	^{63}Ni	Not available	f or a	One pipe and one soil samples	NA	NR	ea PB or AB	ea PB or AB	µCi/g or µCi/mL
IC	Primary inorganics (F^-, NO_2^-, NO_3^-, $C_2H_3O_2^-$, CHO_2^-, $C_2H_3O_3^-$, $C_2O_4^{2-}$)	EPA Method 9056	w	One pipe and one soil samples	ea AB[5]	NR	ea PB	ea AB	µg/g or µg/mL
IC	NH_4^+	EPA Method 300.7	dist	One pipe and one soil samples	ea PB	NR	ea PB	ea PB	µg/g or µg/mL
CVAA	Hg	EPA Method 7471A/7470A	d	One pipe and one soil samples	ea AB	NR	ea AB	ea AB	µg/g or µg/mL
Spectrophotometric	CN^-	EPA Method 9010C	dist	One pipe and one soil samples	ea AB	NR	ea AB	ea AB	µg/g or µg/mL
Sep & beta count	^{90}Sr	Not available	f	One pipe and one soil samples	NA	NR	ea AB	ea AB	µCi/g or µCi/mL

Table 5-1. Chemical, Radiological, and Physical Analytical Requirements for Samples. (3 sheets)

Instrument	Analyte	EPA Analytical Method	Prep method for solids (a/d/f/w/e/dist)	Quality control					
				Duplicate per Pipeline	Matrix spike	Matrix spike DUP	Blank	LCS	Units (for liquids or solids as appro-priate)
Separation, AEA[4]	$^{238, 239/240}Pu$, ^{241}Am, $^{243/244}Cm$, ^{242}Cm	Not available	f	One pipe and one soil samples	NA	NR	ea AB	ea AB	µCi/g or µCi/mL
Sep/liquid scintillation	^{3}H	Not available	w	One pipe and one soil samples	ea AB[5]	NR	ea PB	ea AB	µCi/g or µCi/mL
Sep/liquid scintillation	^{14}C	Not available	w	One pipe and one soil samples	ea AB[5]	NR	ea PB	ea AB	µCi/g or µCi/mL
Anion-cation exchange/distilla-tion/liquid scintillation	^{79}Se	Not available	a	One pipe and one soil samples	NA	NA	ea PB or AB	Standard not available	µCi/g or µCi/mL
ICP/MS	^{99}Tc	EPA Method 6020	f or a	One pipe and one soil samples	ea AB	NR	ea PB or AB	ea PB or AB	µg/g or µg/mL
Sep/GEA	^{129}I	Not available	f/w	One pipe and one soil samples	NA	NA	ea AB	ea AB	µCi/g or µCi/mL
GEA[5]	Primary gamma emitters: $^{152,154,155}Eu$, ^{137}Cs, ^{60}Co, ^{125}Sb, ^{226}Ra	Not available	f	One pipe and one soil samples	NA	NA	ea AB	ea AB	µCi/g or µCi/mL

Table 5-1. Chemical, Radiological, and Physical Analytical Requirements for Samples. (3 sheets)

Instrument	Analyte	EPA Analytical Method	Prep method for solids (a/d/f/w/e/dist)	Quality control					
				Duplicate per Pipeline	Matrix spike	Matrix spike DUP	Blank	LCS	Units (for liquids or solids as appro-priate)
GC/MS	Primary VOC (see Table 5-2)	EPA Method 8260B	d	One pipe and one soil samples	ea AB	ea AB	ea AB	ea AB	µg/L or µg/kg wet wt.
GC/MS	Primary SVOC (see Table 5-2)	EPA Method 8270C	e	One pipe and one soil samples	ea PB	ea PB	ea PB	ea PB	µg/L or µg/kg wet wt.
PH Meter	pH	EPA Method 9045D	d	One pipe and one soil samples	NA	NA	NA	ea AB	pH
GC/ECD	PCBs (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260)	EPA Method 8082	e	One pipe and one soil samples	ea PB	ea PB	ea PB	ea PB	µg/L wet wt. or µg /kg dry wt.

Notes:

[1]Use SpG procedure LA-510-116 when solids are too dry or are observed to contain significant air "pockets" that may affect accuracy or repeatability of the measurements. The LCS is applicable to the SpG analysis only.
[2]Serial dilutions or matrix spikes may be used as necessary.
[3]LCS and spike for ^{232}Th and ^{235}U only. Initial calibration verification and post-digest spike for ^{232}Th, ^{237}Np, ^{235}U, and ^{238}U.
[4]LCS for $^{239/240}$Pu and ^{241}Am only.
[5]LCS for ^{137}Cs and ^{60}Co only.

Prep Method Abbreviations:
e = extraction, d = direct, f = fusion, a = acid, w = water, dist = distillation, sep = separation

Miscellaneous Abbreviations:
ea = each, NA = not applicable, NR = not required, AB = analytical batch, PB = preparation batch, DUP = duplicate analyses

Analytical Method Abbreviations:
AEA = alpha energy analysis.
CVAA = cold vapor atomic absorption.
GC/ECD = gas chromatography/electron capture detector.
GC/MS = gas chromatography/mass spectrometry.
GEA = gamma energy analysis.
IC = ion chromatography.
ICP/AES = inductively coupled plasma/atomic emission spectrometry.
ICP/MS = inductively coupled plasma/mass spectrometry.
ISE = ion selective electrode.
LCS = laboratory control sample.
PCB = polychlorinated biphenyl.
SpG = specific gravity.
SVOC = semivolatile organic compound.
VOC = volatile organic compound.

Table 5-2. Primary Organic Analytes

Primary VOA analytes	CAS No.	Primary SVOA analytes	CAS No.
1,1,1-Trichloroethane	71-55-6	2-Methylphenol (o-cresol)	95-48-7
1,1,2,2-Tetrachloroethene	127-18-4	Butylbenzylphthalate	85-68-7
1,1,2,2-Tetrachloroethane	79-34-5	2,4,5 Trichlorophenol	95-95-4
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	2,4,6-Trichlorophenol	88-06-2
1,1,2-Trichloroethane	79-00-5	2,6-Bis(tert-butyl)-4-methylphenol	128-37-0
1,1,2-Trichloroethylene	79-01-6	2-Chlorophenol	95-57-8
1,1,Dichloroethene	75-35-4	2-Ethoxyethanol	110-80-5
1,2-Dichloroethane	107-06-2	4-Methylphenol (p-cresol)	106-44-5
Chloroethene (vinyl chloride)	75-01-4	Acenaphthene	83-32-9
2-Butanone (MEK)	78-93-3	Cresylic acid (cresol, mixed isomers)	1319-77-3
2-Nitropropane	79-46-9	Cyclohexanone	108-94-1
2-Propanone (Acetone)	67-64-1	Di-n-butylphthalate	84-74-2
4-methyl-2-pentanone (MIBK)	108-10-1	Di-n-octylphthalate	117-84-0
Benzene	71-43-2	N-nitroso-di-n-propylamine	621-64-7
Carbon disulfide	75-15-0	Fluoranthene	206-44-0
Carbon tetrachloride	56-23-5	o-Nitrophenol	88-75-5
Chlorobenzene	108-90-7	p-Chloro-m-cresol (4-Chloro-3-methylphenol)	59-50-7
Chloroform	67-66-3	m-Cresol (3-Methylphenol)	108-39-4
Dichloromethane (methylene chloride)	75-09-2	Pyrene	129-00-0
Ethyl acetate	141-78-6	N-Nitrosomorpholine	59-89-2
Ethylbenzene	100-41-4	1,2,4-Trichlorobenzene	120-82-1
Diethyl ether	60-29-7	2,4-Dinitrotoluene	121-14-2
Toluene	108-88-3	Hexachloroethane	67-72-1
trans-1,3,-Dichloropropene	542-75-6	Hexachlorobutadiene	87-68-3
Trichlorofluoromethane	75-69-4	Nitrobenzene	98-95-3
Xylenes	1330-20-7	Naphthalene	91-20-3
o-Xylene	95-47-6	o-Dichlorobenzene	95-50-1
m-Xylene	108-38-3	Pyridine	110-86-1
p-Xylene	106-42-3	Isobutanol	78-83-1
--	--	n-Butyl alcohol (1-butanol)	71-36-3
--	--	Tributyl phosphate	126-73-8

Notes:

CAS = Chemical Abstracts Service.
SVOA = semivolatile organic analysis.
VOA = volatile organic analysis.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality requirements for conducting River Protection Project (RPP) sampling and analysis are described in DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents*. ATL-MP-1011, *ATL Quality Assurance Project Plan for 222-S Laboratory* specifies the requirements for ensuring the quality of sample analysis conducted at the 222-S Laboratory. This quality assurance (QA) plan meets DOE/RL-96-68 minimum requirements as the baseline for laboratory quality systems.

All activities (sampling and analysis) will be performed using approved methods, procedures, and work packages that are written in accordance with approved operational and laboratory QA plans, which are consistent with the requirements of this SAP. Sampling and analysis activities shall be performed by qualified personnel using properly maintained and calibrated equipment.

6.1 FIELD QUALITY CONTROL

Field QC samples shall be collected to evaluate the potential for cross-contamination and laboratory performance. Field QC for sampling in the 200-IS-1 tank farm pipelines will require the collection of field duplicates, equipment rinsate blank, and trip blank samples, where appropriate. If possible, field duplicates should be collected from contaminated areas so valid comparisons between the samples can be made. However, the samples should not be collected from zones that are expected to contain high levels of transuranic-contaminated soils because of the high cost and added handling requirements associated with transuranic materials. Limited sample material is anticipated as being available within the interior of pipelines. Because of this situation, sufficient sample quantity may not be available for the collection of field QC samples and the percentage frequency goals specified for each type of field QC sample may not be achievable. Available sample material will always be prioritized for use in the analysis of the primary analytical samples. The field QC sample types and the frequency goals for collection are described in the following subsections.

Field Duplicates

Each field duplicate shall be retrieved from the sample interval or location using the same equipment (e.g., collected from same split-spoon or sample mixing bowl) and sampling technique as the original sample. Field duplicates for soil are collected and homogenized before being divided into two samples in the field. If volatile organic analysis (VOA) samples are required, they should be collected before homogenization. The duplicate samples shall be sent to the primary laboratory in the same manner as the routine site samples. Field duplicates provide information regarding the homogeneity of the sample matrix and can be used to evaluate the precision of the analysis process.

At least 5 percent of the total collected soil samples will be duplicated (one field duplicate will be collected for every 20 samples). At least one field duplicate shall be collected from the samples taken for each of the pipeline bins investigated. The duplicate samples shall be suitable for analysis by an offsite laboratory and shall be analyzed for all of the COPCs listed in Table 5-1.

Field Splits

Field split samples will be collected at the same frequency as field duplicate samples. Each split sample shall be retrieved from the same sample interval or location using the same equipment (e.g., collected from same one split-spoon or sample mixing bowl) and sampling technique as the original sample. Samples shall be homogenized, split into two separate aliquots in the field, and sent to two independent laboratories. If VOA samples are required, they should be collected before homogenization. The splits will be used to verify the performance of the primary laboratory.

The split samples will be obtained from a sample medium that is expected to have some contamination and that is suitable for analysis in an offsite laboratory and shall be analyzed for all of the COPCs listed in Table 5-1.

Equipment Rinsate Blanks

Equipment rinsate blanks are used to verify the adequacy of sampling equipment decontamination procedures and shall be collected for each sampling method or type of equipment used. The field geologist can request that additional equipment blanks be taken. Equipment blanks shall consist of deionized water washed through decontaminated sampling equipment and placed in containers identified in the Sampling Authorization Forms. Note that the bottle and preservation requirements for water may differ from the requirements for soil. Equipment rinsate blanks shall be analyzed for the following:

- Gross alpha
- Gross beta
- Metals (excluding hexavalent chromium and mercury)
- Anions (except cyanide)
- VOAs of interest
- SVOAs of interest.

These analytes are considered the best indicators of decontamination effectiveness.

Trip Blanks

The volatile organic trip blanks will constitute at least 5 percent of all volatile organic compound (VOC) samples. If applicable, at least one trip blank shall be collected for each of the pipeline bins. Trip blanks shall consist of laboratory-grade deionized water added to a clean sample container. The trip blanks shall travel to the field with the associated bottle sets and will be returned to the laboratory with the samples. They will remain unopened during their transport and handling. Trip blanks are prepared as a check for possible contamination originating from container preparation methods, shipment, handling, storage, or site conditions. The trip blank shall be analyzed for VOCs only.

Prevention of Cross-Contamination

Special care should be taken to prevent cross-contamination of soil samples. Particular care will be exercised to avoid the following common ways in which cross-contamination or background contamination may compromise the samples:

- Improperly storing or transporting sampling equipment and sample containers
- Contaminating the equipment or sample bottles by setting them on or near potential contamination sources, such as uncovered ground
- Handling bottles or equipment with dirty hands
- Improperly decontaminating equipment before sampling or between sampling events.

6.2 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS FOR LABORATORY ANALYSIS

Laboratories performing analyses in support of this SAP shall have approved and implemented QA plans. These QA plans shall meet the minimum requirements of DOE/RL-96-68 as the baseline for laboratory quality systems. Because Phase 1 sampling will focus on pipelines and soils exhibiting a high level of contamination, samples collected according to this SAP will be analyzed at the 222-S Laboratory in the 200 West Area. The 222-S Laboratory conducts sample analyses according to ATL-MP-1011, which meets the minimum requirements of DOE/RL-96-68.

6.2.1 Quality Control Requirements

Required QC analyses (duplicates, matrix spikes, blanks, laboratory control samples) are identified in Table 5.1. The laboratory shall also use calibration and calibration check standards appropriate for the analytical instrumentation as defined in DOE/RL-96-68. The QC acceptance criteria for laboratory control samples, spikes, and duplicate are specified in the DQO (D&D-30262) and are summarized in Table 6.1. Laboratory blanks shall be evaluated against the method detection limits. The QC criteria are goals for demonstrating reliable method performance. The laboratory will use its internal QA system for addressing any QC failures. If the QC failures are systematic and cannot be resolved by the internal protocols, the project manager/assigned task lead shall be consulted to determine the proper action. The laboratory should suggest a course of action at that time. All data not meeting the QC requirements shall be properly noted and the associated QC failures discussed in the narrative section of the Format V data report.

Table 6-1. Quality Control Parameters for Primary Analytes (2 Sheets)

Analytes	Method	QC Acceptance Criteria		
		LCS % Recovery[5]	Spike % Recovery[5]	Duplicate/ MSD RPD[1]
Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Ni, Se, Ag, Sr, Tl, U, V, Zn	ICP/AES	70-130%	70-130%	≤30%
Hg	CVAA	70-130%	70-130%	≤30%
F^-, NO_2^-, NO_3^-, NH_4^+, $C_2H_3O_2^-$, CHO_2^-, $C_2H_3O_3^-$, $C_2O_4^{2-}$	IC	70-130%	70-130%	≤30%
CN^-	Spectrophotometric	70-130%	70-130%	≤30%
S^{2-}	Distillation/ISE	70-130%	70-130%	≤30%
Bulk Density or SpG	Gravimetric	70-130%[2]	NA	≤30%
pH	pH meter	± 0.1 pH units	NA	NA
VOC	GC/MS	70-130%	70-130%	≤30%
SVOC	GC/MS	70-130%	70-130%	≤30%
PCBs	GC/ECD	70-130%	70-130%	≤30%
Weight percent water	Thermogravimetric	70-130%	NA	≤30%
^{233}U ^{234}U, ^{235}U ^{236}U, ^{238}U, ^{237}Np, ^{230}Th, ^{232}Th	ICP/MS	70-130%[3]	70-130%[3]	≤30%
^{60}Co, ^{137}Cs, ^{226}Ra	GEA	70-130%	NA	≤30%
^{152}Eu, ^{154}Eu, ^{155}Eu, ^{125}Sb	GEA	NA	NA	≤30%
^{129}I	GEA	70-130%	NA	≤30%
^{14}C, ^{3}H	Liquid scintillation counting	70-130%	70-130%	≤30%
^{63}Ni	Liquid scintillation counting	70-130%	NA	≤30%
^{90}Sr	Beta counting	70-130%	NA	≤30%
^{99}Tc	ICP/MS	70-130%	70-130%	≤30%
^{79}Se	Liquid scintillation counting	NA	NA	≤30%
$^{239/240}Pu$, ^{241}Am	Alpha counting	70-130%	NA	≤30%
^{241}Pu	Calculation from ^{238}Pu and $^{239/240}Pu$ [4]	NA	NA	NA
^{228}Th	Calculation from ^{232}U and ^{232}Th. ^{232}U to be calculated from U or U isotopes [4]	NA	NA	NA
^{238}Pu, ^{242}Cm, $^{243/244}Cm$	Alpha counting	NA	NA	≤30%

Abbreviations:

CVAA	Cold Vapor Atomic Absorption
GC/ECD	Gas chromatography/electron capture detection
GC/MS	Gas chromatography/mass spectrometry
GEA	Gamma Energy Analysis
IC	Ion Chromatography
ICP/AES	Inductively Coupled Plasma / Atomic Emission Spectroscopy
ICP/MS	Inductively Coupled Plasma / Mass Spectroscopy
ISE	Ion selective electrode
LCS	Laboratory control sample
MSD	matrix spike duplicate
NA	Not applicable
PCB	Polychlorinated biphenyl
QC	quality control
RPD	Relative percent difference
SpG	Specific gravity

Table 6-1. Quality Control Parameters for Primary Analytes (2 Sheets)

Analytes	Method	QC Acceptance Criteria		
		LCS % Recovery[5]	Spike % Recovery[5]	Duplicate/ MSD RPD[1]

SVOC semi-volatile organic compound
VOC volatile organic compound

Notes:

[1]If primary and duplicate results are available above detection limits, RPD will be based on these results.

[2]LCS is applicable to SpG analysis only.

[3]LCS and matrix spike for ^{235}U, ^{237}Np, ^{238}U, and ^{232}Th only.

[4]Calculations will be performed by Process Engineering.

[5]Laboratories must meet statistically based controls if more stringent.

6.2.2 Target Detection Limits

D&D-30262 provides target detection limits for tank farms pipeline sample analysis. Limits for primary radionuclides and chemicals are shown in Table 6.2 and 6.3.

Table 6-2. Target Detection Limits for Primary Radionuclides (2 Sheets)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (pCi/g)	Target Detection Limits (pCi/g)
14234-35-6	Antimony-125	Gamma GS	--	0.3
14596-10-2	Americium-241	Am-241 AEA	31.1	1
14762-75-5	Carbon-14	C-14 LSC (low level)	4.65	1
10045-97-3	Cesium-137	Gamma GS	6.2	0.1
10198-40-0	Cobalt-60	Gamma GS	1.4	0.05
15510-73-3	Curium-242	Am-241/Cu-244 AEA	--	1.0
15757-87-6	Curium-243	Am-241/Cu-244 AEA	110	1.0
13981-15-2	Curium-244	Am-241/Cu-244 AEA	744	1.0
14683-23-9	Europium-152	Gamma GS	3.3	0.1
15585-10-1	Europium-154	Gamma GS	3.0	0.1
14391-16-3	Europium-155	Gamma GS	125	0.1
15046-84-1	Iodine 129	Iodine-129-LSC	0.12	2
13994-20-2	Neptunium-237	ICP/MS	2.5	1
13981-37-8	Nickel-63	Ni-63 LSC	4,026	30
13981-16-3	Plutonium-238	AEA	37.4	1
Pu-239/240	Plutonium-239/240	AEA	33.9	1
13982-63-3	Radium-226	Gamma GS	7.03	0.2
15758-85-9	Selenium-79	Selenium-79-LSC	197,000	10

Table 6-2. Target Detection Limits for Primary Radionuclides (2 Sheets)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (pCi/g)	Target Detection Limits (pCi/g)
Rad-Sr	Strontium-90	Strontium-89,90 - Total Sr - Gas Proportional Counting	4.5	1
14133-76-7	Technetium-99	ICP/MS	1.93	1
4-82-9	Thorium-228	TBD	7.73	1
14269-63-7	Thorium-230	ICP/MS	20.1	1
TH-232	Thorium-232		4.8	1
10028-17-8	Tritium	Tritium – H-3 LSC(mid level)	48.2	30
13966-29-5	Uranium-233/234	ICP/MS	1.1	1
15117-96-1	Uranium-235		101	1
U-238	Uranium-238		1.06	1
N/A	Gross cesium-137 counts	Portable NaI detector		3.1
N/A	Gross alpha	Portable contamination detector		100 d/min/ 100 cm^2
N/A	Gross beta/gamma	Portable contamination detector		5,000 d/min/ 100 cm^2

CUL= cleanup level

TBD = to be determined

GS = gamma spectroscopy.
LSC = liquid scintillation counter.
AEA = alpha energy analysis.
ICP/MS = inductively coupled plasma/masss spectrometry

Table 6-3. Target Detection Limits for Primary Chemicals (4 Sheets)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (mg/kg)	Target Detection Limits (mg/kg)
7429-90-5	Aluminum	EPA Method 6010B	45.2	5
7440-36-0	Antimony	EPA Methods 6010B, 6020, or 200.8 (trace)	5	0.6
7440-38-2	Arsenic	EPA Methods 6010B, 6020, or 200.8	6.5	1
7440-39-3	Barium	EPA Methods 6010B, 6020, or 200.8	132	20
7440-41-7	Beryllium	EPA Methods 6010B, 6020, or 200.8	10	0.5
7440-43-9	Cadmium	EPA Methods 6010B, 6020, or 200.8	0.81	0.5
7440-47-3	Chromium (III)/ Chromium (total)	EPA Methods 6010B, 6020, or 200.8	42	1
7440-48-4	Cobalt	EPA Methods 6010B, 6020, or 200.8	20	2
7440-50-8	Copper	EPA Methods 6010B, 6020, or 200.8	50	1
7439-89-6	Iron	EPA Methods 6010B, 6020, or 200.8	152	5
7439-92-1	Lead	EPA Methods 6010B, 6020, or 200.8	50	5
7439-96-5	Manganese	EPA Methods 6010B, 6020, or 200.8	512	
7439-97-6	Mercury	EPA Methods 7470A, 7471A, 6020, or 200.8	0.33	0.2
7440-02-0	Nickel	EPA Methods 6010B, 6020, or 200.8	30	4
7782-49-2	Selenium	EPA Methods 6010B, 6020, or 200.8	0.3	1
7440-22-4	Silver	EPA Methods 6010B, 6020, or 200.8	13.6	2
7440-24-6	Strontium	EPA Methods 6010B, 6020, or 200.8	2,920	1
7440-28-0	Thallium	EPA Methods 6010B, 6020, or 200.8	1	0.5
7440-61-1	Uranium	EPA Methods 200.8, 6020, or kinetic phosphorescence absorption	3.21	1
7440-62-2	Vanadium	EPA Methods 6010B, 6020, or 200.8	560	2.5

Table 6-3. Target Detection Limits for Primary Chemicals (4 Sheets)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (mg/kg)	Target Detection Limits (mg/kg)
7440-66-6	Zinc	EPA Methods 6010B, 6020, or 200.8	86	1
57-12-5	Cyanide (includes ferrocyanide)	EPA Methods 9010C total cyanide or 335	0.8	0.5
16984-48-8	Fluoride	IC, EPA Method 9056 or 300.0	5.78	5
14797-55-8	Nitrate	IC, EPA Method 9056 or 300.0	40	2.5
14797-65-0	Nitrite	IC, EPA Method 9056 or 300.0	4	2.5
71-50-1	Acetate	IC, EPA Method 9056 or 300.0	--	TBD
64-18-6	Formate	IC, EPA Method 9056 or 300.0	--	10.0
79-14-1	Glycolate	IC, EPA Method 9056 or 300.0	---	TBD
144-62-7	Oxalate	IC, EPA Method 9056 or 300.0	--	TBD
18496-25-8	Sulfide	EPA Method 9030	--	5
NA	Ammonium (NH_4)	EPA Method 300.7	9.23	0.5
67-64-1	Acetone	EPA Method 8260	28.9	0.02
71-43-2	Benzene	EPA Method 8260	0.00448	0.0015
75-15-0	Carbon disulfide	EPA Method 8260	5.65	0.005
56-23-5	Carbon tetrachloride	EPA Method 8260	0.00310	0.0015
108-90-7	Chlorobenzene	EPA Method 8260	0.874	0.005
67-66-3	Chloroform (trichloromethane)	EPA Method 8260	0.0381	0.005
108-94-1	Cyclohexanone	EPA Method 8270C	344	0.5
107-06-2	1,2-Dichloroethane	EPA Method 8260	0.00232	0.0015
75-35-4	1,1-Dichloroethylene	EPA Method 8260	0.000522	0.01
75-09-2	Dichloromethane (methylene chloride)	EPA Method 8260	0.0218	0.002
10061-02-6	Dichloropropene; 1,3,- (trans-)	EPA Method 8260	0.00141	0.005
141-78-6	Ethyl acetate	EPA Method 8015	59.5	5
60-29-7	Diethyl ether	EPA Method 8015, 8260	6.68	5
100-41-4	Ethyl benzene	EPA Method 8260	6.05	0.005
67-72-1	Hexachloroethane	EPA Method 8270C	0.125	0.33
108-10-1	Methyl isobutyl ketone (MIBK hexone)	EPA Method 8260	2.71	0.01
78-93-3	Methyl ethyl ketone (MEK)	EPA Method 8260	19.6	0.01
79-46-9	Nitropropane; 2-	TBD	0.0000208	TBD
79-34-5	Tetrachloroethane; 1,1,2,2-	EPA Method 8260	0.00123	0.005
127-18-4	Tetrachloroethene (PCE)	EPA Method 8260	0.000859	0.005
108-88-3	Toluene	EPA Method 8260	4.65	0.005

Table 6-3. Target Detection Limits for Primary Chemicals (4 Sheets)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (mg/kg)	Target Detection Limits (mg/kg)
76-13-1	trichloro-1,2,2-trifluoroethane; 1,1,2-	EPA Method 8260	22,000	0.010
71-55-6	1,1,1-Trichloroethane (TCA)	EPA Method 8260	1.58	0.005
79-00-5	1,1,2-Trichloroethane	EPA Method 8260	0.00427	0.002
83-32-9	Acenaphthene	EPA Method 8270C	20	0.33
71-36-3	Butanol; n- (n-butyl alcohol)	EPA Method 8260, 8015	6.62	5
85-68-7	Butylbenzylphthalate	EPA Method 8270C	893	0.33
95-57-8	Chlorophenol; 2-	EPA Method 8270C	0.943	0.33
M + P CRESOL	Cresol; m + p (3/4-Methylphenol)	EPA Method 8270C	10.1	0.33
95-48-7	Cresol; o- (2-Methylphenol)	EPA Method 8270C	10.3	0.33
1319-77-3	Cresylic acid (cresol, mixed isomers)	EPA Method 8270C	--	--
84-74-2	Dibutylphthalate (Di-n-butylphthalate)	EPA Method 8270C	2.2	0.33
117-84-0	Di-n-octylphthalate	EPA Method 8270C	0.524	0.33
95-50-1	Dichlorobenzene; 1,2- (ortho-)	EPA Method 8270C	7.03	0.33
121-14-2	Dinitrotoluene; 2,4-	EPA Method 8270C	0.189	0.33
110-80-5	Ethoxyethanol; 2-	TBD	25.7	TBD
206-44-0	Fluoranthene	EPA Method 8270C	631	0.33
87-68-3	Hexachlorobutadiene	EPA Method 8270C	0.605	0.33
78-83-1	Isobutyl alcohol (Isobutanol)	EPA Methods 8260 or 8015	19.4	5
128-37-0	methylphenol; 2,6-Bis(tert-butyl)-4-	TBD	--	--
59-50-7	methylphenol; 4-Chloro-3- (p-Chloro-m-cresol)	EPA Method 8270C	4,000	0.33
91-20-3	Naphthalene	EPA Method 8270C	4.46	0.33
98-95-3	Nitrobenzene	EPA Method 8270C	0.026	0.33
88-75-5	Nitrophenol; o-	EPA Method 8270C	---	0.66
621-64-7	Nitroso-di-n-propylamine	EPA Method 8270C	0.000056	0.33
79-01-6	Trichloroethylene (TCE)	EPA Method 8260	0.0263	0.005
75-69-4	Trichlorofluoromethane	EPA Method 8260	28.4	0.01
75-04-1	Vinyl chloride	EPA Method 8260	0.000184	0.01
1330-20-7	Xylenes	EPA Method 8260	14.6	0.01
108-38-3	Xylene; m-	TBD	84.4	--
95-47-6	Xylene; o-	TBD	91.9	--

Table 6-3. Target Detection Limits for Primary Chemicals (4 Sheets)

Chemical Abstracts Service No. or Constituent Identifier No.	Analyte	Survey or Analytical Method	Lowest Overall CUL (mg/kg)	Target Detection Limits (mg/kg)
106-42-3	Xylene; p-	TBD	172	--
120-82-1	1,2,4 - Trichlorobenzene	EPA Method 8270C	2.98	0.33
59-89-2	Nitrosomorpholine; N-	EPA Method 8270C	--	0.33
129-00-0	Pyrene	EPA Method 8270C	655	0.33
110-86-1	Pyridine	EPA Method 8270C	0.0746	0.66
95-95-4	Trichlorophenol; 2,4,5-	EPA Method 8270C	4	0.33
88-06-2	Trichlorophenol; 2,4,6-	EPA Method 8270C	0.0924	0.33
		EPA Method 8041		0.165
126-73-8	Tributyl phosphate	EPA Method 8270C	6.18	3.3
2674-11-2	Aroclor 1016	PCBs, EPA Method 8082	2.41/0.65	0.02
11104-26-2	Aroclor 1221	PCBs, EPA Method 8082	0.092	0.02
11141-16-5	Aroclor 1232	PCBs, EPA Method 8082	0.092	0.02
53969-21-9	Aroclor 1242	PCBs, EPA Method 8082	0.394	0.02
126572-29-6	Aroclor 1248	PCBs, EPA Method 8082	0.386	0.02
11097-6999-1	Aroclor 1254	PCBs, EPA Method 8082	0.066	0.02
11096-82-5	Aroclor 1260	PCBs, EPA Method 8082	0.5	0.02

CUL = cleanup level.
EPA = U.S. Environmental Protection Agency.
IC = ion chromatography.
TBD = to be determined
N/A= not applicable.
PCB= polychlorinated biphenyl.

7.0 DATA REPORTING

The data package(s) from the 222-S Laboratory will be in Format V. A Format V data package, as defined in ATL-MP-1011 is necessary because the data are expected to receive extensive review from external individuals and organizations. The Format V data package is subject to internal laboratory QA verification and review including peer review prior to release. Upon release, the data package will receive a third party validation.

The Format V data package requires a comprehensive report of analytical data. All analytical data, including waste sample analyses, blank analyses, holding time checks, matrix spike duplicate analyses, and surrogate recoveries shall be verified by the laboratory prior to reporting. The data package shall also include TICs found in volatile organic analysis (VOA) and semivolatile organic analysis (SVOA). A discussion of the TIC evaluation process shall be provided in the narrative.

In addition to the data package(s), an electronic version of the analytical results shall be provided to the Hanford Environmental Information System (HEIS) database.

8.0 CHANGE CONTROL

Field activity and laboratory work scope changes may be required because of unexpected field conditions, new information, health and safety concerns, or other circumstances. Changes to work scope may result in modifications to this SAP. Work scope changes that do not result in deviation from the SAP requirements, can be made in the field or laboratory with the approval of the project manager or assigned task lead. These work scope changes will be documented in the sampling work package and/or Format V laboratory report and the retrieval data report. Justification for the changes to work scope shall be provided in sufficient detail to understand the basis for the change. Alternately, if field or laboratory conditions result in substantial work scope changes, the SAP may be revised with DOE and Ecology approval.

Waste sampling and field measurement methods and analytical strategies (e.g., constituent listings and data analysis) may be updated as new technologies or information become available. The impact of these updates to the SAP will be judged as they are identified to determine if revisions to the SAP will be necessary. Ecology, DOE and its contractors will participate in the SAP update evaluation process and any subsequent revisions to the SAP.

9.0 REFERENCES

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, as amended.

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended.

ATL-MP-1011, 2007, *ATL Quality Assurance Project Plan for 222-S Laboratory*, as revised, Advanced Technologies and Laboratories International, Inc., Richland, Washington.

DOE/RL-96-68, 1998, *Hanford Analytical Services Quality Assurance Requirements Documents*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-96-81, *Waste Site Grouping for 200 Areas Soil Investigations,* U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-98-28, *200 Areas Remediation Investigation/Feasibility Sutdy Implementation Plan – Environmental Restoration Program*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

D&D-30262, 2006, *Data Quality Objectives Summary Report for the 200-IS-1 Operable Unit Pipelines and Appurtenances*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

Ecology, EPA, DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, as amended, U.S Environmental Protection Agency, U.S. Department of Energy, and Washington State Department of Ecology, Olympia, Washington.

EPA, 1986, *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, SW-846, as amended, http://www.epa.gov/epaoswer/hazwaste/test/main.htm, U.S. Environmental Protection Agency, Washington, D. C.

EPA/625/R-92/007, 1993, *Use of Airborne, Surface, and Borehole Geophysical Techniques at Contaminated Sites: A Reference Guide*, U.S. Environmental Protection Agency, Washington, D.C.

Fluor 2007, Waste Information Data System, http://www2.re.gov./phmc/cp/wids, Fluor Hanford, Inc., Richland, Washington.

RPP-RPT-28955, 2006, *Surface Geophysical Exploration of T Tank Farm at the Hanford Site*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code,* as amended.

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN FOR PHASE 1 SAMPLING AND ANALYSIS OF THE 200-IS-1 OPERABLE UNIT TANK FARM PIPELINES

QUALITY ASSURANCE PROJECT PLAN FOR PHASE 1 SAMPLING AND ANALYSIS OF THE 200-IS-1 OPERABLE UNIT TANK FARM PIPELINES

The quality assurance project plan (QAPjP) establishes the quality requirements for environmental data collection, including sampling, field measurements, and laboratory analysis. The QAPjP complies with the requirements of the following:

- U.S. Department of Energy (DOE) Order 414.1C, *Quality Assurance*
- 10 CFR 830.120, "Quality Assurance Requirements"
- EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5.

A-1.0 PROJECT MANAGEMENT

This section addresses the basic areas of project management, and it ensures that the project has a defined goal, that the participants understand the goal and approach to be used, and that the planned outputs have been appropriately documented. The QAPjP is organized according to the elements described in EPA QA/R-5.

A-1.1 PROJECT/TASK ORGANIZATION

The project organization is described in the subsections that follow and is shown in Figure A-1.

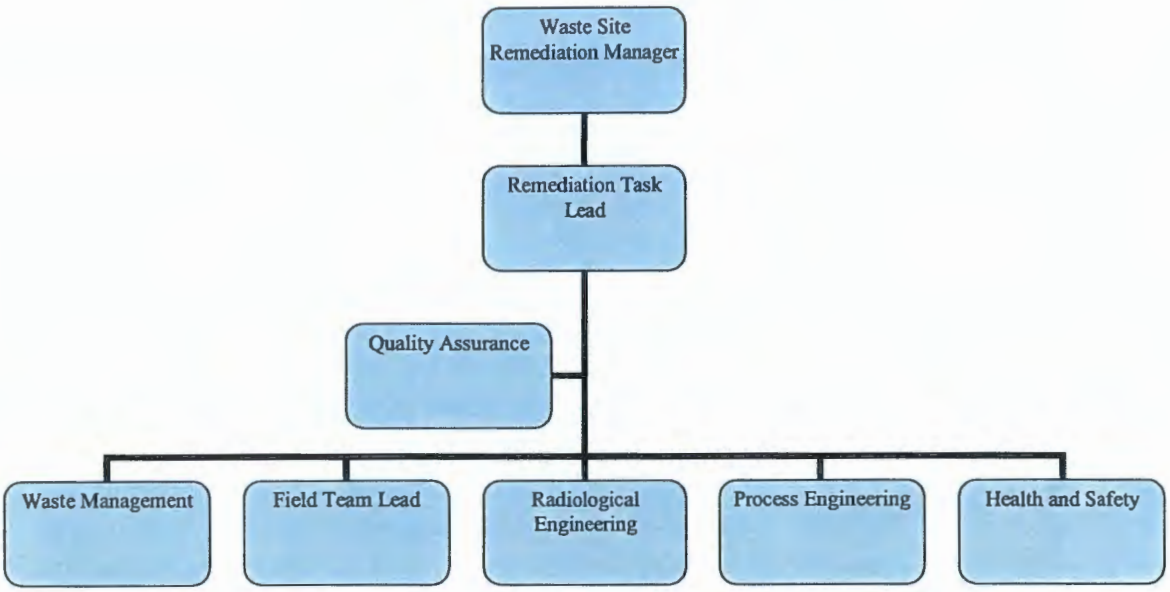
Waste Site Remediation Manager

The Waste Site Remediation manager provides oversight for all activities and coordinates with DOE and Ecology in support of sampling activities. In addition, support is provided to the task lead to ensure that the work is performed safely and cost-effectively.

Remediation Task Lead

The Remediation task lead is responsible for direct management of sampling documents and requirements, field activities, and subcontracted tasks. The task lead ensures that the field team lead, samplers, and others responsible for implementation of this SAP and the QAPjP are provided with current copies of this document and any revisions thereto. The task lead works closely with quality assurance, health and safety, and the field team leader to integrate these and the other lead disciplines in planning and implementing the work scope. The task lead also coordinates with and reports to DOE, Ecology, and the Tank Farm contractor on all sampling activities.

Figure A-1. Project Organization



Quality Assurance

Quality Assurance is responsible for quality assurance issues on the project. Responsibilities include oversight of implementation of the project quality assurance requirements; review of project documents, including SAPs (and the QAPjP); and participation in quality assurance assessments and surveillances on sample collection and analysis activities, as appropriate.

Waste Management

The Waste Management lead communicates policies and procedures and ensures project compliance for storage, transportation, disposal, and waste tracking in a safe and cost-effective manner. Other responsibilities include identifying waste management sampling/characterization requirements to ensure regulatory compliance interpretation (e.g., with WAC 173-303) of the characterization data to generate waste designations, profiles, and other documents that confirm compliance with waste disposal requirements.

Field Team Leader

The field team leader has the overall responsibility for the planning, coordination, and execution of the field sampling activities. Specific responsibilities include converting the sampling design requirements into field task instructions that provide specific direction for field activities. Responsibilities also include directing training, mock-ups, and practice sessions with field personnel to ensure that the sampling design is understood

and can be performed as specified. The field team leader communicates with the Remediation task lead to identify field constraints that could affect the sampling design. In addition, the field team leader directs the procurement and installation of materials and equipment needed to support the field work.

The field team leader oversees field-sampling activities that include sample collection, packaging, provision of certified clean sampling bottles/containers, documentation of sampling activities in controlled logbooks, chain-of-custody documentation, and packaging and transportation of samples to the laboratory or shipping center.

Radiological Engineering

The Radiological Engineering lead is responsible for the radiological engineering and health physics support within the project. Specific responsibilities include conducting ALARA reviews, exposure and release modeling, and radiological controls optimization for all work planning. In addition, radiological hazards are identified and appropriate controls are implemented to maintain worker exposures to the hazards ALARA. Radiological Engineering interfaces with the project safety and health representative and plans and directs radiological control technician support for all activities.

Process Engineering

Process Engineering prepares this SAP and individual pipeline sampling and analysis plans (PSAPs). Process Engineering selects the laboratories that perform the analyses and requests assessments/surveillances of the laboratories. This organization receives the analytical data from the laboratories, arranges for data entry into the Hanford Environmental Information System (HEIS) database, and arranges for data validation. It performs reviews of sample data against existing knowledge and data quality assessments according to guidelines in EPA QA/G-9, *Guidance for Data Quality Assessment*.

Health and Safety

Responsibilities include coordination of industrial safety and health support within the project as carried out through safety and health plans, job hazard analyses, and other pertinent safety documents required by Federal regulation or by internal Tank Farm Contractor work requirements. In addition, assistance is provided to project personnel in complying with applicable health and safety standards and requirements. Personnel protective clothing requirements are coordinated with Radiological Engineering.

A-1.2 PROBLEM DEFINITION/BACKGROUND

See Sections 1.0 and 2.0 of the SAP.

A-1.3 PROJECT/TASK DESCRIPTION

See Section 3.0 of the SAP.

A-1.4 QUALITY OBJECTIVES AND CRITERIA

See Sections 5.0 and 6.0 of the SAP.

A-1.5 SPECIAL TRAINING/CERTIFICATION

Sampling and laboratory personnel shall complete the necessary training and receives appropriate certification to perform assigned tasks in support of the 200-IS-1 characterization project. The environmental safety and health training program provides workers with the knowledge and skills necessary to safely execute assigned duties. Field personnel typically will have completed the following training before starting work:

- Occupational Safety and Health Administration 40-hour hazardous waste worker training and supervised 24-hour hazardous waste site experience
- 8-hour hazardous waste worker refresher training (as required)
- Hanford general employee radiation training
- Radiological worker training.

A graded approach is used to ensure that workers receive a level of training commensurate with their responsibilities that complies with applicable U.S. Department of Energy orders and government regulations. Specialized employee training includes prejob briefings, on-the-job training, emergency preparedness, plan-of-the-day activities, and facility/worksite orientations.

A-1.6 DOCUMENTS AND RECORDS

All information pertinent to field sampling and surveying will be recorded in field checklists and bound logbooks in accordance with existing sample collection protocols. The sampling team will be responsible for recording all relevant sampling information. Entries made in the logbook will be dated and signed by the individual who made the entry. Program requirements for managing the generation, identification, transfer, protection, storage, retention, retrieval, and disposition of records within the Tank Farms Contractor will be followed.

Requirements for laboratory data reporting are discussed in Sections 7.0 and 8.0 of the SAP.

A-2.0 DATA GENERATION AND ACQUISITION

A-2.1 SAMPLING PROCESS DESIGN

See Section 4.1 of the SAP.

A-2.2 SAMPLING METHODS

See Section 4.2 of the SAP.

A-2.3 SAMPLE HANDLING AND CUSTODY

See Section 4.3 of the SAP.

A-2.4 ANALYTICAL METHODS

See Table 5.1 of the SAP.

A-2.5 QUALITY CONTROL

Quality control sample requirements and acceptance criteria for these samples are specified in Section 6.0 of the SAP. Overall quality assurance and quality control requirements for characterization are discussed in this section.

A-2.5.1 Quality Assurance Objective

The quality assurance objective of this plan is to develop implementation guidance that will provide data of known and appropriate quality. Data quality is assessed by representativeness, comparability, accuracy, and precision. The applicable QC guidelines, quantitative target limits, and levels of effort for assessing data quality are dictated by the intended use of the data and the nature of the analytical method. Each of these is addressed in the following subsections:

Representativeness

Representativeness is a measure of how closely the results reflect the actual concentration and distribution of the chemical and radiological constituents in the matrix sampled. Sampling design has been developed and sampling techniques will be selected with the goal of optimizing representativeness of the samples.

Comparability

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using standard procedures and consistent methods and units. Also, split samples will be used to compare performance of laboratories.

Accuracy

Accuracy is an assessment of the closeness of the measured value to the true value. Accuracy of chemical test results is assessed by spiking samples with known standards and establishing the average recovery. A matrix spike is the addition to a sample of a known amount of a standard compound similar to the compounds being measured. Sample accuracy is expressed as the percent recovery of a spiked sample. Table 6-1 provides the accuracy criteria for laboratory analyses.

Precision

Precision is a measure of the data reproducibility when more than one measurement has been taken on the same sample. Precision can be expressed as the relative percent difference for duplicate measurements or relative standard deviation for triplicates. Table 6.1 lists the analytical precision criteria for fixed laboratory analyses.

Detection Limits

Detection limits are functions of the analytical method used to provide the data and the quantity of the sample available for analyses. Method detection limits for the COPCs are presented on Tables 6-2 and 6-3.

Laboratory Quality Control

The laboratory method blanks, duplicates, laboratory control sample/blank spike, and matrix spikes are defined in Chapter 1 of SW-846 and will be run at the frequency specified in Chapter 1 of SW-846. Because of anticipated limited sample quantity being available within the pipelines, sufficient material may be available to perform both method analysis and associated laboratory QC. Available sample quantity will always be prioritized and allocated to completion of the method analysis. If insufficient sample is available for completion of laboratory QC analyses, the laboratory will be make note of the condition in the data package narrative and the associated data results will have laboratory qualifies added as appropriate.

A-2.5.3 Sample Preservation, Containers, and Holding Times

Sample preservation, containers, and holding times for radiological and nonradiological analytes are shown in Table A-1.

Table A-1. Sample Preservation, Container, and Holding Time Guidelines

Analytes	Matrices	Bottle		Preservation	Packing Requirements	Holding Time
		Number	Type			
Radionuclides	Soil/Sludge/ Sediment/Scale	1	G/P	None	None	6 months
IC anions	Soil/Sludge/ Sediment/Scale	1	G/P	None	Cool 4 °C	48 hours
ICP metals	Soil/Sludge/ Sediment/Scale	1	G/P	None	None	6 months
Mercury	Soil/Sludge/ Sediment/Scale	1	G	None	None	28 days
Total cyanide	Soil/Sludge/ Sediment/Scale	1	G	None	Cool 4 °C	14 days
pH (soil)	Soil/Sludge/ Sediment/Scale	1	G/P	None	None	Within 24 hrs of lab receipt
SVOA	Soil/Sludge/ Sediment/Scale	1	AG	None	Cool 4 °C	14/40 days
VOA	Soil/Sludge/ Sediment/Scale	2 - 8	aGs	Methanol (high level) Freeze (low level)	Methanol Cool 4 °C; Freeze < - 7°C and > -20°C	14 days
PCBs	Soil/Sludge/ Sediment/Scale	1	G	None	Cool 4 °C	14 days

AG = amber glass
CVAA = cold vapor atomic absorption
EPA = U.S. Environmental Protection Agency
G = glass
GC = gas chromatography
IC = ion chromatography
ICP = inductively coupled plasma
P = plastic
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
VOA = volatile organic analysis

A-2.5.4 Sample Collection Requirements

Sample Location

Pipeline and soil sample locations are selected as described in Section 4.0 of the SAP. Minor adjustments to the specified locations may be made to mitigate unsafe conditions, avoid structural interferences, or bypass utilities. Changes in sample locations that do not affect the DQOs will require approval of Process Engineering and the task lead. Changes to sample locations that result in impacts to the DQOs will require concurrence by DOE and Ecology.

Surface geophysical and radiation surveys will be conducted at all sample locations. The surface geophysical surveys will be conducted using ground-penetrating radar and/or electromagnetic imaging and will aid in verifying the locations of buried pipelines and in selecting soil probe locations to avoid subsurface obstructions. The surface radiation surveys will identify areas of surface contamination that might affect health and safety of the workers.

Sample Identification

The sample and data-tracking database will be used to track the samples from the point of collection through the collection and laboratory analysis process. The HEIS database is the repository for the laboratory analytical results. The HEIS sample numbers will be issued to the sampling organization for this project in accordance with onsite organizational procedures. Each radiological/nonradiological and physical properties sample will be identified and labeled with a unique HEIS sample number. The sample location, depth, and corresponding HEIS numbers will be documented in the sampler's field logbook.

Each sample container will be labeled with the following information using a waterproof marker on firmly affixed water-resistant labels:

- Sample identification number
- Sample collection date and time
- Name or initials of person collecting the sample
- Preservation method (if applicable).

A list of sample analyses is not required for sample labels because the list could be quite long. The laboratory will consult the PSAPs for appropriate analyses and additional guidance for preparing the sample for analysis.

Sample Custody

See Section 4.3 of the SAP.

Sample Containers and Preservatives

Level I EPA pre-cleaned sample containers will be used for soil samples collected for chemical and radiological analysis. Container sizes may vary depending on laboratory-specific volumes/requirements for meeting analytical detection limits. If, however, the dose rate on the outside of a sample jar or the curie content within the sample exceeds levels acceptable by an offsite laboratory, the sampling lead can send smaller volumes to the laboratory.

Sample Shipping

The radiological control technician will measure the contamination levels on the outside of each sample jar and the dose rates on each sample jar. The radiological control technician also will measure the radiological activity on the outside of the sample container (through the container) and will document the highest contact radiological reading in millirem per hour. This information, along with other data, will be used to select proper packaging, marking, labeling, and shipping paperwork in accordance with U.S. Department of Transportation regulations (49 CFR, "Transportation") and to verify that the sample can be received by the analytical laboratory in accordance with the laboratory's acceptance criteria.

A-2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Measurement and testing equipment used in the field or in the laboratory that directly affects the quality of analytical data will be subject to preventive maintenance measures to ensure minimization of measurement system downtime. Laboratories and onsite measurement organizations must maintain and calibrate their equipment per manufacturer or other applicable guidelines. Maintenance requirements (such as parts lists and documentation of routine maintenance) will be included in the individual laboratory and the onsite organization quality assurance plan or operating procedures (as appropriate). Calibration of laboratory instruments will be performed in a manner consistent with SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, or with auditable U.S. Department of Energy Hanford Site-wide and contractual requirements.

Consumables, supplies, and reagents will be reviewed in accordance with SW-846 requirements and will be appropriate for their use. Note that contamination is monitored by the QC samples discussed in Section 6.1 of the SAP.

A-2.7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

See Sections 7.2 and A-2.6.

A-2.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

See Section A-2.6.

A-2.9 NON-DIRECT MEASUREMENTS

See Section 4.1 for a discussion on use of NDA.

A-2.10 DATA MANAGEMENT

Data generated as a result of sampling and data analysis activities will follow requirements outlined in this QAPjP and shall be managed and stored in accordance with applicable programmatic requirements governing data management procedures. At the direction of the task lead, all analytical data packages shall be subject to final technical review by qualified personnel before the results are submitted to the regulatory agencies or before inclusion in reports. Electronic data access, when appropriate, shall be via a database (e.g., HEIS or a project-specific database). Where electronic data are not available, hard copies shall be provided in accordance with Section 9.6 of the *Hanford Federal Facility Agreement and Consent Order* (Ecology, EPA, and DOE. 1989).

Planning for sample collection and analysis shall be in accordance with the programmatic requirements governing laboratory sample collection activities. In the event that specific procedures do not exist for a particular work evolution, or if it is determined that additional guidance to complete certain tasks is needed, a work package will be developed to adequately control the activities, as appropriate. Examples of the sample teams' requirements include the activities associated with the following:

- Chain of custody/sample analysis requests
- Project and sample identification for sampling services
- Control of certificates of analysis
- Logbooks, checklists
- Sample packaging and shipping.

Approved work control packages and procedures will be used to document radiological measurements when implementing this SAP. Examples of the types of documentation for field radiological data include the following:

- Instructions regarding the minimum requirements for documenting radiological controls information as discussed in 10 CFR 835, "Occupational Radiation Protection"
- Instructions for managing the identification, creation, review, approval, storage, transfer, and retrieval of Hanford Site radiological records
- The minimum standards and practices necessary for preparing, performing, and retaining radiological-related records
- The indoctrination of personnel on the development and implementation of survey/sample plans

- The requirements associated with preparing and transporting regulated material.

A-3.0 ASSESSMENT AND OVERSIGHT

A-3.1 ASSESSMENT AND RESPONSE ACTIONS

Project management and Quality Assurance may conduct random surveillance and assessments to verify compliance with the requirements outlined in this SAP, project work packages, the project quality management plan, procedures, and regulatory requirements. Deficiencies identified by these assessments shall be reported in accordance with existing programmatic requirements. Corrective actions will be implemented as required by the Tank Farms Contractor policy and procedures.

A-3.2 REPORTS TO MANAGEMENT

Management will be made aware of deficiencies identified by assessments and surveillances and subsequent corrective actions.

A-4.0 DATA VALIDATION AND USABILITY

A-4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Sample data will be reviewed against existing knowledge. Verification activities include checking completeness of laboratory analytical data packages (e.g., complete laboratory QC documentation, all data results present, data narrative summary is complete, and all report pages are present). Validation shall be performed on completed data packages by a qualified independent contractor. Validation shall consist of verifying required deliverables, requested versus reported analyses, and transcription errors. Validation also shall include the evaluation and qualification of results based on holding time, method blanks, matrix spikes, laboratory control samples, laboratory duplicates, and chemical and tracer recoveries, as appropriate to the methods used. At least 5 percent of all data shall be validated. No validation will be performed for physical data, field measurements, or NDA results.

A-4.2 VERIFICATION AND VALIDATION METHOD

See above section (Section A-4.1).

A-4.3 RECONCILIATION WITH USER REQUIREMENTS

The data quality assessment process compares completed field-sampling activities to those proposed in corresponding sampling documents and provides an evaluation of the resulting data. The purpose of the data evaluation is to determine if quantitative data are of the correct type and are of adequate quality and quantity to meet the project DQOs. Data quality assessment will be performed according to guidelines in EPA/600/R-96/084, *Guidance for Data Quality Assessment, Practical Methods for Data Analysis*, EPA QA/G-9.

A-5.0 QUALITY ASSURANCE PROJECT PLAN REFERENCES

10 CFR 830.120, "Quality Assurance Requirements," Title 10, *Code of Federal Regulations*, Part 830.120, as amended.

10 CFR 835, "Occupational Radiation Protection, " Title 10, *Code of Federal Regulations*, Part 835, as amended.

49 CFR, "Transportation," Title 49, *Code of Federal Regulations*, as amended.

DOE Order 414.1C, *Quality Assurance*, U.S. Department of Energy, Washington, D.C.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington, as amended.

EPA, 2000, *Guidance for Data Quality Assessment, Practical Methods for Data Analysis*, EPA QA/G-9, QA00 Update, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 2001, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, U.S. Environmental Protection Agency, Quality Assurance Division, Washington, D.C.

SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* as amended by Updates I [July 1992], IIA [August 1993], IIB [January 1995], and III), Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

WAC 173-303, "Dangerous Waste Regulations", *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.