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05-AMCP-0231

APR 8 2005

Mr. Nicholas Ceto, Program Manager
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U.S. Environmental Protection Agency
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RECEIVED
APR 21 2005
EDMC

Dear Mr. Ceto:

TRANSMITTAL OF THE SAMPLING AND ANALYSIS PLAN FOR THE 200-UW-1 OPERABLE UNIT (OU), REVISION 0

The "Sampling and Analysis Plan for the 200-UW-1 Operable Unit" is being transmitted for your review and approval. To date the comments received from the U.S. Environmental Protection Agency technical staff and legal staff are reflected in the enclosed document. Resolution of comments was confirmed in a series of workshops and follow-on communication with the U.S. Department of Energy, Richland Operations Office (RL) and Ecology technical and legal staff.

The SAP will facilitate characterization of the waste sites within the 200-UW-1 OU. This document was prepared by RL in accordance with 40 CFR 300.415(b)(3)(ii), and the joint policy issued in 1995 by RL and the U.S. Environmental Protection Agency, to support the 200-UW-1 OU remedial action. That policy guides RL to conduct remedial activities under the Comprehensive Environmental Response, Compensation and Liability Act of 1980. This SAP may be changed based upon public comments during public review of the 200-UW-1 Proposed Plan.

In accordance with the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), Section 9.0, Documentation and Records, we are requesting EPA approval within 30 days of receipt of the document.

If you have questions, please contact me, or your staff may contact Matt McCormick, Assistant Manager for the Central Plateau, on (509) 373-9971.

Sincerely,

Doug A. Shoop for

Keith A. Klein
Manager

AMCP:KDL

Enclosure

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DOE/RL-2003-51
REVISION 0

Sampling and Analysis Plan for the 200-UW-1 Operable Unit

DRAFT

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

United States Department of Energy
P.O. Box 550
Richland, Washington 99352

DOE/RL-2003-51
Revision 0

Sampling and Analysis Plan for the 200-UW-1 Operable Unit

DRAFT

Date Published
March 2005

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

United States Department of Energy
P.O. Box 550
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Release Approval _____ Date _____

DOE/RL-2003-51
Revision 0

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Approval Page

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CONTENTS

TERMS vii

1.0 INTRODUCTION 1-1
1.1 CONTAMINANTS OF CONCERN 1-13
1.1.1 200-UW-1 OU Contaminants of Concern 1-13
1.2 DATA QUALITY OBJECTIVES 1-14
1.2.1 Statement of the Problem 1-14
1.2.2 Decision Rules 1-15
1.3 200-UW-1 OU SAMPLE DESIGN SUMMARY 1-15
1.3.1 Focused Sampling 1-16
1.3.2 Field Screening 1-17
1.3.3 Sampling Photographic Documentation 1-17
1.3.4 Sampling Change Management 1-17

2.0 QUALITY ASSURANCE PROJECT PLAN 2-1
2.1 PROJECT MANAGEMENT 2-1
2.1.1 Project/Task Organization 2-7
2.1.2 Quality Objectives and Criteria for Measurement Data 2-8
2.1.3 Special Training Requirements and Certification 2-8
2.1.4 Documentation and Records 2-8
2.2 DATA/MEASUREMENT ACQUISITION 2-8
2.2.1 Sampling Identification 2-9
2.2.2 Sample Handling, Shipping, and Custody Requirements 2-9
2.2.3 Analytical Methods Requirements 2-9
2.2.4 Quality Control Requirements 2-9
2.2.5 Instrument Testing, Inspection, and Maintenance Requirements 2-10
2.2.6 Instrument Calibration and Frequency 2-11
2.2.7 Onsite Measurements Quality Control 2-11
2.2.8 Inspection/Acceptance Requirements for Supplies and Consumables 2-11
2.2.9 Sample Preservation, Containers, and Holding Times 2-11
2.3 ASSESSMENT/OVERSIGHT 2-12
2.3.1 Assessments and Response Action 2-12
2.3.2 Reports to Management 2-12
2.4 DATA VERIFICATION, USABILITY, VALIDATION, MANAGEMENT, AND REVIEW 2-12
2.4.1 Data Verification and Usability Methods 2-12
2.4.2 Data Validation 2-12
2.4.3 Data Management and Review 2-13
2.4.4 Data Quality Assessment 2-13
2.5 TECHNICAL PROCESSES AND SPECIFICATIONS 2-13

3.0 FIELD SAMPLING PLAN 3-1

CONTENTS (cont)

3.1 SAMPLING OBJECTIVES 3-1
3.1.1 Field Measurements 3-1
3.1.2 Soil Sampling and Analysis 3-2
3.1.3 Geophysical Logging 3-3
3.1.4 Surveying 3-4
3.1.5 Waste Management Sampling 3-4
3.1.6 Science and Technology Program Sampling Requirements 3-5
3.2 SAMPLING LOCATIONS AND FREQUENCY 3-5
3.3 DRILLING AND PUSH-TECHNOLOGY 3-13
3.4 SAMPLING PROCESSES 3-13
3.5 SAMPLE MANAGEMENT 3-13
3.5.1 Sample Custody 3-13
3.5.2 Sample Packaging and Shipping 3-13
3.5.3 Field Documentation 3-13

4.0 HEALTH AND SAFETY 4-1

5.0 MANAGEMENT OF WASTE 5-1

6.0 REFERENCES 6-1

APPENDICES

A 200-UW-1 OU SOIL WASTE SITE AND SAMPLE LOCATIONS (PLAN AND PROFILE FIGURES) ..... A-i

B CONTAMINANTS OF POTENTIAL CONCERN EXCLUSION RATIONALE FOR 200-UW-1 OU SOIL WASTE SITES ..... B-i

FIGURE

Figure 1-1. 200-UW-1 OU 1-2

TABLES

Table 1-1. Summary of Data Needs. 1-3

Table 1-2. 200-UW-1 OU Soil Waste Sites. 1-13

Table 1-3. 200-UW-1 OU Decision Rules. 1-15

Table 2-1a. Radiological Analytical Performance Requirements 2-2

Table 2-1b. Nonradiological Analytical Performance Requirements 2-3

Table 2-2. Sample Preservation, Container, and Holding Time Guidelines. 2-7

Table 2-3. Field Quality Control Requirements. 2-10

Table 3-1. Field-Screening Methods. 3-1

Table 3-2. 200-UW-1 OU Sampling Plan Summary. 3-6

Table 3-3. Summary of Projected Soil Sample Collection Requirements for Laboratory Analysis 3-12

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TERMS

AEA	alpha energy analysis
aG	amber glass
bgs	below ground surface
CDI	Canyon Disposition Initiative (221-U Facility)
CERCLA	*Comprehensive Environmental Response, Compensation and Liability Act of 1980*
CFR	*Code of Federal Regulations*
COC	contaminant of concern
COPC	contaminant of potential concern
CPP	CERCLA past practice
CVAA	cold vapor atomic absorption
d/min	disintegrations per minute
DCGL	drive casing geophysical logging
DOE	U.S. Department of Energy
DQO	data quality objective
DR	decision rule
Ecology	Washington State Department of Ecology
EIS	Environmental Information System
EPA	U.S. Environmental Protection Agency
G	glass
GEA	gamma energy analysis
GPC	gas-proportional counter
GPR	ground-penetrating radar
HEIS	*Hanford Environmental Information System* (database)
IC	ion chromatography
ICP	inductively coupled plasma
Implementation Plan	*200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program*, DOE/RL-98-28
MESC	maintain existing soil cover
MS	mass spectrometry
MNA	monitored natural attenuation
N/A	not applicable; not available
NaI	sodium iodide
NWTPH	Northwest total petroleum hydrocarbon
P	plastic
PCB	polychlorinated biphenyl
PHMC	Project Hanford Management Contractor
PNNL	Pacific Northwest National Laboratory
QAPjP	quality assurance project plan
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
RCT	radiological control technician
RL	U.S. Department of Energy, Richland Operations Office

RPD	relative percent difference
RPP	RCRA past-practice
S&T	Science and Technology (Program)
SAF	Sampling Authorization Form
SAP	sampling and analysis plan
SRS	surface radiation survey
TSD	treatment, storage, and/or disposal (unit)
UCL	upper confidence limit
VOA	volatile organic analyte

1.0 INTRODUCTION

In 1999, the U.S. Department of Energy (DOE), Richland Operations Office (RL) developed the 200 Area strategy, as described in DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (Implementation Plan). This strategy grouped non-tank-farm waste sites into process-based operable units to streamline characterization and remedial action decisions. Consistent with the 200 Areas strategy and the ongoing effort to accelerate cleanup at the Hanford Site, the DOE partnered with the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA) to identify new approaches for the 200 Areas cleanup process. One of these approaches is the geographic area closure concept (DOE/RL-2002-68, *Hanford's Groundwater Management Plan: Accelerated Cleanup and Protection*). The geographic-based cleanup goals are (1) to reduce environmental risks and protect underlying groundwater by closing high-risk waste sites and (2) to accelerate remediation of the Hanford Site. In addition, economies of scale could be realized by performing remediation of all sites within a given geographic area as an integrated effort. The overall objective of the 200-UW-1 Operable Unit (hereafter referred to as the 200-UW-1 OU) initiative is to accelerate all actions necessary to achieve protectiveness for human health and the environment, prevent contaminant migration to groundwater, and provide conditions suitable for future industrial land use.

The first activities planned in the 200-UW-1 OU approach include remediating waste sites, pipelines, excess facilities, and ancillary equipment. The 200-UW-1 OU was identified for implementing the geographic closure concept for three reasons: (1) it contains high-risk waste sites that are or have been affecting groundwater; (2) the majority of the facilities, waste sites, and pipelines in the area are inactive; and (3) several of the waste sites are sufficiently characterized to apply the analogous site concept in making remedial decisions. These activities would occur concurrently and would need to be completed before implementing the proposed alternative (i.e., partial demolition and an engineered barrier) for the 221-U Building, also known as the U Plant Canyon Disposition Initiative (CDI). Upon completion of the D&D removal actions for excess facilities and ancillary equipment, additional remediation might be required for residual soil contamination, subsurface structures, pipelines, tanks, drains, or unplanned releases. Alternately, the proposed CDI barrier may prove to be sufficient to address this remaining contamination. In either event, adequate waste site characterization data are required to support remedial action decisions for the 200-UW-1 OU and CDI projects.

The U Plant Area consists of the U Plant Canyon (221-U Building), ancillary buildings and equipment, underground pipelines, and numerous waste sites (Figure 1-1). The 33 waste sites, including one RCRA TSD unit, addressed in this document mainly consist of liquid waste disposal sites associated with U Plant operations and a few solid-waste sites (i.e., debris piles and a burial trench). Cleanup of the 200-UW-1 OU will address contaminated soil, rubble and structures (e.g., concrete slabs) associated with cribs, trenches, french drains, debris piles, septic systems, and unplanned releases in coordination with the groundwater operable unit. Of the 33 waste sites evaluated in the data quality objectives (DQO) process, several (e.g., UPR-200-W-118, 2607-W7 Septic Tank, 216-U-4 Reverse Well, 216-U-4A French Drain, 216-U-4B French Drain, and UPR-200-W-78) have been adequately characterized and do not require additional data to support remedial action decisions. However, some of these sites may

require the acquisition of additional data to support remedial design, such as geophysics or surface radiation surveys. The rationale and supporting basis for these decisions were developed in the DQO process, modified through several workshops with RL, EPA, and Ecology, and are summarized in Table 1-1. The waste sites requiring additional data are addressed in this sampling and analysis plan (SAP) and are summarized in Table 1-2.

Figure 1-1. 200-UW-1 OU.

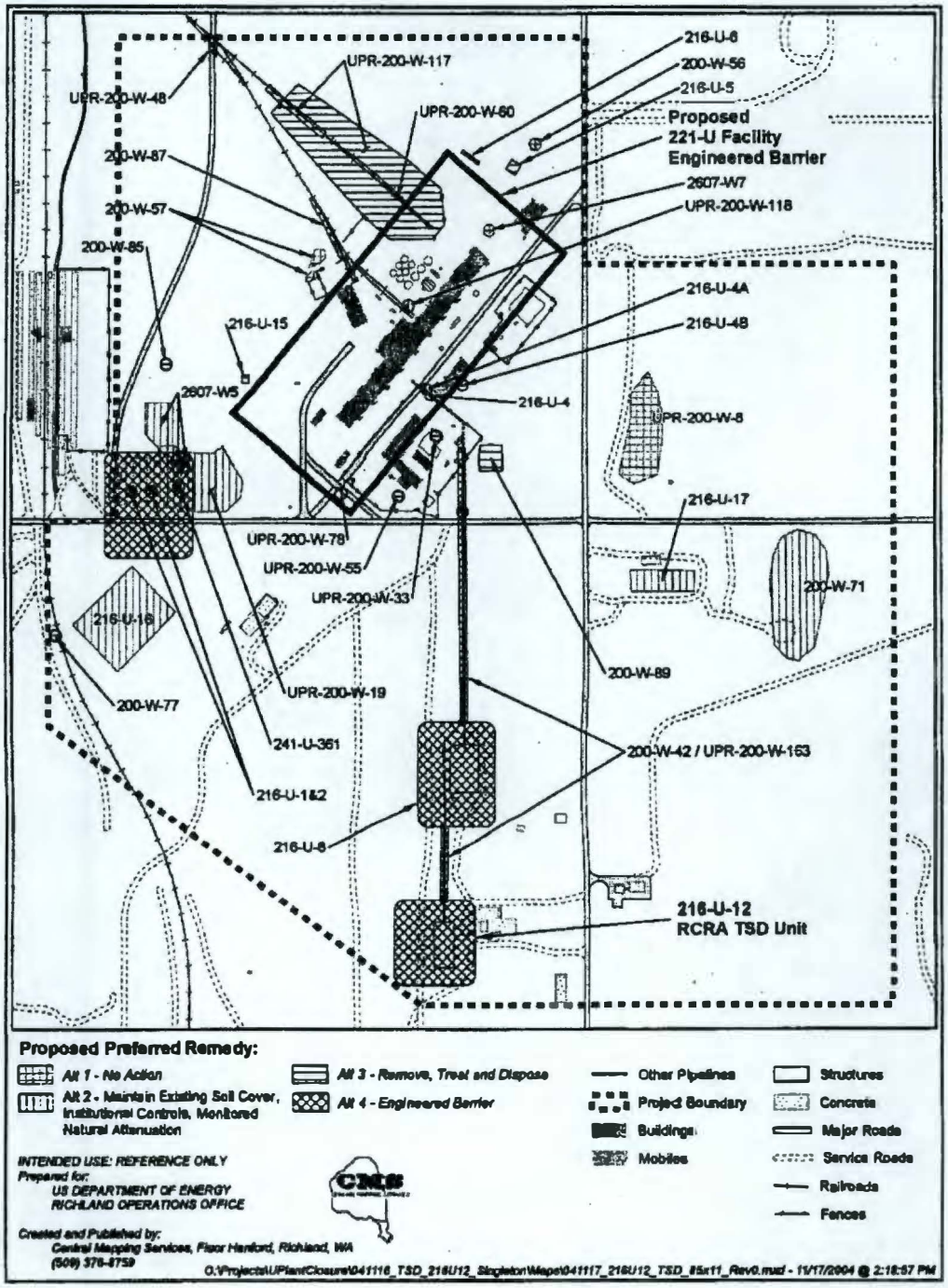

Table 1-1. Summary of Data Needs. (10 Pages)

Site Names	Risk Contaminants of Concern (COC)[a]	Contaminants of Potential Concern (COPC)[b]	Waste Management Contaminant of Interest (COI)[c]	Anticipated Remedial Action	Data Needs	Recommended Approach
216-U-1 and U-2 Cribs Representative Site	Cs-137 and Tc-99	Nitrogen as nitrate/nitrite, antimony, arsenic, mercury, cadmium, uranium (metal), U-235, and U-238	Acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene	Engineered barrier	Lateral extent of contamination to determine the engineered barrier size needed	1) Use geophysical techniques to determine an initial area of lateral contamination for input to the barrier design. Install casing to approximately 50-ft bgs and log with spectral gamma logging system to 50-ft (existing data show maximum rad activity <45-ft bgs). Drive casing locations at 20-ft intervals away from edge of crib to initially define the waste site boundary for sizing the engineered barrier. 2) Use laboratory analytical methods to confirm constituents at the depth of contamination not detected using spectral gamma logging at the edge of the lateral area of contamination at depth. Using a push, auger or other drilling technique, collect samples at nine (9) locations as identified in Appendix A. At location C4712, sample at 11, 31, 36, and 45-feet bgs and analyze the samples for COCs and COPCs to verify the maximum contaminant concentrations are at ~45-feet bgs. Sample the remaining eight (8) locations at the approximately 45 ft bgs or the maximum contaminant depth based on SGLS results from nearby casings/wells and analyze these eight (8) samples for COCs and COPCs. In addition, Ecology requested reporting of other metals from the ICP/MS method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc. If insufficient sample volume is a problem, the priority analytes are Tc-99, antimony, arsenic, mercury, and cadmium. A quick analytical turn-around (7-day) is planned for these samples. Due to the 7-day turn-around, the samples results will be reported "as received", not on a typical "dry weight basis". Eliminating sample drying saves 1-2 days and will result in slightly lower contaminant concentration results compared to dry weight results, contingent on sample moisture levels. The initial lab data used to support engineered barrier size design decisions will not be validated. Since the Tc-99 action level (1 pCi/g) is lower than the standard lab detection limit (15 pCi/g), an effort (increased sample size for extraction and/or longer scintillation counting time) will be made by the lab to reduce the detection limit to better-support design decisions. 3) The selection of a borehole to be sampled for waste management COIs at each waste site was based on reviewing information gathered from the DPT pushes in 2004, spectral gamma data, contaminant plume geometry maps for U-238 and Cs-137, and field screening information. For the 216-U-1 and 2 cribs, location C4710 was determined to best represent contamination for the other planned boreholes and one composite sample will be analyzed for COIs to support waste management decisions.

Table 1-1. Summary of Data Needs. (10 Pages)

Site Names	Risk Contaminants of Concern (COC)[a]	Contaminants of Potential Concern (COPC)[b]	Waste Management Contaminant of Interest (COI)[c]	Anticipated Remedial Action	Data Needs	Recommended Approach
216-U-8 Crib Representative Site	Nitrogen as nitrate/nitrite, Cs-137 anduranium (metal)	Antimony, arsenic, cadmium, mercury, Tc-99, U-235, and U-238	Acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene	Engineered barrier	Lateral extent of contamination to determine the engineered barrier size needed	1) Use geophysical techniques to determine an initial area of lateral contamination for input to the barrier design. Install casing to approximately 50-ft bgs and log with spectral gamma logging system to 50-ft (existing data show maximum rad activity <45-ft bgs). Drive casing locations at 20-ft intervals away from edge of crib to initially define the waste site boundary for sizing the engineered barrier. 2) Use laboratory analytical methods to confirm constituents at the depth of contamination not detected using spectral gamma logging at the edge of the lateral area of contamination at depth. Using a push, auger or other drilling technique, collect samples at nine (9) locations as identified in Appendix A. At location C4717 sample at 2, 38, and 45-feet bgs and analyze the samples for COCs and COPCs to verify the maximum contaminant concentrations are at ~45-feet bgs. Sample the remaining eight (8) locations at the approximately 45 ft bgs or the maximum contaminant depth based on SGLS results from nearby casings/wells and analyze these eight (8) samples for COCs and COPCs. In addition, Ecology requested reporting other metals from the ICP/MS method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc. If insufficient sample volume is a problem, the priority contaminants are nitrogen as nitrate/nitrate, uranium (metal), U-235, U-238, antimony, arsenic, mercury, and cadmium. A quick analytical turn-around (7-day) is planned for these samples. Due to the 7-day turn-around, the samples results will be reported "as received", not on a typical "dry weight basis". Eliminating sample drying saves 1-2 days and will result in slightly lower contaminant concentration results compared to dry weight results, contingent on sample moisture levels. The initial lab data used to support engineered barrier size design decisions will not be validated. Since the Tc-99 action level (1 pCi/g) is lower than the standard lab detection limit (15 pCi/g), an effort (increased sample size for extraction and/or longer scintillation counting time) will be made by the lab to reduce the detection limit to better-support design decisions. 3) The selection of a borehole to be sampled for waste management COIs at each waste site was based on reviewing information gathered from the DPT pushes in 2004, spectral gamma data, contaminant plume geometry maps for U-238 and Cs-137, and field screening information. For the 216-U-8 crib, location C4716 was determined to best represent contamination for the other planned boreholes and one composite sample will be analyzed for COIs to support waste management decisions.

Table 1-1. Summary of Data Needs. (10 Pages)

Site Names	Risk Contaminants of Concern (COC)[a]	Contaminants of Potential Concern (COPC)[b]	Waste Management Contaminant of Interest (COI)[c]	Anticipated Remedial Action	Data Needs	Recommended Approach
216-U-12 Crib Representative Site	Nitrogen as nitrate/nitrite	Antimony, arsenic, cadmium, mercury, uranium (metal),U-235, and U-238	Acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene	Engineered barrier	Lateral extent of contamination to determine the engineered barrier size needed	1) Use geophysical techniques to determine an initial area of lateral contamination for input to the barrier design. Install casing to approximately 50-ft bgs and log with spectral gamma logging system to 50-ft (existing data show maximum rad activity <45-ft bgs). Drive casing locations at 20-ft intervals away from edge of crib to initially define the waste site boundary for sizing the engineered barrier. 2) Use laboratory analytical methods to confirm constituents at the depth of contamination not detected using spectral gamma logging at the edge of the lateral area of contamination at depth. Using a push, auger or other drilling technique, collect samples at eight (8) locations as identified in Appendix A. At location C4730 sample at 19, 39, and 45-feet bgs and analyze the samples for COCs and COPCs to verify the maximum contaminant concentrations are at ~45-feet bgs. Sample the remaining seven (7) locations at the approximately 45 ft bgs or the maximum contaminant depth based on SGLS results from nearby casings/wells and analyze these seven (7) samples for COCs and COPCs. In addition, Ecology requested reporting other metals from the ICP/MS method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc. If insufficient sample volume is a problem, the priority contaminants are nitrogen as nitrate/nitrate, antimony, arsenic, mercury, and cadmium. A quick analytical turn-around (7-day) is planned for these samples. Due to the 7-day turn-around, the samples results will be reported "as received", not on a typical "dry weight basis". Eliminating sample drying saves 1-2 days and will result in slightly lower contaminant concentration results compared to dry weight results, contingent on sample moisture levels. The initial lab data used to support engineered barrier size design decisions will not be validated. Since the Tc-99 action level (1 pCi/g) is lower than the standard lab detection limit (15 pCi/g), an effort (increased sample size for extraction and/or longer scintillation counting time) will be made by the lab to reduce the detection limit to better-support design decisions. 3) The selection of a borehole to be sampled for waste management COIs at each waste site was based on reviewing information gathered from the DPT pushes in 2004, spectral gamma data, contaminant plume geometry maps for U-238 and Cs-137, and field screening information. For the 216-U-12 crib, location C4726 was determined to best represent contamination for the other planned boreholes and one composite sample will be analyzed for COIs to support waste management decisions.

Table 1-1. Summary of Data Needs. (10 Pages)

Site Names	Risk Contaminants of Concern (COC)[a]	Contaminants of Potential Concern (COPC)[b]	Waste Management Contaminant of Interest (COI)[c]	Anticipated Remedial Action	Data Needs	Recommended Approach
216-U-5 Trench (analogous to the 216-U-12 Crib)	Nitrogen as nitrate/nitrite	Uranium (metal), Cs-137, U-235, U-238,and Tc-99	Normal paraffin hydrocarbon, chromium (total), thallium, antimony and tributyl phosphate	Remove, treat, and dispose	Nature and vertical/lateral extent	Use geophysical techniques to verify site boundaries. No analytical sampling is proposed at this time. However, future SAPs will be prepared to address cleanup verification and waste management.
216-U-6 Trench (analogous to the 216-U-12 Crib)	Nitrogen as nitrate/nitrite	Uranium (metal), Cs-137, U-235, U-238,and Tc-99	Normal paraffin hydrocarbon, chromium (total), thallium, antimony and tributyl phosphate	Remove, treat, and dispose	Nature and vertical/lateral extent	Same approach as for the 216-U-5 Trench.
216-U-15 Trench (analogous to the 216-U-12 Crib)	Nitrogen as nitrate/nitrite	Uranium (metal), Cs-137, U-235, U-238, and Tc-99	Normal paraffin hydrocarbon, chromium (total), thallium, antimony and tributyl phosphate	Remove, treat, and dispose	Nature and vertical/lateral extent	Same approach as for the 216-U-5 Trench.
200-W-42/ UPR-200-W-163 (analogous to the 216-U-8 Crib)	Cs-137, nitrogen as nitrate/nitrite and uranium (metal)	Arsenic, pesticides and herbicides	Antimony, chromium (total), thallium and PCBs	Remove, treat, and dispose	Groundwater protection	Use geophysical techniques to verify site boundaries and underground utilities. Drill a single borehole at a worst case location (based on previous auger sampling results at suspected pipe "leak" locations) through the caliche layer (~200 ft bgs). Conduct continuous spectral-gamma logging. Collect soil samples at the bottom of the engineered structure, then at 5-ft intervals to 25 ft bgs, then at major lithologic changes. (See Table 3-2 for specific sample collection depths). Analyze samples for COCs, COPCs and waste management COIs. PCBs, pesticides, and herbicides will be analyzed from surface soils (0-2-ft bgs) just below the surface stabilization layer.
216-U-4B French Drain (analogous to the 216-U-4 Reverse Well / 216-U-4A French Drain)	Cs-137	Uranium (metal)	Chromium (total), thallium and antimony	Remove, treat, and dispose (coordinate action with the well decommis-sioning program)	Nature and vertical/lateral extent	Use geophysical techniques to verify site boundaries and underground utilities. No analytical sampling is proposed for this site.
216-U-16 Crib (analogous to the 216-U-12 Crib)	Nitrogen as nitrate/nitrite	Uranium (metal), Cs-		MESC, IC, MNA	Nature and groundwater	Use geophysical techniques to verify site boundaries. Drill a single borehole in a worst case location (within the first 1/3 of

Table 1-1. Summary of Data Needs. (10 Pages)

Site Names	Risk Contaminants of Concern (COC)[a]	Contaminants of Potential Concern (COPC)[b]	Waste Management Contaminant of Interest (COI)[c]	Anticipated Remedial Action	Data Needs	Recommended Approach
		137, U-235, U-238, Tc-99, antimony, chromium (total) and thallium			protection	the effluent distribution system) to ~165 ft. Use spectral gamma logging to identify the extent of radioactive contamination. Collect soil samples at the bottom of the engineered structure, then at 5-ft intervals to 25 ft bgs, then at major lithologic changes to the caliche layer at ~165 ft. (See Table 3-2 for specific sample collection depths). Analyze samples for COCs and COPCs.
216-U-17 Crib (analogous to the 216-U-12 Crib)	Nitrogen as nitrate/nitrite	Uranium (metal), U-235, U-238, Tc-99, antimony, chromium (total), and thallium		MESC, IC, MNA	Nature and groundwater protection	Same approach as for the 216-U-16 Crib.
241-U-361 Settling Tank (analogous to 216-U-1 and 216-U-2 Cribs)	Cs-137 and Tc-99	Uranium (metal), nitrogen as nitrate/nitrite, U-235, and U-238		Engineered barrier	Lateral extent of contamination to determine the engineered barrier size needed	Use geophysical techniques to verify site boundaries. Drive casing with spectral gamma logging to 50 ft (existing data show maximum rad activity <45 ft bgs). Drive casing locations at 20-ft intervals away from edge of crib to initially define the waste site boundary for sizing the engineered barrier. Spectral gamma logging would be sufficient to initially define contaminant lateral extent (no lab analyses needed) for this purpose. Use laboratory analytical methods to confirm the depth of contamination and the edge of the effective area of the barrier. Due to their proximity to each other, the sampling approach presented for the 216-U-1 and -2 cribs would address the lateral extent of contamination data need for the 241-U-361 tank. The tank and tank contents are not the subject of this document. The focus of this sampling activity is the soil surrounding the tank. The sampling plan is based on the assumption that the tank contents will be removed, treated (as appropriate) and disposed.
200-W-71 Trench (analogous to UPR-200-W-19)	Cs-137	Arsenic, barium, cadmium, copper, lead, mercury, chromium (total), thallium, nickel, selenium, silver, nitrogen as nitrate/nitrite,	Asbestos	MESC, IC, MNA	Nature and vertical extent	Use geophysical techniques to verify site boundaries. Collect three soil samples spatially distributed along the floor of the trench. Analyze samples for COCs, COPCs and waste management COIs.

Table 1-1. Summary of Data Needs. (10 Pages)

Site Names	Risk Contaminants of Concern (COC)[a]	Contaminants of Potential Concern (COPC)[b]	Waste Management Contaminant of Interest (COI)[c]	Anticipated Remedial Action	Data Needs	Recommended Approach
		and uranium (metal)				
UPR-200-W-19 Representative Site	Cs-137	Antimony, chromium (total), thallium, uranium (metal), U-233/234, U-235, and U-238		MESC, IC, MNA	Nature and groundwater protection	Use geophysical techniques to verify site boundaries. Use 241-U-361 Settling Tank characterization data plus drive casing data from the site perimeter. Use spectral gamma logging data to identify an appropriate sample location and collect one analytical soil sample for lab analysis. Analyze the sample for COCs and COPCs.
UPR-200-W-33 (analogous to UPR-200-W-19)	Cs-137	Uranium (metal) U-233/234, U-235, U-238, and nitrogen as nitrate/nitrite	Chromium (total), thallium and antimony	Remove, treat, and dispose	Nature and vertical/lateral extent of contamination	Use geophysical techniques to verify site boundaries and underground utilities. No analytical sampling is proposed for this site.
UPR-200-W-48 (analogous to UPR-200-W-19)	Cs-137	Am-241, Co-60, Eu-152, Eu-154, Eu-155, Np-237, Pu-238, Pu-239/240, Sr-90, Tc-99, uranium (metal), U-233/234, U-235, and U-238	Chromium (total), thallium and antimony	Remove, treat, and dispose	None	No analytical sampling is proposed for this site.
UPR-200-W-55 (analogous to UPR-200-W-19)	Cs-137	Uranium (metal), U-233/234, U-235, and U-238		Remove, treat, and dispose	Nature and vertical/lateral extent of contamination	Use geophysical techniques to verify site boundaries and underground utilities. No analytical sampling is proposed for this site.
200-W-77 unplanned release (analogous to UPR-200-W-19)	Cs-137	Uranium (metal), nitrogen as nitrate/nitrite, U-235, U-238, and Tc-99	Chromium (total), thallium and antimony	Remove, treat, and dispose	None	No analytical sampling is proposed for this site.
200-W-85 unplanned	Cs-137	Am-241, Co-	Chromium	Remove,	Nature and	Use geophysical techniques to verify site boundaries. No analytical

Table 1-1. Summary of Data Needs. (10 Pages)

Site Names	Risk Contaminants of Concern (COC)[a]	Contaminants of Potential Concern (COPC)[b]	Waste Management Contaminant of Interest (COI)[c]	Anticipated Remedial Action	Data Needs	Recommended Approach
release (analogous to UPR-200-W-19)		60, Eu-152, Eu-154, Eu-155, Np-237, Pu-238, Pu-239/240, Sr-90, Tc-99, uranium (metal), U-233/234, U-235, and U-238	(total), thallium and antimony	treat, and dispose	vertical/lateral extent of contamination	sampling is proposed for this site.
200-W-87 unplanned release (analogous to UPR-200-W-19)	Cs-137	Am-241, Co-60, Eu-152, Eu-154, Eu-155, Np-237, Pu-238, Pu-239/240, Sr-90, Tc-99, uranium (metal), U-233/234, U-235, and U-238	Chromium (total), thallium and antimony	Remove, treat, and dispose	None	No analytical sampling is proposed for this site.
200-W-89 unplanned release (analogous to UPR-200-W-19)	Cs-137	PCBs	Chromium (total), thallium and antimony	Remove, treat, and dispose	None	Perform radiation survey of the electrical substation concrete slab surface and the surrounding stabilized area No analytical sampling is proposed for this site.
UPR-200-W-117 (analogous to UPR-200-W-19)	Cs-137	Am-241, Co-60, Eu-152, Eu-154, Eu-155, Np-237, Pu-238, Pu--239/240, Sr-90, Tc-99, uranium (metal), U-233/234, U-235, and U-238	Chromium (total), thallium and antimony	Remove, treat, and dispose	None	No analytical sampling is proposed for this site.
UPR-200-W-60 (analogous to UPR-200-W-19)	Cs-137	Am-241, Co-60, Eu-152, Eu-154, Eu-155, Np-237, Pu-238, Pu-239/240,	Chromium (total), thallium and antimony	Remove, treat, and dispose	None	No analytical sampling is proposed for this site. This site is located in the UPR-200-W-117 site boundary.

Table 1-1. Summary of Data Needs. (10 Pages)

Site Names	Risk Contaminants of Concern (COC)[a]	Contaminants of Potential Concern (COPC)[b]	Waste Management Contaminant of Interest (COI)[c]	Anticipated Remedial Action	Data Needs	Recommended Approach
		Sr-90, Tc-99, uranium (metal), U-233/234, U-235, and U-238				
2607-W5 Septic Tank and Tile Field (analogous to UPR-200-W-19)	Cs-137	Arsenic, barium, cadmium, copper, lead, mercury, chromium (total), thallium, nickel, selenium, silver, and nitrogen as nitrate/nitrite		MESC, IC, MNA	Nature and groundwater protection	Use geophysical techniques to verify site boundaries. Collect a sludge sample (if available) from septic tank for laboratory analysis to support waste management and tank disposition. Analyze the sample for COCs and COPCs. Evacuate tank contents (if appropriate) and stabilize tank by filling with clean material.
2607-W7 Septic Tank (analogous to UPR-200-W-19)	Based on process information, no hazardous or radioactive wastes were disposed of at this site. Therefore, no contamination is expected			No action (site will be located under proposed barrier over the 221-U Building)	None	No verification sampling is required. Tank contents were evacuated in 1999, and the tank was filled with clean material. Use existing site information to support a site closure/de-listing decision. The site is located within the proposed barrier over the 221-U Building. This barrier would further remediate the tank and drain field.
200-W-56 Dump (analogous to UPR-200-W-19)				No further action	None	Site rejected under the MP-14 process.

Table 1-1. Summary of Data Needs. (10 Pages)

Site Names	Risk Contaminants of Concern (COC)[a]	Contaminants of Potential Concern (COPC)[b]	Waste Management Contaminant of Interest (COI)[c]	Anticipated Remedial Action	Data Needs	Recommended Approach
200-W-57 Dump (analogous to UPR-200-W-19)				No further action	None	Site rejected under the MP-14 process
UPR-200-W-8 (analogous to UPR-200-W-19)	Cs-137	Arsenic, barium, cadmium, copper, lead, mercury, chromium (total), thallium, nickel, selenium, silver, Nitrogen as nitrate/nitrite, uranium (metal), Am-241, Co-60, Eu-152, Eu-154, Eu-155, Np-237, Pu-238, Pu-239/240, Sr-90, Tc-99, U-233/234, U-235, and U-238		No action	Verification	Use geophysical techniques to verify site boundaries. Collect three soil samples spatially distributed along the floor of the trench.. Analyze samples for COCs and COPCs.
216-U-4 Reverse Well Representative Site	Cs-137	Mercury and Uranium (metal)	Acetone, bromomethane, chloromethane, Di-n-butylphthalate, mercury, methylene chloride, pentachlorophenol (D037), tetrachloroethene (D039), toluene, and uranium (metal)	MESC, IC, MNA (site will be located under proposed barrier over the 221-U Building)	None	Characterized in 1995, no additional data required.

Table 1-1. Summary of Data Needs. (10 Pages)

Site Names	Risk Contaminants of Concern (COC)[a]	Contaminants of Potential Concern (COPC)[b]	Waste Management Contaminant of Interest (COI)[c]	Anticipated Remedial Action	Data Needs	Recommended Approach
216-U-4A French Drain Representative Site	Cs-137	Mercury and Uranium (metal)		MESC, IC, MNA (site will be located under proposed barrier over the 221-U Building)	None	Characterized in 1995, no additional data required.
UPR-200-W-118 (analogous to UPR-200-W-19)	Cs-137	Uranium (metal) U-233/234, U-235, U-238, and nitrogen as nitrate/nitrite		MESC, IC, MNA (site will be located under proposed barrier over the 221-U Building)	None	No analytical sampling is proposed for this site. The site is located within the proposed barrier over the 221-U Building.
UPR-200-W-78 (analogous to UPR-200-W-19)	Cs-137	Antimony, uranium (metal), U-233/234, U-235, and U-238		MESC, IC, MNA (site will be located under proposed barrier over the 221-U Building)	None	The site is located within the proposed barrier over the 221-U Building. The barrier would remediate any residual uranium not removed in 1969 when the site was discovered.

[a] Contaminants of concern for representative sites were identified in the Focused Feasibility Study risk assessment process. Contaminants of concern for analogous sites were identified based on the representative-site risk-assessment process plus process history information.

[b] Contaminants of potential concern were identified based on process knowledge.

[c] Waste Management contaminants of interest are based on process knowledge and could affect waste disposition/disposal decisions primarily at sites anticipated for the remove, treat, and dispose (RTD) remedial action. The contaminants in this column are listed in addition to COCs and COPCs that may also present waste management issues for RTD sites.

bgs = below ground surface.
IC = institutional controls.
MESC = maintain existing soil cover.
MNA = monitored natural attenuation.
PCB = polychlorinated biphenyl.

Source: DOE/RL-2003-23, *Focused Feasibility Study for the* 200-UW-1 Operable Unit.

Table 1-2. 200-UW-1 OU Soil Waste Sites.

Waste Site	Site Type	Waste Site Structure Type	Waste Site	Site Type	Waste Site Structure Type
200-W-42	RPP	pipeline	216-U-15	CPP	trench
200-W-56	RPP	Dump (rejected)[a]	216-U-16	RPP	crib
200-W-57	RPP	Dump (rejected)[a]	216-U-17	RPP	crib
200-W-71	RPP	trench	241-U-361	RPP	settling tank
200-W-77	RPP	unplanned release	2607-W5	RPP	septic tank and tile field
200-W-85	RPP	unplanned release	UPR-200-W-8	RPP	burial ground
200-W-87	RPP	unplanned release	UPR-200-W-19	RPP	unplanned release
200-W-89	RPP	foundation	UPR-200-W-33	RPP	unplanned release
216-U-1 and 216-U-2	RPP	crib	UPR-200-W-48	RPP	unplanned release
216-U-4		Reverse well	216-U-4A		French drain
216-U-4B		French drain			
216-U-5	RPP	trench	UPR-200-W-55	RPP	unplanned release
216-U-6	RPP	trench	UPR-200-W-117	RPP	unplanned release
216-U-8	RPP	crib	UPR-200-W-163	RPP	unplanned release
216-U-12	TSD	crib	UPR-200-W-60	RPP	unplanned release

[a] Site rejected under the MP-14 process.

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

CPP = CERCLA past practice.

RCRA = *Resource Conservation and Recovery Act of 1976*, 42 USC 6901 et seq.

RPP = RCRA past practice.

TSD = treatment, storage, and/or disposal (unit).

This document contains five major sections:

- Chapter 1.0 summarizes key DQO process decisions
- Chapter 2.0 provides the quality assurance project plan (QAPjP)
- Chapter 3.0 provides the field sampling plan.
- Appendix A provides waste site and sample location figures.
- Appendix B summarizes the contaminants of potential concern (COPC) risk based exclusion and the rationale for their exclusion.

1.1 CONTAMINANTS OF CONCERN

1.1.1 200-UW-1 OU Contaminants of Concern

Participants in the DQO process established a list of COPCs for the 200-UW-1 OU waste sites, based on historical process operations information. The COPCs then were evaluated against

existing analytical data, risk information (i.e., toxicological criteria or low/absent health risks), and practical factors (e.g., short radionuclide half-life, environmental persistence) to determine if the individual COPCs should be excluded from consideration or included in the SAP as contaminants of concern (COC). The COCs that were excluded from the SAP, and the rationale for their exclusion, are documented in Appendix B. The COCs, COPCs and waste management contaminants of interest included in this SAP are listed in Table 1-1. If contaminants not identified as COCs are detected during laboratory analysis, the data will be evaluated against regulatory standards, risk-based levels (if exposure data are available), and existing process knowledge in support of remedial action decision-making.

1.2 DATA QUALITY OBJECTIVES

The EPA document, EPA/600/R-96/055 QA/G-4, *Guidance for the Data Quality Objectives Process* (EPA, 2000, as amended), 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 seven-step DQO process. For additional details, refer to CP-16244.

1.2.1 Statement of the Problem

The 200-UW-1 OU waste sites addressed in this SAP (see Table 1-2) primarily received process wastes from U Plant operations and related activities. Vadose zone soils, structures, and the aquifer have been impacted by effluent released to these waste sites. The DQO process for the 200-UW-1 OU addressed the problems of determining the environmental measurements required to support future remedial investigation/feasibility study processes and remedial action decisions and refining the preliminary waste site conceptual contaminant distribution models.

To support remedial action decisions, analytical and/or field-screening data are needed to confirm the selected remedial actions considering the nature and vertical extent of contamination (consistent with Table 1-1 and associated text within the DQO.) These considerations were based on the characterized representative waste site, the analogous waste site, process knowledge, and the remedy being selected. Examples of such remedy considerations include 1) implementation of the Remove/Treat/Dispose alternative using the observational approach and 2) evaluation of site conditions and integration with other site activities such as the proposed barrier over the 221-U Building. These site specific and proposed remedy considerations are necessary when evaluating the data needs and balancing the associated uncertainty with potential incorrect decisions.

The remedial alternatives identified for the waste sites include the following:

- No action
- Maintain existing soil cover, institutional controls, and monitored natural attenuation

- Excavation and disposal of waste (remove, treat, and dispose)
- Engineered barrier.

1.2.2 Decision Rules

Decision rules are developed during the DQO process and generally are structured as "IF...THEN" statements that indicate the action that would be taken when a prescribed waste site condition is met. Decision rules incorporate the parameters of interest (COCs), the scale of the decision (waste site boundaries), the preliminary action level (risk-based criteria), and the resulting action (remediation needs). The decision rules are summarized in Table 1-3.

Table 1-3. 200-UW-1 OU Decision Rules.

DR #	Decision Rules
	Field Screening
1	If the radiological or chemical maximum field survey results for contaminated media (e.g., soils, pipe, rubble, and engineered structures) within the direct exposure or groundwater protection zones exceed the threshold values in Tables 2-1a or 2-1b, then the site is contaminated and requires remedial action. Otherwise, the site may require no action and would be analytically evaluated according to DR #2.
	Standard Fixed Laboratory Analyses
2	If the radiological or chemical maximum or 95 percent UCL of the mean analytical results for contaminated media (e.g., soils, pipe, rubble, and engineered structures) within the direct exposure or groundwater protection zones exceeds the threshold values in Tables 2-1a or 2-1b, then the site is contaminated and requires remedial action. Otherwise, the site requires no action.
	Field Screening or Standard Fixed Laboratory Analyses
3	If the radiological or chemical contaminant distributions and estimated risks for the analogous waste sites are not consistent with the representative site conceptual models, then the conceptual models will be revised, and additional site sampling and analysis may be required to support remediation decisions. Otherwise, the conceptual models require no revision.

DR = decision rule.
UCL = upper confidence level.

1.3 200-UW-1 OU SAMPLE DESIGN SUMMARY

The nature of the 200-UW-1 OU waste sites supports the use of focused sampling, as identified in Washington State Department of Ecology Toxics Cleanup Program Guidance on Sampling and Data Analysis Methods (Ecology 1995). This guidance document defines "focused sampling" as selective sampling of areas where potential or suspected soil contamination can reliably be expected to be found if a release of a hazardous substance has occurred.

These waste sites have attributes such as visible surface debris, known discharge release points in engineered structures such as cribs or french drains, subsurface debris that can be identified by surface geophysics techniques, or have a primary constituent which has a gamma/and or beta emitter that can be identified by surface/near surface radiological surveys. Therefore, sampling in a focused manner will ensure data collection of the area of greatest impact associated with the release. Additional efforts may be needed to determine the worst-case location for the sample(s) collection within these sites, such as driven soil probes and gamma logging, which will provide additional data on gamma-emitting radionuclides to support the focused sampling regime.

Sampling locations would be selected during site walk downs by PHMC technical staff familiar with the 200-UW-1 OU and the waste sites in question. The primary judgment used in selecting sample locations/materials is field screening results (e.g., radioactive "hot spots" defined with field instruments) or suspicious locations/materials based on visual inspection (e.g., stained soil areas or debris known to represent hazardous/dangerous/radioactive waste in past experiences). The Tri-Parties typically participate in the walk downs and are asked to concur with the sample locations/materials selected.

1.3.1 Focused Sampling

A non-statistical sampling design based on professional judgment was used to select sample locations at the waste sites. This focused sampling approach was selected based on process knowledge, expected behavior of COCs, observed distribution of contamination, waste site configuration, and the conceptual contaminant distribution models developed for the waste sites. Using this approach, sample locations were selected that increase the likelihood of encountering worst case conditions or maximum COC concentrations. The parameter of interest in focused sampling is the maximum detected value.

DOE completed a DQO process (CP-16244), that EPA and Ecology participated in, and developed the following sampling strategies based on current site knowledge and DOE's baseline assumptions about site remedial actions.

- No sampling is required for sites that were adequately characterized during past remedial investigations (i.e., past investigations where sampling designs were agency-approved and appropriate quality assurance/quality control measures were incorporated).
- For most "remove-and-dispose" sites, observational approach sampling would be used to define the vertical and lateral extent of contamination during excavation.
- For most "engineered barrier" sites, sampling is needed to establish the lateral extent of contamination.
- For some sites without existing analytical information, sampling is needed to confirm that site conditions (COC nature and vertical extent) are consistent with representative site data and that future remedial decisions can be supported.
- For "no-action" sites, a minimum of four analytical samples is required to verify that site contaminants comply with human health, groundwater protection, and environmental risk criteria. Subsequent to the DQO, it was decided that site specific information and field screening may be suitable to support "no action" site decisions.

Physical sample collection options for the waste sites include surface samples (0 to 2 ft deep; typically collected with hand tools [i.e., trowel or shovel]), test pit and test trench samples (up to 25 ft deep; typically collected with a backhoe or trackhoe), conventional drilling samples (boreholes more than 50 ft deep), and cone penetrometer/drive casing samples ("pushes" up to 50 ft deep). Field-screening data collection options include only radionuclide testing equipment (spectral gamma logging and portable sodium iodide [NaI] detector).

The total number of samples for the waste sites was selected based on waste site conceptual contaminant distribution models, physical setting information, and previous site investigations. Based on previous site investigation results, the models suggest that the highest COC concentrations should be detected near the bottoms of the cribs or trenches and should decrease with depth. Therefore, a greater frequency of sampling is planned in the zone immediately below the COC release point (i.e., the bottom of the crib or trench) and the sampling frequency then would decrease with depth. Additional samples will be collected at the discretion of the site geologist, based on the field-screening data and geological conditions encountered during drilling or test-pit development. All material excavated will be screened as described in Chapter 2.0 (QAPjP). Field screening will be performed to reduce the potential of overlooking contaminated zones. The sample designs are presented in Chapter 3.0.

1.3.2 Field Screening

If applicable for the radiological COCs at specific waste sites, field screening may be used to establish site contamination presence/absence and preliminary activity levels, and to determine if samples are required for specific analyses. A site can be shown to be contaminated and can require remediation if field-screening results indicate COC concentrations or activities above the action levels (analytical data are not required). However, field-screening results cannot be used alone to support no-action decisions. Field-screening results suggesting that the no-action alternative is appropriate must be verified through analytical sampling and analysis.

1.3.3 Sampling Photographic Documentation

Photographs should be taken to document sampling activities and provide visual information to the decision-makers concerning the nature and distribution of waste. Photographs will be especially useful at sites where sampling is conducted through test pits and test trenches, but also should be considered where borehole, drive point, hand tool, and geophysical sampling is conducted.

1.3.4 Sampling Change Management

Changes to the work scope detailed in this SAP may be required because of unexpected field conditions, new information, health and safety concerns, or other circumstances. Minor changes that have no adverse effect on the technical adequacy of the work or schedule can be made in the field with the approval of the project manager or assigned task lead and will be documented in the daily field logbook and/or field summary reports. Changes that impact DQOs will require concurrence by RL and the lead regulatory agency and can be documented through unit managers' meetings. Alternately, if substantial changes are needed, the SAP can be revised and issued as a separate document, requiring RL and regulator approval.

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2.0 QUALITY ASSURANCE PROJECT PLAN

This section of the SAP, the QAPjP, establishes the quality requirements for environmental data collection, including sampling, field measurements, and laboratory analysis. The QAPjP, in concert with the other SAP sections, complies with the requirements of *EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans (EPA 2001, as revised).*

The Implementation Plan provides the general framework of technical and administrative requirements that apply to operable units in the 200 Areas.

To meet the site-specific needs for the 200-UW-1 OU waste sites, this QAPjP identifies supplemental requirements developed during the DQO process. These requirements are listed below.

- **Analytical Performance.** Requirements for detection limits, precision, and accuracy are presented in Tables 2-1a and 2-1b. The analytical methods also are shown.
- **Field Quality Control.** The frequency and type of quality control samples to be collected are addressed in Section 2.2.4.
- **Sample Preservation, Containers, and Holding Time.** The requirements for the specific test/laboratory methods are addressed in Section 2.2.9 and in Table 2-2.
- **Onsite Measurements Quality Control.** The specific types of quality control samples for onsite measurements and the frequency of collection are addressed in Section 2.2.7.
- **Data Validation and Usability.** Specific validation requirements, including the frequency and level of validation, are addressed in Section 2.4.

The following sections describe the site quality requirements and the procedural controls applicable to this investigation.

2.1 PROJECT MANAGEMENT

The following subsections address the basic areas of project management and will ensure that the project has a defined goal, the participants understand the goal and the approach to be used, and the planned outputs have been appropriately documented.

Table 2-1a. Radiological Analytical Performance Requirements.

Contaminants of Concern	Chemical Abstracts Service #	Lowest Preliminary Action Level[a] (pCi/g)	Name/Analytical Technology	Required Target Quantitation Limits	Precision Req't (% RPD)	Accuracy Req't (% Recovery)
				Soil-Other Low Activity (pCi/g)		
Americium-241	14596-10-2	335	Americium isotopic – AEA	1	±30%	70-130%
Cesium-137	10045-97-3	23.4	GEA	0.01	±30%	70-130%
Cobalt-60	10198-40-0	4.9	GEA	0.05	±30%	70-130%
Europium-152	14682-23-9	11.4	GEA	0.1	±30%	70-130%
Europium-154	15585-10-1	10.3	GEA	0.1	±30%	70-130%
Europium-155	14391-16-3	426	GEA	0.1	±30%	70-130%
Neptunium-237	13994-20-2	59.2	Neptunium-237 – AEA	1	±30%	70-130%
Plutonium-238	13981-16-3	470	Plutonium isotopic – AEA	1	±30%	70-130%
Plutonium-239/240	PU-239/240	425	Plutonium isotopic – AEA	1	±30%	70-130%
Strontium-90	10098-97-2	22.5	Total radioactive strontium – GPC	1	±30%	70-130%
Technetium-99	14133-76-7	1	Technetium-99 – liquid scintillation	15[b]	±30%	70-130%
Uranium-233/234	13966-29-5	1.76	Uranium isotopic – AEA (pCi) ICP/MS (mg)	1	±30%	70-130%
Uranium-235	15117-96-1	1	Uranium isotopic – AEA (pCi) ICP/MS (mg)	1	±30%	70-130%
Uranium-238	U-238	1.69	Uranium isotopic – AEA (pCi) ICP/MS (mg)	1	±30%	70-130%

[a]The preliminary action level is the lowest regulatory / risk-based value used to determine appropriate analytical requirements (e.g., detection limits) and are consistent with those presented in the Focused Feasibility Study for the 200-UW-1 Operable Unit (DOE/RL-2003-23). Units are in pCi/g unless otherwise specified.

[b] Because the Tc-99 action level (1 pCi/g) is lower than the standard lab detection limit (15 pCi/g), an effort (increased sample size for extraction and/or longer scintillation counting time) will be made by the lab to reduce the detection limit to better-support design decisions.

AEA = alpha energy analysis.
GEA = gamma energy analysis.
GPC = gas-proportional counter.
ICP = inductively coupled plasma.
MS = mass spectrometry.
RPD = relative percent difference.

Table 2-1b. Nonradiological Analytical Performance Requirements. (4 Pages)

Contaminants of Concern	Chemical Abstracts Service #	Lowest Preliminary Action Level[a] (mg/kg)	Name/Analytical Technology[b]	Required Target Quantitation Limits: Soil-Other Low Activity (pCi/g or mg/kg unless otherwise indicated)	Precision Req't (% RPD)	Accuracy Req't (% Recovery)
Metals						
Antimony	7440-36-0	5.4	Metals – 6010 – ICP (trace) or 200.8 ICP/MS	0.6	±30%	70-130%
Arsenic	7440-38-2	6.47 (background)	Metals – 1311/6010 – ICP or 1311/200.8 ICP/MS	500 µg/L	±30%	70-130%
			Metals – 6010 – ICP or 200.8 ICP/MS	1	±30%	70-130%
Asbestos	N/A	N/A[c]	Polarized light microscopy	1 %	N/A	N/A
Barium	7440-39-3	132	Metals – 1311/6010 – ICP or 1311/200.8 ICP/MS	10,000 µg/L	±30%	70-130%
			Metals – 6010 – ICP or 200.8 ICP/MS	2		
Cadmium	7440-43-9	0.81 (background)	Metals – 6010 – ICP or 200.8 ICP/MS	0.5	±30%	70-130%
Chromium (total)	7440-47-3	N/A[c]	Metals – 6010 – ICP or 200.8 ICP/MS	1	±30%	70-130%
Cobalt	7440-48-4	290	Metals – 6010 – ICP or 200.8 ICP/MS	2	±30%	70-130%
Copper	7440-50-8	217	Metals – 6010 – ICP	1	±30%	70-130%
Lead	7439-92-1	118	Metals – 1311/6010 – ICP or 1311/200.8 ICP/MS	500 µg/L	±30%	70-130%
			Metals – 6010-ICP or 200.8 ICP/MS	5	±30%	70-130%
Manganese	7439-96-5	512				
			Metals – 6010 – ICP or 200.8 ICP/MS	5	±30%	70-130%

Table 2-1b. Nonradiological Analytical Performance Requirements. (4 Pages)

Contaminants of Concern	Chemical Abstracts Service #	Lowest Preliminary Action Level[a] (mg/kg)	Name/Analytical Technology[b]	Required Target Quantitation Limits: Soil-Other Low Activity (pCi/g or mg/kg unless otherwise indicated)	Precision Req't (% RPD)	Accuracy Req't (% Recovery)
Mercury	7439-97-6	2.09	Mercury – 1311/7470 – CVAA or 1311/200.8 ICP/MS	20 µg/L	±30%	70-130%
			Mercury – 7471 – CVAA or 200.8 ICP/MS	0.2	±30%	70-130%
Nickel	7440-02-0	130[d]	Metals – 6010 – ICP or 200.8 ICP/MS	4	±30%	70-130%
Selenium	7782-49-2	1	Metals – 1311/6010 – ICP or 1311/200.8 ICP/MS	100 µg/L	±30%	70-130%
			Metals – 6010 – ICP (trace) or 200.8 ICP/MS	1		
Silver	7440-22-4	13.6	Metals – 1311/6010 – ICP or 1311/200.8 ICP/MS	500 µg/L	±30%	70-130%
			Metals – 6010 – ICP (trace) or 200.8 ICP/MS	0.2	±30%	70-130%
Strontium	7440-24-6	2,920	Metals – 6010 – ICP (trace) or 200.8 ICP/MS	1	±30%	70-130%
Thallium	7440-28-0	1.59	Metals – 6010 – ICP (trace) or 200.8 ICP/MS	0.5	±30%	70-130%
Titanium	7440-32-6	Unlimited	Metals – 6010 – ICP (trace) or 200.8 ICP/MS	1	±30%	70-130%
Uranium (metal)	7440-61-1	3.2	Uranium total – kinetic phosphorescence analysis or 200.8 ICP/MS	1	±30%	70-130%
Vanadium	7440-62-2	2,240	Uranium total – kinetic phosphorescence analysis or 200.8 ICP/MS	2.5	±30%	70-130%

Table 2-1b. Nonradiological Analytical Performance Requirements. (4 Pages)

Contaminants of Concern	Chemical Abstracts Service #	Lowest Preliminary Action Level[a] (mg/kg)	Name/Analytical Technology[b]	Required Target Quantitation Limits Soil-Other Low Activity (pCi/g or mg/kg unless otherwise indicated)	Precision Req't (% RPD)	Accuracy Req't (% Recovery)
Zinc	7440-66-6	360	Uranium total – kinetic phosphorescence analysis or 200.8 ICP/MS	1	±30%	70-130%
Inorganics						
Nitrogen in nitrate or nitrite	NO_2+NO_3-N	40	Anions – 353.1/2/3	0.75	±30%	70-130%
Nitrate (as N)	NO_3-N	40	Anions – 300.0 – IC	0.75	±30%	70-130%
Organics						
Acetone	67-64-1	N/A [c,d]	N/A	N/A	N/A	N/A
Bromomethane	74-83-9	N/A [c,d]	N/A	N/A	N/A	N/A
Chloromethane	74-87-3	N/A [c,d]	N/A	N/A	N/A	N/A
Di-n-butylphthalate	84-74-2	N/A [c,d]	N/A	N/A	N/A	N/A
Herbicides	N/A	N/A [c,e]	8151	0.1→10	±30%	70-130%
Methylene chloride	75-09-2	N/A [c,d]	N/A	N/A	N/A	N/A
Normal paraffin hydrocarbons	TPHKERO-SENE TPHDIESEL	2,000 [c]	NWTPH-D extended to kerosene range organics	5	±30%	70-130%
Polychlorinated biphenyls	N/A	N/A [c]	8082	0.02	±30%	70-130%
Penta-chlorophenol	87-86-5	N/A [c,d]	N/A	N/A	N/A	N/A
Pesticides	N/A	N/A [c,f]	8081	0.002→0.02	±30%	70-130%
1,1,2,2-Tetra-chloroethane	79-34-5	N/A [c,d]	N/A	N/A	N/A	N/A
Toluene	108-88-3	N/A [c,d]	N/A	N/A	N/A	N/A
Tributyl phosphate	126-73-8	N/A [c]	8270	3.3	±30%	70-130%

Table 2-1b. Nonradiological Analytical Performance Requirements. (4 Pages)

Contaminants of Concern	Chemical Abstracts Service #	Lowest Preliminary Action Level[a] (mg/kg)	Name/Analytical Technology[b]	Required Target Quantitation Limits	Precision Req't (% RPD)	Accuracy Req't (% Recovery)
				Soil-Other Low Activity (pCi/g or mg/kg unless otherwise indicated)		
Performance Requirements for Field Measurements						
Gross Cs-137 counts	10045-973	N/A	Portable NaI detector	100 d/min/100 cm^2	N/A	N/A
Gross alpha	12587-46-1	N/A	Portable combination detector	100 d/min/100 cm^2	N/A	N/A
Gross beta/ gamma	12587-47-2	N/A	Portable combination detector	100 d/min/100 cm^2	N/A	N/A

[a]The preliminary action level is the lowest regulatory / risk-based value used to determine appropriate analytical requirements (e.g., detection limits) and are consistent with those presented in the Focused Feasibility Study for the 200-UW-1 Operable Unit (DOE/RL-2003-23). Units are in mg/kg unless otherwise specified.

[b]All four-digit numbers refer to SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. For Test Method 200.8, see EPA/600/R-94/111, *Methods for the Determination of Metals in Environmental Samples, Supplement I*; for Test Method 300.0, see EPA/600/4-79/020, *Methods of Chemical Analysis of Water and Wastes*; for Test Methods 353.1/2/3, see EPA/600/4-79/020 and EPA/600/R-93/100, *Methods for the Determination of Inorganic Substances in Environmental Samples*.

[c]Waste management contaminant of interest; not a human health or ecological risk driver.

[d]Sufficient contaminant data already exist to support remediation and/or waste management decisions; no additional analytical data are required.

[e]The reported results will include all Method 8151 herbicides.

[f]The reported results will include all Method 8081 pesticides.

CVAA = cold vapor atomic absorption.
d/min = disintegrations per minute.
IC = ion chromatography.
ICP = inductively coupled plasma.
MS = mass spectrometry.
N/A = not applicable.
NaI = sodium iodide.
NWTPH-D = northwest total petroleum hydrocarbons-diesel.
RPD = relative percent difference.

Table 2-2. Sample Preservation, Container, and Holding Time Guidelines.

Analytes	Matrix	Bottle		Amount [a,b]	Preservation	Packing Requirements	Holding Time
		Number	Type				
Radionuclides							
Americium-241	Soil	1	G/P	10-1000 g	None	None	6 months
Cesium-137	Soil	1	G/P	100-1500 g	None	None	6 months
Cobalt-60	Soil	1	G/P	100-1500 g	None	None	6 months
Europium-152	Soil	1	G/P	100-1500 g	None	None	6 months
Europium-154	Soil	1	G/P	100-1500 g	None	None	6 months
Europium-155	Soil	1	G/P	100-1500 g	None	None	6 months
Neptunium-237	Soil	1	G/P	10-1000 g	None	None	6 months
Plutonium-238	Soil	1	G/P	10-1000 g	None	None	6 months
Plutonium-239/240	Soil	1	G/P	10-1000 g	None	None	6 months
Sr-90	Soil	1	G/P	10-1000 g	None	None	6 months
Technetium-99	Soil	1	G/P	10-1000 g	None	None	6 months
Uranium-233/234	Soil	1	G/P	10-1000 g	None	None	6 months
Uranium-235	Soil	1	G/P	10-1000 g	None	None	6 months
Uranium-238	Soil	1	G/P	10-1000 g	None	None	6 months
Nonradionuclides							
Asbestos	Soil	1	G	40 g	None	Cool 4 °C	14 days
PCBs	Soil	1	aG	120 g	None	Cool 4 °C	14/40 days
Pesticides	Soil	1	aG	250 g	None	Cool 4 °C	14/40 days
Herbicides	Soil	1	aG	300 mL	None	Cool 4 °C	14/40 days
Tributyl phosphate	Soil	1	aG	250 g	None	Cool 4 °C	14/40 days
ICP metals	Soil	1	G/P	10-500 g	None	None	6 months
Mercury	Soil	1	G	5-125 g	None	None	28 days
NWTPH-D	Soil	1	G	125-250 g	None	Cool 4 °C	14 days
300.0 [c] – nitrate	Soil	1	G/P	50-100 g	None	Cool 4 °C	48 hours
353.N [c] – nitrate + nitrite	Soil	1	G/P	50-100 g	None	Cool 4 °C	28 days

[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] Mixed soil samples may be obtained and submitted to the analytical laboratory for analyses for specific analytes including: Radionuclides – 100 g of soil for all radionuclides (except C-14, tritium, and Tc-99; they require approximately 10 g each sample); Chemicals – a 10 g soil sample is required for all ICP analyses, a 10 g soil sample is required for IC anion analysis, a 5 g soil sample for hexavalent chromium analysis, a 10 g soil sample for NWTPH-D analysis, and 125 g soil samples for Method 8270 analyses (SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*).

[c] For Test Method 300.0, see EPA/600/4-79/020, *Methods of Chemical Analysis of Water and Wastes*; for Test Methods 353.N, see EPA/600/4-79/020 and EPA/600/R-93/100, *Methods for the Determination of Inorganic Substances in Environmental Samples*.

aG = amber glass.
G = glass.
IC = ion chromatography.
ICP = inductively coupled plasma.
NWTPH-D = northwest total petroleum hydrocarbons-diesel.
P = plastic.
PCB = polychlorinated biphenyl.

2.1.1 Project/Task Organization

The prime contractor (PHMC) to RL or its approved subcontractors will be responsible for collecting, packaging, and shipping soil/debris samples to the laboratory. Detailed responsibilities of those involved in all aspects of the sampling and analysis, from sample collection to disposition, including data generation and acquisition, assessment and oversight, and data validation and usability, are described in applicable implementing internal work requirements and processes.

2.1.2 Quality Objectives and Criteria for Measurement Data

The detection limits and precision and accuracy requirements for each analysis to be performed are summarized Tables 2-1a and 2-1b.

2.1.3 Special Training Requirements and Certification

Training and certification requirements are established in internal work requirements and processes that provide the training and qualification programs for project personnel who operate, support, or supervise D&D project activities and satisfy multiple training drivers imposed by the Project Hanford Management Contract (including applicable CFRs, DOE Orders, ANSI/ASME Standards, and WAC requirements). In addition, the 200-UW-1 Operable Unit project site specific health and safety plan, work packages, permits, and job hazards analysis forms will provide additional training requirements. A 200-UW-1 Operable Unit project D&D training matrix will be prepared to summarize and reference the specific training requirements for all personnel for each phase of the project.

Field personnel typically will have completed the following training before starting work:

- Occupational Safety and Health Administration 40-hour Hazardous Waste Worker Training
- 8-hour hazardous waste worker refresher training (as required)
- Radiation Worker II Training
- Hanford General Employee Training.

Field personnel training records will be documented and kept on file by the training organization.

2.1.4 Documentation and Records

Documentation and records, regardless of media or format, are controlled in accordance with internal work requirements and processes that are comprised of a collection of document control systems and processes that use a graded approach for the preparation, review, approval, distribution, use, revision, storage/retention, retrieval, disposition, and protection of documents and records generated or received in support of PHMC work.

2.2 DATA/MEASUREMENT ACQUISITION

The following subsections present the requirements for sampling methods, sample handling and custody, analytical methods, and field and laboratory quality control. Instrument calibration, maintenance supply inspections, and data management requirements also are addressed.

2.2.1 Sampling Identification

The *Sample Data Tracking System* database will be used to track the samples from the point of collection through the laboratory analysis process when the results will be used for future 200-UW-1 OU activities. The *Hanford Environmental Information System* (HEIS) database is the repository for laboratory analytical results. The HEIS sample numbers will be issued to the sampling organization for this project. For sample results used to manage matrices destined for ERDF, HEIS will not be used.

2.2.2 Sample Handling, Shipping, and Custody Requirements

Samples are collected, labeled, packaged, shipped, stored, and dispositioned in accordance with approved project and analytical laboratory technical work requirements and processes, and/or work packages that ensure samples are collected, transferred, stored, and analyzed by authorized personnel; that sample integrity is maintained from collection through disposition; and that an accurate record of handling and custody is maintained from collection through disposition.

An unbroken chain of custody is established and documented using internal work requirements and processes. All field sampling activities are documented in controlled field logbooks in accordance with internal work requirements and processes that, as a minimum, record the names of those collecting samples, the date and time samples are collected, the locations samples are collected, the sample identification numbers, the sample container type and size, and the description of the sample media.

2.2.3 Analytical Methods Requirements

Analytical parameters and methods are listed in Tables 2-1a and 2-1b.

2.2.4 Quality Control Requirements

Quality Control must be provided in the field and laboratory to ensure that reliable data are obtained. When performing this field sampling effort, care shall be taken to prevent the cross-contamination of sampling equipment, sample bottles, and other equipment that could compromise sample integrity. Deviations shall be controlled and documented in accordance with requirements for managing field logbooks.

Analytical laboratories implement the QC requirements specified in their Quality Assurance Plans. Quality control of radiological surveys is implemented in accordance with internal work requirements and processes that satisfy minimum requirements established by 10 CFR 835, *Occupational Radiation Protection Final Rule,* and provide the basis for consistent and uniform implementation of radiological control requirements.

Table 2-3 lists the field quality control requirements for sampling. If disposable (i.e., single use) or dedicated equipment is used, equipment rinsate blanks are not required. If volatile organic compound samples are not collected, field trip blanks are not required. The collection of quality

control samples for onsite measurements is not applicable to field-screening techniques described in this plan.

Table 2-3. Field Quality Control Requirements.

Sample Type	Frequency	Purpose
Duplicate	5% (1 sample in 20)	Check the precision of the laboratory analyses.
Equipment rinsate blank	As required (about 5%)	Check decontamination process effectiveness.
Field trip blank	One per day when volatile organic analytes are sampled	Check for contamination during transport.

Field Duplicates. Field duplicates provide information regarding the homogeneity of the sample matrix and also may provide an evaluation of the precision of the analysis process. Field duplicates will be retrieved from sample intervals using the same equipment and sampling technique. The duplicates should be collected from areas expected to be contaminated, so that valid comparisons between the samples can be made (i.e., at least some of the COCs will be above the detection limit). 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 prior to homogenization. The duplicate samples will be sent to the primary laboratory in the same manner that the routine site samples are sent.

Equipment Rinsate Blanks. Equipment rinsate blanks are used to verify the adequacy of sampling equipment decontamination procedures. Equipment blanks will consist of deionized water washed through decontaminated sampling equipment, placed in containers, and analyzed for the COCs identified for the waste site being sampled.

Prevention of Cross-Contamination. Care will be exercised to avoid the following ways in which cross-contamination or background contamination may compromise the samples: (1) improperly storing or transporting sampling equipment and containers; (2) contaminating equipment or sample bottles by exposing them to contamination sources, such as uncovered ground; (3) handling bottles or equipment with dirty hands; or (4) improperly decontaminating equipment before or between sampling events.

2.2.5 Instrument Testing, Inspection, and Maintenance Requirements

All onsite environmental instruments and measuring equipment are tested, inspected, and maintained in accordance with the manufacturers' requirements and in accordance with approved work packages. The results of tests, inspections, and maintenance activities are documented in logbooks and/or work packages.

Analytical laboratory instruments and measuring equipment are tested, inspected, and maintained in accordance with the laboratories' quality assurance plan. Daily response checks for radiological field survey instruments are performed in accordance with approved work packages.

2.2.6 Instrument Calibration and Frequency

All onsite environmental instruments and measuring equipment are calibrated in accordance with internal work requirements and processes and/or work packages that provide direction for equipment calibration or verification of accuracy by analytical methods. The results of calibrations are documented in logbooks and/or work packages.

Analytical laboratory instruments and measuring equipment are calibrated in accordance with the laboratories' quality assurance plan. Calibration of radiological field survey instruments on the Hanford Site is performed under contract by PNNL or by the PHMC on an annual basis, as specified in the program documentation.

2.2.7 Onsite Measurements Quality Control

The collection of quality control samples for onsite measurements is not applicable to field-screening techniques. Field-screening instrumentation will be calibrated and controlled according to the manufacturer instructions. Field measurements will be conducted according to internal work processes and requirements.

2.2.8 Inspection/Acceptance Requirements for Supplies and Consumables

Supplies and consumables procured by the PHMC, which are used in support of sampling and analysis activities, are procured in accordance with internal work requirements and processes which describe the PHMC acquisition system and the responsibilities and interfaces necessary to ensure structures, systems, and components, or other items and services procured/acquired for the PHMC meet the specified 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 prior to use.

Supplies and consumables procured by the analytical laboratories are procured, checked, and used in accordance with their Quality Assurance Plan.

2.2.9 Sample Preservation, Containers, and Holding Times

Sample preservation, container, and holding time guidance is summarized in Table 2-2. Final sample collection requirements will be identified on the Sampling Authorization Form (SAF). Should there be conflicting guidance between this SAP and the SAF regarding preservation, containers, or holding times, the SAF will take precedence.

2.3 ASSESSMENT/OVERSIGHT

2.3.1 Assessments and Response Action

The PHMC compliance and quality programs group may conduct random surveillance and assessments to verify compliance with the requirements of this SAP, project work packages, the project quality management plan, procedures, and regulatory requirements.

Deficiencies identified will be reported to the 200 Areas task lead. When appropriate, corrective actions will be taken by the project engineer in accordance with internal work processes and procedures to minimize recurrence.

2.3.2 Reports to Management

Management will be made aware of all deficiencies identified by self-assessments. Identified deficiencies will be reported to the 200 Areas task lead.

2.4 DATA VERIFICATION, USABILITY, VALIDATION, MANAGEMENT, AND REVIEW

2.4.1 Data Verification and Usability Methods

Data review and verification will be performed by the laboratory to confirm that the sampling and chain-of-custody documents are complete, the sample number is tied to the sampling location, the required holding times were met, and the analyses met the data quality requirements specified in this SAP.

All data verification and usability assessments will be performed in accordance with approved work processes and requirements.

2.4.2 Data Validation

Validation will be performed on completed laboratory data packages by qualified personnel or by a qualified independent contractor. Validation will consist of verifying required deliverables, requested versus reported analyses, and transcription errors. Validation also 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. At least 5 percent of all data will be validated.

Data verification and validation shall be performed in accordance with EPA QA/G-8, *Guidance on Environmental Data Verification and Data Validation* (EPA 2001). A validation performed in a comparable manner to Level C will be performed on onsite laboratory analyses. This allows

the review of all QC data, transcription error verification, and holding time review. This level is the middle validation level and does not require review of raw data and recalculation of data. Should problems arise from the Level C review, the project reserves the option to review or recalculate. No validation for field-screening data or quick turn-around (e.g., 7-day turn-around) data will be performed.

2.4.3 Data Management and Review

Data resulting from the implementation of the SAP will be managed and stored by the organization in accordance with document control and record management systems that define requirements for managing the generation, identification, transfer, protection, storage, retention, retrieval, and disposition of DOE records.

All validated reports and supporting analytical data packages shall be subject to final technical review by qualified reviewers before submittal to regulatory agencies or inclusion in reports or technical memoranda, at the direction of the project task lead. Electronic data access, when appropriate, shall be through computerized databases. 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* (Tri-Party Agreement) *Action Plan* (Ecology et al. 1998).

All validated reports and supporting analytical data packages will be retained and dispositioned in accordance with established document control and record management systems.

2.4.4 Data Quality Assessment

The data quality assessment process is used to determine if the data are adequate to support the remedial action decisions established in the DQO process. The data quality will be assessed in accordance with internal work processes and requirements.

2.5 TECHNICAL PROCESSES AND SPECIFICATIONS

Soil sampling and field measurements will be conducted according to the following approved work processes:

Sample Location. Borehole, test pit, and drive casing locations will be staked and labeled by the technical lead or field team leader. After the locations have been staked, minor location adjustments are allowed to avoid unsafe conditions, structural interference, or utilities. Minor sample location changes that will not affect the DQOs only require the approval of the project engineer. Significant changes to sample locations that will impact the DQOs require project manager and decision-maker (RL, Ecology, and EPA) concurrence.

Before invasive sampling activities are begun (i.e., boreholes, test pits, or drive casings) surface geophysical and radiation surveys must be conducted. The surface geophysical surveys will be conducted using ground-penetrating radar and/or electromagnetic imaging and will aid in verifying waste site construction and geometry and in selecting sampling locations to avoid

subsurface obstructions. The surface radiation surveys will identify areas of surface contamination that might impact the sampling activities and worker health and safety.

Drive casing geophysical logging (DCGL) is required to resolve historical data inconsistencies that could affect health and safety document preparation at the UPR-200-W-8 and 200-W-71 Trench waste sites. The DCGL results are required to determine the appropriate sampling approach for these two sites (e.g., test pits, GeoProbe,[1] or soil borings) from a worker safety perspective. In addition, the DCGL results could be useful in identifying sampling zones.

Sample Identification. The *Sample Data Tracking System* database will be used to track the samples through the collection and laboratory analysis process. The HEIS database is the repository for the laboratory analytical results. HEIS sample numbers will be issued to the sampling organization. Each 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:

- HEIS number
- Sample collection date/time
- Name/initials of person collecting the sample
- Analysis required
- Preservation method, if applicable.

Field Sampling Log. All information pertinent to field sampling and analysis will be recorded in bound logbooks in accordance with applicable internal work processes and requirements. 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.

Sample Custody. A chain-of-custody record will be initiated at the time of sampling and will accompany each set of samples shipped to the laboratory. The analyses requested for each sample will be indicated on the accompanying Chain of Custody/Sample Analysis Request form. Chain-of-custody procedures will be followed throughout sample collection, transfer, analysis, and disposal to ensure that sample integrity is maintained. Each time responsibility for custody of the sample changes, the new and previous custodians will sign the record and note the date and time. The sampler will make a copy of the signed record before the sample is shipped and will transmit it to Environmental Information System (EIS) Sample and Data Management within 24 hours of shipping.

A custody seal (i.e., evidence tape) will be affixed to the lid of each sample jar in a manner that would indicate tampering. The container seal will be inscribed with the sampler's initials and the date sealed. For samples collected inside a glovebag or glovebox to control radiological contamination and "bagged out," the evidence tape may be affixed to the seal of the bag. This

[1]GeoProbe is a registered trademark of GeoProbe Systems, Salinas, Kansas.

will eliminate problems associated with contaminated soils adhering to the custody tape while inside the glovebag/glovebox.

Sample Containers and Preservatives. Level I EPA precleaned sample containers will be used for soil samples. Container sizes may vary, depending on laboratory-specific volumes needed to meet analytical detection limits. If, however, the dose rate on the outside of a sample jar, or the curie content, exceeds levels acceptable by an offsite laboratory, the sampling lead and task lead can send smaller volumes to the laboratory after consultation with EIS Sample and Data Management to determine acceptable volumes. Preliminary container types and volumes are identified in Table 2-2. Final container types and volumes will be provided on the SAF.

Sample Shipping. A radiological control technician (RCT) will survey each sample jar to verify that the container is free of smearable surface contamination. The RCT also will measure the radiological activity on the outside of the sample container (through the container) and will mark the container with the highest contact radiological reading in either disintegrations per minute or millirem per hour, as applicable. Total activity analysis performed by the Radiological Counting Facility, the 222-S Laboratory, or another suitable onsite laboratory will be used for determining U.S. Department of Transportation shipping criteria. This information, along with other data that may prequalify the samples, 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 offsite analytical laboratory. The sampler will send copies of the shipping documentation to EIS Sample and Data Management within 24 hours of shipping.

As a general rule, samples will be sent to the Waste Sampling and Characterization Facility (WSCF). Samples with activities less than 1 mR/h may be shipped to an offsite laboratory. Samples with activities between 1 mR/h and 10 mR/h also may be shipped to an offsite laboratory, but must first be evaluated by EIS Sample and Data Management. Samples with activities greater than 10 mR/h will be sent to an onsite laboratory arranged by EIS Sample and Data Management.

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3.0 FIELD SAMPLING PLAN

3.1 SAMPLING OBJECTIVES

The primary objective of the field sampling plan is to clearly identify and describe the sampling and analysis activities that will be conducted to support 200-UW-1 OU remedial action decisions. The field sampling plan uses the sampling approaches developed in the DQO process and subsequent workshops with RL, EPA, and Ecology as the basis for the site-specific sampling plans presented in the following sections.

3.1.1 Field Measurements

Surface Radiation Survey. A surface radiation survey will be performed at each waste site to document existing surface contamination and to support preparation of supporting health and safety documentation. Surface radiation surveys will be conducted by qualified RCTs in accordance with internal work processes and requirements. A survey report will be prepared for each site. Post-sampling surveys also will be performed at each sampling site to ensure that sampling activities have not contributed to surface contamination.

Soil Screening. The field action level for radionuclide screening is twice background. Intervals above this field action level will be assessed for sampling by the field geologist. All samples, borehole cuttings, and excavated test-pit materials will be field screened for evidence of radioactive contamination by an RCT or other qualified personnel. Surveys of these materials will be conducted with field instruments and visual observations. Potential screening instruments are listed in Table 3-1 with their respective detection limits. The RCT will record all field measurements, noting the depth of the sample and the instrument reading.

Table 3-1. Field-Screening Methods.

Measurement Type	Emission Type	Method/Instrument	Detection Limit
Exposure/dose rate	Beta/gamma	RO-20/RO-03 portable ionization chamber[a]	0.5 mrem/h
Contamination level	Alpha/beta-gamma	E-600 rate meter with a SHP380-A/B scintillation probe[a]	100 d/min 1,921 d/min
Contamination level	Gamma	SPA-3 NaI detector[a]	2x background

[a]RO-20, RO-03, E-600, SHP380-A/B, and SPA-3 are trademarks of Eberline Instruments, a subsidiary of Thermo Electron Corporation, Waltham, Massachusetts.

NaI = sodium iodide.

Before sampling begins, a local background activity reading will be taken at a location selected in the field. Field screening and interpretations of geologic conditions will be used to identify the bottom of the waste site (i.e., crib/trench), adjust sampling points if needed, assist in determining sample shipping requirements, determine equipment/personnel decontamination needs, and support worker health and safety monitoring. The site geologists will use professional judgment and screening data to finalize sampling decisions.

Ground-Penetrating Radar. Ground-penetrating radar (GPR) analyses will be used to help establish waste site boundaries, identify the locations of underground anomalies (e.g., structures or geological changes), and to refine sampling approaches (e.g., borehole locations, test pit requirements, and sampling depths).

Field-screening instruments will be used, maintained, and calibrated in accordance with the instrument program, manufacturer's specifications, and other approved procedures. The field geologist will record field-screening results on the borehole log.

3.1.2 Soil Sampling and Analysis

The general intent of the design is to begin sampling at the most contaminated part of a site and continue sampling at pre-established depth and/or lateral intervals (based on the site conceptual contaminant distribution model, results of nearby borehole logs, and professional judgment). The zone of highest expected contamination likely will contain low-mobility contaminants. Additional samples above, below, or away from this zone of highest contamination will be collected based on characteristics exhibited during the field-screening activities and geologic observations. Additional samples may be collected and analyzed at the discretion of the field engineer/geologist, based on field conditions, measurements, or observations made during the conduct of remedial investigations. All appropriate data, including the rationale for collecting specific samples, will be recorded in field notebooks.

The release point or bottom of each waste site is considered a critical sample point, because the highest COC levels are expected to begin at this location. Samples from 4.6 m (15 ft) below ground surface (bgs) and 7.6 m (25 ft) bgs also are considered critical sampling points for evaluating exposure scenarios and remedial alternatives. Samples from depths greater than 7.6 m (25 ft) bgs will be used to verify the conceptual contaminant distribution models, support remedial action alternative decisions, and evaluate potential groundwater impacts.

Borehole sampling will be performed in accordance with internal work processes and requirements, using a split-spoon sampler. The split-spoon samplers will be equipped with four separate stainless steel or transparent polycarbonate (LEXAN[1] or equivalent liners). Only seamless stainless steel liners will be used for VOA samples. With the exception of the VOA samples, soil will be transferred to a precleaned stainless steel mixing bowl, homogenized, and containerized in accordance with the sampling procedure. All soil samples collected, whether planned or discretionary, will be analyzed as required by the waste control plan.. If sample volume requirements cannot be met, constituent priorities are presented in Table 3-2. When a specific sampling depth is designated, then the sample shall be collected starting one foot above the designated depth to one foot below the designated depth.

[1]LEXAN is a registered trademark of General Electric Company, New York, New York.

Test pit and surface soil sampling will be conducted according to internal work processes and requirements. Soil will be transferred to a precleaned stainless steel mixing bowl, homogenized, and containerized in accordance with the sampling procedure. All soil samples collected, whether planned or discretionary, will be analyzed as required by the waste control plan. If sample volume requirements cannot be met, constituent priorities are presented in Table 3-2. If health and safety concerns preclude test pit sampling at the UPR-200-W-8 or 200-W-71 Trench waste sites, an alternate sampling approach will be developed in consultation with health and safety staff.

Investigation-derived waste generated will be handled according to WMP-18128, *Waste Control Plan for the U Plant Closure Area Waste Sites.*

Preshipment Sample Screening. A representative portion of each sample to be shipped to an offsite laboratory will be submitted to the Radiological Counting Facility, 222-S Laboratory, or other suitable onsite laboratory for total activity analysis before it is shipped. Total activities will be used for sample preshipment characterization. Samples that slightly exceed the offsite-laboratory size criterion may be reduced in volume to allow offsite shipment. Onsite and offsite laboratories will be identified before field activities are initiated and will be mutually acceptable to the EIS Sample and Data Management group and to the task lead.

Sample storage and shipping will be according to internal work processes and requirements. Samples exceeding 0.5 mrem/h will be stored at a temporary radioactive material storage area at the sampling location until they are shipped to the laboratory. Samples less than 0.5 mrem/h will be stored at the sample storage and shipping facility until they are shipped to the laboratory.

3.1.3 Geophysical Logging

Borehole and Drive Casing Logging

When specified in Table 3-2, the planned boreholes and drive casings will be geophysically logged with a high-resolution spectral gamma-ray logging system to determine the vertical distribution and concentration of gamma-emitting radionuclides in accordance with approved geophysical logging subcontractor procedures. Relative soil moisture will be evaluated using a neutron logging tool. The boreholes and drive casings will be logged before the casing is telescoped and before the borehole is abandoned. The starting point for logging will be recorded; this is usually ground surface or top of casing. Downhole tools and cable will be cleaned between boreholes/drive casings (after each sample site is finished and before moving to the next sample site).

Geophysical Logging to Support Health and Safety

Geophysical logging for up to six direct-push drive casings is required before test pit or test trench activities are initiated at UPR-200-W-8 and 200-W-71 Trench to support worker health and safety document preparation. The casings will be pushed to a maximum depth of 25 ft bgs (the anticipated depth limit for test pit excavation) and logged with a 3.8 cm (1.5-in.) outer diameter bismuth-germinate gross gamma scintillation detector (or equivalent). If the logging results indicate health and safety concerns and preclude test pit sampling, an alternate sampling

approach will be developed in consultation with health and safety staff, RL, EPA, and Ecology. The logging results also will be used to identify appropriate waste site sampling zones.

3.1.4 Surveying

The location of all planned sample locations will be surveyed after the sampling and abandonment activities are completed. Surveys will be performed according to internal work processes and requirements. Data will be recorded in compliance with NAVD88, *North American Vertical Datum of 1988*, and with NAD83, the Washington State Plane (South Zone) *North American Datum of 1983*, with the 1991 adjustment for horizontal coordinates. All survey data will be recorded in meters and feet.

3.1.5 Waste Management Sampling

A supplemental DQO process was conducted by the project team to identify additional contaminant analyses required to support waste designation, disposal, and management decisions in accordance with Environmental Restoration Disposal Facility requirements. This supplemental DQO process culminated in the waste control plan (WMP-18128) which was reviewed and approved by RL and Ecology.

This process included a review of the COPCs identified for the 200-UW-1 OU soil waste sites, particularly those that were excluded in the initial DQO process. Of the 31 contaminants initially excluded, 21 still were of concern for waste designation/disposal decisions. Waste profiles WP-216U8001, *Waste Profile for the 216-U-8 Crib*; WP-216U12001, *Waste Profile for the 216-U-12 Waste Site*; WP-216U4001, *Waste Profile for the Borehole 299-W19-98 of the 216-U-4 Site*; and/or WP-299W1996001, *Waste Profile for the 299-W19-96 Borehole (216-U-1&2 Waste Sites)*, were consulted in evaluating the excluded contaminants, and it was determined that most of the initial contaminant exclusions were valid. The contaminants requiring data to support remediation and waste management decisions for the 200-UW-1 OU waste sites are presented in Table 3-2.

The majority of the waste management data needs were addressed by the COC list developed in the initial DQO (CP-16244). Subsequent waste management data needs have been addressed by adding several of the initially excluded COPCs (e.g., chromium, antimony, and thallium) to the RTD waste site analyte lists. The other initially excluded COPCs were added to the analyte lists for select waste sites that are representative of the other sites addressed in this SAP as follows.

- Tributyl phosphate will be analyzed at the 216-U-5, 216-U-6, and 216-U-15 Trenches, because these were the only three sites where this compound reportedly was used (DOE/RL-96-81, *Waste Site Grouping for 200 Areas Soil Investigations*, and DOE/RL-98-28.)

- Polychlorinated biphenyls (PCB), pesticides, and herbicides will be analyzed at the 200-W-42 Vitrified Clay Pipeline from surface soils (0 to 2 ft bgs) just below the stabilization layer. This site is expected to be contaminated by these compounds based on existing site information and process history (BHI-00621, *RARA FY 1995 Summary*

Report). The PCB/pesticide/herbicide profile for 200-W-42 Vitrified Clay Pipeline can be applied to other site wastes for waste management purposes.

- Asbestos will be analyzed at 200-W-71 Trench, because this was a debris disposal site where asbestos would be expected (DOE/RL-96-81). This site represents maximum contamination for these compounds relative to the other waste sites, so the asbestos profile can be applied to the other site wastes.

The site-specific contaminant lists are summarized in Table 3-2.

3.1.6 Science and Technology Program Sampling Requirements

The Hanford Vadose Zone Science and Technology (S&T) Program may request sample material from the 200-UW-1 OU remedial investigation to use in studying groundwater or other waste-related issues. If practicable, additional soil samples would be collected. Chains of custody would be prepared when the samples were collected, and the samples would be transferred to the S&T Program. Once the samples were transferred, the S&T Program would be responsible for sample management, storage, analysis, and disposal according to their own sample management, disposition, and waste management plan. The waste management plan will be prepared by the S&T Program and approved by RL and the appropriate regulatory agencies before 200-UW-1 OU samples are collected. Sample collection is contingent on the availability of S&T Program funding to support collection and analysis.

3.2 SAMPLING LOCATIONS AND FREQUENCY

Table 3-2 lists the sampling techniques and the samples required for the 200-UW-1 OU waste sites. Table 3-3 summarizes the number of samples and the quality assurance/quality control samples required for each waste site. While it is expected that the sample locations will be sampled once, all the waste sites are accessible and additional sampling may be conducted if the initial results prove to be insufficient to support site remediation decisions. Sample locations for the waste sites (plan and profile views) are presented in Appendix A.

Table 3-2. 200-UW-1 OU Sampling Plan Summary. (6 Pages)

Waste Site	Sample Collection Methodology	Sample Location	Max. Depth (bgs) of Investi-gation	Sample Interval Depth (ft) bgs	Analyte List[a]
Sites Identified for Engineered barrierplng					
216-U-1 & 216-U-2	GPR, SRS, Drive Casing, push, auger or drilling technique	Figure A-8	50 ft	Drive casing continuous spectral gamma log[b] Collect soil samples at 11, 31, 36, and 45-feet bgs for location C4712 and at ~45-feet bgs for other 8 locations.	Spectral Gamma Logging System for Cs-137 and U-238/U-235. Soil Samples: Tc-99[c], nitrogen as nitrate/nitrite, mercury, cadmium, uranium (metal), U-235, U-238 antimony and arsenic. Ecology requested reporting other metals from the ICP/MS method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc (which the lab will report but not do QC runs since they are not COPCs). To support waste management decisions the following COIs would also be analyzed: acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene. If insufficient sample volume is a problem, the priority contaminants are Tc-99, antimony, arsenic, mercury, and cadmium.

Table 3-2. 200-UW-1 OU Sampling Plan Summary. (6 Pages)

Waste Site	Sample Collection Methodology	Sample Location	Max. Depth (bgs) of Investi-gation	Sample Interval Depth (ft) bgs	Analyte List[a]
216-U-8	GPR, SRS, Drive Casing, push, auger or drilling technique	Figure A-6	50 ft	Drive casing continuous spectral gamma log[b] Collect soil samples at 2, 38, and 45-feet bgs for location C-4717 and at ~45-feet bgs for other 7 locations.	Spectral Gamma Logging System for Cs-137 and U-238/U-235. Soil Samples: Tc-99[c], nitrogen as nitrate/nitrite, mercury, cadmium, uranium (metal), U-235, U-238 antimony and arsenic. Ecology requested reporting other metals from the ICP/MS method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc (which the lab will report but not do QC runs since they are not COPCs). To support waste management decisions the following COIs would also be analyzed: acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene. If insufficient sample volume is a problem, the priority contaminants are uranium (metal), U-235, U-238, nitrogen as nitrate/nitrite, antimony, arsenic, mercury, and cadmium.

Table 3-2. 200-UW-1 OU Sampling Plan Summary. (6 Pages)

Waste Site	Sample Collection Methodology	Sample Location	Max. Depth (bgs) of Investi-gation	Sample Interval Depth (ft) bgs	Analyte List[a]
216-U-12	GPR, SRS, Drive Casing, push, auger or drilling technique	Figure A-9	50 ft	Drive casing continuous spectral gamma log[b] Collect soil samples at 19, 39, and 45-feet bgs for location C4730, and at ~45-feet bgs for other 7 locations.	Spectral Gamma Logging System for Cs-137 and U-238/U-235. Soil Samples: nitrogen as nitrate/nitrite, mercury, cadmium, uranium (metal), U-235, U-238 antimony and arsenic. Ecology requested reporting other metals from the ICP/MS method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc (which the lab will report but not do QC runs since they are not COPCs). To support waste management decisions the following COIs would also be analyzed: acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene. If insufficient sample volume is a problem, the priority contaminants are nitrogen as nitrate/nitrite, antimony, arsenic, mercury, and cadmium.
241-U-361	GPR, SRS, Drive Casing	Figure A-8	N/A	N/A	No analytical sampling is proposed for this site (previous data from the 216-U-1/2 cribs will fill 241-U-361 data gaps).
Sites Identified for Remove/Treat/Dispose					
200-W-42	GPR, SRS, Borehole	Figure A-6	~200 ft	Continuous log[b] 0-2, 13-15.5, 18-20.5, 23-25.5, 28-30.5, 40-42.5, 164.5-167, 197-199.5	Arsenic, Antimony, chromium (total), PCBs, pesticides, herbicides, thallium, uranium (metal), nitrogen as nitrate/nitrite, and Cs-137.
200-W-77	GPR, SRS	Figure A-7	N/A	N/A	No analytical sampling is proposed for this site.
200-W-85	GPR, SRS	Figure A-4	N/A	N/A	No analytical sampling is proposed for this site.
200-W-87	GPR, SRS	Figure A-4	N/A	N/A	No analytical sampling is proposed for this site.
216-U-4B	GPR, SRS	Figure A-2	N/A	N/A	No analytical sampling is proposed for this site.
216-U-5	GPR	Figure A-5	N/A	N/A	No analytical sampling is proposed for this site.

Table 3-2. 200-UW-1 OU Sampling Plan Summary. (6 Pages)

Waste Site	Sample Collection Methodology	Sample Location	Max. Depth (bgs) of Investi-gation	Sample Interval Depth (ft) bgs	Analyte List[a]
216-U-6	GPR	Figure A-5	N/A	N/A	No analytical sampling is proposed for this site.
216-U-15	GPR	Figure A-4	N/A	N/A	No analytical sampling is proposed for this site.
UPR-200-W-33	GPR, SRS	Figure A-2	N/A	N/A	No analytical sampling is proposed for this site.
UPR-200-W-48	GPR, SRS	Figure A-1	N/A	N/A	No analytical sampling is proposed for this site.
UPR-200-W-55	GPR, SRS	Figure A-2	N/A	N/A	No analytical sampling is proposed for this site.
UPR-200-W-117	GPR, SRS	Figure A-1	N/A	N/A	No analytical sampling is proposed for this site.
UPR-200-W-163	N/A	Figure A-6	N/A	N/A	200-W-42 Vitrified Clay Pipeline sampling will address UPR-200-W-163 data needs
200-W-89	GPR, SRS	Figure A-2	N/A	N/A	No analytical sampling is proposed for this site.
UPR-200-W-60	N/A	Figure A-1	N/A	N/A	No analytical sampling is proposed for this site.
Sites Identified for Maintain Existing Surface Cover, Institutional Controls, Monitored Natural Attenuation					
200-W-71	GPR, SRS, DCGL, Test Pit or Test Trench	Figure A-3	~ 25 ft (maximum depth target is bottom of original excavation)	0, 5, 10, 15, 20, 25	Cs-137, asbestos, chromium (total), thallium, arsenic, barium, cadmium, copper, lead, mercury, nickel, selenium, silver, nitrogen as nitrate/nitrite, and uranium (metal)
UPR-200-W-118	N/A		N/A	N/A	No analytical sampling is proposed for this site.
UPR-200-W-78	N/A		N/A	N/A	No analytical sampling is proposed for this site
216-U-4	N/A	Figure A-2	N/A	N/A	Characterized in 1995, no additional data required.
216-U-4A	N/A	Figure A-2	N/A	N/A	Characterized in 1995, no additional data required.

Table 3-2. 200-UW-1 OU Sampling Plan Summary. (6 Pages)

Waste Site	Sample Collection Methodology	Sample Location	Max. Depth (bgs) of Investi-gation	Sample Interval Depth (ft) bgs	Analyte List[a]
216-U-16	GPR, SRS, Borehole	Figure A-7	~165 ft	Continuous log[b] 17-19.5, 22-24.5, 27-29.5, 101-103.5, 148-150.5	Antimony, chromium (total), thallium, uranium (metal), nitrogen as nitrate/nitrite, Cs-137, U-235, U-238, and Tc-99
216-U-17	GPR, SRS, Borehole	Figure A-3	~165 ft	Continuous log[b] 20-22.5, 25-27.5, 30-32.5, 60-62.5, 157-159.5	Antimony, chromium (total), thallium, uranium (metal), nitrogen as nitrate/nitrite, U-235, U-238, and Tc-99
UPR-200-W-19	GPR, SRS, Drive Casing	Figure A-8	50 ft	Continuous log, one soil sample (depth and location based on log results)	Antimony, Chromium (total), thallium, Cs-137, uranium (metal), U-233/234, U-235, and U-238
2607-W5	GPR, SRS, Sludge	Figure A-8	10 ft	Sludge at tank bottom	Chromium (total), thallium, Cs-137, arsenic, barium, cadmium, copper, lead, mercury, nickel, selenium, silver, and nitrogen as nitrate/nitrite
Sites Identified for No Action					
200-W-56	N/A	Figure A-5	N/A	N/A	No analytical sampling is proposed for this site. Site rejected under the MP-14 process.
2607-W7	N/A		N/A	N/A	No analytical sampling is proposed for this site
200-W-57	N/A	Figure A-4	N/A	N/A	No analytical sampling is proposed for this site. Site rejected under the MP-14 process.
UPR-200-W-8	GPR, SRS, DCGL, Test Pit	Figure A-3	~25 ft (maximum depth target is bottom of original excavation)	~10 ft	Chromium (total), thallium, Cs-137, arsenic, barium, cadmium, copper, lead, mercury, nickel, selenium, silver, nitrogen as nitrate/nitrite, uranium (metal), Am-241, Co-60, Eu-152, Eu-154, Eu-155, Np-237, Pu-238, Pu-239/240, Sr-90, Tc-99, U-233/234, U-235, and U-238

Table 3-2. 200-UW-1 OU Sampling Plan Summary. (6 Pages)

Waste Site	Sample Collection Methodology	Sample Location	Max. Depth (bgs) of Investi-gation	Sample Interval Depth (ft) bgs	Analyte List[a]

[a] See Tables 2-1a and 2-1b for detection limits and other analytical parameters.
[b] Continuous spectral gamma logging.
[c] Because the Tc-99 action level (1 pCi/g) is lower than the standard lab detection limit (15 pCi/g), an effort (increased sample size for extraction and/or longer scintillation counting time) will be made by the lab to reduce the detection limit to better-support design decisions.

DCGL = drive casing geophysical logging.
GPR = ground-penetrating radar.
N/A = not applicable.
PCB = polychlorinated biphenyl.
SRS = surface radiation survey.

Table 3-3. Summary of Projected Soil Sample Collection Requirements for Laboratory Analysis.

Site Number	200-W-42	200-W-56 (rejected)	200-W-57 (rejected)	200-W-71	200-W-77	200-W-85	200-W-87	200-W-89
Number of characterization samples	8	0	0	3	0	0	0	0
Duplicates	1	--	--	0	--	--	--	--
Equipment blanks	1	--	--	0	--	--	--	--
Approximate number of field QC samples	2	--	--	0	--	--	--	--
Approximate total number of samples	10	0	0	3	0	0	0	0
Site Number	**216-U-1 and 216-U-2**	**216-U-5**	**216-U-6**	**216-U-8**	**216-U-12**	**216-U-4B**	**216-U-15**	**216-U-16**
Number of characterization samples	12	0	0	10	10	0	0	5
Duplicates	1	--	--	1	1	0	--	1
Equipment blanks	1	--	--	1	1	0	--	1
Approximate number of field QC samples	2	--	--	2	2	0	--	2
Approximate total number of samples	14	0	0	12	12	0	0	7
Site Number	**216-U-17**	**241-U-361**	**2607-W5**	**UPR-200-W-8**	**UPR-200-W-19**	**UPR-200-W-33**	**UPR-200-W-48**	**UPR-200-W-55**
Number of characterization samples	5	0	1	3	1	0	0	0
Duplicates	1	--	--	0	--	--	--	--
Equipment blanks	--	--	--	--	--	--	--	--
Approximate number of field QC samples	1	--	--	0	--	--	--	--
Approximate total number of samples	6	0	1	3	1	0	0	0
Site Number	**UPR-200-W-60**	**UPR-200-W-117**	**UPR-200-W-163**	**2607-W7**	**216-U-4**	**UPR-200-W-118**	**UPR-200-W-78**	**Project Total**
Number of characterization samples	0	0	0	0	0	0	0	58
Duplicates	--	--	--	--	--	--	--	6
Equipment blanks	--	--	--	--	--	--	--	5
Approximate number of field QC samples	--	--	--	--	--	--	--	11
Approximate total number of samples	0	0	0	0	0	0	0	69

QC = quality control.

3.3 DRILLING AND PUSH-TECHNOLOGY

Drilling will be performed in accordance with drilling, installation, and well maintenance internal work processes and requirements. Appropriate drilling methods include push, auger or cable tool drilling techniques as determined by the PHMC field superintendent.

3.4 SAMPLING PROCESSES

The sampling processes to be implemented in the field shall be implemented consistent with the requirements outlined in the *Tri-Party Agreement Action Plan, Section 7.8, Quality Assurance.* The project may utilize the WSCF Sampling and Mobile Labs organization or other approved sampling organization to perform the sample collection at the 200-UW-1 OU. The approved sampling organization will perform the sample collection activities in accordance with established instructions for sample collection, collection equipment, and sample handling.

3.5 SAMPLE MANAGEMENT

Sample and data management activities will be performed in accordance with the PHMC quality assurance program. Sample preservation, container, and holding-time requirements will be indicated on Chain of Custody/Sample Analysis Request forms in accordance with internal work processes and requirements, and the specific analytical method prepared for specific sample events.

3.5.1 Sample Custody

All samples obtained during the project will be controlled from the point of origin to the analytical laboratory, as required by internal work processes and requirements.

3.5.2 Sample Packaging and Shipping

Sample packaging/shipping will be addressed through internal work processes and requirements.

3.5.3 Field Documentation

Sample preservation and container details will be addressed on the Chain of Custody/Sample Analysis Request form in accordance with the requirements specified in internal work processes and requirements.

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4.0 HEALTH AND SAFETY

All field operations will be performed in accordance with PHMC health and safety requirements outlined in a project specific health and safety plan. In addition, a work control package will be prepared that will further control site operations. This work package will include an activity hazard analysis, and will also reference applicable radiological control requirements.

The sampling processes and associated activities will take into consideration exposure reduction and contamination control techniques that will minimize the radiation exposure to the sampling team as required by internal work requirements and processes that satisfy minimum requirements established by 10 CFR 835, *Occupational Radiation Protection Final Rule*, and provide the basis for consistent and uniform implementation of radiological control requirements.

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5.0 MANAGEMENT OF WASTE

Waste management will be performed per internal work requirements and processes. The requirements for waste containment, labeling, and tracking are specified in applicable internal work requirements and processes. These requirements and processes have been prepared to implement the requirements of the Washington State Department of Ecology, found in "Environmental Restoration Program Strategy for Management of Investigation Derived Waste" (Ecology et al., 1999). Management of investigation-derived waste, minimization practices, and waste types applicable to the 200-UW-1 OU are described in WMP-18128.

Unused samples and associated laboratory waste for the analysis will be dispositioned in accordance with the laboratory contract, which in most cases will allow the laboratory to dispose of this material. The approval of the project manager is required before returning unused samples or waste from offsite laboratories.

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APPENDIX A

200-UW-1 OPERABLE UNIT WASTE SITE AND SAMPLE LOCATIONS

(PLAN AND PROFILE FIGURES)

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APPENDIX A

200-UW-1 OPERABLE UNIT WASTE SITE AND SAMPLE LOCATIONS

(PLAN AND PROFILE FIGURES)

Figure A-1. Waste Site Locations for Unplanned Releases UPR-200-W-48, UPR-200-W-117, UPR-200-W-60, and UPR-200-W-118.

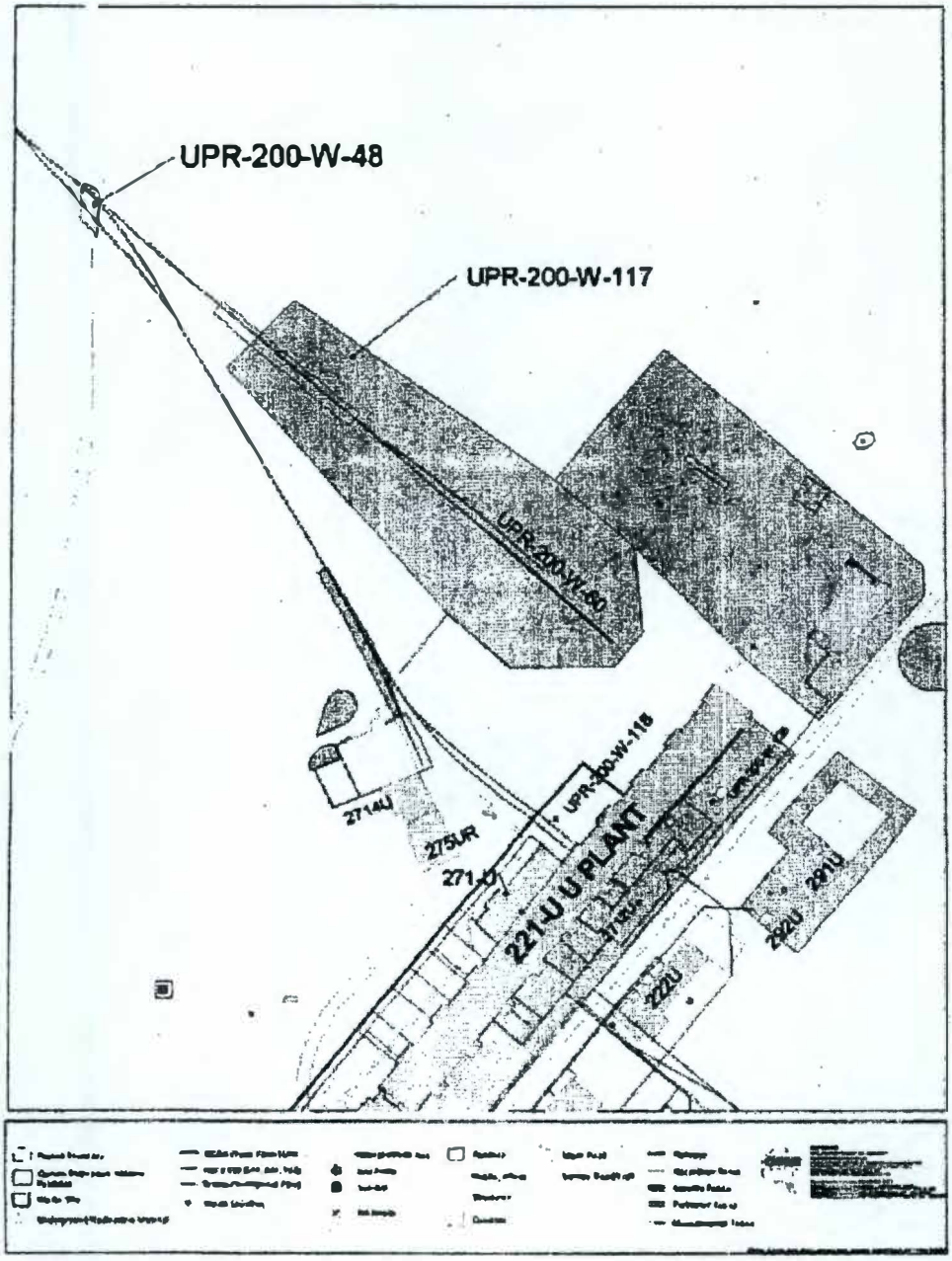


Figure A-2. Waste Site Locations for 216-U-4, 216-U-4a, 216-U-4b, UPR-200-W-33, 200-W-89, UPR-200-W-55, and UPR-200-W-78.

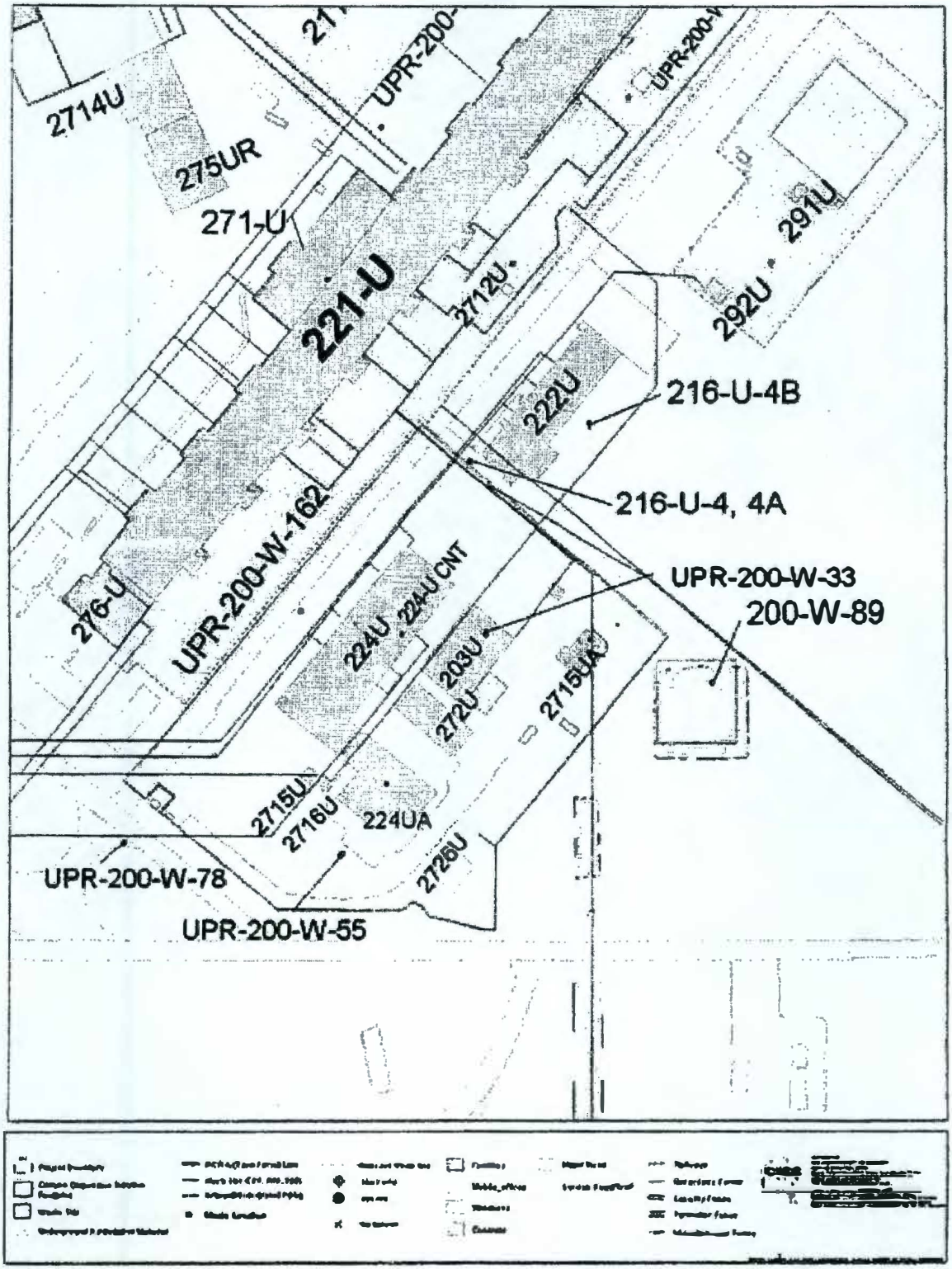


Figure A-3. Waste Site and Sample Locations for UPR-200-W-8, 200-W-71 Trench, and 216-U-17.

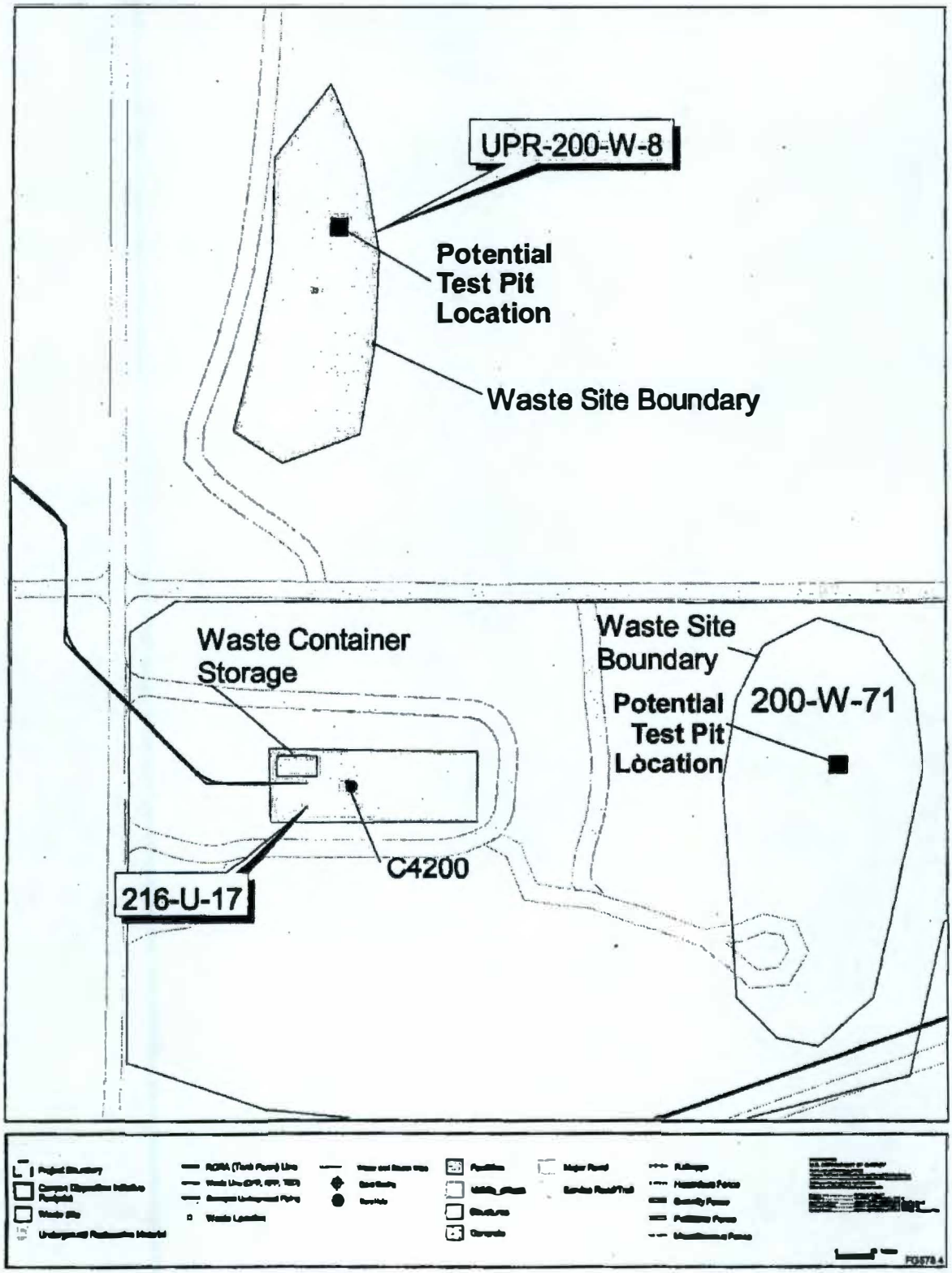


Figure A-3a. 200-W-71 Test Pit Sampling Profile.

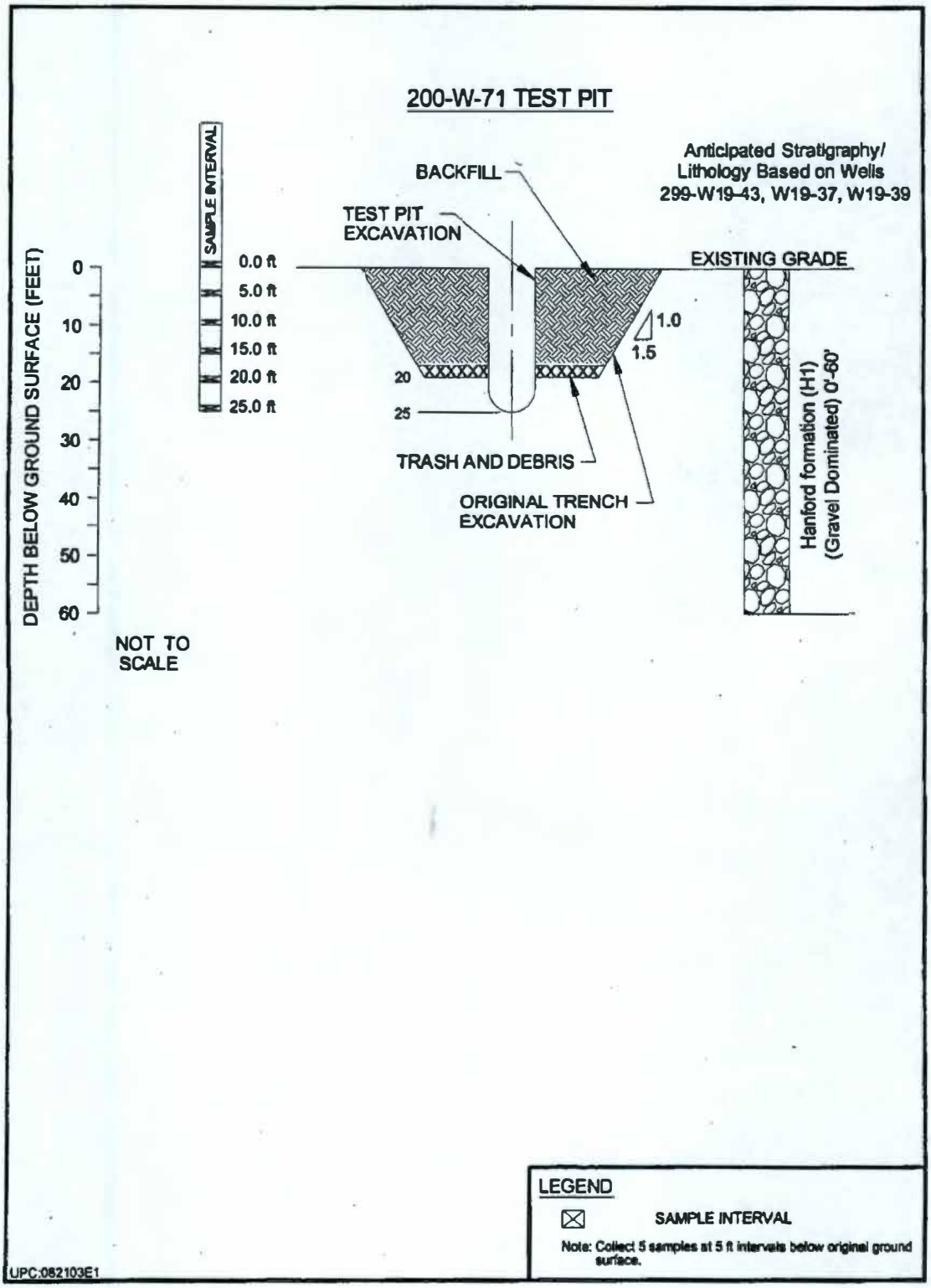


Figure A-3b. 216-U-17 Crib Borehole Sampling Profile.

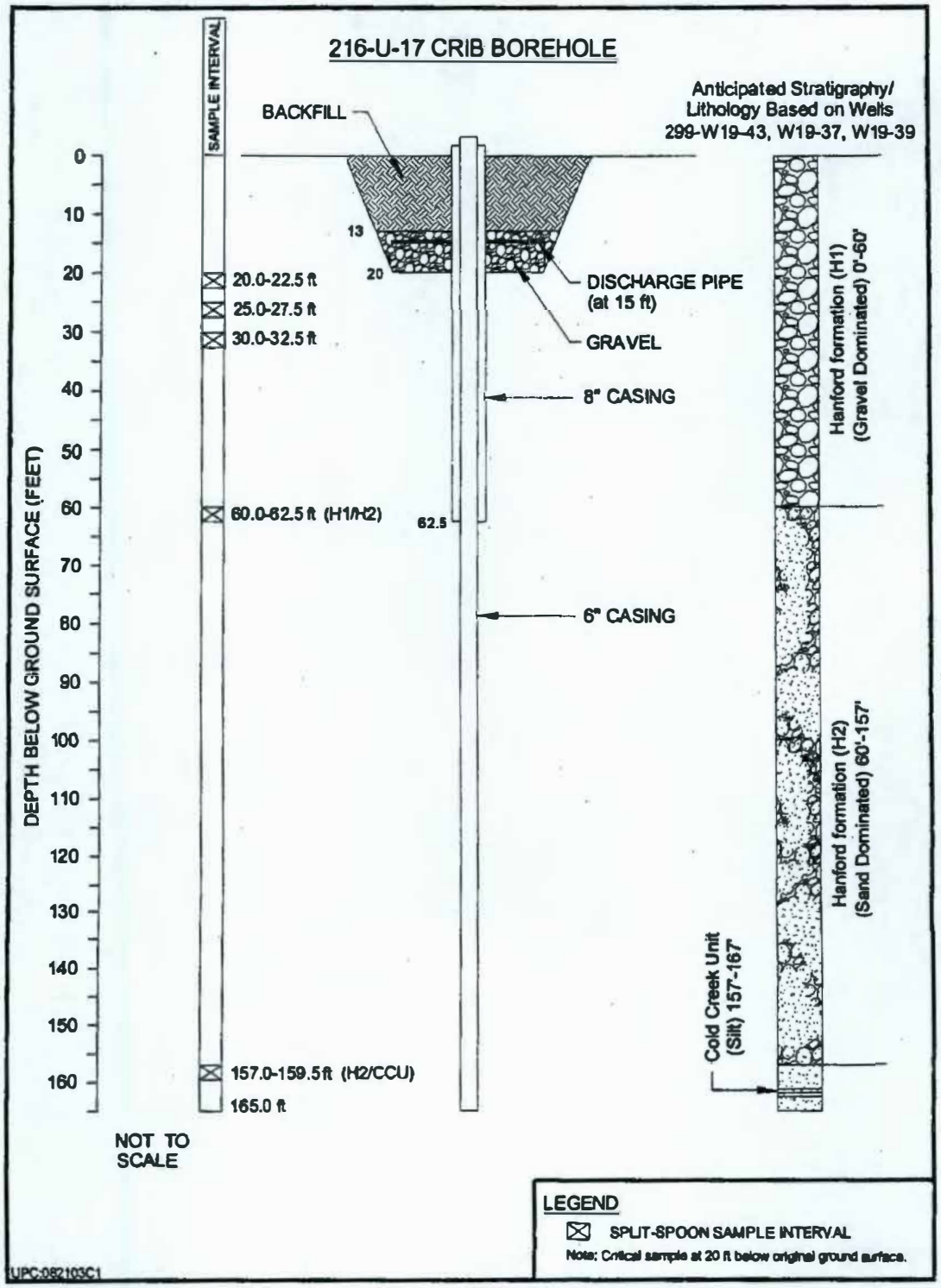


Figure A-3c. Unplanned Release UPR-200-W-8 Test Pit Sampling Profile.

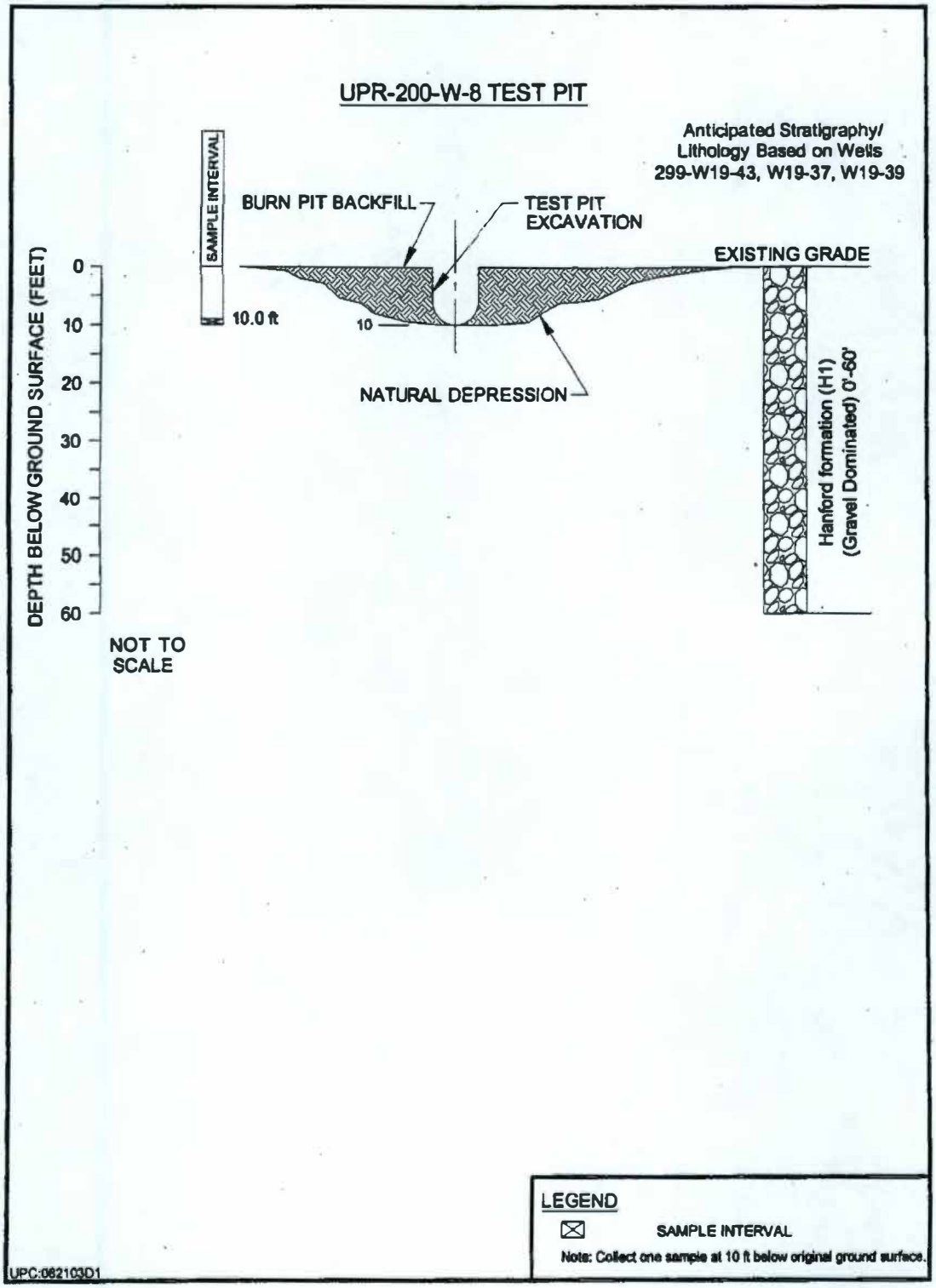


Figure A-4. Waste Site and Sample Locations for 200-W-87, 200-W-57, 200-W-85, and 216-U-15.

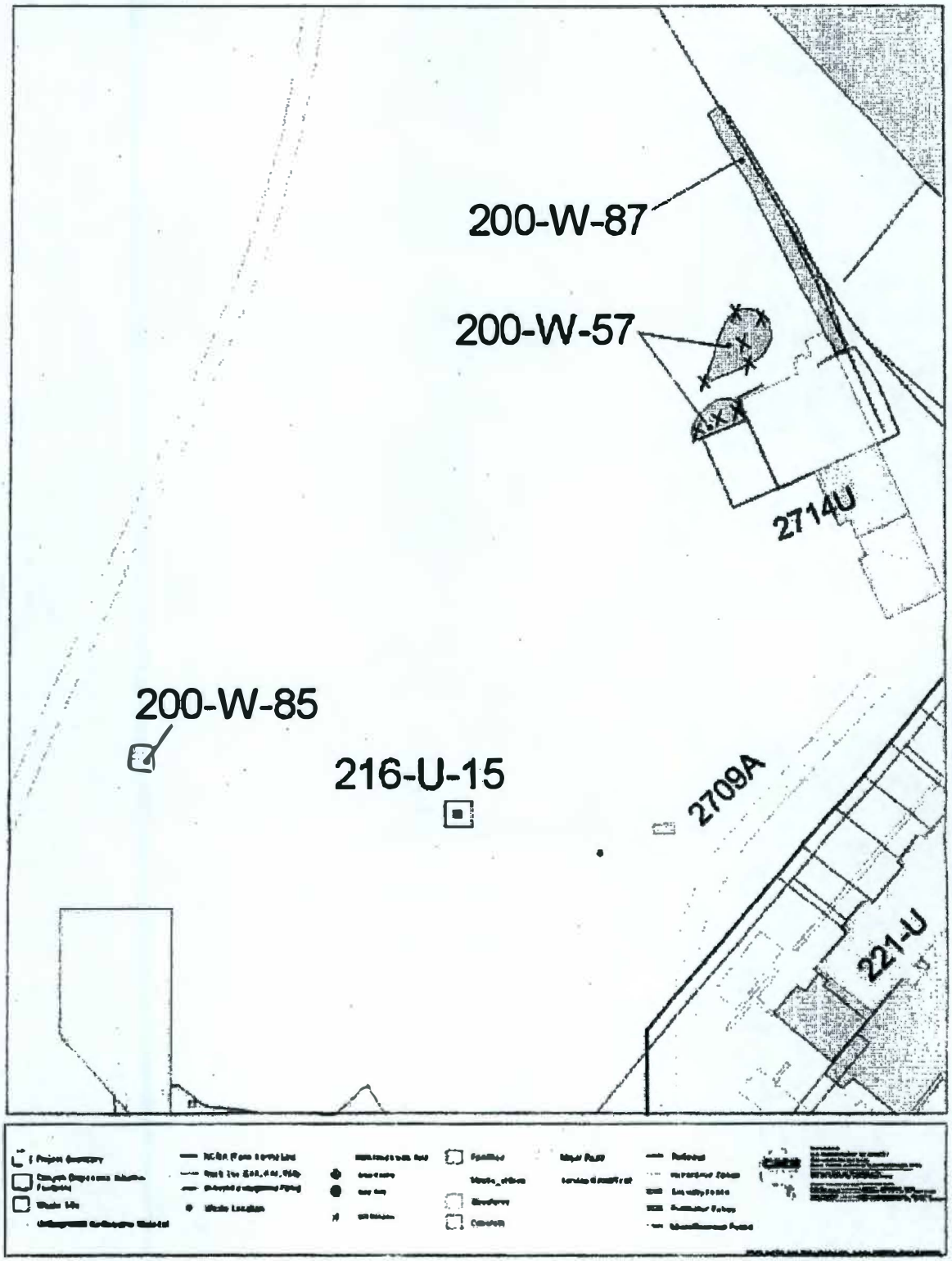


Figure A-5. Waste Site and Sample Locations for 200-W-56, 216-U-5, 216-U-6, and 2607-W7.

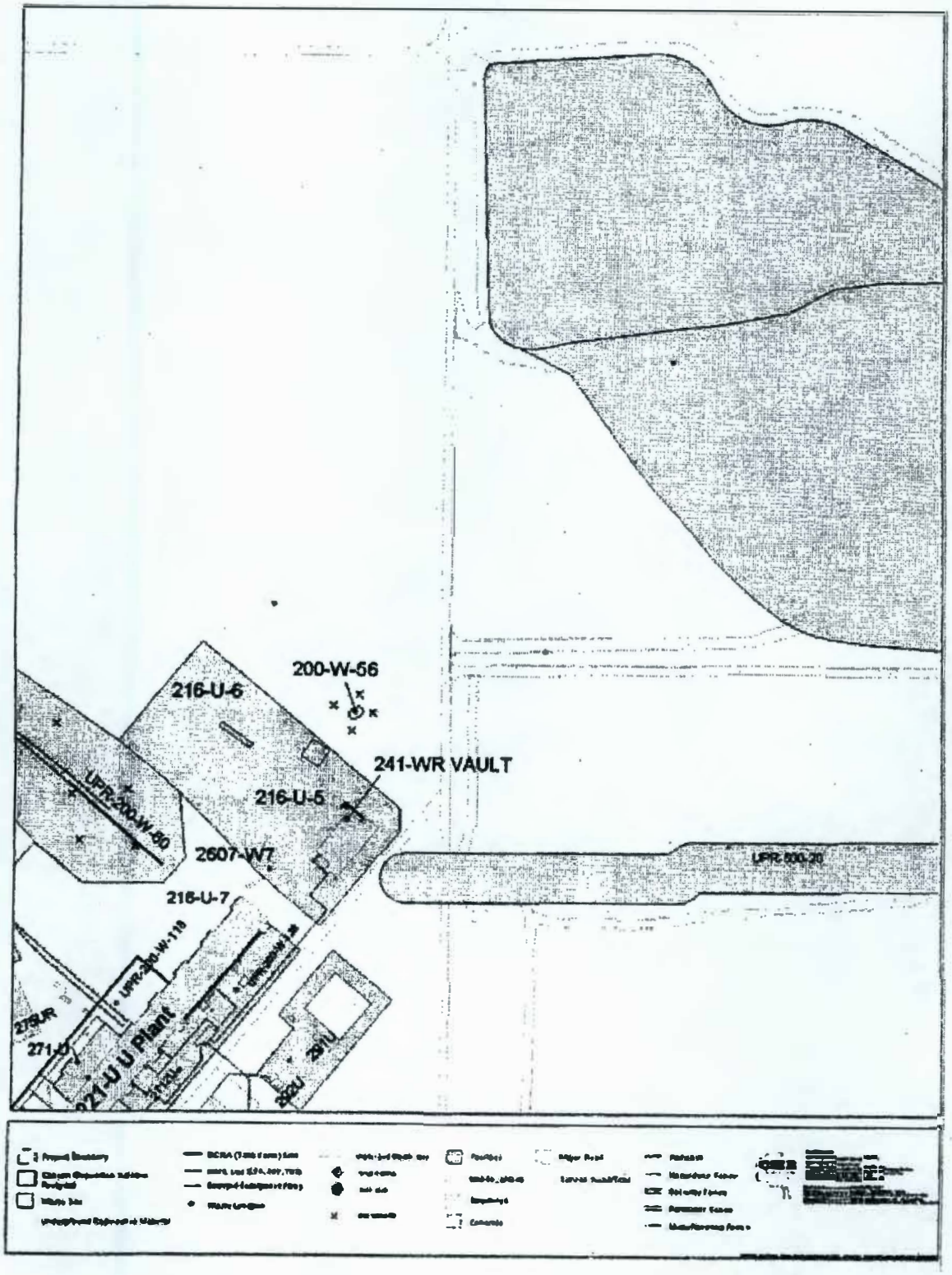
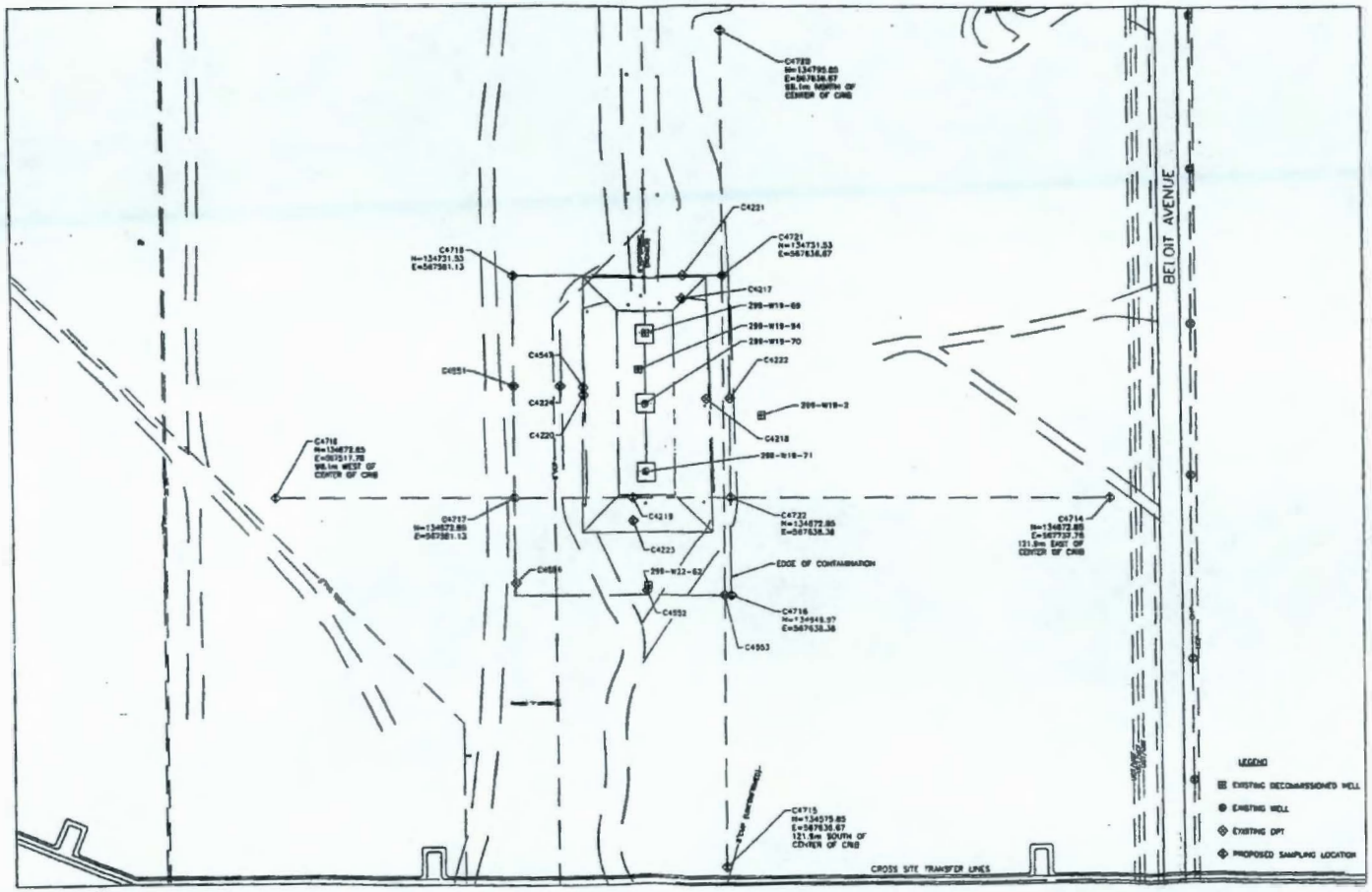


Figure A-6. Waste Site and Sample Locations for 200-W-42, UPR-200-W-163, and 216-U-8.



Page 79 of 98 of D7628799

Figure A-6a. Pipeline 200-W-42 Vitrified Clay Pipeline Borehole Sampling Profile.

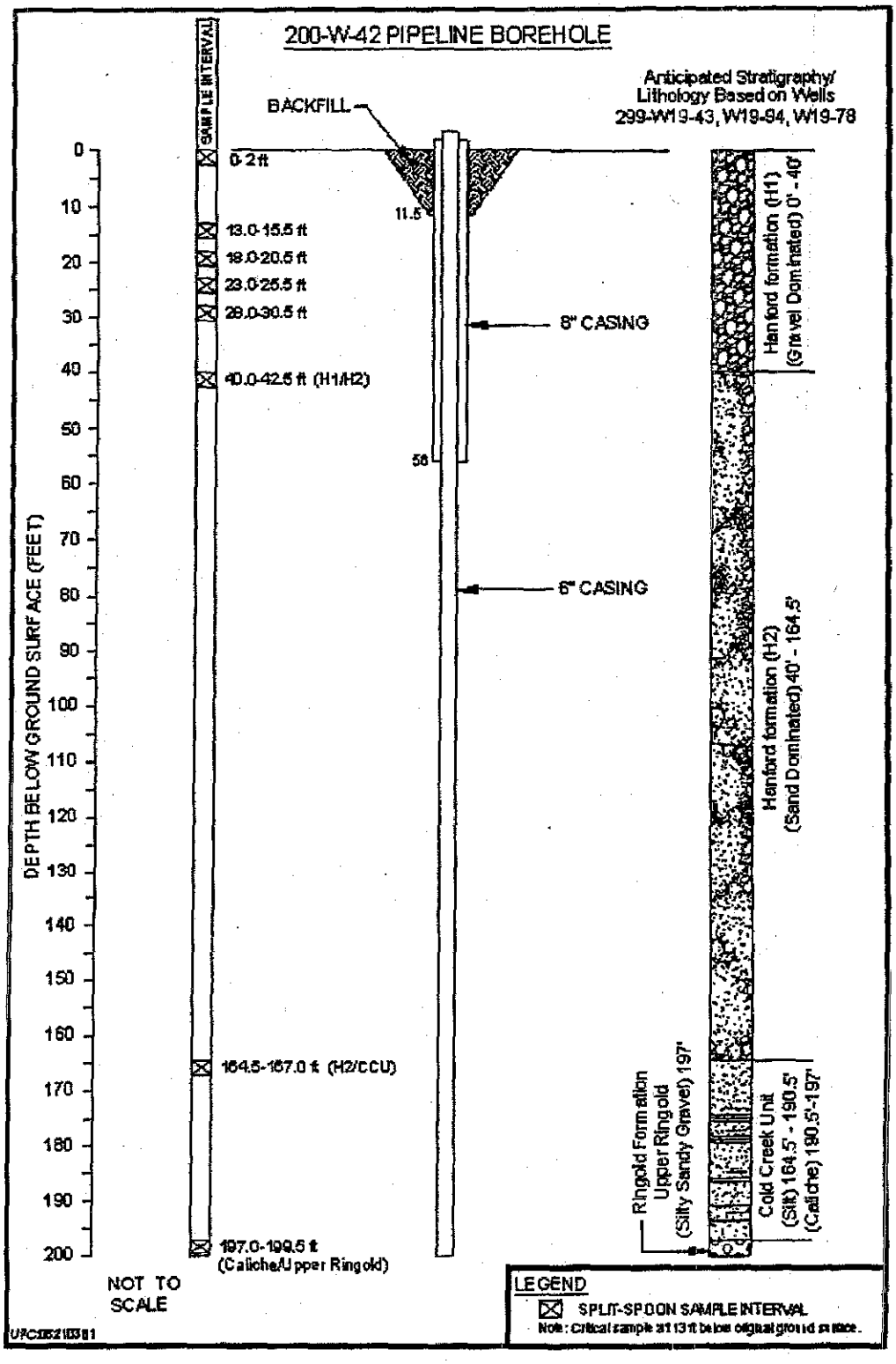


Figure A-7. Waste Site and Sample Locations for 200-W-77 and 216-U-16.

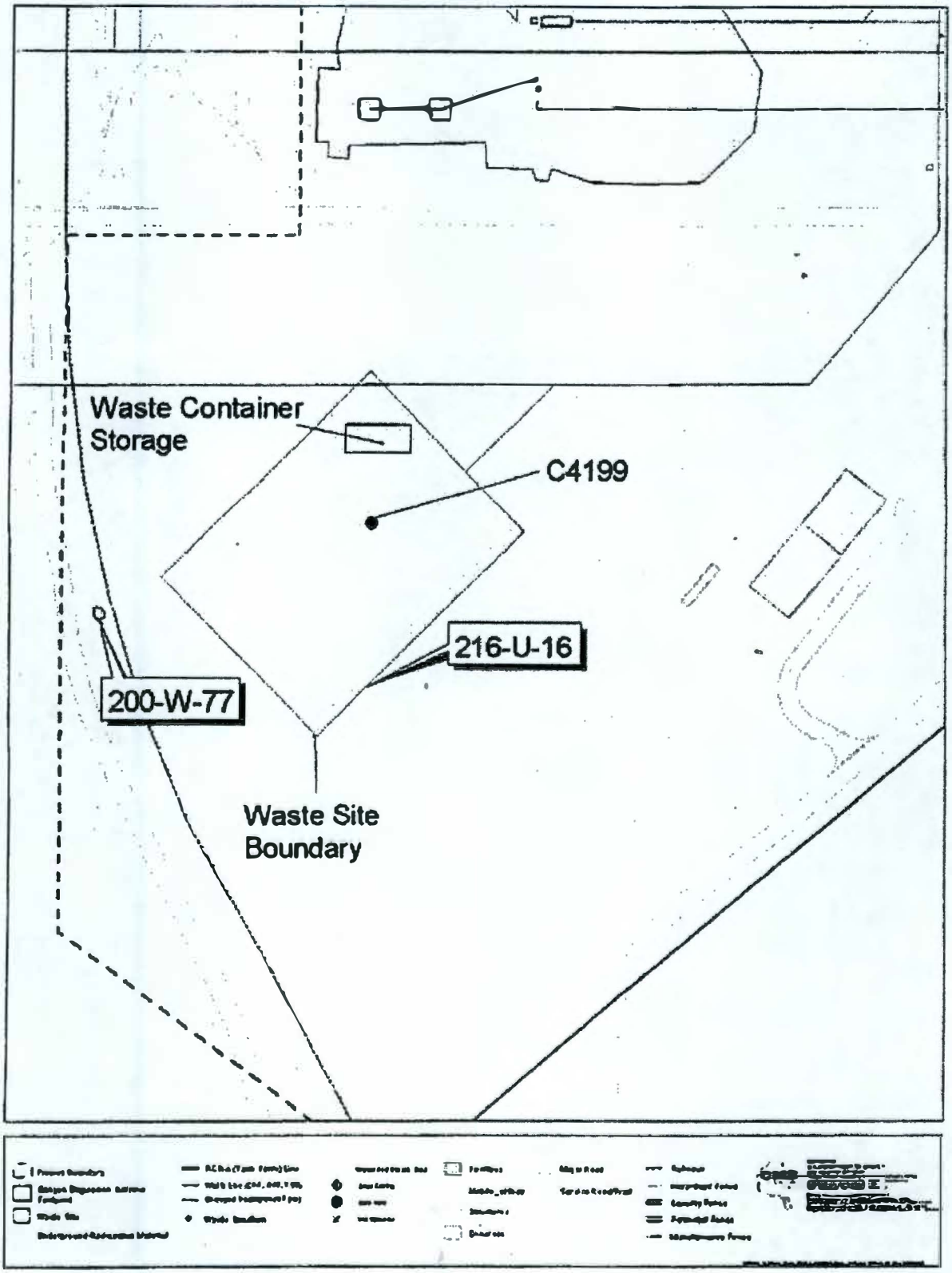


Figure A-7a. 216-U-16 Crib Borehole Sampling Profile.

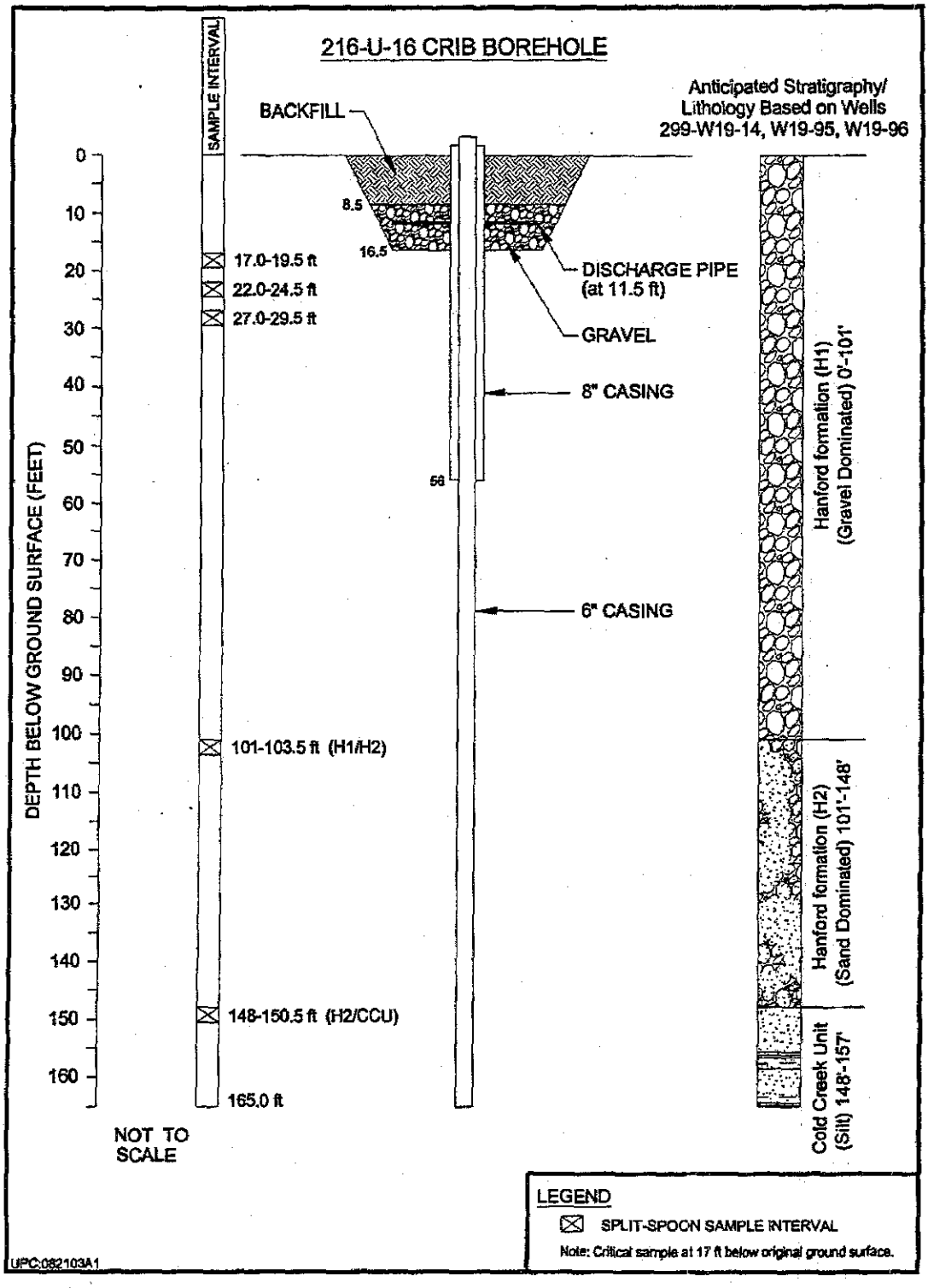
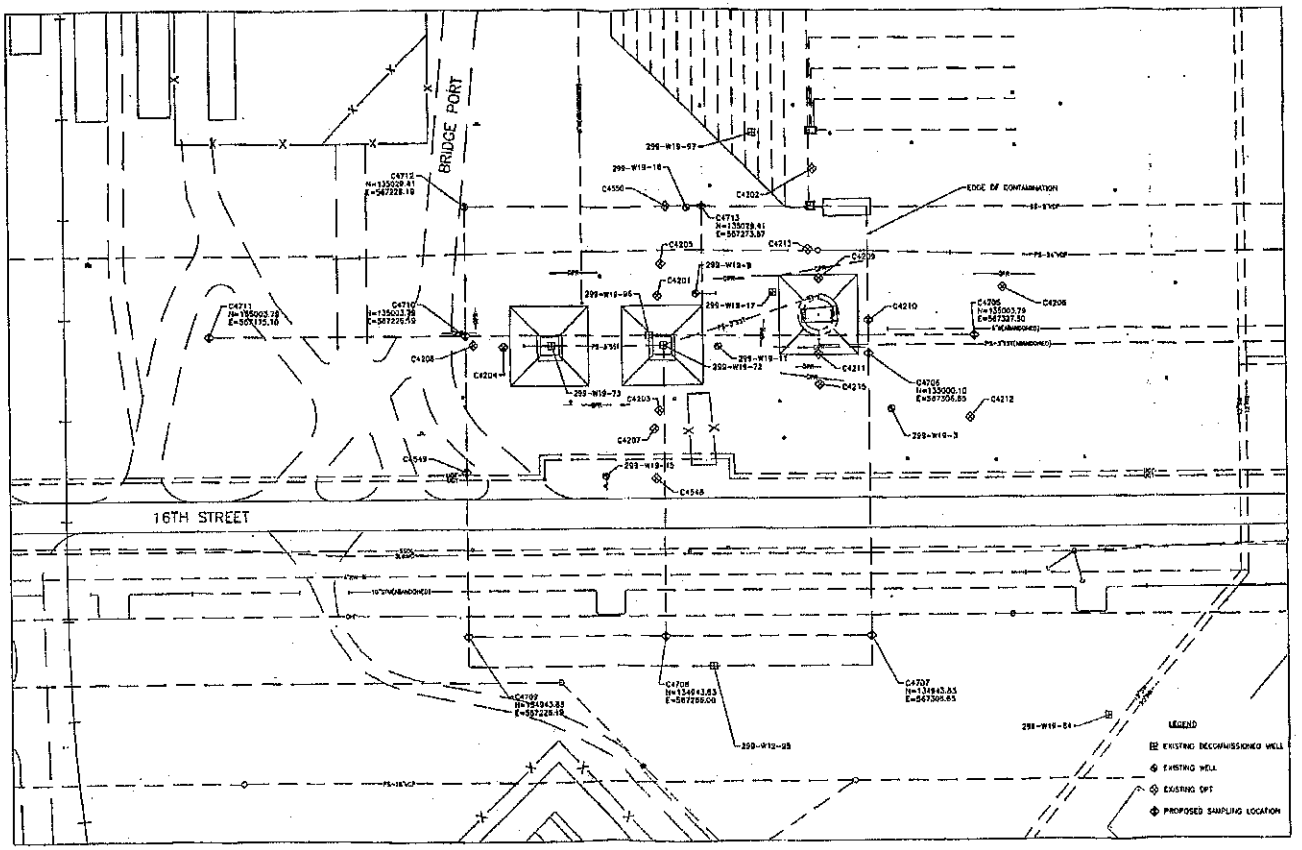


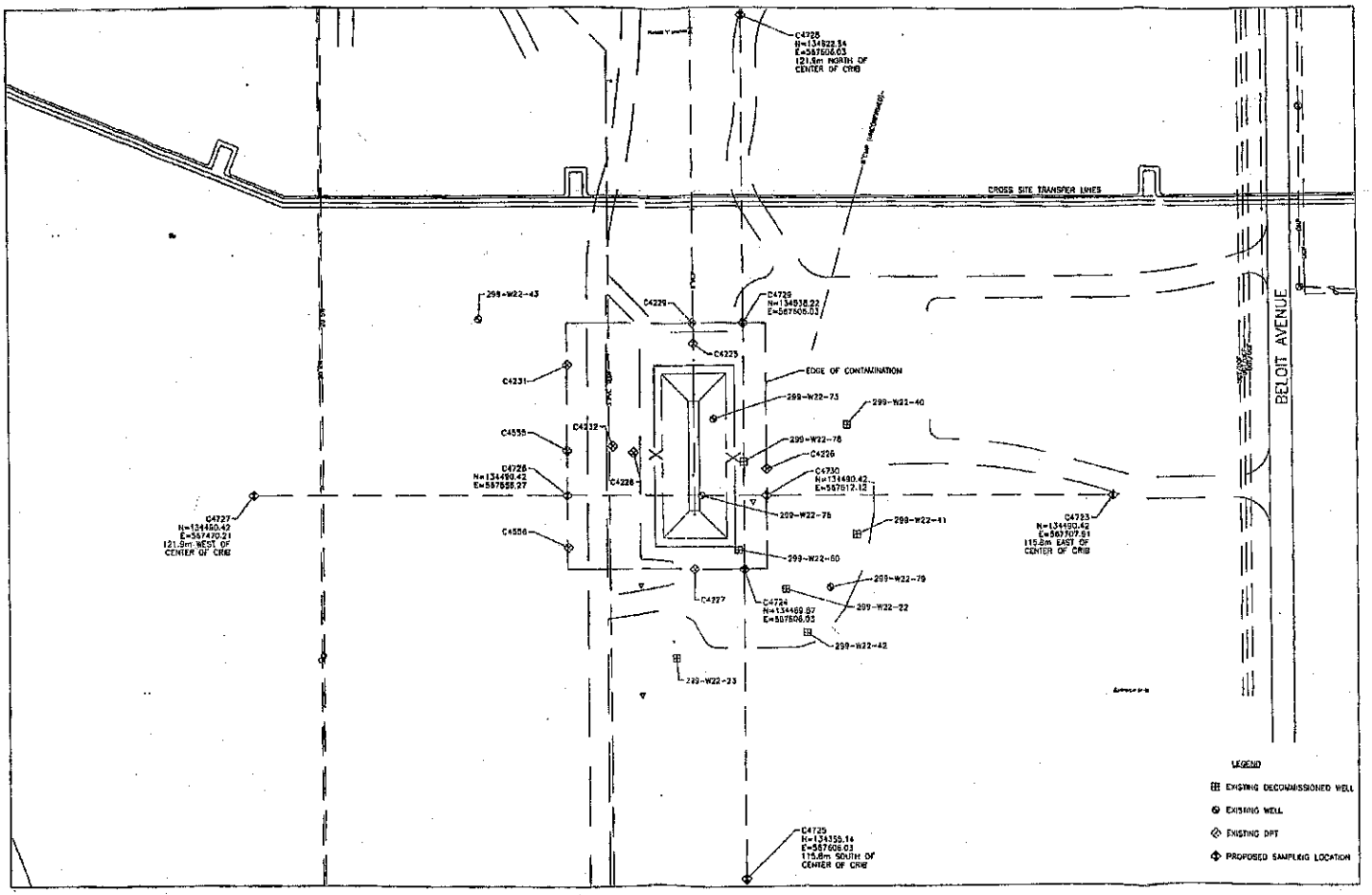
Figure A-8. Waste Site and Sample Locations for 216-U-1, 216-U-2, 2607-W5, UPR-200-W-19, and 241-U-361.[a]



[a]Required drive casings will be 20 ft from the edge of the waste site. Optional drive casings will be 40 ft from the waste site edge. These drive casings will be used to verify the lateral extent of the site contamination to size the proposed engineered barrier. It is anticipated that contamination from these sites does not extend laterally for more than 20 ft, but if the 20-ft locations identify contamination, then the 40-ft locations would be used to verify the lateral contamination extent.
[b]UPR-200-W-19 drive casings will be outside the proposed 216-U-1 and 2 Cribs/241-U-361 Settling Tank engineered barrier footprint. One soil sample will be collected with its location/depth determined from the geologging results.

Page 83 of 98 of D7626799

Figure A-9. Waste Site and Sample Locations for 216-U-12.



APPENDIX B

CONTAMINANTS OF POTENTIAL CONCERN EXCLUSION RATIONALE FOR 200-UW-1 OPERABLE UNIT WASTE SITES

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APPENDIX B

CONTAMINANTS OF POTENTIAL CONCERN EXCLUSION RATIONALE FOR 200-UW-1 OPERABLE UNIT WASTE SITES

Table B-1. Contaminants of Potential Concern Risk Based Exclusion Rationale for 200-UW-1 OU Soil Waste Sites. (5 Pages)

Chemical Class	Chemical	Reason for Exclusion as Contaminants of Concern	Reason for Inclusion as Contaminants of Concern
CONV	Chloride	Toxicity value not available	--
CONV	Fluoride	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
CONV	Nitrate (as NO_3)	Did not exceed human health, groundwater protection, or ecological PRG	
CONV	Nitrite	Did not exceed human health, groundwater protection, or ecological PRG	--
CONV	Nitrogen in Nitrite and Nitrate	--	Exceeds groundwater protection PRG
CONV	Phosphate	Toxicity value not available	--
CONV	Sulfate	Toxicity value not available	--
METAL	Antimony	Did not exceed human health, groundwater protection, or ecological PRG	
METAL	Arsenic	Arsenic concentrations did not exceed MTCA protectiveness standards for human health, ecological receptors, or groundwater.	--
METAL	Asbestos	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Barium	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Cadmium	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Chromium	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Cobalt	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Copper	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Lead	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Manganese	Manganese concentrations did not exceed MTCA industrial toxicity-based protectiveness standards for human health or ecological receptors. Manganese has no toxicity-based soil standard for groundwater protection.	--
METAL	Mercury	Did not exceed human health, groundwater protection, or ecological PRG	
METAL	Nickel	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--

Table B-1. Contaminants of Potential Concern Risk Based Exclusion Rationale for 200-UW-1 OU Soil Waste Sites. (5 Pages)

Chemical Class	Chemical	Reason for Exclusion as Contaminants of Concern	Reason for Inclusion as Contaminants of Concern
METAL	Selenium	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Silver	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Strontium	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Thallium	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Titanium	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Uranium	--	Exceeds groundwater protection PRG
METAL	Vanadium	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Yttrium	Toxicity value not available	--
METAL	Zinc	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
METAL	Zirconium	Toxicity value not available	--
RAD_D	Americium-241	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Cesium-134	Short-lived radionuclide (half-life less than three years)	--
RAD_D	Cesium-137	--	Exceeds 15 mrem/yr for direct contact and ecological PRGs
RAD_D	Cobalt-60	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Curium-244	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Europium-152	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Europium-154	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Europium-155	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Neptunium-237	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Plutonium-238	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Plutonium-239/240	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Potassium-40	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--

Table B-1. Contaminants of Potential Concern Risk Based Exclusion Rationale for 200-UW-1 OU Soil Waste Sites. (5 Pages)

Chemical Class	Chemical	Reason for Exclusion as Contaminants of Concern	Reason for Inclusion as Contaminants of Concern
RAD_D	Radium-226	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Radium-228	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Selenium-79	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Sodium-22	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Strontium-90	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Technetium-99	--	Exceeds 4 mrem/yr for groundwater protection
RAD_D	Thorium-228	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Thorium-232	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Uranium-233/234	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	--
RAD_D	Uranium-235	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	
RAD_D	Uranium-238	Did not exceed most stringent human health, groundwater protection, or ecological target dose threshold	
SVOA	1,4-Dichlorobenzene	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
SVOA	2-(2-ethoxyethoxy)ethanol	Toxicity value not available	--
SVOA	2,3,7-trimethyloctane	Toxicity value not available	--
SVOA	2,6,10,15-tetramethyl-heptadecane	Toxicity value not available	--
SVOA	2,6-di-tert-butyl-p-benzoquinone	Toxicity value not available	--
SVOA	2,7,10-trimethyl-dodecane	Toxicity value not available	--
SVOA	2-Chlorophenol	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
SVOA	2-Methylnaphthalene	Toxicity value not available	--
SVOA	4-Chloro-3-methylphenol	Toxicity value not available	--
SVOA	Acenaphthene	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
SVOA	Acenaphthylene	Toxicity value not available	--
SVOA	Benzo(ghi)perylene	Toxicity value not available	--
SVOA	Benzoic acid	Did not exceed most stringent human health, groundwater protection, or	--

Table B-1. Contaminants of Potential Concern Risk Based Exclusion Rationale for 200-UW-1 OU Soil Waste Sites. (5 Pages)

Chemical Class	Chemical	Reason for Exclusion as Contaminants of Concern	Reason for Inclusion as Contaminants of Concern
		ecological PRG	
SVOA	Bis(2-ethylhexyl) phthalate	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
SVOA	Decamethylcyclopentasiloxane	Toxicity value not available	--
SVOA	Diacetone alcohol	Toxicity value not available	--
SVOA	Di-n-butylphthalate	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
SVOA	Dodecane	Toxicity value not available	--
SVOA	Eicosane	Toxicity value not available	--
SVOA	Hexadecane	Toxicity value not available	--
SVOA	Hexanal	Toxicity value not available	--
SVOA	Normal Paraffin Hydrocarbon	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
SVOA	PCBs, herbicides, and pesticides	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
SVOA	Pentachlorophenol	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
SVOA	Pentadecane	Toxicity value not available	--
SVOA	Pyrene	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
SVOA	Sulfur (atomic)	Toxicity value not available	--
SVOA	Tetradecane	Toxicity value not available	--
SVOA	Tributylphosphate	Toxicity value not available	--
SVOA	Tridecane	Toxicity value not available	--
SVOA	Undecane	Toxicity value not available	--
TPH	Kerosene	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
VOA	2-Butanone	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
VOA	Acetone	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
VOA	Bromomethane	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
VOA	Carbon disulfide	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
VOA	Chloromethane	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
VOA	Hexane	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
VOA	Methylene Chloride	Did not exceed most stringent human health, groundwater protection, or	--

Table B-1. Contaminants of Potential Concern Risk Based Exclusion Rationale for 200-UW-1 OU Soil Waste Sites. (5 Pages)

Chemical Class	Chemical	Reason for Exclusion as Contaminants of Concern	Reason for Inclusion as Contaminants of Concern
		ecological PRG	
VOA	Tetrachloroethene	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--
VOA	Toluene	Did not exceed most stringent human health, groundwater protection, or ecological PRG	--

NOTES:

CONV = conventional parameter.
MTCA = WAC 173-340-740 (7[c]), "Model Toxics Control Act – Cleanup."
PRG = preliminary remediation goal.
RAD_D = decayed radiological.
SVOA = semivolatile organic compound.
TPH = total petroleum hydrocarbon.
VOA = volatile organic compound.

Source: CP-16244, *Data Quality Objectives Summary Report for the U Plant Closure Area Waste Sites*, Rev. 0; DOE/RL-2003-23, *Focused Feasibility Study for the 200-UW-1 Operable Unit.*

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