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Revision 0

Sampling and Analysis Plan for Remediation of 200 North Area Waste Sites Located in the 200-CW-3 Operable Unit

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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

Approved for Public Release;
Further Dissemination Unlimited

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APPROVAL

DOE/RL-2007-54, *Sampling and Analysis Plan for Remediation of 200 North Area Waste Sites Located in the 200-CW-3 Operable Unit*, Rev. 0

D. A. Faulk, Unit Manager
Hanford Site Project
U.S. Environmental Protection Agency

7/23/08
Date

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DOE/RL-2007-54, *Sampling and Analysis Plan for Remediation of 200 North Area Waste Sites Located in the 200-CW-3 Operable Unit*, Rev. 0

M. S. McCormick, Assistant Manager
U.S. Department of Energy
Richland Operations Office

7/23/08
Date

EXECUTIVE SUMMARY

This sampling and analysis plan defines the approach to conduct waste characterization and Removal, Treatment and Disposal remedy confirmation at the 216-N-1, 216-N-4, and 216-N-6 waste site ponds; the 200-N-3 solid waste site; the UPR-200-N-1 and UPR-200-N-2 unplanned release waste sites; and the 600-285-PL, 600-286-PL, and 600-287-PL pipeline waste sites all located in the 200 North Area in the 200-CW-3 Operable Unit.

The U.S. Department of Energy prepared an evaluation on remedial alternatives for 100 Area waste site groups, which includes the 200 North Area waste sites, in accordance with *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* and *Resource Conservation and Recovery Act of 1976* requirements. The evaluation, DOE/RL-94-61, *Remedy Selection Process for Remaining Source Operable Unit Waste Sites*, Appendix N, addresses all 100 Area source waste sites not identified in previous records of decision or as proximity sites and identifies Removal, Treatment and Disposal, and analytical sampling effort sites.

This sampling and analysis plan is being prepared in support of the *Interim Action Record of Decision Department of Energy Hanford 100 Area and 200 Area*, EPA/ROD/R10-99/039, July 15, 1999 (EPA 1999a). In conjunction with preparation of the data quality objectives summary report (BHI-01249, *DQO Summary Report for 100/300 Area Remaining Sites Analytical Sampling Effort*) and this SAP, a remedial action work plan (DOE/RL-2007-55, *Remedial Design/Remedial Action Work Plan for 200 North Area Waste Sites Located in the 200-CW-3 Operable Unit*) is being prepared for the 200-CW-3 Operable Unit Waste Site Remediation project. Chapter 1.0 for the 200-CW-3 Operable Unit Waste Site Remediation project provides an introduction, including project scope, goals, assumptions and a list of the potential contaminants of concern. Chapter 2.0 is the activity-specific quality assurance project plan. The sampling strategy for the project is presented in Chapter 3.0 of this sampling and analysis plan.

The overall goals of the sampling identified in this sampling and analysis plan are to provide the data needed to support waste disposal if the waste sites must be excavated and to confirm Removal, Treatment and Disposal as the selected remedy for each waste site in support of a future remedial action to remove soil. If the Removal, Treatment and Disposal remedy is not selected, the overall goal will be to provide the preliminary investigation analytical information, which will be used to develop a Work Instruction to confirm a No Acton remedy or to conduct further sampling and analysis in support of remedy selection. The preferred remedial action under consideration for these waste sites, as identified in DOE/RL-94-61, *Remedy Selection Process for Remaining Source Operable Unit Waste Sites*, Appendix N, is Removal, Treatment and Disposal. The U.S. Environmental Protection Agency's data quality objective guidance[1] was used to identify project data quality needs, evaluate sampling and analysis options, and document project data quality decisions.

The following sampling strategy was developed based on current site knowledge and likely site remedial actions.

- For the Removal, Treatment and Disposal waste sites, field radiological surveys will be used to define the areas of highest contamination in the soil within each waste site. The presence of cesium-137 and/or strontium-90 detected during field surveys will be used as an "indicator" to determine areas that require further sampling and analysis. Those areas with detectable radiological contamination will be flagged for collection of samples.

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

- For evaluation of each waste site that does not meet the Removal, Treatment and Disposal remedy, a Work Instruction will be developed for each waste site and approved by the U.S. Department of Energy, Richland Operations Office, and the U.S. Environmental Protection Agency. The Work Instruction will include any waste site-specific historical data, geophysical survey information, a summary of field screening information and analytical results from the preliminary investigation sampling and analysis, conducted under this sampling and analysis plan, which will be used to support the decision of No Action or confirm additional sampling required. The Work Instruction will also include a sampling design and a list of contaminants of concern.

- Physical sample collection options for the 200-CW-3 Operable Unit Waste Site Remediation project may include, but are not limited to, soil grab samples (or the use of other soil sample collection methods), soil core or test pit sampling, and radiological field screening. Field-screening data collection options may include visual inspection of the soil in the waste sites, and field radionuclide monitoring equipment (e.g., Geiger-Mueller meter, Portable Alpha meter and portable Sodium Iodide detector).

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TERMS

ALARA	as low as reasonably achievable
AEA	alpha energy analysis
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
Ci	curie
COPC	contaminant of potential concern
CWC	Central Waste Complex
d/min	disintegrations per minute
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy, Richland Operations Office
DQA	data quality assessment
DQO	data quality objective
DR	decision rule
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ft	feet
GEA	gamma energy analysis
GPS	global positioning systems
HEIS	*Hanford Environmental Information System* database
m	meter
mg/kg	milligram(s) per kilogram
N/A or NA	not applicable
OU	operable unit
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
QA	quality assurance
QAPjP	quality assurance project plan
QC	quality control
RCT	radiological control technician
RPD	relative percent difference
SAP	sampling and analysis plan
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
WAC	*Washington Administrative Code*
WSCF	Waste Sampling and Characterization Facility

METRIC CONVERSION CHART

Into metric units			Out of metric units		
If you know	Multiply by	To get	If you know	Multiply by	To get
Length			**Length**		
inches	25.40	millimeters	millimeters	0.03937	inches
inches	2.54	centimeters	centimeters	0.393701	inches
feet	0.3048	meters	meters	3.28084	feet
yards	0.9144	meters	meters	1.0936	yards
miles (statute)	1.60934	kilometers	kilometers	0.62137	miles (statute)
Area			**Area**		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.09290304	square meters	square meters	10.7639	square feet
square yards	0.8361274	square meters	square meters	1.19599	square yards
square miles	2.59	square kilometers	square kilometers	0.386102	square miles
acres	0.404687	hectares	hectares	2.47104	acres
Mass (weight)			**Mass (weight)**		
ounces (avoir)	28.34952	grams	grams	0.035274	ounces (avoir)
pounds	0.45359237	kilograms	kilograms	2.204623	pounds (avoir)
tons (short)	0.9071847	tons (metric)	tons (metric)	1.1023	tons (short)
Volume			**Volume**		
ounces (U.S., liquid)	29.57353	milliliters	milliliters	0.033814	ounces (U.S., liquid)
quarts (U.S., liquid)	0.9463529	liters	liters	1.0567	quarts (U.S., liquid)
gallons (U.S., liquid)	3.7854	liters	liters	0.26417	gallons (U.S., liquid)
cubic feet	0.02831685	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.7645549	cubic meters	cubic meters	1.308	cubic yards
Temperature			**Temperature**		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit
Energy			**Energy**		
kilowatt hour	3,412	British thermal unit	British thermal unit	0.000293	kilowatt hour
kilowatt	0.94782	British thermal unit per second	British thermal unit per second	1.055	kilowatt
Force/Pressure			**Force/Pressure**		
pounds (force) per square inch	6.894757	kilopascals	kilopascals	0.14504	pounds per square inch

06/2001

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE., Third Ed., 1993, Professional Publications, Inc., Belmont, California.

SAMPLING AND ANALYSIS PLAN FOR REMEDIATION OF 200 NORTH AREA WASTE SITES LOCATED IN THE 200-CW-3 OPERABLE UNIT

1.0 INTRODUCTION

The Hanford Site (Figure 1-1) is a 1,517 km^2 (586 mi^2) Federal facility located in southeastern Washington State along the Columbia River. From 1943 to 1990, the primary mission of the Hanford Site was the production of nuclear materials for national defense. In July 1989, the 100, 200, 300, and 1100 Areas of the Hanford Site were placed on the National Priorities List (40 *Code of Federal Regulations* [CFR] 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Appendix B, "National Priorities List") pursuant to the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) *of 1980.*

The Central Plateau is located in the central portion of the Hanford Site and is divided into three areas: 200 East Area, 200 West Area, and 200 North Area. Operations in the 200 East and 200 West Areas were related to chemical separation, plutonium and uranium recovery, processing of fission products, and waste partitioning. Major chemical processes in the Central Plateau resulted in delivery of high-activity waste streams to systems of large underground tanks called "tank farms." The liquid wastes often were neutralized before being sent to the tanks and later evaporated (concentrated). The storage tanks were used to allow the heavier constituents to settle from the liquid effluents, forming sludge. Low-activity liquid wastes were discharged to trenches, cribs, drains, and ponds, most of which were unlined. The 200 North Area formerly was used for the interim storage and staging of irradiated fuel.

The 200 North Area located within the 200-CW-3 Operable Unit (OU) (Figure 1-2) includes 12 waste sites, 9 of which will require sampling and analysis:

- 216-N-1, 216-N-4, and 216-N-6 waste site ponds are each located 274 meters (900 feet) south, southeast of the 212-N, 212-P and 212-R Buildings, respectively and received basin overflow cooling water from the storage of fuel in each building. The ponds range in size from approximately 152 meters (500 feet) in length with a maximum width of 61 meters (200 feet) and depths ranging from 1.83 meters (6 feet) to 2.74 meters (9 feet), including backfill material. Each pond consisted of a natural depression in the terrain during operation with the discharged water dispersed by evaporation and percolation into the ground.

- 200-N-3 solid waste site was identified as a series of electrical ballast pits located southwest of the 212-P Building and northwest of the intersection of two gravel roads, one road leading north toward 212-P Building and the other leading west toward the 212-N Building. The pits were originally used as a source of rock for the railroad track beds and now contain a large amount of gravel-sized rock with some metal pipes, wood, electrical insulators, metal cans and rusted drums.

- UPR-200-N-1 and UPR-200-N-2 are unplanned release waste sites. UPR-200-N-1 site is a 300-foot (91-meter) leg of the railroad track extending south from the 212-R Building. From 1944 to 1952, irradiated fuel rods were transported to the 212-R Building from the 100 Area reactors by train in water-filled cask cars. The fuel rods were transferred from the railcars to water-filled storage basins inside the building, where the short-lived radionuclides were allowed to decay before transporting the fuel rods to the 200 Areas for processing. From 1982 to 1986, the 212-R Building was used as a maintenance facility for radiologically contaminated railcars in need of brake and wheel maintenance. Over time, movement and repair of the contaminated railcars caused the track and soil to become contaminated. Presently, two locomotives are staged over the top of the waste site.

The UPR-200-N-2 unplanned release waste site is an area with approximate dimensions of 20 feet by 20 feet (6.1 meters by 6.1 meters). There are two open wood-lined holes with valves inside the radiologically posted area. The holes measure approximately 1 meter square and are approximately 1 meter in depth. The waste site is adjacent to the northern Well Pump House (referred to as Well House No. 2) foundation located east of the 212-R Building. The Well Pump House was demolished in September of 2004. The two valve boxes are associated with the old well water supply system. However, there is no information to explain the exact nature or cause of the radiological contamination.

- 600-285-PL, 600-286-PL, and 600-287-PL pipeline waste sites are 18-inch (46-centimeter) diameter vitrified clay pipe. Each underground pipeline serviced one 212 Building and extended to one of the 216-N Ponds for gravity-fed discharge of basin liquids, specifically:
  - 212-N Building discharged through 600-285-PL to 216-N-1 Pond
  - 212-P Building discharged through 600-286-PL to 216-N-4 Pond
  - 212-R Building discharged through 600-287-PL to 216-N-6 Pond.

- 2607-N, 2607-P, and 2607-R septic tank waste sites each consist of a rectangular concrete reinforced tank, buried to grade-level, and now filled with soil. The original tank systems consisted of a tank that was 4 feet (1.2 meters) long, 2 feet (0.6 meters wide and 8.25 feet (2.5 meters) deep (inner dimensions) with a capacity of between 210 gallons (795 liters) and 240 gallons (910 liters) based on a user capacity for 6 people. Each tank was connected to a drain field that extends south of the septic tank. Each tank was tied to a Guard House, specifically:
  - 2743-N Guard House was serviced by the 2607-N Septic System
  - 2743-P Guard House was serviced by the 2607-P Septic System
  - 2743-R Guard House was serviced by the 2607-R Septic System.

  All three guard houses have been demolished. The Septic Systems were taken out of service in the early 1950s. NOTE: No sampling or analysis is necessary for the three septic systems.

The map of the Hanford Site provided in Figure 1-1 depicts the 200 North Area. Figure 1-2 identifies the 12 specific waste sites within the 200-CW-3 OU.

This sampling and analysis plan (SAP) defines the approach to conduct characterization and conceptual model Removal, Treatment and Disposal confirmation sampling at nine of the 200 North waste sites in the 200-CW-3 OU as part of the Waste Site Remediation project. Chapter 2.0 is the activity-specific quality assurance project plan. The sampling strategy for the project is presented in Chapter 3.0 of this SAP.

The overall goals of the sampling identified in this SAP are to provide the data needed to support waste disposal from excavating the waste sites and confirm the Removal, Treatment and Disposal remedial action for the nine waste sites. If the Removal, Treatment and Disposal remedy is not selected, the overall goal is to provide the preliminary investigation analytical information, which will be used to develop a Work Instruction to confirm a No Acton remedy or to conduct further sampling and analysis in support of remedy selection.

1.1 PROJECT SCOPE

This SAP includes sampling of nine waste sites for selection of the appropriate remedial action for the 200-CW-3 OU. The sampling and any remedial action tasks in support of sampling and field investigation are collectively referred to hereafter as the 200-CW-3 OU Waste Site Remediation project.

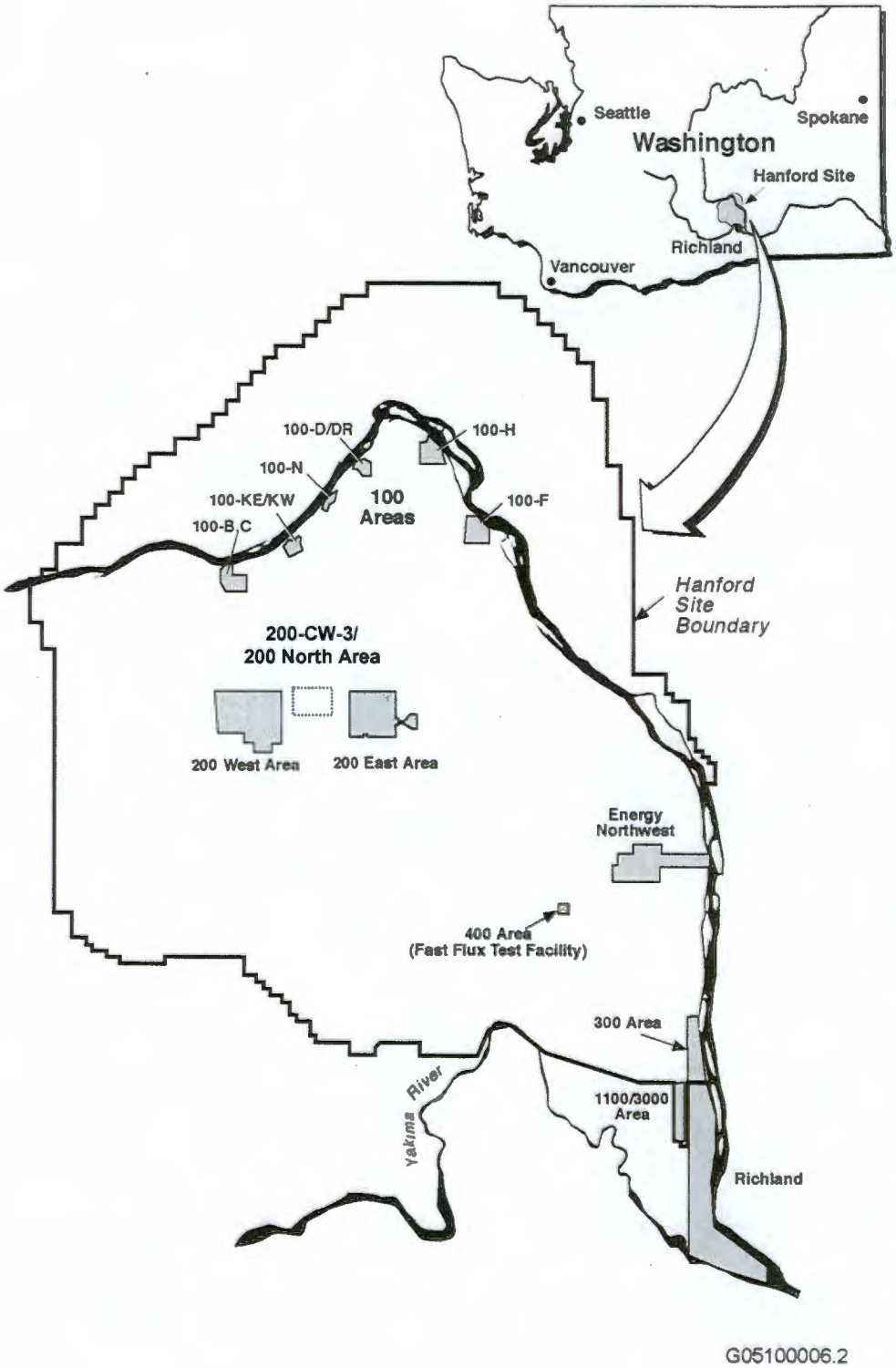

Figure 1-1. Hanford Site.

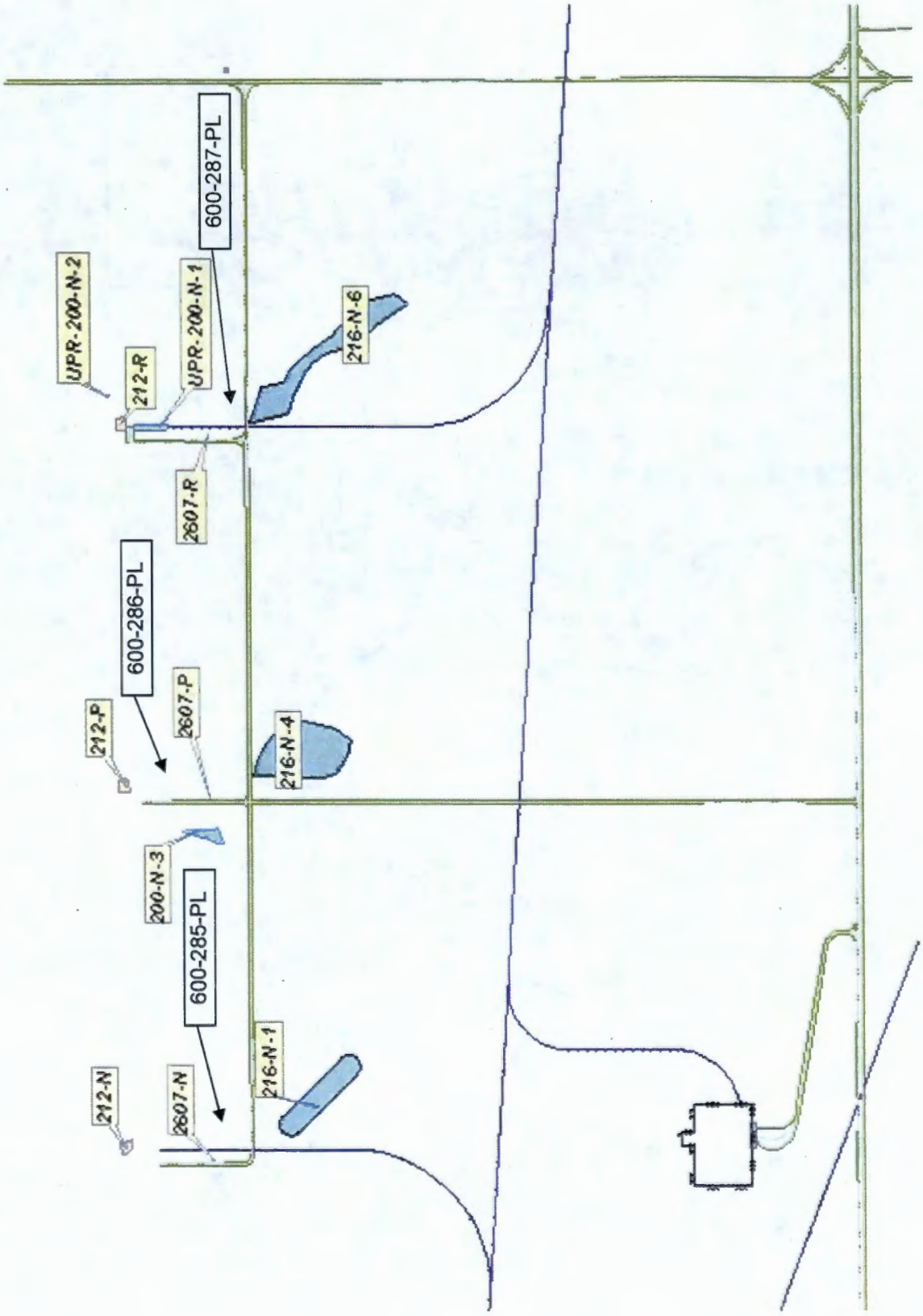

Figure 1-2. 200 North Waste Sites Within the 200-CW-3 Operable Unit.

The scope of this project includes the data quality objective (DQO) process and development of this SAP for the 200-CW-3 OU Waste Site Remediation project to confirm the Removal, Treatment and Disposal remedial action for the 216-N-1, 216-N-4, and 216-N-6 waste site ponds; the 200-N-3 solid waste site; the UPR-200-N-1 and UPR-200-N-2 unplanned release waste sites; and the 600-285-PL, 600-286-PL, and 600-287-PL pipeline waste sites, and provide characterization data for waste disposal. Overall sampling efforts for the 200-CW-3 OU Waste Site Remediation project include the following:

- Waste characterization sampling. Data collection for waste materials (i.e., soil) to ensure compliance with the Environmental Restoration Disposal Facility (ERDF) waste acceptance criteria (WCH-191, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*).

- Remedy confirmation sampling. Data collection to confirm that the site conceptual model for the 200-CW-3 OU waste sites agrees with the site conceptual model used to recommend the preferred remedial alternative of Removal, Treatment and Disposal.

- Evaluation of the No Action remedy. Data collection documented in a Work Instruction providing preliminary investigation analytical and field screening information, which will be used to either confirm the No Action remedy or to support further sampling and analysis in support of remedy selection. The Work Instruction will include any waste site-specific historical data, geophysical survey information, a summary of field screening information and analytical results from the preliminary investigation sampling and analysis, conducted under this sampling and analysis plan, which will be used to support the decision of No Action or confirm additional sampling required. The Work Instruction will also include a sampling design and a list of contaminants of concern.

1.2 PROJECT GOALS

The goals of this project are: (1) Use historical and process knowledge to the maximum extent practicable to identify the chemical and radiological hazards that comprise the 200-CW-3 OU waste sites; (2) Identify the waste streams that will be generated during the remedial action, including the soil and any debris found; (3) Establish sampling and analytical requirements for any materials needing additional characterization; and (4) Perform all activities in a manner that is protective of human health and the environment.

1.3 PROJECT ASSUMPTIONS

The following project assumptions are based on project team discussions from regular team meetings and input received during the DQO scoping checklist review. In addition, interviews with the key decision makers were held to provide a forum for eliciting ideas and issues for inclusion in the DQO process.

1. The project has little historical characterization data. The list of contaminants of potential concern (COPCs) have been derived from the *Sampling and Analysis Plan for the 100 Area Remaining Sites*, DOE/RL-99-58, and the *Data Quality Objectives Summary Report for the 100 Area Remaining Confirmatory Sampling Effort Sites*, BHI-01249.

2. The 200 North waste sites are not anticipated to contain free liquid, but may contain stains and/or sludge that could be sampled. Raw water will be used for dust suppression. A comparison of the COPCs to the annual test data for the Columbia River do not indicate that the raw water would add detectable levels of contaminants to the soil.

3. Based on existing information, soil and/or debris removed from these waste sites in support of the conceptual model confirmation are not anticipated to require ex-situ treatment to meet disposal requirements at the ERDF or to reduce waste volumes. Contaminated soil will be containerized

on site and transported to the ERDF. Low-level radioactive waste and/or hazardous waste are acceptable for disposal at the ERDF, in accordance with the waste acceptance criteria (WCH-191).

1.4 200 NORTH AREA WASTE SITE CONTAMINANTS

As outlined in U.S. Environmental Protection Agency (EPA) Superfund Record of Decision, EPA/ROD/R10-99/039 (EPA 1999a), 200-CW-3 OU waste sites may be contaminated with any or none of the Table 1-1 contaminants. Based on discussions with U.S. Department of Energy (DOE) and EPA, sampling activities will include analysis for all of the Table 1-1 contaminants. The list of contaminants is presented in Table 1-1 and their corresponding detection limits listed in Table 2-2.

Table 1-1. 200 North Waste Sites within the 200-CW-3 OU Contaminants of Potential Concern.

Nonradioactive Contaminants	Radioactive Contaminants
Barium	Americium-241
Antimony	Cesium-137
Arsenic	Cobalt-60
Chromium (III)	Europium-152
Mercury	Europium-154
Chromium (VI)	Europium-155
Cadmium	Plutonium-238
Lead	Plutonium-239/240
Manganese	Nickel-63
Zinc	Tritium-3
Polychlorinated Biphenyls	Strontium-90
	Technetium-99
	Thorium-232
	Uranium-233/234
	Uranium-235
	Uranium-238

1.5 DATA QUALITY OBJECTIVES

EPA/600/R-96/055, *Guidance for the Data Quality Objectives Process*, EPA QA/G-4 (EPA 2000a), 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 BHI-01249.

1.5.1 Statement of the Problem

This SAP supports the collection of data for three purposes: 1) waste designation for disposal of excavated soil; 2) confirmation of conceptual model and Removal, Treatment and Disposal remedy; and 3) preliminary investigation for No Action remedy confirmation.

To designate waste, process knowledge, as well as field sampling and laboratory analytical data are needed to complete the waste profile. Where needed for completeness, the existing knowledge pertaining to radionuclides and chemical contaminants will be supplemented with data from additional characterization to ensure compliance with the disposal facilities' waste acceptance criteria.

Field screening and sampling and laboratory analyses will provide confirmation that the remedy for the waste sites of Removal, Treatment and Disposal is correct. If the Removal, Treatment and Disposal remedy is not confirmed for a waste site, then the preliminary field and analytical information will be compiled in a Work Instruction to confirm a No Action remedy or to conduct further sampling and analysis in support of remedy selection.

1.5.2 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 (e.g., COPCs), the scale of the decision (waste site boundaries), the action level (risk-based criteria), and the resulting action (remediation needs). The decision rules are summarized in Table 1-2.

Table 1-2. Decision Rules.

DR #	Decision Rules
1	**If** process knowledge or the maximum sample concentration for contaminated materials is determined to exceed the ERDF waste acceptance criteria, **then** the materials will be evaluated for storage at the CWC in accordance with DR #2 through DR #8, as applicable. **If** process knowledge or the maximum sample concentration for contaminated materials is determined to not exceed the final action levels, **then** the materials will be evaluated for disposal at the ERDF in accordance with DR #2 through DR #8, as applicable.
2 – 8*	**If** process knowledge or the maximum sample concentration for contaminated materials indicates that the materials are to be designated as listed, characteristic, toxic, persistent, PCB, or asbestos-containing material, **then** materials will be evaluated for treatment or disposal at the ERDF, or storage at the CWC in accordance with DR #9. **If** process knowledge or the maximum sample concentration for contaminated materials indicates that the materials are not to be designated as listed, characteristic, toxic, persistent, PCB, or asbestos-containing material, **then** materials will be evaluated for being sent to a solid waste landfill in accordance with DR #9.
9	**If** process knowledge or the maximum sample concentration dictate land disposal restriction-imposed treatment, **then** the materials will be treated and disposed of at the ERDF or stored at the CWC pending future treatment and final disposal. **If** process knowledge or the maximum sample concentration does not dictate land disposal restriction-imposed treatment of the materials, **then** the materials will be disposed of at the ERDF.

Table 1-2. Decision Rules.

DR #	Decision Rules
10	**If** the maximum sample concentration for soil in the excavations indicates that the soil exceeds the action levels, **then** soil remediation will be performed and a verification sampling and analysis plan will be developed, approved, and implemented. Data will be evaluated against the remedial action goals and objectives. **If** the maximum sample concentration for soil in the excavation indicates that the soil does not exceed the action levels, **then** the results will be documented in a Work Instruction to confirm that no further remedial action will be required or to conduct further sampling and analysis in support of remedy selection.

*DR #2 through DR #8 support waste designation.
CWC = Central Waste Complex.
DR = decision rule.
ERDF = Environmental Restoration Disposal Facility.
PCB = polychlorinated biphenyl.

1.6 GENERAL SAMPLE DESIGN CONCEPTS

The nature of the 200-CW-3 OU waste sites supports the use of judgment/focused sampling for the waste site investigations, as identified in EPA/240/R-02/005, *Guidance on Choosing a Sampling Design for Environmental Data Collection* (EPA 2002). 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 ponds, or 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 for waste characterization purposes. Additional efforts may be needed to determine the worst-case location for the sample 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 will be selected during site walk downs by prime contractor technical staff familiar with the 200-CW-3 OU and the waste sites in question. The primary judgment used in selecting sample locations/materials is field-screening results (e.g., detectable radioactive contamination as 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 the past).

1.6.1 Focused Sampling

Focused sampling designs are appropriate for waste characterization to ensure compliance with the receiving facilities' waste acceptance criteria, for confirmation of a conceptual model or remedy, and for evaluation of preliminary data to determine the need for further sampling and analysis. Statistical sampling designs will not be implemented for this portion of the sampling effort. Samples will be collected from site locations where existing analytical data, process knowledge, and field radiological surveys indicate maximum contamination, or "worst case," concentrations are expected to establish the maximum concentrations of the contamination. The number of samples, the depth of sampling, the types of samples, and their locations would be developed judgmentally based on site knowledge. Details of the focused sampling design are presented in Chapter 3.0.

1.6.2 Radiological Field Screening

For the sampling effort, field screening will be used to establish site radiological contamination levels. In addition, field screening for radiological contamination (Cs-137) may be used as an "indicator" to locate areas of chemical contamination. If field-screening results indicate the presence of radiological contamination, the areas can be further characterized with laboratory analytical samples. Further details regarding field screening are presented in Chapter 3.0.

1.7 WASTE DISPOSITION OPTIONS

Project activities will result in generation of waste. The majority of the contaminated media likely will be designated as low-level waste; however, quantities of mixed waste, dangerous waste, and solid waste not contaminated with hazardous substances may be generated.

Waste generated will be disposed at an appropriate disposal site, most likely the ERDF. Recycling and/or reuse options will be evaluated and implemented where possible to reduce the volume of material disposed.

Contaminated waste for which no reuse, recycle, or decontamination option is identified will be assigned an appropriate waste designation (e.g., solid, asbestos, polychlorinated biphenyl, radioactive, dangerous, or mixed) and disposed at an approved disposal location. For the purposes of this project, most of the contaminated waste generated during implementation of this project is assumed to be disposed onsite at the ERDF in accordance with the CERCLA onsite identification. Alternate potential disposal locations may be considered during the project if a suitable and cost-effective location is identified. Alternate potential disposal locations will be evaluated using appropriate performance standards to ensure that they are adequately protective of human health and the environment.

The ERDF is considered to be onsite under CERCLA for management and/or disposal of waste from this project. There is no requirement to obtain a permit to manage or dispose CERCLA waste at the ERDF. It is expected that the great majority of the waste generated during the project can be disposed of onsite at the ERDF. For waste that must be sent offsite, including the Central Waste Complex, the EPA must make a determination in accordance with 40 CFR 300.440, "National Oil and Hazardous Substances Pollution Contingency Plan," "Procedures for Planning and Implementing Off-Site Response Actions," regarding acceptability of the proposed disposal site for receiving this CERCLA remedial action waste. Because the Central Waste Complex is considered offsite for the management of CERCLA waste from this project, an offsite determination must be made by the EPA before shipment of project waste to the Central Waste Complex.

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2.0 QUALITY ASSURANCE PROJECT PLAN

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

- DOE O 414.1C, "Quality Assurance"
- 10 CFR 830, Subpart A, "Quality Assurance Requirements"
- EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*, EPA QA/R-5, as amended (EPA 2001).

The following sections describe the quality requirements and controls applicable to this investigation. Correlation between EPA/240/B-01/003 (QA/R-5) (EPA 2001) requirements and this SAP is provided in Table 2-1.

Table 2-1. Quality Assurance Crosswalk.

EPA QA/R-5 Criteria	EPA QA/R-5 Title	Reference Section
Project Management	Project/Task Organization	2.1, 2.1.1
	Problem Definition and Background	1.0, 1.1, 1.2
	Project Task Description	1.0, 1.1, 1.2
	Quality Objectives and Criteria	1.5, 2.3
	Training/Qualifications	2.1.2
	Documents and Records	2.6, 2.7, 3.4
Data Generation and Acquisition	Sample Process Design	1.6, 3.1, 3.2
	Sampling Methods	1.6, 3.1, 3.3, Table 3-1
	Sample Handling and Custody	2.4, Table 2-3, 3.4
	Analytical Methods	2.3, Table 2-2
	Quality Control	2.2, 2.3, Table 3-1
	Instrument/Equipment Testing, Inspection and Maintenance	2.3.1
	Instrument/Equipment Calibration and Frequency	2.3.1, 2.5, 2.7
	Inspection and Acceptance of supplies and consumables	2.3.1
	Non Direct Measurement/Direct Measurement	1.4, Table 2-2
	Data Management	2.6
Assessment and Oversight	Assessment and Response Actions	2.5.2
	Reports to Management	2.5.3

Table 2-1. Quality Assurance Crosswalk.

EPA QA/R-5 Criteria	EPA QA/R-5 Title	Reference Section
Data Validation and Usability	Data Review, Verification and Validation	2.6
	Verification and Validation Methods	2.7
	Reconciliation with User Requirements	2.8

EPA = U.S. Environmental Protection Agency

2.1 PROJECT MANAGEMENT

The following subsections address the basic areas of project management and will ensure that the 200-CW-3 OU Waste Site Remediation project has a defined goal, the participants understand the goal and the approach to be used, and the planned outputs have been appropriately documented.

2.1.1 Project/Task Organization

The primary contractor, or its approved subcontractor, will be responsible for collecting, packaging, and shipping soil and other media samples to the laboratory. The project organization, in regard to sampling and characterization, is described in the subsections that follow and is shown graphically in Figure 2-1. With the exception of the DOE Remedial Project Manager, all other roles and responsibilities are completed by the primary contractor or its approved subcontractor. Note: For each functional primary contractor role, there is a corresponding oversight role within DOE.

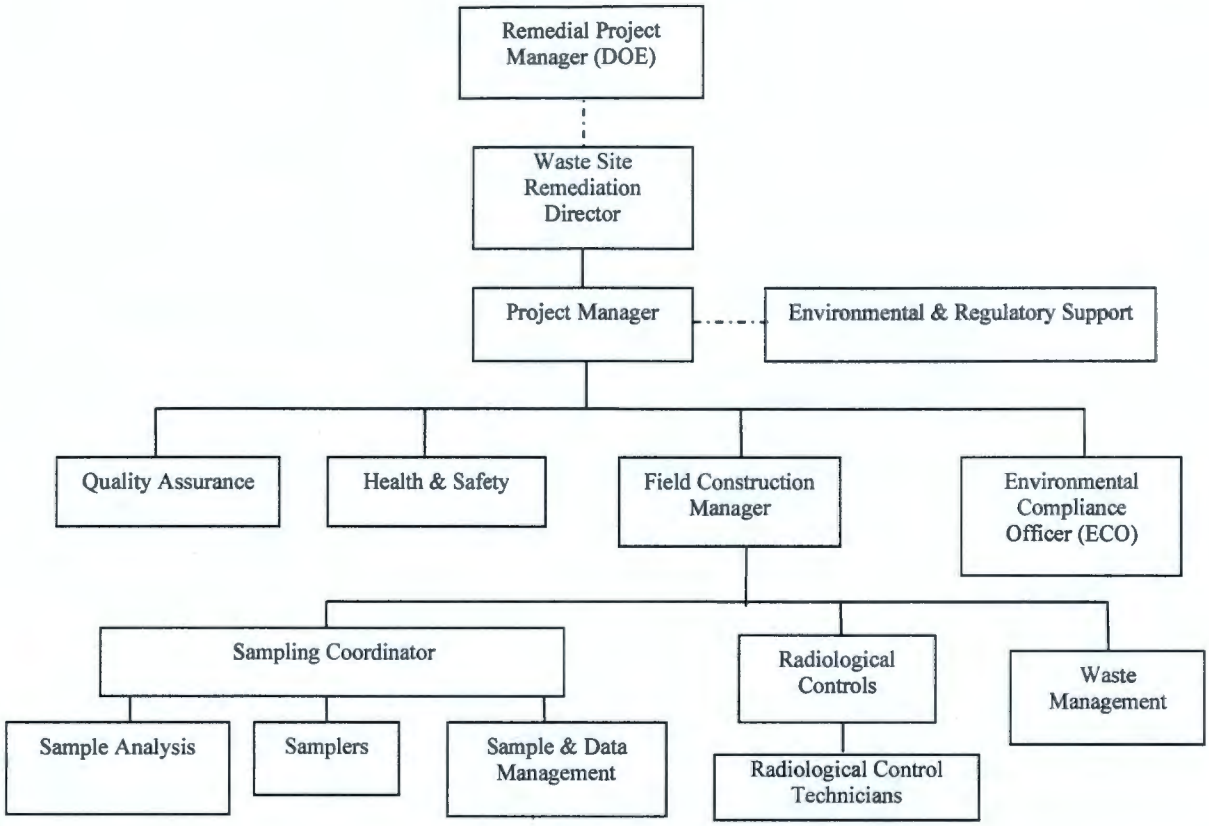

Figure 2-1. Project Organization.

2.1.1.1 Remedial Project Manager

The Remedial Project Manager directs response efforts and coordinates all other efforts for this remedial action per 40 CFR 300.120. Therefore, changes to the field sampling plan may be made in the field by the designated Remedial Project Manager.

2.1.1.2 Waste Site Remediation Director

The Director of Waste Site Remediation provides oversight for all activities and coordinates with U.S. Department of Energy, Richland Operations Office (DOE-RL), regulators, and primary contractor management in support of sampling activities. In addition, support is provided to the 200-CW-3 OU Project Manager to ensure that the work is performed safely and cost-effectively.

2.1.1.3 200-CW-3 Operable Unit Project Manager

The 200-CW-3 OU Project Manager is responsible for direct management of sampling documents and requirements, field activities, and subcontracted tasks. The 200-CW-3 OU Project Manager ensures that the Field Construction Manager, Sampling Coordinator, Samplers, and others responsible for implementation of this SAP and QAPjP are provided with current copies of this document and any revisions thereto. The 200-CW-3 OU Project Manager also works closely with the Quality Assurance and Health and Safety organizations and the Field Construction Manager to integrate these and the other lead disciplines in planning and implementing the workscope. The 200-CW-3 OU Project Manager also

coordinates with, and reports to DOE-RL, the regulators, and primary contractor management on all sampling activities.

2.1.1.4 Quality Assurance

The Quality Assurance Lead is matrixed to the 200-CW-3 OU Project Manager and is responsible for quality assurance (QA) issues on the project. Responsibilities include oversight of implementation of the project QA requirements; review of project documents, including DQO summary reports, SAPs, and the QAPjP; and participation in QA assessments on sample collection and analysis activities, as appropriate.

2.1.1.5 Health and Safety

The Health and Safety organization responsibilities include coordination of industrial safety and health support within the project as carried out through health and safety plans, job hazard analyses, and other pertinent safety documents required by Federal regulation or by internal primary contractor work requirements. In addition, assistance is provided to project personnel in complying with applicable health and safety standards and requirements. Personnel protective clothing requirements are coordinated with Radiological Controls Lead.

2.1.1.6 Field Construction Manager

The Field Construction Manager has the overall responsibility for supporting the Sampling Coordinator in the planning, coordination, and execution of field characterization activities. Responsibilities also include directing training, mock-ups, and practice sessions with field personnel to ensure that the sampling design is understood and can be performed as specified. The Field Construction Manager communicates with the 200-CW-3 OU Project Manager to identify field constraints that could affect the sampling design. In addition, the Field Construction Manager directs the procurement and installation of materials and equipment needed to support the field work.

2.1.1.7 Environmental and Regulatory Support

The Environmental and Regulatory Support Lead is responsible for the performance of EPA's 7-step DQO process that, for this project, results in the development of the sampling design. Responsibilities include development and documentation of the sampling DQOs and sampling and analysis plan, which includes the sampling design and associated presentations and the resolution of technical issues. The Environmental and Regulatory Support Lead also supports the Data Quality Assessment process as described in Section 2.8.

2.1.1.8 Environmental Compliance Officer

The Environmental Compliance Officer provides technical oversight, direction and acceptance of project and subcontracted environmental work and develops appropriate mitigation measures with a goal of minimizing adverse environmental impacts. The Environmental Compliance Officer also reviews plans, procedures and technical documents to ensure that all environmental requirements have been addressed, identifies environmental issues that affect operations and develops cost effective solutions, and responds to environmental/regulatory issues or concerns raised by DOE and/or regulatory agency staff.

2.1.1.9 Sampling Coordinator

The Sampling Coordinator's specific responsibilities include conversion of the sampling design requirements into field task instructions that provide specific direction for field activities. The Sampling Coordinator also provides oversight of the Sample and Data Management Organization and the Field

Samplers, develops and oversees the implementation of the Letter of Instruction to the Sample Analysis Contractor, and oversees data validation.

The **Sample and Data Management Organization** selects the laboratories that perform the analyses. This organization also ensures that the laboratories conform to Hanford Site internal laboratory quality assurance requirements, or their equivalent, as approved by DOE-RL, the EPA, and the Washington State Department of Ecology (Ecology). Sample and Data Management receives the analytical data from the laboratories, performs the data entry into the *Hanford Environmental Information System* (HEIS), and arranges for data validation.

The **Samplers** collect all samples, including replicates/duplicates and prepare all sample blanks according to the sampling and analysis plan and corresponding field procedures and work packages. The Samplers also complete the field logbook and chain-of-custody forms, as well as any shipping paperwork. The Samplers also deliver the samples to the analytical laboratory.

The **Sample Analysis Organization** analyzes samples in accordance with established procedures and provides necessary sample reports and explanation of results in support of data validation.

2.1.1.10 Radiological Controls

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

2.1.1.11 Waste Management

The Waste Management Lead communicates policies and procedures and ensures project compliance for storage, transportation, disposal, and waste tracking in a safe and cost-effective manner. Other responsibilities include identifying waste management sampling/characterization requirements to ensure regulatory compliance and interpreting the characterization data to generate waste designations, profiles, and other documents that confirm compliance with waste acceptance criteria.

2.1.2 Training Requirements

Typical training requirements or qualifications have been instituted by the primary contractor management team to meet training requirements imposed by the Project Hanford Management Contract, regulations, DOE Orders, DOE contractor requirements documents, American National Standards Institute/American Society of Mechanical Engineers, *Washington Administrative Code*, etc. For example:

- Training requirements or qualifications needed by sampling personnel will be in accordance with quality assurance requirements.

- The environmental, safety and health training program provides workers with the knowledge and skills necessary to safely execute assigned duties. Field personnel typically will have completed the following training before starting work:
  - Occupational Safety and Health Administration 40-hour hazardous waste worker training and supervised 24-hour hazardous waste site experience
  - 8-hour hazardous waste worker refresher training (as required)

- Hanford general employee radiation training
- Radiological worker training.

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

2.2 FIELD QUALITY CONTROL

Field quality control (QC) samples will be collected to evaluate the potential for cross-contamination and to provide information pertinent to field variability. Field QC for sampling in the Central Plateau will require the collection of field duplicates, trip and/or field blanks, and equipment blanks. The QC samples and the required frequency for collection are described in Table 3-1.

2.2.1 Field Duplicates

Field duplicate samples are used to evaluate sample consistency and the precision of field sampling methods. Field duplicates will be collected when conducting discrete or focused sampling.

2.2.2 Field and/or Trip Blanks

Field and/or Trip Blanks are collected, containerized and handled in the same manner as the samples. These blanks can be used to indicate sample contamination throughout the entire process (a field blank) or just the shipment process (a trip blank). Field and trip blanks will consist of silica sand, or other appropriate media, placed in containers and analyzed the same as the samples they correspond with.

2.2.3 Equipment Blanks

Equipment blanks are collected for any soil-sampling device that is reused. Equipment blanks will consist of silica sand or deionized water poured over the decontaminated sampling equipment and placed in containers, as identified on the project Sampling Authorization Form. Equipment blanks will be analyzed the same as the samples they correspond with.

If disposable (i.e., single-use) equipment is used, equipment blanks will not be required.

2.2.4 Prevention of Cross-Contamination

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

- Improperly storing or transporting sampling equipment and sample containers
- Contaminating the equipment or sample bottles by setting the equipment/sample bottle on or near potential contamination sources (e.g., uncovered ground)
- Handling bottles or equipment with dirty hands or gloves
- Improperly decontaminating equipment before sampling or between sampling events.

2.3 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Quality objectives and criteria for soil measurement data are presented in Table 2-2 for all analytes. The ability to meet the detection limit requirements is dependant on the amount of sample obtained and matrix interferences.

2.3.1 Measurement and Testing Equipment

Measurement and testing equipment used in the field or in the laboratory that directly affects the quality of analytical data will be subject to preventive maintenance measures to ensure minimization of measurement system downtime. Laboratories and onsite measurement organizations must maintain and calibrate their equipment. Maintenance requirements (such as parts lists and documentation of routine maintenance) will be included in the individual laboratory and the onsite organization QA plan or operating procedures (as appropriate). Calibration of laboratory instruments will be performed in a manner consistent with SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods* (EPA 1999b), as amended, or with auditable DOE Hanford Site and contractual requirements. Calibration of radiological field instruments is discussed in Section 2.7.

Consumables, supplies, and reagents will be reviewed per SW-846 (EPA 1999b) requirements and will be appropriate for their use. Note that contamination is monitored by the QC samples discussed in Section 2.3.3.

Table 2-2. Analytical Performance Requirements.

Data Type	Analyte	Analytical Method	Detection Limit Requirements[a]	Accuracy Req't (% Recovery)	Precision Req't (%RPD)
Performance Requirements for Laboratory Measurements (Radiological)					
Rad	Am-241	AmAEA	1 pCi/g	70-130	30
Rad	Co-60	GEA	0.05 pCi/g	70-130	30
Rad	Cs-137	GEA	0.05 pCi/g	70-130	30
Rad	Eu-152	GEA	0.1 pCi/g	70-130	30
Rad	Eu-154	GEA	0.1 pCi/g	70-130	30
Rad	Eu-155	GEA	0.1 pCi/g	70-130	30
Rad	Ni-63	Chemical separation/liquid scintillation	30 pCi/g	70-130	30
Rad	Pu-238	PuAEA	1 pCi/g	70-130	30
Rad	Pu-239/240	PuAEA	1 pCi/g	70-130	30
Rad	Sr-90	Sr-Gas Proportional Counter	1 pCi/g	70-130	30
Rad	Tc-99	Chemical separation/liquid scintillation	1 pCi/g	70-130	30
Rad	Th-232	ICP-MS (converted from µg/kg to pCi/g)	1 pCi/g	70-130	30
Rad	H-3	Distillation/liquid scintillation	30 pCi/g	70-130	30
Rad	U-233/234	UAEA	1 pCi/g	70-130	30
Rad	U-235	UAEA	1 pCi/g	70-130	30
Rad	U-238	UAEA	1 pCi/g	70-130	30

Table 2-2. Analytical Performance Requirements.

Data Type	Analyte	Analytical Method	Detection Limit Requirements[a]	Accuracy Req't (% Recovery)	Precision Req't (%RPD)
Performance Requirements for Field Measurements (Radiological)					
Rad	Gross alpha	Portable contamination detector	100 d/min/ 100 cm^2	N/A	N/A
Rad	Gross beta/gamma	Portable contamination detector	5,000 d/min/ 100 cm^2	N/A	N/A
Performance Requirements for Laboratory Measurements (Nonradiological)					
Chem	As	EPA 6010/200.8	0.5 mg/kg	70-130	30
Chem	Ba	EPA 6010/200.8	0.2 mg/kg	70-130	30
Chem	Cd	EPA 6010/200.8	0.1 mg/kg	70-130	30
Chem	Cr	EPA 6010/200.8	1 mg/kg	70-130	30
Chem	Cr(VI)	EPA 7196	0.5 mg/kg	70-130	30
Chem	Pb	EPA 6010/200.8	0.5 mg/kg	70-130	30
Chem	Hg	EPA 6010/200.8	0.05 mg/kg	70-130	30
Chem	Mn	EPA 6010/200.8	0.5 mg/kg	70-130	30
Chem	Sb	EPA 6010/200.8	0.6 mg/kg	70-130	30
Chem	Zn	EPA 6010/200.8	1 mg/kg	70-130	30
Chem	Polychlorinated biphenyls (per Aroclors)	EPA 8082	0.5 mg/kg	50-150	30

[a] Detection limit requirements are taken from DOE/RL-99-58.

NOTE: Accuracy criteria for associated batch laboratory control sample percent recoveries. With the exception of GEA, additional analysis-specific evaluations also are performed for matrix spikes, tracers, and carriers as appropriate to the method. Precision criteria for batch laboratory replicate sample analyses. Precision criteria for batch laboratory sample replicate and matrix spike replicate determinations are only applicable when results are greater than 5 to 10 times the method detection limit.

NOTE: Accuracy criteria for associated batch matrix spike percent recoveries. Evaluation based on statistical control of laboratory control samples also is performed. Precision criteria for batch laboratory replicate matrix spike analyses or replicate sample analyses. Compounds spiked in the laboratory control sample or matrix spike are those specified in SW-846 (EPA 1999b). Criteria based on laboratory statistical control limits are acceptable. Precision criteria for batch laboratory sample replicate and matrix spike replicate determinations are only applicable when results are greater than 5 to 10 times the method detection limit.

AEA = alpha energy analysis.
d/min = disintegrations per minute.
EPA = U.S. Environmental Protection Agency.
GEA = gamma energy analysis.

2.3.2 Laboratory Sample Custody

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

2.3.3 Quality Assurance Objective

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

2.3.3.1 Representativeness

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

2.3.3.2 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using standard procedures, consistent methods, and consistent units. Table 2-2 lists applicable fixed laboratory methods for analytes and target detection limits. Actual detection limits will depend on the sample matrix and the sample quantity available. Data will be reported as defined for specific samples.

2.3.3.3 Accuracy

Accuracy is an assessment of the closeness of the measured value to the true value. Radionuclide measurements that require chemical separations use this technique to measure method performance. For radionuclide measurements that are analyzed by gamma spectroscopy, laboratories typically compare results of blind audit samples against known standards to establish accuracy. Validity of calibrations are evaluated by comparing results from the measurement of a standard to known values and/or by generation of in-house statistical limits based on three standard deviations (+/- 3s). Table 2-2 lists the accuracy provided for fixed laboratory analyses for the project.

2.3.3.4 Precision

Precision is a measure of the data spread when more than one measurement has been taken on the same sample. Precision can be expressed as the relative percent difference for duplicate measurements. Analytical precision for fixed laboratory analyses are listed in Table 2-2.

2.3.3.5 Completeness

Completeness is a measure of the amount of valid data obtained from the analytical measurement process and the complete implementation of defined field procedures.

2.3.3.6 Detection Limits

Detection limits are functions of the analytical method used to provide the data and the quantity of the sample available for analyses.

2.3.4 Laboratory Quality Control

The laboratory method blanks and laboratory control sample/blank spike are defined in Chapter 1 of SW-846 (EPA 1999b) and will be run at the frequency specified in Chapter 1 of SW-846 (EPA 1999b).

2.4 SAMPLE PRESERVATION, CONTAINERS, AND HOLDING TIMES

Soil sample preservation, containers, and holding times for the nonradiological and radiological analytes of interest and physical property tests are presented in Table 2-3. Final sample collection requirements will be identified on a sampling analysis form/chain-of-custody.

Table 2-3. Sample Preservation, Container, and Holding Time Guidelines.

Analytes	Matrix	Bottle		Preservation	Packing Requirements	Holding Time[a]
		Number	Type			
Radionuclides						
Americium-241	Soil	1	G/P	None	None	None
Thorium-232	Soil	1	G/P	None	None	None
Cesium-137	Soil	1	G/P	None	None	None
Cobalt-60	Soil	1	G/P	None	None	None
Europium-152	Soil	1	G/P	None	None	None
Europium-154	Soil	1	G/P	None	None	None
Europium-155	Soil	1	G/P	None	None	None
Nickel-63	Soil	1	G/P	None	None	None
Plutonium-238	Soil	1	G/P	None	None	None
Plutonium-239/240	Soil	1	G/P	None	None	None
Strontium-90	Soil	1	G/P	None	None	None
Technetium-99	Soil	1	G/P	None	None	None
Tritium-3	Soil	1	G/P	None	None	None
Uranium-233/234	Soil	1	G/P	None	None	None
Uranium-235	Soil	1	G/P	None	None	None
Uranium-238	Soil	1	G/P	None	None	None
Nonradionuclides						
PCBs	Soil	1	aG	None	Cool 4 °C	None
ICP metals	Soil	1	G/P	None	None	6 months
Mercury	Soil	1	G	None	None	28 days
Chromium (VI)	Soil	1	G	None	Cool 4 °C	1 month/4 days

[a] Where two numbers are indicated with a "/" in between, the first number is the time from sample collection to extraction, and the second number is after extraction through analysis.

aG = amber glass.
G = glass.
ICP = inductively coupled plasma.
P = plastic.
PCB = polychlorinated biphenyl.

2.5 ONSITE MEASUREMENTS QUALITY CONTROL

The collection of QC samples for onsite measurement QC is not applicable to the field-screening techniques described in this SAP. Field-screening instrumentation will be calibrated and controlled according to Section 2.7, as applicable.

2.5.1 Assessment/Oversight

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

2.5.2 Assessments and Response Action

The primary contractor regulatory compliance group may conduct random surveillance and assessments to verify compliance with the requirements outlined in this SAP, project work packages, procedures, and regulatory requirements.

Deficiencies identified by these assessments will be reported in accordance with existing programmatic requirements. Central Plateau Projects Quality Assurance coordinates the corrective actions/deficiencies in accordance with the primary contractor QA program. When appropriate, corrective actions will be taken by the 200-CW-3 OU Project Manager.

2.5.3 Reports to Management

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

2.6 DATA MANAGEMENT

Analytical data resulting from the implementation of this QAPjP will be managed and stored in accordance with the applicable programmatic requirements governing data management procedures. At the direction and discretion of the 200-CW-3 OU Project Manager, all analytical data packages will be subject to final technical review by qualified personnel before they are submitted to the regulatory agencies or included in reports. Electronic data access, when appropriate, will be via a database (e.g., HEIS or a project-specific database). Where electronic data are not available, hard copies will be available in accordance with Section 9.6 of the Tri-Party Agreement Action Plan (Ecology et al. 2003).

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

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

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

- Instructions regarding the minimum requirements for documenting radiological controls information as per 10 CFR 835, "Occupational Radiation Protection"
- Instructions for managing the identification, creation, review, approval, storage, transfer, and retrieval of primary contractor radiological records
- The minimum standards and practices necessary for preparing, performing, and retaining radiological-related records
- The indoctrination of personnel on the development and implementation of sample plans
- The requirements associated with preparing and transporting regulated material.

2.6.1 Resolution of Analytical System Errors

Errors reported by the laboratories are reported to the Sampling Coordinator, who initiates a Sample Disposition Record in accordance with primary contractor procedures. This process is used to document analytical errors and to establish resolution with the 200-CW-3 OU Project Manager. In addition, the primary contractor QA receives quarterly reports that provide summaries and summary statistics of the analytical errors.

2.7 VALIDATION AND VERIFICATION REQUIREMENT

Completed data packages will be validated by qualified primary contractor Sample and Data Management 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 evaluating and qualifying the results based on holding times, method blanks, laboratory control samples, laboratory duplicates, and chemical and tracer recoveries, as appropriate. No other validation or calculation checks will be performed.

Level C data validation as defined in the contractor's validation procedures, which are based on EPA functional guidelines (e.g., Bleyler 1988a, *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*; Bleyler 1988b, *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*), will be performed for up to 5 percent of the data by matrix and analyte group. Analyte group refers to radionuclides, semivolatiles, PCBs, metals, etc. The goal is to cover the various analyte groups and matrices during the validation.

When outliers or questionable results are identified in the data quality assessment, additional data validation will be performed. The additional validation will be up to 5 percent of the statistical outliers and/or questionable data. The additional validation will begin with Level C and may increase to Levels D and E as needed to ensure that the data are usable. Note that Level C validation is a review of the QC data, while Levels D and E include review of calibration data and calculations of representative samples from the dataset. All data validation will be documented in data validation reports. An example of questionable data is the positive detections greater than the practical quantitation limit or reporting limit in soil from a reference site that should not have exhibited contamination. Similarly, results below background would not be expected and could trigger a validation inquiry. With the exception of "R" qualified or rejected data, all data will be used.

At least one data validation package will be generated. Validation requirements identified in this section are consistent with Level C validation, as defined in data validation procedures. Relative to analytical data in sample media, physical data and/or field screening results are of lesser importance in making inferences of risk. Because of the secondary importance of such data, no validation for physical property data and/or field screening results will be performed. However, field QA/QC will be reviewed to ensure that the data are useable. Field instrumentation, calibration, and QA checks will be performed in accordance with the following.

- Calibration of radiological field instruments on the Hanford Site is performed under contract by Pacific Northwest National Laboratory, as specified in their program documentation.

- Daily calibration checks will be performed and documented for each instrument used to characterize areas that are under investigation. These checks will be made on standard materials that are sufficiently like the matrix under consideration that direct comparison of data can be made. Analysis times will be sufficient to establish detection efficiency and resolution.

The approval of field-data collection plans by the Radiological Controls organization represents the data validation and usability review for handheld field radiological measurements.

For the use of hand-held global positioning systems (GPS), auto-calibration is based on satellite positioning and manufacturer's instructions. GPS field instrumentation will comply with the National Marine Electronic Association standards, and will be accurate to within one foot of each excavated area.

2.8 DATA QUALITY ASSESSMENT

The Data Quality Assessment (DQA) process compares completed field sampling activities to those proposed in corresponding sampling documents and provides an evaluation of the resulting data. The purpose of the data evaluation is to determine if quantitative data are of the correct type and are of adequate quality and quantity to meet the project DQOs. The U.S. Environmental Protection Agency DQA process, EPA/600/R-96/084, *Guidance for Data Quality Assessment* (EPA 2000b), identifies five steps for evaluating data generated from this project, as summarized below:

Step 1. Review Data Quality Objectives and Sampling Design. This step requires a comprehensive review of the sampling and analytical requirements outlined in the project-specific DQO summary report and SAP.

Step 2. Conduct a Preliminary Data Review. In this step, a comparison is made between the actual QA/QC achieved (e.g., detection limits, precision, accuracy, completeness) and the requirements determined during the DQO. Any significant deviations will be documented. Basic statistics will be calculated from the analytical data at this point, including an evaluation of the distribution of the data.

Step 3. Select the Statistical Test. Using the data evaluated in Step 2, select appropriate statistical hypothesis tests or graphical data analyses and justify this selection.

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

Step 5. Draw Conclusions from the Data. The analyses are applied in this step, and the results will be used to select among four possible outcomes for each COPC.

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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 the 200-CW-3 OU Waste Site Remediation project decisions. The field sampling plan uses the sampling approaches developed in the DQO process (BHI-01249) and subsequent workshops with DOE-RL, EPA, and Ecology as the basis for the site-specific sampling plan presented in the following sections. The overall sampling strategy is outlined in Table 3-1. Changes to the field sampling plan may be made in the field by the designated Remedial Project Manager.

3.1.1 Radiological Field Measurements

Surface Radiation Survey. A surface radiation survey will be performed on the soil 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 radiological control technicians. A survey report will be prepared documenting the results of each survey. Post-sampling surveys also will be performed at each sampling site to ensure that sampling activities have not contributed to surface contamination.

Radiological Screening. For the sampling effort at the 200-CW-3 OU Waste Site excavations, field screening will be used to establish site radiological contamination levels. In addition, field screening for radiological contamination will be used as an indicator to locate areas of chemical contamination, because process knowledge shows that discharges to the 200-CW-3 OU Waste Sites contained both radiological and chemical constituents. At each foot in depth, starting at the surface and descending down to 15 feet for each test pit in a waste site, the soil in each excavator bucket will be radiologically screened using field survey instruments. If field-screening results indicate the presence of cesium-137 or strontium-90, the areas with the highest levels of contamination will be further characterized with analytical samples to identify the contaminant(s) levels.

The screening results will be documented in a radiological survey report and in the Work Instruction for waste sites that do not meet the Removal, Treatment and Disposal remedy.

Table 3-1. 200-CW-3 Operable Unit Waste Site Remediation Sampling Plan.

Waste Site(s)	Data Needs	Recommended Sampling Approach	Location and Number of Samples	COPCs
216-N-1, 216-N-4, and 216-N-6	Radiological and chemical data for characterization for waste disposal, for confirmation of the conceptual model/remedy, or for preliminary investigation to determine the need for further sampling and analysis for these waste sites.	• Utilize a GPS system to document coordinates for each sample location. • Perform geoprobe (i.e. direct push technique), test pits, or another comparable sampling technique, sampling down to a depth of 15 feet. • Perform field radiological survey(s) of sample(s) collected from each test pit or direct push at every foot in depth (or other sampling technique); document results, including depth of sample collection. • Using Cs-137 or Sr-90 (as appropriate) as an indicator, collect soil samples as specified under the **Location and Number of Samples** column. • Excavate and use radiological field screening techniques to determine the extent of contamination spread within each waste site in support of future remedial actions. Conduct screening using the same techniques and documentation as for the focused samples collected, including GPS coordinates. • Photographs of the sampling activities may be used for documentation purposes. • A radiological survey report will be prepared to document the field information gathered.	Collect ten focused soil samples. Collect five of the samples at highest field radiological survey reading from each waste site and collect the other five samples at the 15-foot level starting at the outfall for the discharge point. QC Samples: Collect one duplicate sample for each of the three waste sites plus one field blank and one trip blank for laboratory analysis from the combination of all three waste sites. In addition, collect 1 equipment blank for each waste site for laboratory analysis.	All radiological and chemical constituents listed in Table 1-1, unless otherwise specified. NOTE: For the trip blank, only analyze for tritium.
200-N-3	Radiological and chemical data for characterization for waste disposal, for confirmation of the conceptual model/remedy, or for preliminary investigation to determine the need for further sampling and	• Utilize a GPS system to document coordinates for each sample location. • Perform test pit sampling technique or another comparable sampling technique, sampling down to a depth of 15 feet. • Perform field radiological survey(s) of sample(s) collected from each test pit or direct push at every foot in depth (or other sampling technique); document results, including depth of sample collection. • Using Cs-137 or Sr-90 (as appropriate) as	Collect two focused soil samples. Collect one of the samples at the highest field radiological survey reading or for an area with visual staining from a spill or release for the waste site and collect the other sample at the 15-foot level in the middle of the waste site. NOTE: If no radiological contamination is detected during field screening, and no visual soil staining is found, then only one	All radiological and chemical constituents listed in Table 1-1, unless otherwise specified.

Table 3-1. 200-CW-3 Operable Unit Waste Site Remediation Sampling Plan.

Waste Site(s)	Data Needs	Recommended Sampling Approach	Location and Number of Samples	COPCs
	analysis for this waste site.	an indicator, collect soil samples as specified under the **Location and Number of Samples** column. • Excavate and use radiological field screening techniques to determine the extent of contamination spread within the waste site in support of future remedial actions. Conduct screening using the same techniques and documentation as for the focused samples collected, including GPS coordinates. • Photographs of the sampling activities may be used for documentation purposes. • A radiological survey report will be prepared to document the field information gathered.	sample will be collected at the 15-foot level. QC Samples: Collect one duplicate sample for the waste site plus one field blank and one trip blank for laboratory analysis. In addition, collect 1 equipment blank for the waste site for laboratory analysis	NOTE: For the trip blank, only analyze for tritium.
UPR-200-N-1 and UPR-200-N-2	Radiological and chemical data for characterization for waste disposal, for confirmation of the conceptual model/remedy, or for preliminary investigation to determine the need for further sampling and analysis for these waste sites.	• Utilize a GPS system to document coordinates for each sample location. • Perform geoprobe (i.e. direct push technique), test pits, or another comparable sampling technique, sampling down to a depth of 15 feet. • Perform field radiological survey(s) of sample(s) collected from each test pit or direct push at every foot in depth (or other sampling technique); document results, including depth of sample collection. • Using Cs-137 or Sr-90 (as appropriate) as an indicator, collect soil samples as specified under the **Location and Number of Samples** column. • Excavate and use radiological field screening techniques to determine the extent of contamination spread within each waste site in support of future remedial actions. Conduct screening using the same techniques and documentation as for the focused samples collected, including GPS coordinates.	For UPR-200-N-1, collect four focused soil samples. Collect two of the samples at the highest field radiological survey reading from the waste site and collect the other two samples at the 15-foot level starting in the middle of the waste site for one sample and closest to the building for the second sample. For UPR-200-N-2, collect two focused soil samples. Collect one of the samples at the highest field radiological survey reading from the waste site and collect the other sample at the 15-foot level starting in the middle of the waste site. QC Samples: Collect one duplicate sample for each waste site, plus one field blank and one trip blank for laboratory analysis for each waste site. In addition, collect 1 equipment blank for each waste site.	All radiological and chemical constituents listed in Table 1-1, unless otherwise specified. NOTE: For the trip blank, only analyze for tritium.

Table 3-1. 200-CW-3 Operable Unit Waste Site Remediation Sampling Plan.

Waste Site(s)	Data Needs	Recommended Sampling Approach	Location and Number of Samples	COPCs
		• Photographs of the sampling activities may be used for documentation purposes. • A radiological survey report will be prepared to document the field information gathered.		
600-285-PL, 600-286-PL and 600-287-PL	Radiological and chemical data for characterization for waste disposal, for confirmation of the conceptual model/remedy, or for preliminary investigation to determine the need for further sampling and analysis for these waste sites.	• Utilize a GPS system to document coordinates for each outfall pipe end location. • Perform excavation to locate the outfall end of each pipeline. • Perform field radiological survey(s) using Cs-137 or Sr-90 (as appropriate) as an indicator, for each pipeline outfall end and collect sample(s) from each pipeline; document results. • Collect samples as specified under the **Location and Number of Samples** column. • If possible, also collect smear samples from the manhole for each pipeline for field screening with GPS readings identifying the coordinates for each manhole. • Photographs of the sampling activities may be used for documentation purposes. • A radiological survey report will be prepared to document the field information gathered.	Collect one focused pipe sample at each pipeline outfall for the highest field radiological survey reading. QC Samples: Split each focused sample from each pipeline waste site into two samples to use as duplicates. In addition, for the combined pipeline waste sites utilize one field blank, one trip blank and 1 equipment blank for laboratory analysis.	All radiological and chemical constituents listed in Table 1-1, unless otherwise specified.

COPCs = contaminants of potential concern.
GPS = global positioning systems.
WSCF = Waste Sampling and Characterization Facility.

Before sampling begins, a local background activity reading will be taken at a location selected in the field near the waste site. Field screening will be used to identify detectable radiological contamination, adjust sampling points if needed, assist in determining sample shipping requirements, determine equipment/personnel decontamination needs, and support worker health and safety monitoring.

Field-screening instruments will be used, maintained, and calibrated in accordance with the instrument program, manufacturers' specifications, and other approved procedures. Field screening instruments include the Geiger-Mueller meter, Portable Alpha meter and portable Sodium Iodide detector.

3.1.2 Media Sampling and Analysis

For waste designation and profiling, and for remedy confirmation or the need for further investigation of the 200-CW-3 OU Waste Site, soil test pits or another comparable sampling technique will be used. Samples will be collected from site locations where existing analytical data, process history, and/or field survey results indicate maximum contamination, or "worst case," concentrations. These results will establish the maximum concentrations of the contamination.

3.2 SAMPLING LOCATIONS AND FREQUENCY

Table 3-1 lists the sampling techniques and the samples required for the 200-CW-3 OU Waste Site Remediation project. Table 3-1 also summarizes the number of samples required for each location or media. While it is expected that the sample locations will be sampled only once, all the sites or media are accessible and additional sampling may be conducted as described in an approved Work Instruction if the initial results prove to be insufficient to support site remediation decisions.

3.3 SAMPLING PROCESSES

The sampling processes to be conducted in the field shall be implemented consistent with the requirements outlined in the *Hanford Federal Facility Agreement and Consent Order Action Plan* (Tri-Party Agreement) (Ecology et al. 2003), Section 7.8, "Quality Assurance." The project will use the Sampling and Mobile Laboratory organization or other approved sampling organization to perform the sample collection associated with the 200-CW-3 OU Waste Site Remediation project. The approved sampling organization will perform the sample collection activities in accordance with established instructions for sample collection, collection equipment, and sample handling.

3.4 SAMPLE MANAGEMENT

Sample and data management activities will be performed in accordance with the prime contractor quality assurance program. Sample preservation, container, and holding-time requirements will be indicated on Chain-of-Custody/Sample Analysis Request forms in accordance with SW-846 (EPA 1999b), and the specific analytical method prepared for specific sample events.

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

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
- Sample weight
- Preservation method, if applicable.

Field Sampling Log. All information pertinent to field sampling and analysis will be recorded in bound logbooks in accordance with SW-846 (EPA 1999b). 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 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.

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 Coordinator/Field Samplers can send smaller volumes to the laboratory after consultation with Sample and Data Management to determine acceptable volumes. Final container types and volumes will be provided by the Waste Sampling and Characterization Facility (WSCF) and the Sampling and Mobile Laboratory organization.

Sample Shipping. A radiological control technician will survey each sample jar to verify that the container is free of smearable surface contamination. The radiological control technician 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 millirem per hour. Activity level determinations will be made by utilizing dose rates, and ratioed against a bounding isotopic distribution or transported in accordance with provisions in an approved sample routine radiological shipping record. 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 Sample and Data Management within 24 hours of shipping.

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

4.0 HEALTH AND SAFETY

All field operations will be performed in accordance with prime contractor health and safety requirements outlined in a site-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 reference applicable radiological control requirements.

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

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5.0 MANAGEMENT OF WASTE

All waste (including unexpected waste) generated by sampling activities will be managed in accordance with the waste management portion of the *Remedial Design/Remedial Action Work Plan for200 North Area Waste Sites Located in the 200-CW-3 Operable Unit*, DOE/RL-2007-55. Unused samples and associated laboratory waste for the analysis will be dispositioned in accordance with the laboratory contract and agreements for return to the project site. Pursuant to 40 CFR 300.440, EPA Unit Manager approval is required before returning unused samples or waste from offsite laboratories.

In addition, EPA Unit Manager approval is required before shipping sample waste from Hanford onsite laboratories (e.g., 222-S Analytical Laboratories or WSCF) back to the waste site of origination.

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