DOE/RL-2016-25
Draft A

Sampling and Analysis Plan for Removal of the 236Z and 242Z Slabs

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

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

P.O. Box 1600
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Sampling and Analysis Plan for Removal of the 236Z and 242Z Slabs

Document Type: PLAN Program/Project: PFP Closure

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Date Published
July 2016

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APPROVED
By Janis Aardal at 4:14 pm, Jul 13, 2016

Release Approval Date

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Printed in the United States of America

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Terms

AEA	alpha energy analysis
ALARA	as low as reasonably achievable
ASTM	American Society for Testing and Materials
CAS	Chemical Abstracts Service
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CHPRC	CH2M HILL Plateau Remediation Company
D4	deactivation, decontamination, decommissioning, and demolition
DOE	U.S. Department of Energy
DOE-RL	DOE Richland Operations Office
DQA	data quality assessment
DQI	data quality indicator
DQO	data quality objective
EB	equipment rinsate blank
ECO	environmental compliance officer
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FTB	full trip blank
FWS	field work supervisor
FXR	field transfer blank
G/P	glass/plastic
HASQARD	*Hanford Analytical Services Quality Assurance Requirements Document* (DOE/RL-96-68)
HEIS	Hanford Environmental Information System
ICP	inductively coupled plasma
ICP-MS	inductively coupled plasma-mass spectrometry
N/A	not applicable
NDA	nondestructive assay
PFP	Plutonium Finishing Plant

QA	quality assurance
QAPjP	quality assurance project plan
QC	quality control
RAWP	removal action work plan
RCRA	*Resource Conservation and Recovery Act of 1976*
RCT	radiological control technician
RPD	relative percent difference
SAP	sampling and analysis plan
SMR	Sample Management and Reporting
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989a)
TRU	transuranic
VOA	volatile organic analysis
VOC	volatile organic compound
WIDS	Waste Information Data System

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1 Introduction

The scope of this sampling and analysis plan (SAP) is the removal and disposal of the Hanford Site Plutonium Finishing Plant (PFP) 236Z and 242Z Building concrete slabs and associated soil (Figures 1-1 and 1-2). The slabs are the floors of the buildings that will remain after demolition of the above-grade structures. Removal of the slabs is expected to reduce hazards during the surveillance and maintenance phase and will support the final remedial action.[1] Additional parts of the foundation for these buildings may be left in place.

The objective of this slab removal SAP is to provide the characterization information necessary to safely remove the slabs and associated soils and debris, to compliantly dispose the removed materials, and to prepare for follow-up remedial actions. These objectives were identified using the data quality objective (DQO) process, which is discussed in Section 1.2.

The strategy presented in this SAP will help to obtain additional characterization information that will be used for the following purposes:

- To identify the controls necessary to protect workers during slab removal
- To make waste management decisions
- To develop waste profiles for waste disposed to the Hanford Site Environmental Restoration Disposal Facility (ERDF), or other approved and appropriate treatment/disposal facility if needed
- To provide additional waste site information for entry of the remaining soil footprint into the Waste Information Data System (WIDS)

1.1 Background

The U.S. Department of Energy (DOE), Richland Operations Office (DOE-RL) determined that a *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) removal action was warranted to mitigate the potential risk to human health and the environment presented by the inactive PFP structures. DOE-RL was delegated with the authority to conduct removal actions under Section 104 of CERCLA by Executive Order 12580, *Superfund Implementation*.

The structures included in this removal action scope were evaluated in DOE/RL-2004-05, *Engineering Evaluation/Cost Analysis for the Plutonium Finishing Plant Above-Grade Structures*. These removal activities (which include deactivation, decontamination, decommissioning, and demolition [D4]) are authorized in DOE/RL-2005-13, *Action Memorandum for the Plutonium Finishing Plant Above-Grade Structures Non-Time Critical Removal Action*.

A removal action work plan (RAWP) (DOE/RL-2011-03, *Removal Action Work Plan for the Deactivation, Decontamination, Decommissioning, and Demolition of the Plutonium Finishing Plant Complex*) was prepared to complete the D4 activities that support the non-time-critical removal action for PFP above-grade structures. DOE-RL and the lead regulatory agency, the Washington State Department of Ecology (Ecology), amended the RAWP to incorporate removal of the 236Z and 242Z Building slabs to achieve the removal action objective to reduce the potential for contaminant migration to the environment. For the 236Z/242Z slabs, controls for safe removal and disposal will be established during

[1] For the purposes of this SAP, removal of the slabs includes removing the building floor; it may also include approximately 0.9 m (3 ft) of underlying soils, if necessary.

D4 activities. Sampling will be performed as needed to ensure proper slab disposal and to ensure the remaining footprint will be left in a protective state that would not preclude future remediation.

1.2 Data Quality Objectives Summary

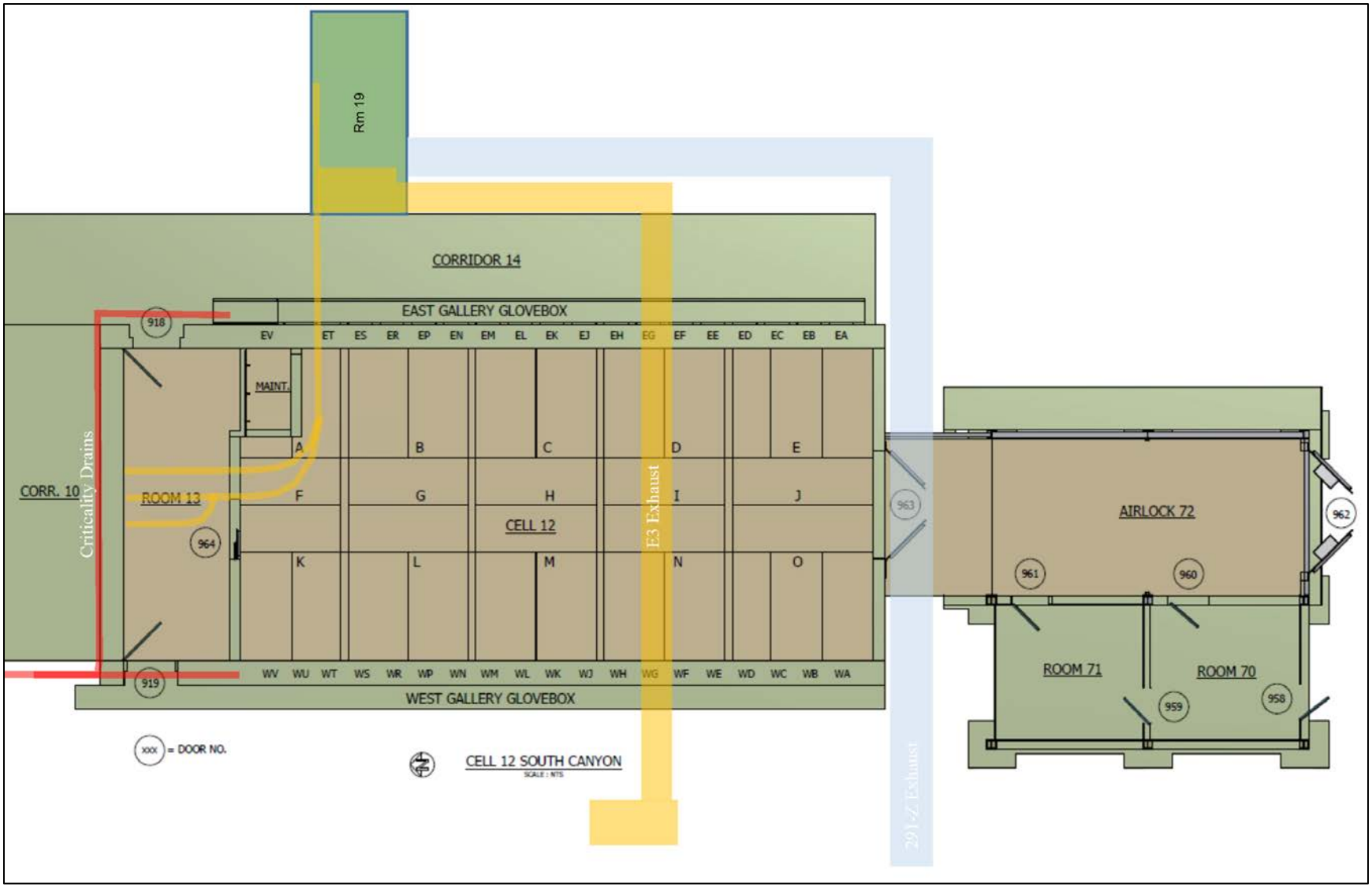
The DQO process is a strategic planning approach used to define the data collection design criteria to ensure that the type, quantity, and quality of data are appropriate for the intended application. The DQO process was used to support the sample design presented in the SAP.

Consistent with DOE/RL-2004-05, the PFP structures are no longer required to support Hanford Site operations and are undergoing/will undergo D4 activities. Sufficient information must be obtained so the slabs can be safely removed and disposed of under the D4 process, and residual contamination in the soil underneath the slabs can be used for the WIDS discovery process. The proposed characterization of the slabs during the D4 process will support safe removal and disposal of the 236Z and 242Z Building slabs.

1.3 Contaminants of Concern

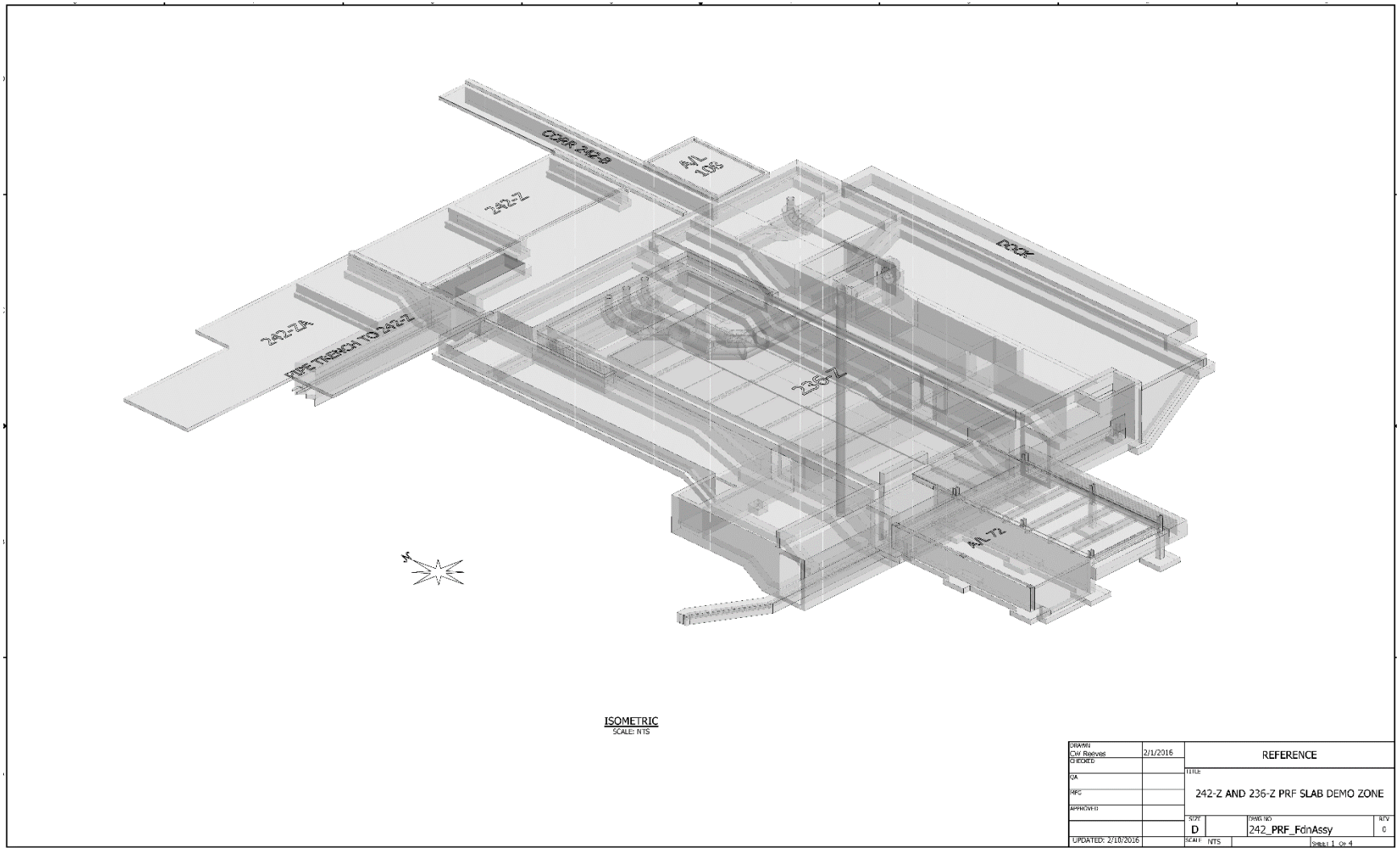
The final COCs that will be considered for the waste generated during D4 of the PFP above-grade structures are listed below.

- Chemical COCs
  - Metals
  - Nitrites/nitrates
  - Beryllium (236Z only)
- Radionuclide COCs
  - Americium-241
  - Plutonium-238
  - Plutonium-239
  - Plutonium-240
  - Plutonium-241
  - Plutonium-242
  - Uranium-233 and uranium-234
  - Uranium-235
  - Uranium-238



NTS = not to scale

Figure 1-1. Conceptual Layout of 236Z Subsurface Trenches



NTS = not to scale

Figure 1-2. Three-Dimensional Version of Both 236Z and 242Z Buildings

1.4 Project Schedule

The current time frame for the project schedule is provided below.

- **Following removal of above-grade structures:** Perform radiological survey and inspection of the slabs for evidence of staining, cracks, penetrations, or other areas of interest for characterization. Perform nondestructive assay (NDA) of the slabs.
- **After radiological survey is completed, approximately 60 days:** Determine if additional characterization data are needed to make a decision about how and if to remove slabs. If additional data are needed, obtain samples and ship samples to laboratory for analysis.
- **After additional characterization if needed, approximately 60 days:** Review analytical results, NDA, and other data to make decisions regarding slab removal.
- **After data review to support slab removal:** Prepare work packages and train workers to complete slab removal.
- **After work package preparation:** Remove slabs and disposition waste.
- **After slab removal is completed:** Perform radiological survey of excavation footprint and backfill with clean soil.
- **After backfill is completed:** Enter data and other pertinent information into WIDS.

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2 Quality Assurance Project Plan

This quality assurance project plan (QAPjP) provided in this chapter establishes the quality requirements for environmental data collection. It includes planning, implementation, and assessment of sampling tasks, field measurements, laboratory analysis, and data review. This chapter also describes the applicable environmental data collection requirements and controls based on the quality assurance (QA) elements found in the following documents:

- 10 CFR 830, "Nuclear Safety Management," Subpart A, "Nuclear Safety Management; Quality Assurance Requirements"
- DOE O 414.1D Admin Chg1, *Quality Assurance*
- DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD)
- EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5)

Sections 6.5 and 7.8 of the Tri-Party Agreement Action Plan (Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*) require that the QA/quality control (QC) and sampling and analysis activities specify the QA requirements for treatment, storage, and disposal units, as well as for past-practice processes. This QAPjP demonstrates conformance to the Part B requirements of ANSI/ASQC E4-1994, *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs*.

In addition to the requirements cited, EPA-505-B-04-900A, *Intergovernmental Data Quality Task Force Uniform Federal Policy for Quality Assurance Project Plans: Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs, Part 1: UFP-QAPP Manual*, was also used as a resource to identify the QAPjP elements.

The EPA manual (EPA-505-B-04-900A) is not imposed through the Tri-Party Agreement (Ecology et al., 1989a, *Hanford Federal Facility Agreement and Consent Order*). However, it is a valuable resource and provides a comprehensive treatment of quality elements that could be addressed in a SAP. It was also designed to be compatible with EPA/240/B-01/003 (EPA QA/R-5), which forms the basis for this QAPjP.

This QAPjP is divided into the following four sections, which describe the quality requirements and controls applicable to this investigation:

- **Project Management (Section 2.1):** This section addresses elements of project management, including project history and objectives, roles, and responsibilities of the participants. These elements ensure that the project has a defined goal, that the participants understand the goal and the approach to be used, and that the planning outputs are documented.
- **Data Generation and Acquisition (Section 2.2):** This section addresses aspects of project design and implementation. Implementation of these elements ensures that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and QC activities are properly used and documented.
- **Assessment and Oversight (Section 2.3):** This section addresses the activities for assessing the effectiveness of the project implementation and the associated QA and QC activities. Assessment ensures that the QAPjP is implemented as prescribed.

- **Data Validation and Usability (Section 2.4):** This section addresses the QA activities occurring after the data collection or generation phase of the project has been completed. Implementation of these elements ensures that data conform to the specified criteria, thus achieving project objectives.

2.1 Project Management

This section addresses the basic aspects of project management to ensure that project roles and responsibilities are understood. It also describes quality specifications, training, and the management of project documents.

2.1.1 Project/Task Organization

DOE-RL is the lead agency for the removal action presented in this SAP. Implementation of the SAP is performed via direction from DOE-RL to a contractor who is responsible for planning, coordinating, and sampling, as well as preparing, packaging, and shipping samples to the laboratory. The project organization (in regard to sampling and characterization) is described in the following subsections.

2.1.1.1 Regulatory Project Manger

Ecology is responsible for regulatory oversight of cleanup projects and activities as identified in the Tri-Party Agreement (Ecology et al., 1989a). Ecology, as lead regulatory agency for D4 of the PFP complex removal action, has approval authority for the work being performed under this SAP. The lead regulatory agency will work with DOE-RL to resolve any concerns regarding the work described in this SAP in accordance with the Tri-Party Agreement.

2.1.1.2 DOE-RL Removal Action Manager

DOE-RL is responsible for the Hanford Site cleanup. The DOE-RL project manager is responsible for monitoring contractor performance of activities under CERCLA, the *Resource Conservation and Recovery Act of 1976* (RCRA), the *Atomic Energy Act of 1954*, and the Tri-Party Agreement (Ecology et al., 1989a) for the Hanford Site. The DOE-RL project manager is also responsible for obtaining lead regulatory agency approval of the SAP authorizing the field sampling activities.

2.1.1.3 Removal Action Project Manager

The PFP removal action project manager is responsible and accountable for project-related activities and coordinates with DOE-RL, the regulatory agencies, and contractor management in support of sampling activities. In addition, support is provided to the project to ensure that work is performed safely and cost effectively. The PFP removal action project manager (or designee) is responsible for managing sampling documents and requirements, field activities, and subcontracted tasks, and for ensuring that the project files are properly maintained. The removal action project manager is responsible for ensuring that the project personnel are working to the most current version of the SAP. The removal action project manager ensures that the sampling design requirements are converted into field instructions providing specific direction for all field activities. The removal action project manager works closely with the environmental compliance officer (ECO), QA, Health and Safety, the field work supervisor (FWS), and the Sample Management and Reporting (SMR) organization to integrate these and other lead disciplines in planning and implementing the work scope. The project manager maintains a list of individuals or organizations filling each of the functional elements of the project organization.

2.1.1.4 Environmental Compliance Officer

The ECO 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 ECO also reviews plans, protocols, and technical documents to ensure that

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-RL and/or the regulatory agencies. The ECO also oversees project implementation for compliance with applicable internal and external environmental requirements.

2.1.1.5 Quality Assurance

The QA point of contact is responsible for QA issues on the project. Responsibilities include overseeing implementation of the project QA requirements, reviewing project documents (including the DQO summary report and SAP), and participating in QA assessments on sample collection and analysis activities, as appropriate.

2.1.1.6 Health and Safety

The Health and Safety organization is responsible for coordinating 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 regulations or by internal primary contractor work requirements. In addition, the Health and Safety organization assists project personnel in complying with applicable health and safety standards and requirements. The Health and Safety organization coordinates with Radiological Engineering to determine personal protective clothing requirements.

2.1.1.7 Radiological Engineering

The Radiological Engineering lead is responsible for radiological/health physics support within the project. Specific responsibilities include conducting as low as reasonably achievable (ALARA) reviews, exposure, and release modeling, as well as optimizing the radiological controls for all work planning. The Radiological Engineering lead also identifies radiological hazards and implements appropriate controls to maintain worker exposures ALARA (e.g., requiring personal protective equipment). The Radiological Engineering lead also interfaces with the project Health and Safety contact and assists in planning and directing radiological control technician (RCT) support for all activities.

2.1.1.8 Sample Management and Reporting Organization

The SMR organization coordinates laboratory analytical work, ensuring that the laboratories conform to Hanford Site internal laboratory QA requirements (or their equivalent), as approved by DOE-RL, the U.S. Environmental Protection Agency (EPA), and Ecology. SMR receives the analytical data from the laboratories, enters the data into Hanford Environmental Information System (HEIS) database, and arranges for data validation. The organization is responsible for informing the project manager of any issues reported by the analytical laboratory. The SMR organization develops and oversees the implementation of the letter of instruction/statement of work to the analytical laboratories, oversees data validation, and works with the project manager to prepare a characterization report on sampling and analysis results.

2.1.1.9 Analytical Laboratories

The laboratories analyze samples in accordance with established protocols and provide results of sample analyses in accordance with analytical requirements. The laboratories must have a QA plan in place that meets the applicable portions of HASQARD (DOE/RL-96-68).

2.1.1.10 Waste Management

Waste Management communicates policies and protocols, and also ensures project compliance for storage, transportation, disposal, and waste tracking in a safe and cost-effective manner. In addition, Waste Management is responsible for identifying waste management sampling/characterization requirements to ensure regulatory compliance, interpreting the characterization data to generate waste

designations and profiles, and preparing and maintaining other documents confirming compliance with waste acceptance criteria.

2.1.1.11 Field Work Supervisor

The FWS is responsible for planning and coordinating field sampling resources. The FWS ensures that samplers are appropriately trained and available. Additional related responsibilities include ensuring that the sampling design is understood and can be performed as specified by directing training, performing mock-ups, and holding practice sessions with field personnel.

The FWS directs the samplers who take the physical samples. The samplers collect groundwater, soil, vapor, and multimedia samples (including replicates/duplicates); collect field parameters; and prepare QC samples in accordance with the SAP, and in accordance with corresponding standard methods and the field and sample instructions. The samplers complete field logbook entries, maintain chain-of-custody of the samples, prepare shipping paperwork as qualified, and ensure delivery of the samples to the analytical laboratory, all in accordance with the applicable portions of HASQARD (DOE/RL-96-68).

The FWS acts as a technical interface between the removal action project manager and the field crew supervisors and ensures that technical aspects of the field work will be met. The FWS reviews the SAP for field sample collection concerns, analytical requirements, and special sampling requirements. The FWS, in consultation with the PFP removal action project manager and SMR, resolves issues arising from the translation of technical requirements to field operations and also coordinates the resolution of sampling issues.

2.1.2 Quality Objectives and Criteria

The QA objective of this plan is to develop guidance for obtaining data of known and appropriate quality. Data quality indicators (DQIs) describe data quality by evaluation against identified DQOs and the work activities identified in this SAP. 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. The principal DQIs are precision, bias or accuracy, representativeness, comparability, completeness, and sensitivity, and are defined for the purposes of this document in the following subsections. The DQIs are also shown in Table 2-1.

Data quality is defined by the degree of rigor in the acceptance criteria assigned to the DQIs. The applicable QC guidelines, DQI acceptance criteria, and levels of effort for assessing data quality are dictated by the intended use of the data and the requirements of the analytical method. DQIs are evaluated during the data quality assessment (DQA) process (Section 2.4.3).

The problem statement description from the DQO process for the 236Z/242Z slab removal and disposal is summarized as follows:

> The 236Z/242Z slabs have been contaminated to some degree from PFP chemical and radiological processes. Residual radiological and chemical constituents associated with these activities have potentially contaminated the slabs and may pose a threat to human health and the environment. Contaminant concentration information obtained during D4 activities will help to support identification of required controls for removal and disposal. After slab removal, the underlying soil may contain residual chemical and/or radiological contaminants that should be identified to support future remedial activities.

Table 2-1. Data Quality Indicators

DQI	Definition*	Determination Methodologies	Corrective Actions
Precision	Precision measures the agreement among a set of replicate measurements. Field precision is assessed through the collection and analysis of field duplicates. Analytical precision is estimated by duplicate/replicate analyses, usually on laboratory control samples, spiked samples and/or field samples. The most commonly used estimates of precision are the relative standard deviation and, when only two samples are available, the relative percent difference.	Use the same analytical instrument to make repeated analyses on the same sample. Use the same method to make repeated measurements of the same sample within a single laboratory. Acquire replicate field samples for information on sample acquisition, handling, shipping, storage, preparation, and analytical processes and measurements.	If duplicate data do not meet objective: • Evaluate apparent cause (e.g., sample heterogeneity). • Request reanalysis or re-measurement. • Qualify the data before use.
Accuracy	Accuracy is the closeness of a measured result to an accepted reference value. Accuracy is usually measured as a percent recovery. Quality control analyses used to measure accuracy include standard recoveries, laboratory control samples, spiked samples, and surrogates.	Analyze a reference material or reanalyze a sample to which a material of known concentration or amount of pollutant has been added (a spiked sample).	If recovery does not meet objective: • Qualify the data before use. • Request reanalysis or re-measurement.
Representativeness	Sample representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. It is dependent on the proper design of the sampling program and will be satisfied by ensuring the approved plans were followed during sampling and analysis.	Evaluate whether measurements are made and physical samples collected in such a manner that the resulting data appropriately reflect the environment or condition being measured or studied.	If results are not representative of the system sampled: • Identify the reason for them not being representative. • Reject the data; or, if data are otherwise usable, qualify the data for limited use and define the portion of the system that the data represent. • Redefine sampling and measurement requirements and protocols. • Resample and reanalyze.

Table 2-1. Data Quality Indicators

DQI	Definition*	Determination Methodologies	Corrective Actions
Comparability	Comparability expresses the degree of confidence with which one data set can be compared to another. It is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the approved plans are followed and that proper sampling and analysis techniques are applied.	Use identical or similar sample collection and handling methods, sample preparation and analytical methods, holding times, and quality assurance protocols.	If data are not comparable to other data sets: • Identify appropriate changes to data collection and/or analysis methods • Identify quantifiable bias, if applicable. • Qualify the data as appropriate. • Resample and/or reanalyze if needed. • Revise sampling/analysis protocols to ensure future comparability.
Completeness	Completeness is a measure of the amount of valid data collected compared to the amount planned. Measurements are considered to be valid if they are unqualified or qualified as estimated data during validation. Field completeness is a measure of the number of samples collected versus the number of samples planned. Laboratory completeness is a measure of the number of valid measurements compared to the total number of measurements planned.	Compare the number of valid measurements completed (samples collected or samples analyzed) with those established by the project's quality criteria (data quality objectives or performance/acceptance criteria).	If data set does not meet completeness objective: • Identify appropriate changes to data collection and/or analysis methods. • Identify quantifiable bias, if applicable. • Qualify the data as appropriate. • Resample and/or reanalyze if needed. • Revise sampling/analysis protocols to ensure future comparability.

Table 2-1. Data Quality Indicators

DQI	Definition*	Determination Methodologies	Corrective Actions
Bias	Bias is the systematic or persistent distortion of a measurement process that causes error in one direction (e.g., the sample measurement is consistently lower than the sample's true value). Bias can be introduced during sampling, analysis, and data evaluation. Analytical bias refers to deviation in one direction (i.e., high, low, or unknown) of the measured value from a known spiked amount.	Sampling bias may be revealed by analysis of replicate samples. Analytical bias may be assessed by comparing a measured value in a sample of known concentration to an accepted reference value or by determining the recovery of a known amount of contaminant spiked into a sample (matrix spike).	For sampling bias: • Properly select and use sampling tools. • Institute correct sampling and subsampling procedures to limit preferential selection or loss of sample media. • Use random sampling designs. • Use sample handling procedures, including proper sample preservation that limit the loss or gain of constituents to the sample media. Analytical data that are known to be affected by either sampling or analytical bias are flagged to indicate possible bias. Laboratories that are known to generate biased data for a specific analyte are asked to correct their methods to remove the bias as best as practicable. Otherwise, samples are sent to other laboratories for analysis.
Sensitivity	Sensitivity is an instrument or method minimum concentration that can be reliably measured (i.e., instrument detection limit or limit of quantitation).	Determine the minimum concentration or attribute to be measured by an instrument (instrument detection limit) or by a laboratory (limit of quantitation). The lower limit of quantitation is the lowest level which can be routinely quantified and reported by a laboratory.	If detection limits do not meet objective: • Request reanalysis or re-measurement using methods or analytical conditions that will meet required detection or limit of quantitation. • Qualify/reject the data before use.

*From SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V.*
DQI = data quality indicator

2.1.2.1 Precision

Precision is a measure of the data spread when more than one measurement exists of the same sample. Precision can be expressed as the relative percent difference (RPD) for duplicate measurements, or relative standard deviation for triplicates. Analytical precision for laboratory analyses is included in Tables 2-2 and 2-3.

2.1.2.2 Accuracy

Accuracy is an assessment of the closeness of the measured value to the true value. Radionuclide measurements requiring chemical separations use the yield recovery of a tracer to measure method performance. For radionuclide measurements analyzed by gamma spectroscopy, laboratories typically compare results of blind audit samples against known standards to establish accuracy. Accuracy determination for chemical analyses is based on spiked sample results (e.g., matrix spike and laboratory control sample). The validity of calibrations is evaluated by comparing results from the measurement of a standard to known values and/or by generating in-house statistical limits based on three standard deviations (plus or minus three standard deviations). Tables 2-2 and 2-3 list the laboratory accuracy parameters for this SAP.

2.1.2.3 Representativeness

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

2.1.2.4 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using standard procedures, uniform methods, and consistent units.

2.1.2.5 Completeness

Tables 2-2 and 2-3 identify the sample analytes, field parameters, and analytical performance requirements for samples collected under the scope of this SAP. The analytical data set will be considered 100 percent complete if all target analytes are reported for each of the samples identified for collection, with no rejected data.

2.1.2.6 Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest. A measure of sensitivity is the detection limit.

2.1.2.7 Method-Based Analysis

All analyses being performed for total constituent determinations for target analytes against the requirements in Tables 2-2 and 2-3 will include a method-based analysis design. The laboratory will be directed to report all results for all constituents determined through multi-constituent analysis (e.g., ion chromatography, inductively coupled plasma, gamma energy analysis, gas chromatography, and mass spectrometry), regardless of whether the reported constituents are designated target analytes. The analytical performance requirements will be applicable only to the target analytes. Poor QC related to non-target analyte results would not result in any required corrective action by the laboratory, except for the application of proper result qualification flags.

Table 2-2. Analytical Performance Requirements for Radionuclides

Analyte Name	CAS Number	Hanford Site Background[a] (pCi/g)	Name/Analytical Technology	Soil		
				Estimated Quantitation Limit[b] (pCi/g)	Precision[c] (%)	Accuracy[c] (%)
Americium-241	14596-10-2	—	Americium isotopic – AEA	1	≤30	70-130
Plutonium-238	13981-16-3	0.00378	Plutonium isotopic – AEA	1	≤30	70-130
Plutonium-239/240	PU-239/240	0.0248	Plutonium isotopic – AEA	1	≤30	70-130
Plutonium-241/242	PU-241/242	—	Plutonium isotopic – AEA	1	≤30	—
Uranium-233/234[d]	U-233/234	1.1[i]	Uranium isotopic – AEA or ICP-MS	1	≤30	70-130
Uranium-235	15117-96-1	0.109	Uranium isotopic – AEA or ICP-MS	1	≤30	70-130
Uranium-238	U-238	1.06	Uranium isotopic – AEA or ICP-MS	1	≤30	70-130

a. Values are from DOE/RL-96-12, *Hanford Site Background: Part 2, Soil Background for Radionuclides*, at the 90th percentile for a lognormal distribution.

b. Estimated quantitation limits for soil are based on a 500 g (1.1 lb) sample. If a 60 g (0.13 lb) sample is submitted for gamma energy analysis, the detection limits will increase as follows: cesium-137: 0.14 pCi/g; cobalt-60: 0.14 pCi/g; europium-152: 0.28 pCi/g; europium-154: 0.35 pCi/g; europium-155: 0.35 pCi/g.

c. Precision and accuracy requirements as identified and defined in the referenced U.S. Environmental Protection Agency procedures implemented by laboratory analysis and quality assurance procedures.

d. If ICP-MS is used, individual isotopes will be quantified.

AEA = alpha energy analysis

CAS = Chemical Abstracts Service

ICP-MS = inductively coupled plasma-mass spectrometry

Table 2-3. Analytical Performance Requirements for Nonradionuclides

Analyte Name	CAS Number	Hanford Site Background[a] (mg/kg)	Name/ Analytical Technology	Soil		
				Required Detection Limits (mg/kg)[b]	Precision (%)[c]	Accuracy (%)[c]
Nonradioactive Metals						
Antimony	7440-36-0	0.13[d]	EPA Method 6010 ICP trace or EPA Method 6020 or EPA Method 200.8	0.6	<30	70-130
Arsenic	7440-38-2	6.47	EPA Method 6010 ICP trace or EPA Method 6020 or EPA Method 200.8	2	<30	70-130
Barium	7440-39-3	132	EPA Method 6010 ICP trace or EPA Method 6020 or EPA Method 200.8	0.5	<30	70-130
Beryllium	7440-41-7	1.51	EPA Method 6010 ICP trace or EPA Method 6020 or EPA Method 200.8	—	—	—
Boron	7440-42-8	5.86[d]	EPA Method 6010 ICP trace or EPA Method 6020 or EPA Method 200.8	—	—	—
Cadmium	7440-43-9	0.563[d]	EPA Method 6010 ICP trace or EPA Method 6020 or EPA Method 200.8	0.5	<30	70-130
Chromium (Total)	7440-47-3	18.5	EPA Method 6010 ICP trace or EPA Method 6020 or EPA Method 200.8	0.2	<30	70-130
Chromium(VI)	18540-29-9	—	EPA Method 7196 – colorimetric	0.5	<30	70-130
Cobalt	7440-48-4	15.7	EPA Method 6010 ICP trace or EPA Method 6020 or EPA Method 200.8	—	—	—
Copper	7440-50-8	22	EPA Method 6010 ICP trace or EPA Method 6020 or EPA Method 200.8	1	<30	70-130
Iron	7439-89-6	32,600	EPA Method 6010 ICP trace or EPA Method 6020 or EPA Method 200.8	—	—	—

Table 2-3. Analytical Performance Requirements for Nonradionuclides

Analyte Name	CAS Number	Hanford Site Background[a] (mg/kg)	Name/ Analytical Technology	Soil		
				Required Detection Limits (mg/kg)[b]	Precision (%)[c]	Accuracy (%)[c]
Lead	7439-92-1	10.2	EPA Method 6010 ICP trace or EPA Method 6020 or EPA Method 200.8	0.5	<30	70-130
Manganese	7439-96-5	512	EPA Method 6010 ICP or EPA Method 6020 or EPA Method 200.8	5	<30	70-130
Mercury	7439-97-6	0.013[d]	EPA Method 7471 (soil) or EPA Method 6020 or EPA Method 200.8	0.2	<30	70-130
Nickel	7440-02-0	19.1	EPA Method 6010 ICP or EPA Method 6020 or EPA Method 200.8	4	<30	70-130
Selenium	7782-49-2	0.78	EPA Method 6010 ICP or EPA Method 6020 or EPA Method 200.8	1	<30	70-130
Silver	7440-22-4	0.167[d]	EPA Method 6010 ICP or EPA Method 6020 or EPA Method 200.8	0.2	≤30	70-130
Uranium (Total)	7440-61-1	3.21	U total – kinetic phosphorescence analysis or EPA Method 200.8 or EPA Method 6020	1	≤30	70-130
Vanadium	7440-62-2	85.1	EPA Method 6010 ICP or EPA Method 6020 or EPA Method 200.8	—	≤30	70-130
Zinc	7440-66-6	67.8	EPA Method 6010 ICP or EPA Method 6020 or EPA Method 200.8	—	≤30	70-130

Table 2-3. Analytical Performance Requirements for Nonradionuclides

Analyte Name	CAS Number	Hanford Site Background[a] (mg/kg)	Name/ Analytical Technology	Soil		
				Required Detection Limits (mg/kg)[b]	Precision (%)[c]	Accuracy (%)[c]
Inorganics						
Nitrate	14797-55-8	52	EPA Method 300.0[e] – IC	2.5	≤30	70-130
Nitrite	14797-65-0	—	EPA Method 300.0[e] – IC	2.5	≤30	70-130

a. Unless noted, values are from DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, using the 90th percentile with lognormal distribution.

b. Estimated quantitation limit for setting laboratory detection limits generally is established using the action levels or background, whichever is lower.

c. Precision and accuracy requirements as defined in EPA procedures and implemented by laboratory analysis and quality assurance procedures. Precision criteria for batch laboratory replicate sample analyses. Accuracy criteria for associated batch laboratory control sample percent with additional evaluations also performed for matrix spikes, tracers, and carriers as appropriate to the method.

d. Value is from ECF-HANFORD-11-0038, *Soil Background for Interim Use at the Hanford Site*.

e. EPA Method 300.0 in EPA/600/R-93/100, *Methods for the Determination of Inorganic Substances in Environmental Samples*.

CAS = Chemical Abstracts Service
EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma

2.1.2.8 Analytical Priority

If sample volume is insufficient to analyze for all of the analytes listed for a given waste site, the highest priority analytes critical for supporting waste site decisions are required to be analyzed. Attempts will be made to collect at least every other sample of the lesser priority analytes that are important for supporting waste site decisions. Lowest priority analytes not critical for supporting waste site decisions will be analyzed only if sufficient sample volumes are collected.

2.1.3 Special Training/Certification

A graded approach is used to ensure that workers receive a level of training commensurate with their responsibilities and that complies with applicable DOE orders and government regulations. The FWS, in coordination with line management, will ensure that special training requirements for field personnel are met.

Typical training requirements or qualifications have been instituted by the contractor management team to meet training and qualification programs to satisfy multiple training drivers imposed by the applicable *Code of Federal Regulations* and *Washington Administrative Code* requirements. For example, 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
- Hanford General Employee Training
- Radiological Worker Training

Project-specific safety training, geared specifically toward the project and the day's activity, will be provided. Project-specific training includes, but is not limited to, the following:

- Training requirements or qualifications needed by sampling personnel and NDA technicians will be in accordance with QA requirements.
- Samplers are required to have received training and required certifications for the type of sampling that is being performed in the field.
- Qualification requirements for RCTs are established by the Radiation Protection Program; the RCTs assigned to these activities will be qualified through the prescribed training program and will undergo ongoing training and qualification activities.

In addition, pre-job briefings will be performed in accordance with work management and work release documents to evaluate an activity and associated hazards by considering various factors, including the following:

- Objective of the activities
- Individual tasks to be performed
- Hazards associated with the planned tasks
- Controls applied to mitigate the hazards

- Environment in which the job will be performed
- Facility where the job will be performed
- Equipment and material required
- Safety protocols applicable to the job
- Training requirements for individuals assigned to perform the work
- Level of management control
- Proximity of emergency contacts

Training records are maintained for each individual employee in an electronic training record database. The training organization maintains the training records system. Line management will confirm that an individual employee's training is appropriate and up to date prior the employee performing any field work.

2.1.4 Documents and Records

The removal action project manager is responsible for ensuring that the current version of the SAP is being used and for providing any updates to field personnel. Version control is maintained by the administrative document control process. Changes to the SAP affecting the DQOs will be reviewed and approved by DOE-RL and the lead regulatory agency (Ecology) before implementation. Table 2-4 defines the types of changes that may be made to the sampling design and the documentation requirements.

Table 2-4. Change Control for Sampling Projects

Type of Change	Action	Documentation
Adding constituents for specific waste sites, changing sampling strategy or investigation depth	Project management approval; notify regulatory if appropriate	Project's schedule tracking system
Changing SAP analyte list (Table 2-2 or Table 2-3), adding or subtracting waste sites	Revise SAP (or Tri-Party Agreement* change notice, if appropriate); obtain regulatory approval; distribute plan	Letter report documenting changes or revised plan (or approved Tri-Party Agreement Change Notice)

**Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989a).

SAP = sampling and analysis plan

The FWS is responsible for ensuring that field instructions are maintained and aligned with any revisions or approved changes to the SAP. The FWS will ensure that deviations from the SAP or problems encountered in the field are documented appropriately (e.g., in the field logbook or on nonconformance report forms) in accordance with internal corrective action protocols.

The removal action project manager, construction management lead, FWS, or designee is responsible for communicating field corrective action requirements and ensuring immediate corrective actions are applied to field activities.

Logbooks are required most for field activities. A logbook must be identified with a unique project name and number. The individual(s) responsible for logbooks will be identified in the front of the logbook, and only authorized persons may make entries in logbooks. Logbooks will be signed by the FWS, supervisor, cognizant scientist/engineer, or other responsible individual. Logbooks will be permanently bound, waterproofed, and ruled with sequentially numbered pages. Pages will not be removed from logbooks for

any reason. Entries will be made in indelible ink. Corrections will be made by marking through the erroneous data with a single line, entering the correct data, and initialing and dating the changes.

The removal action project manager is responsible for ensuring that a project file is properly maintained. The project file will contain the records or references to the storage locations. The project file will include the following, as appropriate:

- Field logbooks or operational records
- Data forms
- Global positioning system data
- Chain-of-custody forms
- Sample receipt records
- Inspection or assessment reports, and corrective action reports
- Interim progress reports
- Final reports
- Laboratory data packages
- Verification and validation reports

The laboratory is responsible for maintaining, and having available upon request, the following:

- Analytical logbooks
- Raw data and QC sample records
- Standard reference material and/or proficiency test sample data
- Instrument calibration information

Records may be stored in either electronic or hardcopy format. Documentation and records, regardless of medium or format, are controlled in accordance with internal work requirements and processes to ensure the accuracy and retrievability of stored records. Records required by the Tri-Party Agreement (Ecology et al., 1989a) will be managed in accordance with the requirements identified therein (Table 2-5).

2.2 Data Generation and Acquisition

The following subsections address data generation and acquisition to ensure that the project's methods for sampling, measurement and analysis, data collection or generation, data handling, and QC activities are appropriate and documented. The sampling design is presented in the field sampling plan (Chapter 3 of this SAP).

The FWS is responsible for ensuring that all field procedures are followed completely and that field sampling personnel are adequately trained to perform sampling activities under this SAP. The FWS must document all deviations from procedures or other issues pertaining to sample collection, chain-of-custody, laboratory impacts, sample transport, or noncompliant monitoring. As appropriate, such deviations or issues will be documented in the field logbook or in accordance with internal corrective action procedures. The PFP removal action project manager or FWS is responsible for communicating field corrective action requirements and for ensuring that immediate corrective actions are applied to field activities.

Table 2-5. Tri-Party Agreement Change Control for Sampling Projects

Type of Change[a]	Type of Change (Tri-Party Agreement Action Plan[b])	Action	Documentation
Minor change: Change has no impact on the sample or field analytical result, and little or no impact on performance or cost. Furthermore, the change does not affect the DQOs specified in the SAP.	**Minor field change:** Changes that have no adverse effect on the technical adequacy of the job or the work schedule.	Field personnel recognizing the need for a field change will consult with the PFP removal action project manager prior to implementing the field change.	Minor field changes will be documented in the field logbook. The logbook entry shall include the field change, the reason for the field change, and the names and titles of those approving the field change.
Significant change: Change has a considerable effect on performance or cost, but still allow for meeting the DQOs specified in the SAP.	**Minor change:** Changes to approved plans that do not affect the overall intent of the plan or schedule.	The PFP removal action manager will inform the DOE-RL project manager and the regulatory lead of the change and seek concurrence at a unit managers' meeting or comparable forum. The lead regulatory agency determines that there is no need to revise the document.	Documentation of this change approval would be in the unit managers' meeting minutes or comparable record, such as a change notice.[c]
Fundamental change: Change has significant effect on the sample or the field analytical result, performance, or cost, and the change does not meet the requirements specified in the DQOs in the SAP.	**Revision necessary:** Lead regulatory agency determines that changes to approved plans require revision to document.	If it is anticipated that a fundamental change will require approval of the regulatory lead, the applicable DOE-RL project manager will be notified by the PFP removal action project manager and will be involved in the decision prior to implementation of a fundamental change. The lead regulatory agency determines the change requires a revision to the document.	Formal revision of the sampling document.

a. Consistent with DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD).

b. Consistent with Sections 9.3 and 12.4 of Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan* (Tri-Party Agreement Action Plan).

c. The Tri-Party Agreement Action Plan, Section 9.3, defines the minimum elements of a change notice.

DOE-RL = U.S. Department of Energy, Richland Operations Office
DQO = data quality objective
PFP = Plutonium Finishing Plant
SAP = sampling and analysis plan

2.2.1 Analytical Methods Requirements

Information on analytical methods is provided in Tables 2-2 and 2-3. These analytical methods are controlled in accordance with the laboratory's QA plan and the requirements of this QAPjP. The primary contractor participates in assessing analytical laboratories to qualify the laboratories for performing Hanford Site analytical work.

If the laboratory uses a nonstandard or unapproved method, then the laboratory must provide method validation data to confirm that the method is adequate for the intended use of the data. This includes information such as determination of detection limits, quantitation limits, typical recoveries, and analytical precision and bias. Deviations from the analytical methods noted in Tables 2-2 and 2-3 must be approved by the SMR organization in consultation with the PFP removal action project manager.

Laboratories providing analytical services in support of this SAP will have a corrective action program in place that addresses analytical system failures and that documents the effectiveness of any corrective actions. Issues that may affect analytical results will be resolved by the SMR organization in coordination with the PFP removal action project manager.

2.2.2 Quality Control

The QC protocols must be followed in the field and laboratory to ensure that reliable data are obtained. Field QC samples will be collected to evaluate the potential for cross-contamination and to provide information pertinent to field sampling variability. Field QC sampling will include collecting full trip blank (FTB), field transfer blank (FXR), equipment rinsate blank (EB), field duplicate, and field split samples as dictated by the sampling instruction or intended data use. Field QC sampling will include the collection of FTB, FXR, EB, field duplicate, and field split samples. Laboratory QC samples estimate the precision and bias of the analytical data. Field and laboratory QC samples are summarized in Table 2-6.

Table 2-6. Field and Laboratory QC Requirements

Sample Type	Purpose	Frequency
Field QC		
Field duplicate	Estimate precision, including sampling and analytical variability.	One per 20 soil samples collected.
Equipment rinsate blank	Verify adequacy of sampling equipment decontamination.	As needed[a]. If only disposable equipment is used, then an equipment rinsate blank is not required. Otherwise, one per 10 soil samples.
Field split	Estimate precision, including sampling, analytical, and interlaboratory variability.	As needed.
Full trip blank	Assess contamination from containers or transportation.	One per 20 soil samples.
Field transfer blank	Assess contamination from sampling site.	One each day that volatile organic compounds are sampled.

Table 2-6. Field and Laboratory QC Requirements

Sample Type	Purpose	Frequency
Laboratory QC[b]		
Method blank	Assess response of an entire laboratory analytical system.	At least one per batch[b] or as identified by the method guidance.
Matrix spike	Identify analytical (preparation and analysis) accuracy; possible matrix effect on the analytical method used.	When required by the method guidance, at least one per batch[b] or as identified by the method guidance.
Matrix duplicate or matrix spike duplicate	Estimate analytical accuracy and precision.	When required by the method guidance, at least one per batch[b] or as identified by the method guidance, per media sampled.
Laboratory control sample	Assess method accuracy.	At least one per batch[b] or as identified by the method guidance, per media sampled.

a. An equipment blank shall be collected for all nondedicated equipment, until it can be shown that less frequent collection of equipment blanks is adequate to monitor the decontamination procedure for the nondedicated equipment.

b. Batching across projects is allowed for similar matrices (e.g., Hanford Site groundwater). The maximum batch size is 20 samples.

QC = quality control

2.2.2.1 Field Quality Control Samples

Field QC samples will be collected to evaluate the potential for cross-contamination and to provide information pertinent to field sampling variability and laboratory performance. The QC samples and the required frequency for collection are described in this section. Field QC samples are not normally collected for samples whose collection purpose is industrial hygiene, in-process, special studies, transportation, radiological control, and/or waste designation.

- **Full trip blanks (FTBs):** Prepared by the sampling team prior to traveling to the sampling site, FTBs are primarily used for volatile organic compounds (VOCs) analysis. The preserved bottle set is either for VOC only or is identical to the set that will be collected in the field. Filled with an appropriate media (silica sand for solid matrices), the bottles are sealed and will be transported, unopened, to the field in the same storage containers used for samples collected the same day. The FTBs are typically analyzed for the same constituents as the samples from the associated sampling event. FTBs are used to evaluate potential contamination of the samples attributable to the sample bottles, preservative, handling, storage, and transportation.

- **Field transfer blanks (FXRs):** Preserved volatile organic analysis (VOA) sample vials are filled at the sample collection site with silica sand and transported to the field. The samples will be prepared during sampling to evaluate potential contamination attributable to field conditions. After collection, FXR sample vials will be sealed and placed in the same storage containers with the samples collected the same day for the associated sampling event. FXR samples will be analyzed for VOCs only.

- **Equipment rinsate blanks (EBs):** Collected for reused sampling devices to assess the adequacy of the decontamination process. EBs will consist of silica sand poured over the decontaminated sampling equipment and placed in containers, as identified on the project sampling authorization form. If disposable (e.g., single-use) equipment is used, EB samples will not be required.

For the field blanks (i.e., FTBs, FXRs, and EBs), results greater than two times the method detection limit are identified as suspected contamination. However, for common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the limit is greater than five times the method detection limit. For radiological data, blank results are flagged if they are greater than two times the total minimum detectable activity.

- **Field duplicate:** Used to evaluate sample consistency and the precision of field sampling methods, field duplicates are independent samples collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, numbered sequentially, and analyzed independently.

  A minimum of one soil field duplicate is obtained at a 5 percent interval (one added sample at the same location for every 20 locations sampled). The duplicate should be collected generally from an area that is expected to have some contamination so valid comparisons between the samples can be made (i.e., at least some of the constituents will be above detection limit). When sampling is performed from a split spoon, samples for VOA samples will be collected prior to homogenization of the bulk soil material. The remaining volatile organic duplicate samples are collected directly from the sampler. The remaining soil is then composited in a stainless-steel mixing bowl. The soil sample and duplicate sample are collected from this composited material.

  Field duplicates will be stored and transported to the laboratory in the same manner as the routine site samples and will be analyzed together for the same constituents. The field duplicate samples will be used to determine precision for both sampling and laboratory measurements. Evaluation of the results can provide an indication of intralaboratory variability. Large RPDs can be an indication of potential laboratory performance problems and should be investigated.

- **Field split:** Field splits are two samples collected as close as possible to the same time and same location and are intended to be identical. VOA soil splits will be sampled as collocated samples, as described previously. Field split samples will be stored in separate containers and analyzed by different laboratories for the same or similar analytes. Split samples are interlaboratory comparison samples used to evaluate comparability between laboratories. Large RPDs can be an indication of potential laboratory performance problems and should be investigated.

2.2.2.2 Laboratory Quality Control Samples

The laboratory QC samples (e.g., method blanks, laboratory control sample/blank spike, and matrix spike) are defined for the three-digit EPA methods (EPA-600/4-79-020, *Methods for Chemical Analysis of Water and Wastes*) and for the four-digit EPA methods (SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V*), and will be run at the frequency specified in the respective reference unless superseded by agreement between the primary contractor and laboratory.

2.2.2.3 Quality Control Requirements

Field duplicates and splits must agree within 30 percent (as measured by the RPD) to be acceptable. Only those field duplicates with at least one result greater than five times the appropriate detection limit are evaluated. Field duplicate results not satisfying evaluation criteria will be qualified and flagged in the HEIS database, as appropriate.

For chemical analyses, the control limits for laboratory duplicate samples, matrix spike samples, matrix spike duplicate samples, and laboratory control samples are typically derived from historical data at the laboratories in accordance with SW-846. Typical control limits are within 20 percent of the expected

values, although the limits may vary considerably depending upon the method and analyte. For this project, the control limits for laboratory QC samples are specified in Tables 2-2 and 2-3.

Holding time is the elapsed period between sample collection and analysis. Exceeding required holding times could result in changes in constituent concentrations due to volatilization, decomposition, or other chemical alterations. If holding times are exceeded, the effects of the holding-time exceedance on the results will be evaluated on a case-by-case basis. Required holding times depend on the analytical method, as specified for three-digit EPA methods (EPA-600/4-79-020) or for the four-digit EPA methods (SW-846).

Additional QC measures include laboratory audits and participation in nationally based performance evaluation studies. The contract laboratories participate in national studies, such as the EPA-sanctioned Water Pollution and Water Supply Performance Evaluation studies. The CH2M HILL Plateau Remediation Company (CHPRC) Soil and Groundwater Remediation Project periodically audits the analytical laboratories to identify, resolve, and prevent quality problems. Audit results are used to improve performance. Summaries of audit results and performance evaluation studies are presented in the Hanford Site annual groundwater monitoring report.

Failure of QC will be determined and evaluated during data validation and DQA processes. Data will be qualified and flagged in the HEIS database, as appropriate.

2.2.2.4 Instrument and Equipment Testing, Inspection, and Maintenance

Equipment used for collection, measurement, and testing should meet applicable standards (e.g., American Society for Testing and Materials [ASTM]) or should have been evaluated as acceptable and valid in accordance with the procedures, requirements, and specifications. The FWS, or equivalent, will ensure that the data generated from instructions using a software system are backed up and/or downloaded on a regular basis. Software configuration will be acceptance tested before use in the field.

Measurement and testing equipment used in the field or in the laboratory directly affecting 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 (e.g., documentation of routine maintenance) will be included in the individual laboratory and onsite organization's QA plan or operating procedures, as appropriate. Maintenance of laboratory instruments will be performed in a manner consistent with the three-digit EPA methods (EPA-600/4-79-020) and four-digit EPA methods (SW-846), as amended, or with contractual requirements. Consumables, supplies, and reagents will be reviewed in accordance with SW-846 requirements and will be appropriate for their use.

2.2.2.5 Instrument and Equipment Calibration and Frequency

Specific field equipment calibration information is provided in Section 2.7. Analytical laboratory instruments and measuring equipment are calibrated in accordance with the laboratory's QA plan.

2.2.2.6 Inspection and Acceptance of Supplies and Consumables

Supplies and consumables used to support sampling and analysis activities are procured in accordance with internal work requirements and processes described in the contractor acquisition system. Responsibilities and interfaces necessary to ensure that items procured/acquired for the contractor meet the specific technical and quality requirements must be in place. The procurement system ensures that purchased items 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 the laboratory's QA plan.

2.2.2.7 Nondirect Measurements

Nondirect measurements include data obtained from sources such as computer databases, programs, literature files, and historical databases. Nondirect measurements will not be evaluated as part of the activities under the scope of this SAP.

2.2.3 Data Management

The SMR organization, in coordination with the PFP removal action project manager, is responsible for ensuring that analytical data are appropriately reviewed, managed, and stored in accordance with the applicable programmatic requirements governing data management procedures. Electronic data access, when appropriate, will be via a database (e.g., HEIS or a project-specific database). Where electronic data are not available, hardcopies will be provided in accordance with Section 9.6 of the Tri-Party Action Plan (Ecology et al., 1989b).

Laboratory errors are reported to the SMR organization on a routine basis. For reported laboratory errors, a sample issue resolution form will be initiated in accordance with contractor procedures. This process is used to document analytical errors and to establish their resolution with the PFP removal action project manager. Sample issue resolution forms become a permanent part of the analytical data package for future reference and for records management.

Planning for sample collection and analysis will be in accordance with the programmatic requirements governing fixed laboratory sample collection activities, as discussed in the sampling procedures. In the event that specific procedures do not exist for a particular work evolution, or if it is determined that additional guidance is needed to complete certain tasks, a work package will be developed to provide adequate control of the activities, as appropriate. Examples of sampling procedure 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 field activities, including radiological measurements, when this SAP is implemented. Field activities will be recorded in the field logbook. Examples of the types of documentation for field radiological data include the following:

- Instructions regarding the minimum requirements for documenting radiological control information in accordance with 10 CFR 835, "Occupational Radiation Protection"
- Instructions for managing the identification, creation, review, approval, storage, transfer, and retrieval of primary contractor radiological records
- Minimum standards and practices necessary for preparing, performing, and retaining radiological-related records
- Indoctrination of personnel on the development and implementation of sample plans

- Requirements associated with preparing and transporting regulated material
- Daily reports of radiological surveys and measurements collected during conduct of field investigation activities (data will be cross-referenced between laboratory analytical data and radiation measurements to facilitate interpreting the investigation results)

2.2.3.1 Laboratory Quality Control Samples

The laboratory QC samples (e.g., method blanks, matrix spikes, and laboratory control samples) are defined for the three-digit EPA methods (EPA/600/4-79-020) and the four-digit EPA methods (SW-846) and will be run at the frequency specified in the respective reference, unless superseded by agreement. Laboratory QC requirements are also specified in HASQARD (DOE/RL-96-68).

The QC checks outside of control limits will be reflected in the narrative of the analytical report and during the DQA, if performed.

For inorganic, metals, and radiochemical analyses, QC acceptance criteria for laboratory duplicate samples, matrix spike samples, matrix spike duplicate samples, surrogate recoveries, and laboratory control samples are provided in HASQARD (DOE/RL-96-68). For organic analyses, QC acceptance criteria are typically statistically derived from historical data at the laboratories in accordance with SW-846.

2.2.4 Measurement Equipment

Each user of the measuring equipment is responsible to ensure the equipment is functioning as expected, properly handled, and is properly calibrated at required frequencies in accordance with methods governing the control of measuring equipment. Onsite environmental instrument testing, inspection, calibration, and maintenance shall be recorded in accordance with approved methods. Field screening instruments will be used, maintained, and calibrated in accordance with the manufacturers' specifications and other approved methods.

2.2.5 Instrument and Equipment Testing, Inspection, and Maintenance

Collection, measurement, and testing equipment should meet applicable standards (e.g., ASTM) or should have been evaluated as acceptable and valid in accordance with methods, requirements, and specifications. Software applications will be acceptance tested prior to use in the field.

Measurement and testing equipment used in the field or laboratory directly affecting 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 (e.g., documentation of routine maintenance) will be included in the individual laboratory and onsite organization's QA plan or operating protocols, as appropriate. Maintenance of laboratory instruments will be performed in a manner consistent with applicable Hanford Site requirements.

2.2.6 Instrument/Equipment Calibration and Frequency

Analytical laboratory instruments and measuring equipment are calibrated in accordance with the laboratory's QA plan and applicable Hanford Site requirements.

2.2.7 Inspection/Acceptance of Supplies and Consumables

Consumables, supplies, and reagents will be reviewed in accordance with SW-846 requirements and will be appropriate for their use. Supplies and consumables used to support sampling and analysis activities are procured in accordance with internal work requirements and processes. Responsibilities and interfaces

necessary to ensure that items procured/acquired for the contractor meet the specific technical and quality requirements must be in place. The procurement system ensures that purchased items comply with applicable procurement specifications. Supplies and consumables are checked and accepted by users prior to use.

2.3 Assessment and Oversight

The elements in assessment and oversight address the activities for assessing the effectiveness of project implementation and associated QA and QC activities. The purpose of assessment is to ensure that the QAPjP is implemented as prescribed.

2.3.1 Assessments and Response Actions

Contractor management, Environmental Compliance, QA, and/or Health and Safety organizations may conduct random surveillances and assessments to verify compliance with the requirements outlined in this SAP, project work packages, procedures, and regulatory requirements.

If circumstances arise in the field dictating the need for additional assessment activities, then additional assessments will be performed. Deficiencies identified by these assessments will be reported in accordance with existing programmatic requirements. The project's line management chain coordinates the corrective actions/deficiencies in accordance with the contractor QA program, the corrective action management program, and associated procedures implementing these programs.

Oversight activities in the analytical laboratories, including corrective action management, are conducted in accordance with the laboratories QA plans. The contractor oversees offsite analytical laboratories and qualifies the laboratories for performing Hanford Site analytical work.

2.3.2 Reports to Management

Reports to management on data quality issues will be made when these issues are identified. Issues reported by the laboratories are communicated to the SMR organization, which then initiates a sample issue resolution form in accordance with contractor procedures. This process is used to document analytical or sample issues and to establish resolution with the removal action project manager.

2.4 Data Validation and Usability

The elements in this section address the QA activities that occur after the data collection or generation phase of the project has been completed. Implementation of these elements determines whether the data conform to the specified criteria, thus satisfying project objectives.

2.4.1 Data Review, Verification, and Validation

The criteria for verification include, but are not limited to, review for completeness (samples were analyzed as requested), use of the correct analytical method/procedure, identification of transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight, and correct application of conversion factors. Laboratory personnel may perform data verification.

Data validation will be performed to ensure that the data quality goals established during the planning phase have been achieved. Data validation will be in accordance with internal procedures. The criteria for data validation are based on a graded approach. The primary contractor has defined five levels of validation: Levels A through E. Level A is the lowest level and is the same as verification. Level E is a 100 percent review of data (e.g., calibration data; calculations of representative samples from the data set).

Validation will be performed to contractor Level C, which is a review for the QC data. Level C validation specifically requires verification of deliverables; requested versus reported analyses; and qualification of the results based on analytical holding times, method blank results, matrix spike/matrix spike duplicates, surrogate recoveries, duplicates, and analytical method blanks. Level C validation will be performed on at least 5 percent of the data by matrix and analyte group. Analyte group refers to categories, such as radionuclides, VOCs, semi-VOCs, polychlorinated biphenyls, metals, and anions. The goal is to cover the various analyte groups and matrices during the validation.

Relative to analytical data in sample media, physical data and/or field screening results are of lesser importance in making inferences of risk. Field QA/QC will be reviewed to ensure that physical property data and/or field screening results are useable.

Review, verification, and validation of NDA-derived data are completed in accordance with program procedures.

2.4.2 Validation Methods

Validation activities will be based on EPA functional guidelines. Data validation may be performed by the SMR organization and/or by a party independent of both the data collector and the data user. Data validation qualifiers must be compatible with the HEIS database.

When outliers or questionable results are identified, additional data validation will be performed. The additional validation will be performed for 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 data are usable. 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 data set. Data validation will be documented in data validation reports. An example of questionable data is if the positive detections are greater than the practical quantitation limit or reporting limit in soil/aquifer sediment from a site that should not have exhibited contamination. Similarly, results below background would not be expected and could trigger a validation inquiry. The determination of data usability will be conducted and documented in a DQA report. Data validation will be documented in data validation reports, which will be included in the project file.

2.4.3 Reconciliation with User Requirements

The 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 data needs. The results of the DQA will be used in interpreting the data and determining if the objectives of this activity have been met.

3 Field Sampling Plan

The field sampling plan defines project sampling and analytical requirements, including sampling methods and analyses that will be performed. Before beginning field investigations, sampling design requirements will be converted into sampling instructions (e.g., work packages) that will provide specific direction regarding the number and location of samples for the various media (e.g., concrete or soil).

3.1 Sampling Activities

This field sampling plan identifies the sampling activities designed to meet the 236Z/242Z slab removal data needs:

- A determination of controls required for safe slab removal (completed by D4 characterization)
- A determination of localized soil contamination (hot spots) underneath the slabs
- An estimate of the radiological contamination remaining after the slab in the underlying soil

Table 3-1 provides a general summary of the sampling that will be conducted. Data from the sampling and characterization activities prior to and during D4 removal activities and process information will be used to support the safe removal and disposal of the slabs and any associated soil. No additional characterization will be conducted for slab removal and disposal under this SAP. It is anticipated that some of the waste will be transuranic (TRU) and will shipped to the Central Waste Complex for storage and then to eventual disposal at the Waste Isolation Pilot Plant near Carlsbad, New Mexico. The remaining waste is expected to be non-TRU and will be shipped to ERDF for disposal.

3.2 Sampling Design

The purpose of this sampling design is to guide sampling and data acquisition to support the characterization of the soil underneath the slabs and the WIDS waste site discovery process. The characterization needs for the safe removal and disposal of the 236Z/242Z slabs will be conducted as part of the D4 activities and not part of this sampling design. The two sampling areas identified during the systematic planning process are as follows:

- Localized surface soil contamination underneath the slabs
- Remaining soil underlying the slab

A general discussion of the data being gathered is provided in the following subsections. Sampling and characterization activities that are being conducted for 236Z/242Z D4 activities will be used to support slab removal and disposal.

Before beginning field investigations described in this SAP, sampling design requirements will be converted into field instructions (e.g., work packages) providing specific direction for field activities through PFP procedures and work processes.

3.2.1 Localized Surface Soil Contamination

Following evaluation of the construction information and process history for the 236Z/242Z Buildings, samples will be obtained of the underlying soil during slab demolition. Portions of the concrete slab may be removed prior to disposal for additional characterization. The sampling design for potential localized soil contamination or soil hot spots is based on focused/judgmental sampling. In focused/judgmental sampling, the selection of sampling units (i.e., number, location, and/or timing of sample collection) is based on knowledge of the feature or condition under investigation and on professional judgment.

Table 3-1. General Sampling Table Summary

Waste Sites	Data Needs	General Sampling Approach	Location and Number of Samples	Sample Analytes
All sites	Radiological and chemical data for slab removal and waste disposal	Perform initial site evaluation, including site historical document review, visual inspections, and initial radiation surveys to guide comprehensive radiological field screening. Perform field radiological surveys and/or chemical field surveys and document (photographs, field screening reports, etc.) to identify contamination is below normal action levels. Where zones of contamination (hot spots) are indicated by inspections and field screening that require sampling: • Perform focused, judgmental grab sampling of soil as specified under the "Location and Number of Samples" column, and document sampling activities, including depth of sample collection, and field activities (photographs, field screening reports, etc.). As required, perform sampling of the balance of the site (non-hot spot locations).	Collect one quality control duplicate and one field blank for each slab. At each noncontiguous sample location, collect at least one focused, judgmental soil sample. The sample can be of surface soil where excavation is not indicated or at excavation sites from the bottom of the excavation. For small areas, collect at least one sample from random site grids possibly using the coordinates established for the radiological survey. For larger areas, collect up to four samples using a similar grid system.	Where both chemical and radiological contamination is indicated, analyze samples for all constituents. Where only chemicals are present and radiological field screening identifies no radionuclide contamination, analyze only for chemicals. Where only radiological contamination is present, radiological surveys will be used to verify removal action levels are met.

3.2.2 Radiological Survey of Remaining Soil Footprint

After removal of the 236Z and 242Z concrete slabs and the determining the potential contamination of the underlying soils (approximately 0.9 m [3 ft] below the slabs), radiological characterization will be completed on all newly exposed soil surfaces prior to backfilling. The survey will encompass the entire footprint of the 236Z/242Z slabs.

3.3 Sample Location

The sampling location for slab and underlying soil contamination will be determined during removal of the concrete slabs. Focused/judgmental sampling locations for the slabs are based on process history for the 236Z/242Z Buildings, where accumulations of liquids may have occurred. Locations for focused/judgmental sampling of the surface soil contamination will be determined (1) during the slab characterization where areas of liquids may have occurred, and (2) if there is any evidence of soil staining from liquid releases or higher-than-expected radiation levels. The PFP work processes and sampling instructions will identify the sampling locations and number of samples needed.

3.4 Sampling Methods

Potential field sampling methods are described in the following subsections. Sampling instructions will be developed during the implementation of PFP work processes and will contain information necessary for sampling locations and methods to be used. Depending on the sampling location, methods such as grab sampling or split spoon may be used.

3.4.1 Radiological Surveys

When the removal is complete, surveys will be performed over the excavated footprint to quantify the residual exposure potential. Portable ion-chamber dose rate and scintillation alpha activity survey instrumentation will be used. The final survey will be separately reported by Radiological Engineering and will be used for the WIDS transition process.

3.4.2 Surface Soil Sampling of Localized Soil Contamination

Collection of localized surface soil samples (hot spots) can be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material is brushed aside and a stainless-steel or plastic scoop is then used to collect the sample. The remaining concrete and/or debris may be scraped away to reach bare soil with a clean stainless-steel spade or trowel.

3.4.3 Sample Containers/Preservation/Holding Time

To ensure sample and data usability, sampling will be performed in accordance with HASQARD (DOE/RL-96-68) pertaining to sample collection, collection equipment, and sample handling.

Suggested sample container, preservation, and holding-time requirements are specified in Table 3-2 for samples and are in accordance with the analytical method specified. The final container types and volumes will be identified on the sampling authorization form and the chain-of-custody form. This SAP defines a “sample” as a filled sample bottle for starting the clock for holding-time restrictions.

Holding time is the elapsed time period between sample collection and analysis. Exceeding required holding times could result in changes in constituent concentrations due to volatilization, decomposition, radiological decay, or other alterations. Required holding times depend on the analytical method, as specified in three-digit EPA methods (EPA-600/4-79-020) or the four-digit EPA methods (SW-846).

For some samples, preservatives are required. Preservatives may be added to the collection bottles before their use in the field, or it is allowable to add the preservatives immediately after sample collection.

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

Analytes[a]	Matrix	Bottle		Amount[b,c]		Preservation	Packing Requirements	Holding Time[d]
		Number	Type	Minimum	Optimal			
Radionuclides								
Americium-241	Soil	1	G/P	8 g	20 g	None	None	6 months
Plutonium-238	Soil	1	G/P	8 g	20 g	None	None	6 months
Plutonium-239/240	Soil	1	G/P	8 g	20 g	None	None	6 months
Uranium-233/234	Soil	1	G/P	5 g	10 g	None	None	6 months
Uranium-235	Soil	1	G/P	5 g	10 g	None	None	6 months
Uranium-238	Soil	1	G/P	5 g	10 g	None	None	6 months
Chemicals								
Ion Chromatography Anions – EPA Method 300.0	Soil	1	G/P	30 g	60 g	Cool 4°C	Cool ≤6°C	28 days/ 48 hours[e]
Metals by ICP, ICP-MS	Soil	1	G/P	10 g	20 g	Cool 4°C	Cool ≤6°C	6 months

a. Four-digit EPA methods are found in SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V*. EPA Method 300.0 is found in EPA/600/R-93/100, *Methods for the Determination of Inorganic Substances in Environmental Samples*.

b. Optimal sample amounts, which may be adjusted downward to accommodate the possibility of retrieval of a small amount of sample. Minimum sample size includes material needed for laboratory batch QC.

c. Mixed soil samples (collocated subsamples that are homogenized to ensure that the minimum sample amount requirements are met) may be obtained and submitted to the analytical laboratory for analyses for specific analytes.

d. The first number shown is the number of days to extract and the second number is the number of days to analyze the extract.

e. The EPA Method 300.0 nitrate, nitrite, and phosphate holding time is 48 hours after sample extraction preparation. The holding time of 28 days applies to all other anions quantified by EPA Method 300.0.

EPA = U.S. Environmental Protection Agency
G/P = glass/plastic
ICP = inductively coupled plasma
ICP-MS = inductively coupled plasma-mass spectrometry

3.4.4 Decontamination of Sampling Equipment

Sampling equipment shall be decontaminated in accordance with the appropriate sampling equipment decontamination methods. To prevent potential contamination of samples, care should be taken to use decontaminated equipment for each sampling activity.

Special care should be taken 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

3.4.5 Radiological Field Data

Alpha and beta/gamma data collection in the field will be used as needed to support sampling and analysis efforts. Radiological screening shall be performed by RCTs or other qualified personnel. RCTs will record field measurements, noting the depth of the sample and the instrument reading.

The following information will be distributed to personnel performing work in support of this SAP:

- Instructions to RCTs on the methods required to measure sample activity and media for gamma, alpha, and/or beta emissions, as appropriate.
- Information regarding portable radiological field instrumentation, including a physical description of the instruments, radiation and energy response characteristics, calibration/maintenance and performance testing descriptions, and the application/operation of the instrument. These instruments are commonly used on the Hanford Site to obtain measurements of removable surface contamination measurements and direct measurements of total surface contamination.
- Instructions regarding the minimum requirements for documenting radiological controls information in accordance with 10 CFR 835.
- Instructions for managing the identification, creation, review, approval, storage, transfer, and retrieval of radiological information.
- The minimum standards and practices necessary for preparing, performing, and retaining radiological-related information.
- The requirements associated with preparing and transporting regulated material.
- Daily reports of radiological surveys and measurements collected during conduct of field investigation activities. Data will be cross-referenced between laboratory analytical data and radiation measurements to facilitate interpreting the investigation results.

3.5 Documentation of Field Activities

Logbooks or data forms are required for field activities. A logbook must be identified with a unique project name and number. The individual(s) responsible for logbooks will be identified in the front of the logbook and only authorized persons may make entries in logbooks. All logbook entries will be reviewed by the FWS, cognizant scientist/engineer or other responsible manager; the review will be documented with signature and date. Logbooks will be permanently bound, waterproof, and ruled with sequentially numbered pages. Pages will not be removed from logbooks for any reason. Entries will be made in indelible ink. Corrections will be made by marking through the erroneous data with a single line, entering the correct data, and initialing and dating the changes.

Data forms may be used to collect field information; however, the information recorded on data forms must follow the same requirements as those for logbooks. The data forms must be referenced in the logbooks.

A summary of information to be recorded in logbooks is as follows:

- Purpose of activity
- Day, date, time, and weather conditions
- Names, titles, and organizations of personnel present
- Deviations from the QAPjP
- All site activities, including field tests
- Materials quality documentation (e.g., certifications)
- Details of samples collected (e.g., preparation, splits, duplicates, matrix spikes, and blanks)
- Location and types of samples
- Chain-of-custody details and variances relating to chain-of-custody
- Field measurements
- Field calibrations testing, inspections, maintenance and surveys, and equipment identification numbers, as applicable
- Equipment decontaminated, number of decontaminations, and variations to decontamination methods
- Equipment failures or breakdowns, and descriptions of any corrective actions
- Telephone calls relating to field activities

3.5.1 Corrective Actions and Deviations for Sampling Activities

The PFP removal action project manager, FWS, and SMR personnel must document deviations from protocols, issues pertaining to sample collection, chain-of-custody forms, target analytes, contaminants of potential concern, sample transport, or noncompliant monitoring. Examples of deviations include samples not collected due to field conditions, changes in sample locations due to physical obstructions, or additions of sample depth(s).

As appropriate, such deviations or issues will be documented in the field logbook or on nonconformance report forms in accordance with internal corrective action methods. The PFP removal action project manager, FWS, or SMR personnel will be responsible for communicating field corrective action requirements and for ensuring that immediate corrective actions are applied to field activities.

Changes in sample activities require notification, approval, and documentation as noted in Tables 2-4 and 2-5.

3.6 Calibration of Field Equipment

The FWS is responsible for ensuring that field equipment is calibrated appropriately. Onsite environmental instruments are calibrated in accordance with the manufacturers' operating instructions, internal work requirements and processes, and/or field instructions that provide direction for equipment calibration or verification of accuracy by analytical methods. The results from all instrument calibration activities are recorded in accordance with HASQARD (DOE/RL-96-68).

Field instrumentation, calibration, and QA checks will be performed as follows:

- Prior to initial use of a field analytical measurement system.
- At the frequency recommended by the manufacturer or methods, or as required by regulations.
- Upon failure to meet specified QC criteria.
- Calibration of radiological field instruments on the Hanford Site is performed by the other Hanford Site prime contractors, as specified by their calibration program.
- Daily calibration checks will be performed and documented for each instrument used to characterize areas under investigation. These checks will be made on standard materials sufficiently similar to the matrix under consideration to allow for direct comparison of data. Analysis times will be sufficient to establish detection efficiency and resolution.
- Standards used for calibration will be traceable to nationally or internationally recognized standard agency source or measurement system, if available.

3.7 Sample Handling

This section describes packaging, container labeling, sample custody, and sample transportation.

3.7.1 Packaging

Pre-cleaned sample containers with certificates of analysis denoting compliance with EPA specifications (EPA 540/R-93/051, *Specifications and Guidance for Contaminant-Free Sample Containers*) for the intended analyses will be used for samples collected for chemical analysis. Container sizes may vary depending upon laboratory-specific volumes/requirements for meeting analytical detection limits. The Radiological Engineering organization will measure the contamination levels and the dose rates associated with the sample containers. This information, along with other data, will be used to select proper packaging, marking, labeling, and shipping paperwork and to verify that the sample can be received by the analytical laboratory in accordance with the laboratory's acceptance criteria. If the dose rate on the outside of a sample container or the curie content exceeds levels acceptable by an offsite laboratory, the Field Team Leader (in consultation with the SMR organization) can send smaller volumes to the laboratory. Preliminary sample bottle types identified in Table 3-2.

3.7.2 Container Labeling

The sample locations, depths, and corresponding HEIS numbers are documented in the sampler's field logbook. A custody seal (e.g., evidence tape) is affixed to each sample container and/or the sample collection package in such a way as to indicate potential tampering.

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

- Sampling authorization form
- HEIS number
- Sample collection date and time
- Analysis required
- Preservation method (if applicable)
- Sample authorization form number

In addition, sample records must include the following information:

- Analysis required
- Source of sample
- Matrix (e.g., water and soil)
- Field data (e.g., pH and radiological readings)

A custody seal (i.e., evidence tape) will be affixed to the lid of each sample container. The custody seal will be inscribed with the sampler's initials and the date. Custody seals and any other required labels or documentation can be fixed to the exterior of a plastic bag holding the samples in a manner that allows detection of potential tampering.

3.7.3 Sample Custody

Sample custody will be maintained in accordance with existing Hanford Site protocols to ensure the maintenance of sample integrity throughout the analytical process. Chain-of-custody procedures will be followed throughout sample collection, transfer, analysis, and disposal to ensure that sample integrity is maintained. A chain-of-custody record will be initiated in the field at the time of sampling and will accompany each set of samples shipped to any laboratory.

Shipping requirements will determine how sample shipping containers are prepared for shipment. The analyses requested for each sample will be indicated on the accompanying chain-of-custody form. Each time the responsibility changes for the custody of the sample, the new and previous custodians will sign the record and note the date and time. The sampler will make a copy of the signed record before sample shipment and will transmit the copy to the SMR organization within 48 hours of shipping.

The following information is required on a completed chain-of-custody form:

- Project name
- Signature of sampler
- Unique sample number
- Date and time of collection
- Matrix
- Preservatives
- Signatures of individual involved in sample transfer
- Requested analyses (or reference thereto)

3.7.4 Sample Transportation

Sample transportation will be in compliance with the applicable regulations for packaging, marking, labeling, and shipping hazardous materials, hazardous substances, and hazardous waste mandated by the U.S. Department of Transportation (49 CFR 171, "Transportation," "General Information, Regulations, and Definitions," through 49 CFR 177, "Carriage by Public Highway," Chapter 1) in association with the International Air Transportation Authority, DOE requirements, and applicable program-specific implementing procedures.

3.8 Management of Waste

All waste (including unexpected waste) generated by sampling activities will be managed in accordance with the waste management sections of the RAWP (DOE/RL-2011-03). Pursuant to 40 CFR 300.440, "National Oil and Hazardous Substances Pollution Contingency Plan," "Procedures for Planning and

Implementing Off-Site Response Actions," approval from the CERCLA DOE-RL remedial project manager is required before returning unused samples or waste from offsite laboratories.

3.9 Health and Safety Plan

Field operations will be performed in accordance with 10 CFR 851, "Worker Safety and Health Program," health and safety requirements, and appropriate CHPRC PFP requirements. Work control documents will be prepared to provide further control of site operations. Safety documentation will include an activity hazard analysis and, as applicable, radiological work permits. The sampling procedures and associated activities will implement ALARA practices to minimize radiation exposure to the sampling team, consistent with the requirements defined in 10 CFR 835.

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4 References

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