DOE/RL-2014-20
Revision 1

# Sampling and Analysis Plan for the 200-PW-1 Operable Unit Calendar Year 2015 Rebound Sampling

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

CH2MHILL
Plateau Remediation Company
**P.O. Box 1600**
**Richland, Washington 99352**

**Approved for Public Release;**
**Further Dissemination Unlimited**

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***APPROVED***
***By Ashley R Jenkins at 7:22 am, Jun 08, 2015***

Release Approval | Date

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**Title** DOE/RL-2014-20, *Sampling and Analysis Plan for the 200-PW-1 Operable Unit Calendar Year 2015 Rebound Sampling*

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U.S. Department of Energy, Richland Operations Office

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U.S. Environmental Protection Agency

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# Terms

| | |
|---|---|
| ALARA | as low as reasonably achievable |
| ASTM | ASTM International, formerly American Society for Testing and Materials |
| BTR | Buyer's Technical Representative |
| CAS | Chemical Abstracts Service |
| CCS | continuing calibration check standards |
| CCU | Cold Creek unit |
| CERCLA | *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* |
| CHPRC | CH2M HILL Plateau Remediation Company |
| CPT | cone penetrometer |
| CY | calendar year |
| DOE | U.S. Department of Energy |
| DOE-RL | DOE Richland Operations Office |
| DOT | U.S. Department of Transportation |
| DQA | data quality assessment |
| DQI | data quality indicator |
| DQO | data quality objective |
| ECO | Environmental Compliance Officer |
| Ecology | Washington State Department of Ecology |
| EPA | U.S. Environmental Protection Agency |
| FSO | Field Sampling Operations |
| FTB | full trip blank |
| FXR | field transfer blank |
| FWS | Field Work Supervisor |
| GC/MS | gas chromatography–mass spectrometry |
| HASQARD | *Hanford Analytical Services Quality Assurance Requirements Document* (DOE/RL-96-68) |
| HEIS | Hanford Environmental Information System |
| IATA | International Air Transportation Association |

| | |
|---|---|
| ICS | initial calibration check standards |
| LCS | laboratory control sample |
| LRA | lead regulatory agency |
| MB | method blank |
| MDL | method detection limit |
| MS | matrix spike |
| MSA | Mission Support Alliance |
| MSD | matrix spike duplicate |
| N/A | not available, not applicable |
| NCO | Nuclear Chemical Operator |
| OU | operable unit |
| QA | quality assurance |
| QAPjP | quality assurance project plan |
| QC | quality control |
| RD/RAWP | remedial design/remedial action work plan |
| RDR | request for data review |
| ROD | record of decision |
| RPD | relative percent difference |
| S&GRP | Soil and Groundwater Remediation Project |
| SAF | sample analysis form |
| SAP | sampling and analysis plan |
| SMR | Sample Management and Reporting |
| SPLIT | field split |
| SUR | surrogate |
| SVE | soil vapor extraction |
| TPA | Tri-Party Agreement |
| Tri-Party Agreement | *Hanford Federal Facility Agreement and Consent Order* |
| VOA | volatile organic analysis |
| VOC | volatile organic compound |

# 1 Introduction

This sampling and analysis plan (SAP) provides the quality assurance project plan (QAPjP) and field sampling requirements for soil vapor rebound sampling to be conducted at existing soil vapor sampling locations at the 200-PW-1 Operable Unit (OU) in the Inner Area of the Hanford Site (Figure 1-1). Soil vapor extraction (SVE) has been used to remove carbon tetrachloride and its degradation products (e.g., methylene chloride) from the vadose zone at the 200-PW-1 OU since 1992. Active SVE systems were last shut down in October 2012. Passive SVE wells were taken out of service permanently in March 2013. Analytical results from this rebound sampling event will support decision making regarding permanently discontinuing operation of the SVE system.

## 1.1 Background

From the time the Z Plant complex (now referred to as the Plutonium Finishing Plant [PFP] Complex) came online in 1949, it generated large volumes of waste effluent from chemical processes and plutonium finishing activities. Waste effluents were discharged to the soil column at subsurface engineered waste sites. These engineered waste sites were designed to provide effective disposal of effluent to the soil column but were operated in a manner intended to limit adverse impacts to groundwater. Three of these waste sites (216-Z-9 Trench, 216-Z-1A Tile Field, and 216-Z-18 Crib) primarily received waste streams from solvent extraction systems. In addition to radiological and inorganic contaminants, these waste streams included significant volumes of organics, principally carbon tetrachloride, tributyl phosphate, and lard oil. The organics were discharged in dissolved phase as part of the aqueous waste streams and as nonaqueous phase liquids (batch discharges of spent solvent). The three sites were operated sequentially from April 1955 until May 1973, being replaced when conditions warranted. A fourth waste site (216-Z-12 Crib) is estimated to have received a small volume of organics, including carbon tetrachloride.

In 1992, an expedited response action was initiated at the 200-PW-1 OU to mitigate ongoing impacts to groundwater associated with residual carbon tetrachloride in the vadose zone at these three waste sites. Three SVE systems were used for continuous, full-scale operations at each of the three sites from 1992 through 1997. From 1998 through 2008, due to substantial reductions in accessible vapor-phase carbon tetrachloride, two of the extraction systems were taken out of service, and the third system was operated seasonally (typically from April through September) and alternated between the 216-Z-9 well field and the combined 216-Z-1A/216-Z-18 well field. From 2009 through 2012, two new SVE systems were operated seasonally: one at the 216-Z-9 well field and one at the combined 216-Z-1A/216-Z-18 well field. Between April 1991 (when the pilot test was conducted) and December 2012, approximately 80,107 kg (176,604 lb) of carbon tetrachloride was removed from the vadose zone using the SVE systems (SGW-54566, *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Calendar Year 2012*).

Passive SVE systems were installed on eight wells in the 216-Z-1A/216-Z-18 well field in fiscal year 1999. Passive SVE is a natural process driven by barometric pressure fluctuations and often is referred to as barometric pumping. Between October 1999 and March 2013, when they were taken out of service, the passive SVE wells removed approximately 110 kg (253 lb) of carbon tetrachloride from the vadose zone of the 200-PW-1 OU (SGW-54566).

Carbon tetrachloride concentrations in the extracted soil vapor have decreased significantly at the 216-Z-9 and 216-Z-1A/216-Z-18 well fields since SVE operations began. Carbon tetrachloride concentrations in soil vapor extracted from the 216-Z-9 well field, using the active SVE systems, declined from approximately 30,000 ppmv at startup in 1993 to a maximum of 14 ppmv in 2012. Carbon tetrachloride concentrations in soil vapor extracted from the 216-Z-1A/216-Z-18 well field, using the SVE systems,

declined from approximately 1,500 ppmv at startup in 1992 to a maximum of 11 ppmv in 2012. In the most recent discussion of the conceptual site model (PNNL-21326, *Treatability Test Report: Characterization of Vadose Zone Carbon Tetrachloride Source Strength Using Tomographic Methods at the 216-Z-9 Site*), the remaining carbon tetrachloride mass is likely held in fine-grained layers (e.g., the Cold Creek unit [CCU]) in the vadose zone, where it is less easily removed using SVE.

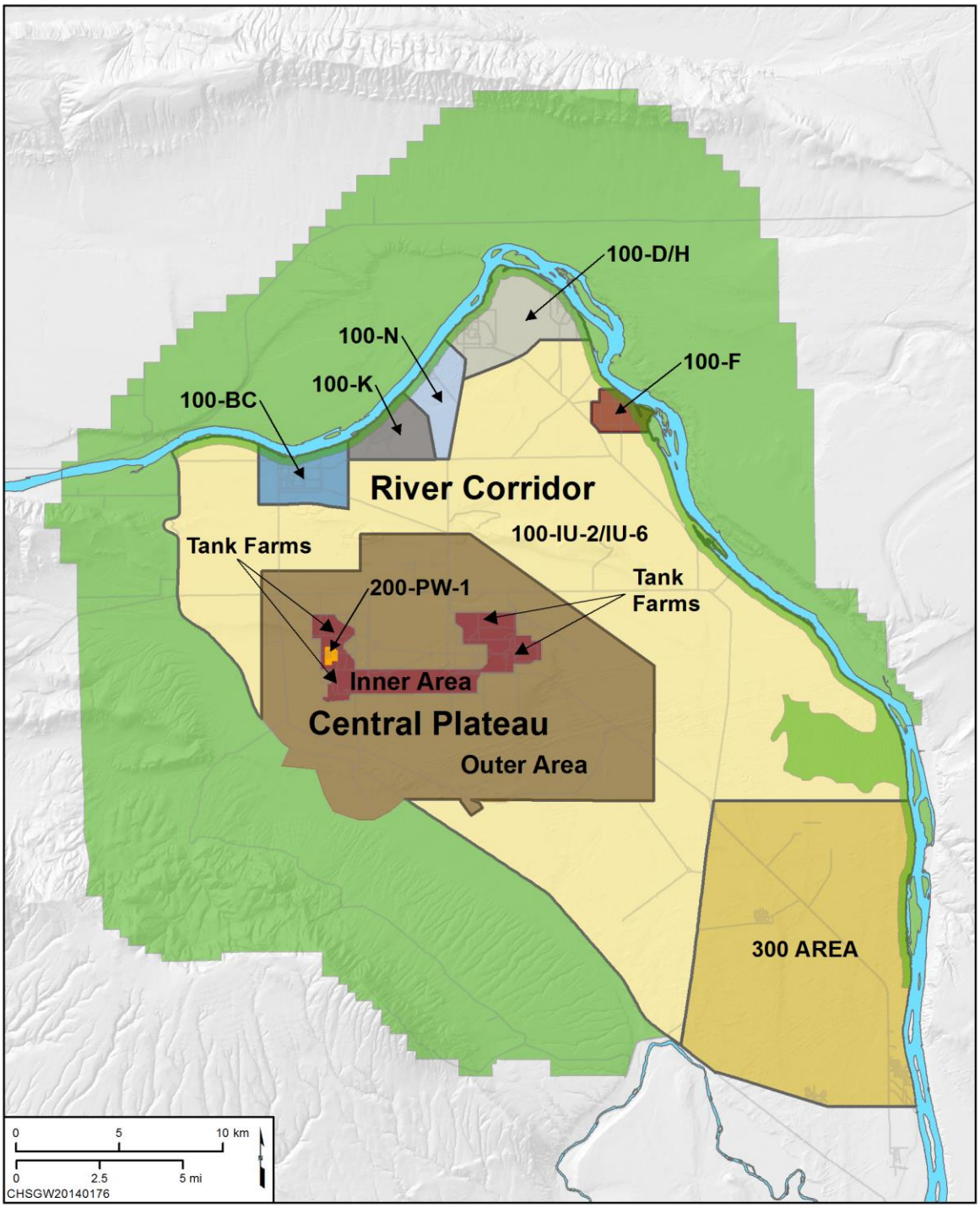
The 200-PW-1 OU record of decision (ROD) (EPA et al., 2011, *Record of Decision Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*) identified carbon tetrachloride and methylene chloride as contaminants of concern for soil vapor. Table 35 of the 200-PW-1 OU ROD (EPA et al., 2011) specified the final cleanup levels for carbon tetrachloride and methylene chloride in soil vapor as 100 and 50 ppmv, respectively, for protection of groundwater, subject to WAC 173-340, "Model Toxics Control Act—Cleanup". Analytical results from the most recent soil vapor samples (May 2014) showed carbon tetrachloride and methylene chloride concentrations were below these cleanup levels in all sampled wells/probes except CPT-28, located roughly 90 m (300 ft) south-southwest of 216-Z-9, and CPT-21A, located roughly 40 m (130 ft) south of 216-Z-9, where results slightly exceeded the soil vapor cleanup level for carbon tetrachloride.

## 1.2 Regulatory History

Between February 1992 and October 2011, SVE was operated as an interim action in accordance with "Action Memorandum: Expedited Response Action Proposal for 200 West Area Carbon Tetrachloride Plume" (Smith and Stanley, 1992). In 2012, SVE was operated in accordance with the 200-PW-1 OU ROD (EPA et al., 2011), which selected SVE as the final remedial action for vadose zone carbon tetrachloride contamination at these waste sites and the associated vadose zone that received carbon tetrachloride waste liquids. The 200-PW-1 OU ROD (EPA et al., 2011) specifies that SVE will continue to be implemented in accordance with the expedited response action until the remedial design/remedial action work plan (RD/RAWP) is approved. The RD/RAWP is to be submitted to the U.S. Environmental Protection Agency (EPA) for review by September 30, 2015 (Section 12.4 of the 200-PW-1 OU ROD [EPA et al., 2011]).

## 1.3 Purpose

The purpose of this SAP is to define sampling and analytical requirements for a soil vapor rebound sampling event in the 200-PW-1 OU. The SAP guides evaluation of the new data, in conjunction with previous soil vapor data collected since active SVE systems were put on standby in October 2012, to assess rebound of carbon tetrachloride and methylene chloride in soil vapor. Both the magnitude and trending of rebound will be assessed to support decision making regarding permanently discontinuing operation of the SVE systems. The proposed sampling locations are shown in Figures 1-2 and 1-3.




Source: Modified from DOE/RL-2011-118, *Hanford Site Groundwater Monitoring for 2011*.

**Figure 1-1. Location of the 200-PW-1 OU in the Inner Area of the Hanford Site**

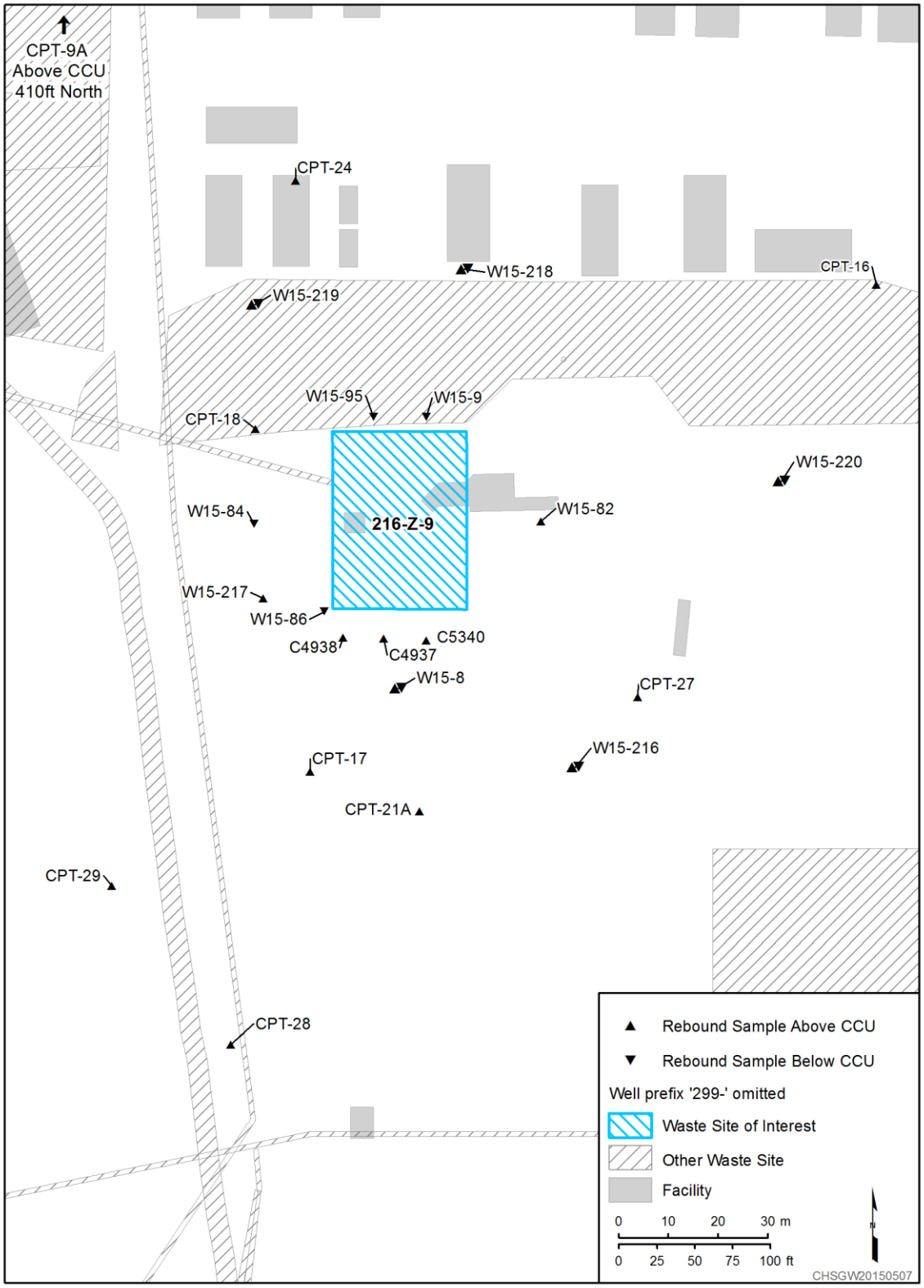



**Figure 1-2. Proposed Soil Vapor Sampling Locations near 216-Z-9**

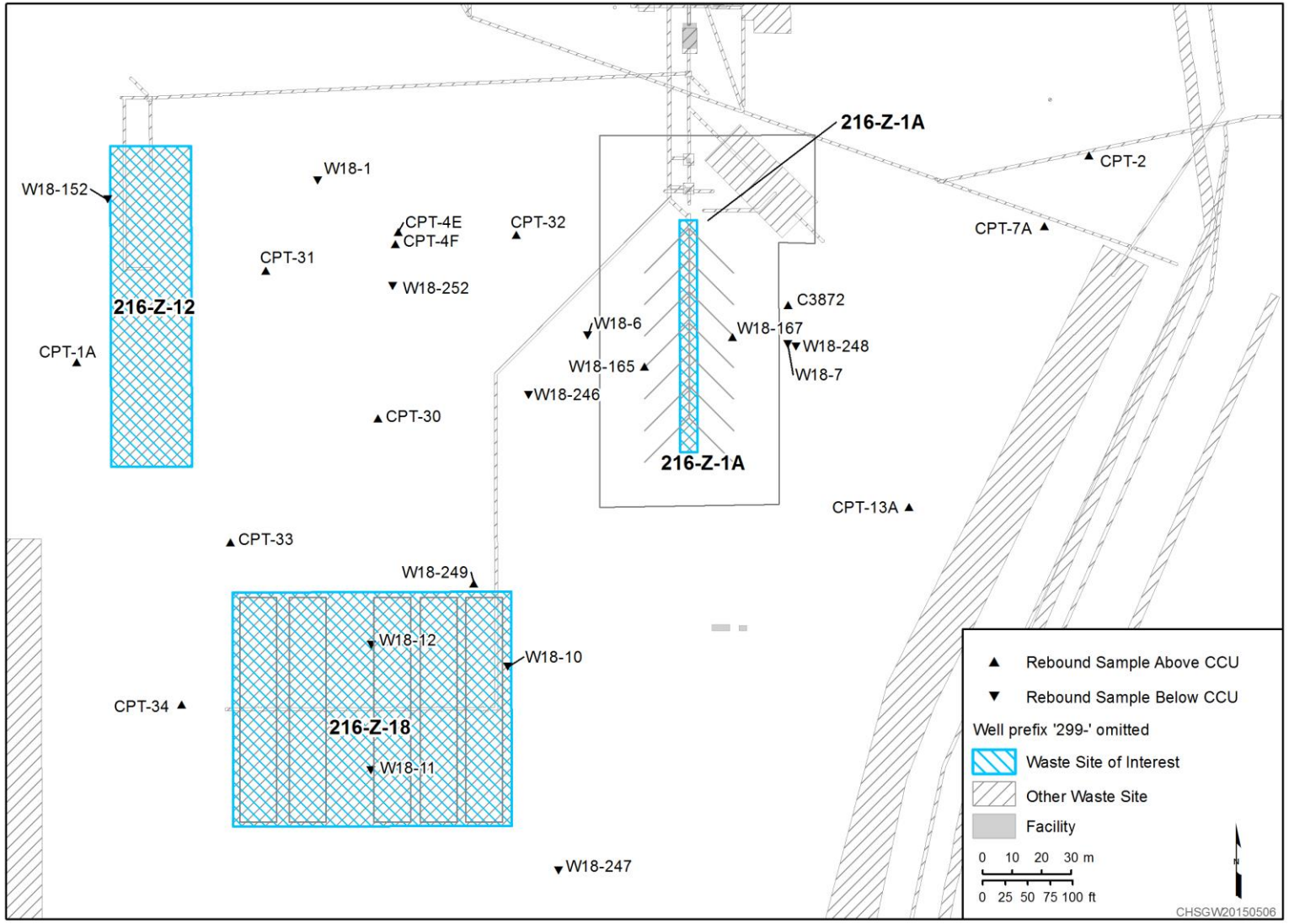



**Figure 1-3. Proposed Soil Vapor Sampling Locations near 216-Z-1A and 216-Z-18**

## 1.4 Objective

The primary objective is to collect and analyze soil vapor samples that reflect current concentrations of carbon tetrachloride and methylene chloride in the vadose zone at the 200-PW-1 OU. Analytical data will help define the magnitude and trending of contaminant concentration rebound over the 30-month period following the most recent shutdown of the active SVE systems (October 2012).

Comparison with previous soil vapor data from the same sample locations will provide an indication of the threat to groundwater posed by residual carbon tetrachloride and methylene chloride in the vadose zone of the 200-PW-1 OU. This, in turn, will support decision making regarding permanently discontinuing operation of the SVE systems.

## 1.5 Scope

This SAP guides the collection and analysis of soil vapor samples from existing 200-PW-1 OU soil vapor monitoring and extraction locations (Figures 1-2 and 1-3). Additionally, the status of each well with respect to its isolation from barometric effects (i.e., sealed to preclude barometric effects, partially sealed, not sealed, or unknown) will be documented during sampling at the following locations:

- Locations monitored after SVE shutdown in October 2012
- Locations formerly used as passive SVE (below the CCU)
- Locations below the CCU (216-Z-9)
- Locations at the perimeter of the study area

## 1.6 Site Geology/Hydrogeology

Detailed discussion of the stratigraphic units beneath the 200-PW-1 OU waste sites is provided in Section 3.1.3 of DOE/RL-2006-51, *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*. Briefly, the vadose zone underlying the primary carbon tetrachloride disposal sites of the 200-PW-1 OU consists of approximately 70 m (230 ft) of relatively permeable sand and gravel within the Ringold Formation (lower portion) and Hanford formation (upper portion). This section is interrupted from a depth of 38 to 45 m (125 to 148 ft) by the CCU, a less permeable interval composed of 4 m (13 ft) of silt and sand and 3 m (10 ft) of carbonate-rich silt and sand. Because of its higher concentration of calcium carbonate, the less permeable CCU is informally referred to as the caliche layer. The less permeable CCU interval constitutes a relatively low-flow zone and effectively divides the subsurface into the following two distinct higher-flow zones:

- Upper zone from the ground surface to the top of the less permeable layer
- Lower zone from the bottom of the less permeable layer to the water table (greater than 70 m [230 ft] bgs)

## 1.7 Statement of the Problem

Carbon tetrachloride and methylene chloride soil vapor concentrations in the 200-PW-1 OU have been steadily decreasing since 1992 due to the implementation of SVE operations. Two active SVE systems were operated until October 2012, and the passive SVE systems were operated until March 2013. Soil vapor samples were collected at SVE extraction and monitoring wells and probes in March 2013. The carbon tetrachloride and methylene chloride vapor concentrations were well below the soil vapor cleanup levels specified in the 200-PW-1 OU ROD (EPA et al., 2011) (carbon tetrachloride: 100 ppmv, methylene

chloride: 50 ppmv) in all SVE extraction and monitoring wells and in all but one soil vapor probe (CPT-28 at 26.5 m [87 ft] bgs), where carbon tetrachloride results slightly exceeded the soil vapor cleanup level. Because soil vapor impacts to groundwater are projected to be insignificant, a 1-year rebound study between April 2013 and April 2014 was conducted. Sampling for this phase of rebound was carried out in May 2014. Results showed carbon tetrachloride concentrations were below the cleanup level in all sampled wells and in all but two probes (CPT-28 at 26.5 m [87 ft] bgs and CPT-21A at 26.5 m [86 ft] bgs), where results slightly exceeded the soil vapor cleanup level. All methylene chloride concentrations were below the cleanup level but, at some locations, were elevated an order of magnitude higher than in samples collected in March 2013. It was determined that elevated methylene chloride concentrations were likely due to analytical interferences caused by new Tedlar® bags. Split samples collected in Summa canisters were all nondetect for methylene chloride.

To confirm field sample results, an additional 12-month rebound study was conducted between April 2014 and April 2015. It is now necessary to design a soil vapor sampling program to measure representative soil vapor concentrations at SVE extraction and monitoring wells and probes. The sampling results will be used to determine the rebound trends and evaluate whether SVE can be permanently terminated as recommended per DOE/RL-2014-48, *Endpoint Evaluation for the 200-PW-1 Operable Unit Soil Vapor Extraction System Operations*. Residual contamination will also be evaluated to ensure that groundwater cleanup levels will not be exceeded.

At issue is whether residual carbon tetrachloride and methylene chloride soil vapors in the vadose zone of the 200-PW-1 OU pose an unacceptable threat to groundwater.

## 1.8 Decision Statements and Decision Rules (or Data Needs)

The decision statements consolidate potential questions and alternative actions. Table 1-1 presents the decision statements and decision rules identified during the streamlined data quality objectives (DQOs) process.

Decision rules 2, 3, 4, and 5 do not drive sampling and analysis activities but do support interpretation of the rebound study results, supporting decision making with respect to permanently discontinuing operation of the SVE systems.

## 1.9 Contaminants of Potential Concern/Target Analytes

Carbon tetrachloride and methylene chloride are the target analytes. These are the only two contaminants identified in the 200-PW-1 OU ROD (EPA et al., 2011) that have soil vapor cleanup levels.

## 1.10 Sampling Design

The sampling design for the SVE wells and probes is judgmental. In judgmental sampling, selection of the sampling units (i.e., the number and location of sample intervals) is based on knowledge of the feature or condition under investigation and on professional judgment. The sampling locations and depths were selected to provide a current understanding of the concentration of carbon tetrachloride and methylene chloride in the soil vapor in the vadose zone around the 216-Z-9, 216-Z-1A, and 216-Z-18 waste sites, both above and below the CCU. Sampling design is addressed in Section 3.3; sample location and frequency are addressed in Section 3.5.

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## 1.11 Project Schedule

The project schedule is presented in Figure 1-4.

**Table 1-1. Decision Statements and Decision Rules**

| No. | Decision Statement | Decision Rule | Are Additional Data Needed? |
|---|---|---|---|
| 1 | Determine whether CY 2015 carbon tetrachloride and methylene chloride soil vapor concentrations meet the 200-PW-1 OU ROD (EPA et al., 2011) cleanup goals and reflect insubstantial rebound trends and, therefore, could provide EPA necessary information to approve permanently discontinuing operation of the SVE system as recommended per DOE/RL-2014-48, or, depending on the amount of rebound observed, perform either an additional year of rebound study or conduct an active cycle of SVE operations during an additional year. | If CY 2015 carbon tetrachloride and methylene chloride soil vapor concentrations are below the cleanup levels specified in the 200-PW-1 OU ROD (EPA et al., 2011) (100 and 50 ppmv, respectively) and reflect insubstantial rebound trends, then request EPA approval to permanently discontinue operation of the SVE system; otherwise, depending on the amount of rebound observed, either perform an additional year of rebound study, or conduct an active cycle of SVE operations an additional year. | Yes |
| 2 | Determine whether or not there are any wells/probes with anomalous concentrations* that suggest an unidentified contaminant source that could impact groundwater and, if necessary, prepare a design for additional characterization to obtain supplemental data; otherwise, no further characterization or monitoring is required.<br>* For the purposes of this study, anomalous concentrations are defined as more than a 50% increase from the previous measurement at a given well and suggest a substantive increasing trend. | If the concentrations of carbon tetrachloride and methylene chloride in any wells/probes appear anomalous,* suggesting an unidentified contaminant source that could impact groundwater, prepare a design for additional characterization to obtain supplemental data; otherwise, no further characterization or monitoring is required. | No<br>There are no sources outside of the three main disposal sites (DOE/RL-2014-48) |

**Table 1-1. Decision Statements and Decision Rules**

| No. | Decision Statement | Decision Rule | Are Additional Data Needed? |
|---|---|---|---|
| Source References: DOE/RL-2014-48, *Endpoint Evaluation for the 200-PW-1 Operable Unit Soil Vapor Extraction System Operations*.<br>EPA et al., 2011, *Record of Decision Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units.*<br>SGW-33746, *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Fiscal Year 2006*.<br>SGW-37111, *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Fiscal Year 2007*.<br>SGW-40456, *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Fiscal Year 2008*.<br>SGW-44694, *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Fiscal Year 2009*.<br>SGW-49388, *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Calendar Year 2010*.<br>SGW-51807, *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Calendar Year 2011*.<br>SGW-54566, *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Calendar Year 2012*. | | | |
| 3 | Determine whether existing CERCLA documentation adequately defines environmental impact pathways. | If existing CERCLA documentation sufficiently defines site-specific environmental impact pathways to support the closure process, then no further action is required; otherwise, revisit environmental impact pathways to identify aspects requiring further evaluation, and prepare a plan to address those aspects. | No<br>Environmental pathways are well defined at this time. |
| Source References: DOE/RL-2006-51, *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*.<br>DOE/RL-2007-27, *Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*. | | | |
| 4 | Determine whether existing CERCLA documentation adequately addresses cumulative risk to the environment. | If existing CERCLA documentation addresses cumulative risk to the environment sufficiently to support the closure process, then no further action is required; otherwise, revisit cumulative risk to identify aspects requiring further evaluation, and prepare a plan to address those aspects. | No<br>Human health and ecological risk were thoroughly addressed by the 200-PW-1 OU baseline risk assessment. |
| Source References: DOE/RL-2006-51 and DOE/RL-2007-27. | | | |

**Table 1-1. Decision Statements and Decision Rules**

| No. | Decision Statement | Decision Rule | Are Additional Data Needed? |
|---|---|---|---|
| 5 | Determine whether existing SVE remediation goals are adequately defined to support a decision to terminate active SVE. | If existing documentation defines SVE remediation goals sufficiently to support a decision to terminate active SVE, then no further action is required; otherwise, revisit the SVE remediation goals to identify aspects requiring further evaluation, and prepare a plan to address those aspects. | No<br>The 200-PW-1 OU ROD (EPA et al., 2011) and the DOE/RL-2014-48 endpoint evaluation clearly identify SVE remediation goals. |

Source References: DOE/RL-2006-51 and DOE/RL-2007-27.

DOE/RL-2014-48, *Endpoint Evaluation for the 200-PW-1 Operable Unit Soil Vapor Extraction System Operations*.

EPA et al., 2011, *Record of Decision Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*.

Source Reference: EPA et al., 2011, *Record of Decision Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

CY = calendar year

EPA = U.S. Environmental Protection Agency

ROD = record of decision

SVE = soil vapor extraction

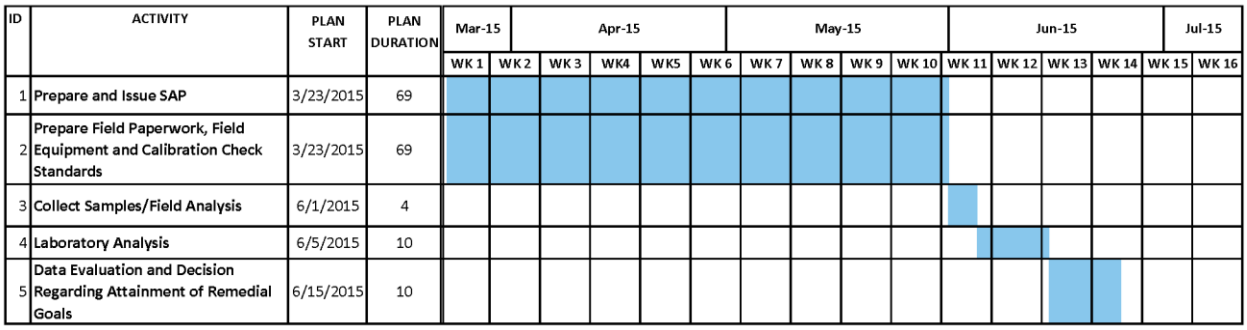


**Figure 1-4. Project Schedule**

# 2 Quality Assurance Project Plan

A QAPjP 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 describes the applicable environmental data collection requirements and controls based on the QA elements found in EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5), and DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD). Sections 6.5 and 7.8 of the Tri-Party Agreement (TPA) Action Plan (Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*) require the quality assurance (QA)/quality control (QC) and sampling and analysis activities to specify the QA requirements for treatment, storage, and disposal units, as well as for past-practice processes. This QAPjP also describes the applicable requirements and controls based on guidance found in Ecology Publication No. 04-03-030, *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*, and EPA/240/R-02/009, *Guidance for Quality Assurance Project Plans* (EPA QA/G-5). This QAPjP is intended to supplement the contractor's environmental QA program plan.

This QAPjP is divided into the following four sections, which describe the quality requirements and controls applicable to the soil vapor monitoring activities: Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Review and Usability.

## 2.1 Project Management

This section addresses project goals, management approaches planned, and planned output documentation.

### 2.1.1 Project/Task Organization

The contractor, or its approved subcontractor, is responsible for planning, coordinating, sampling, and shipping samples to the laboratory. The contractor is also responsible for preparing and maintaining configuration control of the SAP and assisting the U.S. Department of Energy (DOE)-Richland Operations Office (RL) Project Manager in obtaining approval of the SAP and future proposed revisions. The project organization is described in the following subsections and is illustrated in Figure 2-1.

#### *2.1.1.1 Regulatory Lead*

EPA is responsible for regulatory oversight of the 200-PW-1 OU SVE activity. EPA has the approval authority for the SAP. EPA works with DOE-RL to resolve concerns regarding the work described in this SAP in accordance with the TPA (Ecology et al., 1989a).

#### *2.1.1.2 DOE-RL Project Manager*

The DOE-RL Project Manager is responsible for the following tasks:

- Monitoring the contractor's performance of activities under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, *Resource Conservation and Recovery Act of 1976*, *Atomic Energy Act of 1954*, and TPA (Ecology et al., 1989a) for the Hanford Site
- Obtaining EPA approval of the SAP
- Authorizing field sampling activities
- Approving the SAP
- Functioning as primary interface with regulators

#### 2.1.1.3 DOE-RL Technical Lead

The DOE-RL Technical Lead is responsible for the following tasks:

- Providing day-to-day oversight of the contractor's work scope performance
- Working with the contractor and the regulatory agencies to identify and resolve technical issues
- Providing technical input to the DOE-RL Project Manager

#### 2.1.1.4 Operable Unit Project Manager

The OU Project Manager (or designee) is responsible and accountable for the following tasks:

- Completing project-related activities
- Coordinating with DOE-RL, regulators, and contractor management in support of sampling activities to ensure that work is performed safely and cost effectively
- Managing sampling documents and requirements, field activities, and subcontracted tasks and ensuring that the project file is properly maintained

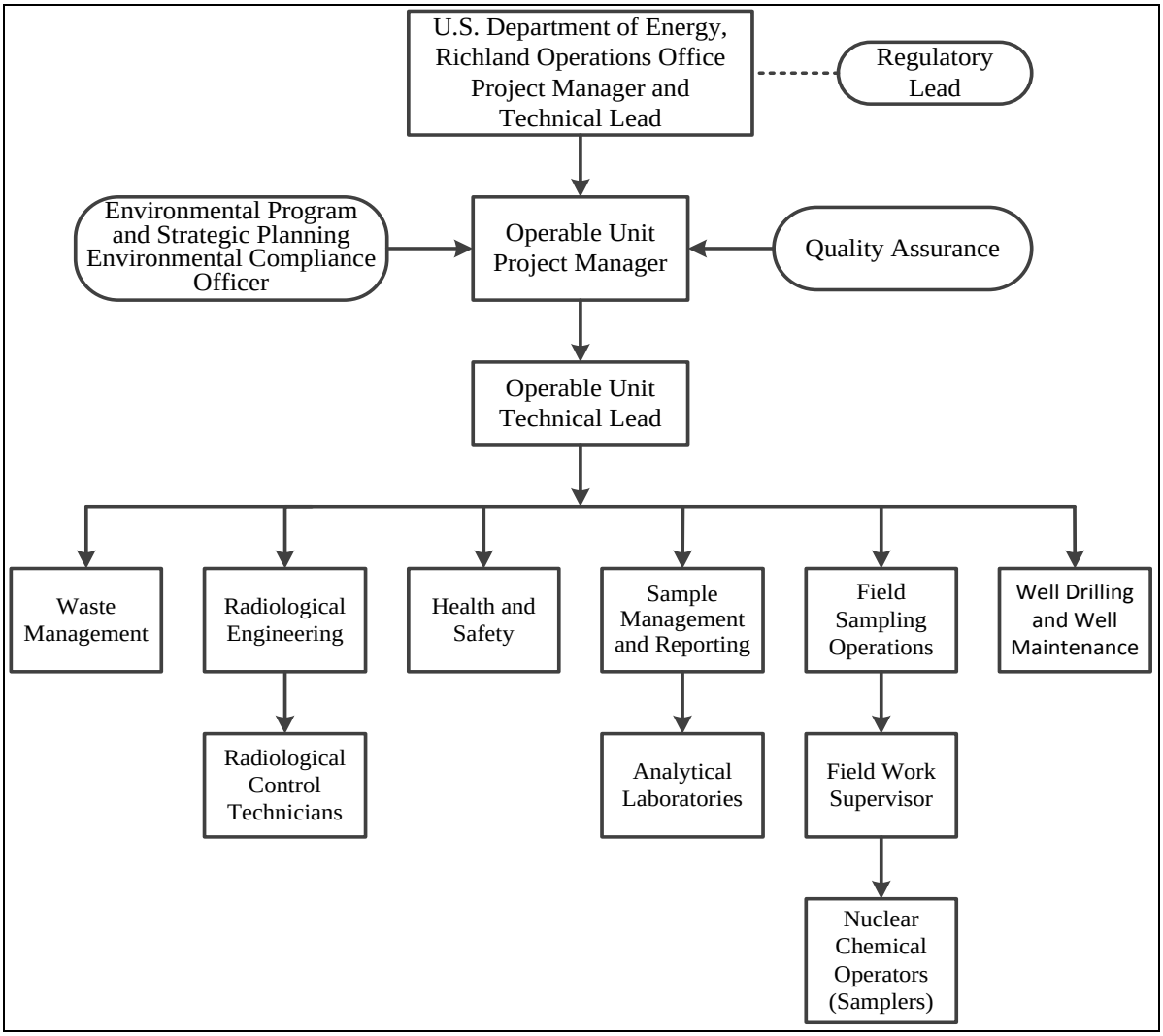


**Figure 2-1. Project Organization**

#### 2.1.1.5 Operable Unit Technical Lead

The OU Technical Lead is responsible for the following tasks:

- Developing specific sampling design, analytical requirements, and QC requirements (either independently or as defined through a systematic planning process)
- Ensuring that sampling and analysis activities, as delegated by the OU Project Manager, are carried out in accordance with the SAP
- Working 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 technical disciplines in planning and implementing the work scope

#### 2.1.1.6 Environmental Compliance Officer

The ECO is responsible for the following tasks:

- Providing technical oversight, direction, and acceptance of project and subcontracted environmental work
- Developing appropriate mitigation measures to minimize adverse environmental impacts
- Reviewing plans, protocols, and technical documents to ensure that environmental requirements have been addressed
- Identifying environmental issues affecting operations and developing cost-effective solutions
- Responding to environmental/regulatory issues or concerns
- Overseeing project implementation for compliance with applicable internal and external environmental requirements

#### 2.1.1.7 Quality Assurance

The QA point-of-contact is responsible for the following tasks:

- Addressing QA issues on the project
- Overseeing implementation of the project QA requirements
- Reviewing project documents (including the DQO summary report, QAPjP, and SAP)
- Reviewing data validation reports from third-party data validation contractors, as appropriate
- Participating in QA assessments on sample collection and analysis activities, as appropriate

#### 2.1.1.8 Health and Safety

The Health and Safety organization is responsible for the following tasks:

- Coordinating industrial safety and health support within the project, in accordance with the health and safety program, job hazard analyses, and other pertinent federal regulation
- Assisting project personnel in complying with the applicable health and safety program
- Coordinating with Radiological Engineering to determine personal protective equipment requirements

#### 2.1.1.9 Radiological Engineering

Radiological Engineering is responsible for the following tasks:

- Providing radiological engineering and project health physics support
- Conducting as low as reasonably achievable (ALARA) reviews, exposure and release modeling, and radiological controls optimization
- Identifying radiological hazards and ensuring that appropriate controls are implemented to maintain worker exposures to hazards at ALARA levels
- Interfacing with the project Health and Safety representative and other appropriate personnel, as needed, to plan and direct project Radiological Control Technician support

#### 2.1.1.10 Sample Management and Reporting Organization

The SMR organization is responsible for the following activities:

- Interfacing between the OU Technical Lead, Field Sampling Operations (FSO), Well Maintenance Organization, and analytical laboratories
- Generating field sampling documents, labels, and instructions for field sampling personnel
- Developing the sampling authorization form (SAF), which provides information and instruction to the analytical laboratories
- Providing instructions to the FSO Nuclear Chemical Operators (NCOs) on the collection of samples, as specified in a SAP
- Monitoring the entire sample and data process
- Coordinating laboratory analytical work and ensuring that the laboratories conform to Hanford Site QA requirements (or their equivalent), as approved by DOE, EPA, and the Washington State Department of Ecology (Ecology)
- Resolving sample documentation deficiencies or issues associated with FSO, laboratories, or other entities to ensure that project needs are met
- Receiving analytical data from the laboratories
- Ensuring that data are uploaded into the Hanford Environmental Information System (HEIS)
- Arranging for, and overseeing, data validation, as requested
- Informing the OU Project Manager and/or OU Technical Lead of any issues reported by the analytical laboratory

#### 2.1.1.11 Analytical Laboratories

Analytical laboratories are responsible for the following tasks:

- Analyzing samples in accordance with established methods
- Providing data packages containing analytical and QC results
- Providing explanations in response to resolution of analytical issues

- Meeting the requirements of this plan
- Being on the Mission Support Alliance (MSA) Evaluated Suppliers List
- Being accredited by Ecology for the analyses performed for the CH2M HILL Plateau Remediation Company (CHPRC) Soil and Groundwater Remediation Project (S&GRP)

#### *2.1.1.12 Waste Management*

Waste Management is responsible for the following tasks:

- Communicating policies and protocols
- Ensuring compliance for waste storage, transportation, disposal, and tracking in a safe and cost-effective manner
- Identifying waste management sampling and characterization requirements to ensure regulatory compliance
- Interpreting data to determine waste designations and profiles
- Preparing and maintaining other documents confirming compliance with waste acceptance criteria

#### *2.1.1.13 Field Sampling Organization*

The FSO is responsible for the following tasks:

- Planning, coordinating, and conducting field sampling activities
- The FWS directing NCOs (samplers) and ensuring that they are appropriately trained and available
- The FWS reviewing the SAP for field sample collection concerns, analytical requirements, and special sampling requirements
- Ensuring that sampling design is understood by NCOs and can be performed as specified; this is achieved by performing mock-ups and holding practice sessions with field personnel
- NCOs collecting all salient samples in accordance with sampling documentation
- Completing field logbook entries, chain-of-custody forms, and shipping paperwork and ensuring delivery of samples to the analytical laboratory
- The FWS acting as a technical interface between the OU Project Manager and the field crew supervisors (such as the Drilling Buyer's Technical Representative [BTR], and Geologist-BTR) and ensuring that technical aspects of the field work are met
- In consultation with the OU Project Manager and SMR, resolving issues arising from translation of technical requirements to field operations and coordinating resolution of sampling issues

#### *2.1.1.14 Well Maintenance*

The Well Maintenance Manager is responsible for the following tasks:

- Completing well maintenance activities
- Coordinating with the OU Technical Lead to identify field constraints that could affect soil vapor sampling

### 2.1.2 Quality Objectives and Criteria

The QA objective of this plan is to ensure the generation of analytical data of known and appropriate quality that are acceptable and useful for decision making. In support of this objective, statistics and data descriptors known as data quality indicators (DQIs) help determine the acceptability and utility of data to the user. The principal DQIs are precision, accuracy, representativeness, comparability, completeness, bias, and sensitivity. DQIs applicable to laboratory analysis are described in Table 2-1.

**Table 2-1. DQIs for Laboratory Analysis**

| 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.<br>• Use the same method to make repeated measurements of the same sample within a single laboratory.<br>• Acquire replicate field samples for information on sample acquisition, handling, shipping, storage, preparation, and analytical processes and measurements. | If duplicate data do not meet the objective:<br>• Evaluate apparent cause (e.g., sample heterogeneity).<br>• Request reanalysis or re-measurement.<br>• 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. QC 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:<br>• Qualify the data before use.<br>• Request reanalysis or re-measurement. |
| Representativeness | Sample representativeness expresses the degree to which data accurately and precisely represent 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 | • Evaluate whether measurements are made and physical samples are 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:<br>• Identify the reason for them not being representative.<br>• Flag for further review.<br>• Review data for usability. |

**Table 2-1. DQIs for Laboratory Analysis**

| DQI | Definition | Determination Methodologies | Corrective Actions |
|---|---|---|---|
| | the sampling program and will be satisfied by ensuring the approved plans were followed during sampling and analysis. | | • If data are usable, qualify the data for limited use, and define the portion of the system that the data represent.<br>• If data are not usable, flag as appropriate.<br>• Redefine sampling and measurement requirements and protocols.<br>• Resample and reanalyze, as appropriate. |
| 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 QA protocols. | If data are not comparable to other data sets:<br>• Identify appropriate changes to data collection and/or analysis methods.<br>• Identify quantifiable bias, if applicable.<br>• Qualify the data as appropriate.<br>• Resample and/or reanalyze if needed.<br>• 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 (DQOs or performance/acceptance criteria). | If the data set does not meet the completeness objective:<br>• Identify appropriate changes to data collection and/or analysis methods.<br>• Identify quantifiable bias, if applicable.<br>• Resample and/or reanalyze if needed.<br>• Revise sampling/analysis protocols to ensure future completeness. |

**Table 2-1. DQIs for Laboratory Analysis**

| 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.<br>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.<br>• 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:<br>• Properly select and use sampling tools.<br>• Institute correct sampling and subsampling procedures to limit preferential selection or loss of sample media.<br>• Use sample handling procedures, including proper sample preservation, that limit the loss or gain of constituents to the sample media.<br>• Analytical data that are known to be affected by either sampling or analytical bias are flagged to indicate possible bias.<br>• Laboratories that are known to generate biased data for a specific analyte are requested to correct their methods to remove the bias as best as practicable. Otherwise, samples are sent to other labs for analysis. |
| Sensitivity | Sensitivity is an instrument's or method's 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).<br>• The lower limit of quantitation is the lowest level that can be routinely quantified and reported by a laboratory. | If detection limits do not meet the objective:<br>• Request reanalysis or re-measurement using methods or analytical conditions that will meet required detection or limit of quantitation.<br>• Qualify/reject the data before use. |

Source: SW-846, Pending, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V*.

DQI = data quality indicator

DQO = data quality objective

QA = quality assurance

QC = quality control

DQIs for soil vapor analysis conducted using the Brüel & Kjær 1302 photoacoustic multi-gas analyzer are described in Table 2-2. DQIs will be evaluated during the data quality assessment (DQA) process (Section 2.4.3).

**Table 2-2. DQIs for VOC Analysis Using Brüel & Kjær 1302 Multi-gas Analyzer**

| QC Measures | Activity (QC Level 2) |
|---|---|
| Blanks | Performed at the beginning and end of analysis batch, more often at the discretion of the analyst (minimum of 1 per day). Method blanks will be less than 3 times the MDL. |
| Initial Calibration | Performed annually by instrument manufacturer or qualified vendor. |
| ICS | Required at the beginning of each day or shift. Calibration checks (or repeat analysis of standard) should recover within ±25%, or the instrument should be recalibrated. |
| CCS | Required at least once in the middle of each day or shift. Calibration checks (or repeat analysis of standard) should recover within ±25%. Repeated failure of CCS will require procurement of a new standard or instrument recalibration. |
| Duplicates | One required per 20 samples or a minimum of 1 per day. Additional duplicates should be analyzed for those samples with suspected matrix interferences. Duplicates may also be analyzed if results for a well-studied area do not agree with historical data. Duplicates should agree within ±25% RPD for samples greater than 5 times the MDL. |
| LCS | At least once during each day or shift. The LCS should recover within ±25%. Failure of the LCS will require repeat analysis of the standard. Repeated failure of the LCS will require the instrument be recalibrated. |

CCS = continuing calibration check standards
DQI = data quality indicator
ICS = initial calibration check standards
LCS = laboratory control sample
MDL = method detection limit
RPD = relative percent difference
QC = quality control
VOC = volatile organic compound

### 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 compliant 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.

Pre-job briefings, in accordance with work management and work release requirements, document the following evaluation activities and associated hazards:

- 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

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

### 2.1.4 Documents and Records

The OU Project Manager (or designee) is responsible for ensuring that the current version of the SAP is being used and providing updates to field personnel. Version control is maintained by the administrative document control process. Changes to the sampling document are handled consistent with HASQARD (DOE/RL-96-68) and the TPA Action Plan (Ecology et al., 1989b). The OU Project Manager is responsible for tracking all SAP changes, obtaining appropriate review, and alerting DOE-RL of these changes. Appropriate documentation will follow, in accordance with the requirements for the type of change. Table 2-3 summarizes the changes that may be made and their documentation requirements.

The FWS, SMR, and appropriate BTR are responsible for ensuring that field instructions are maintained and aligned with any revisions or approved changes to the SAP. SMR will ensure that any deviations from the SAP are reflected in revised paperwork for the samplers and the analytical laboratory. The FWS, or appropriate BTR, will ensure that deviations from the SAP or problems encountered in the field are documented appropriately (e.g., in the field logbook) in accordance with corrective action protocols.

The OU Project Manager, FWS, or designee, is responsible for communicating field corrective action requirements and ensuring immediate corrective actions are applied to field activities. The OU Project Manager is responsible for ensuring that a project file is properly maintained. The project file will contain records or references to their storage locations. The project file will include the following items, as appropriate:

- Operational records and logbooks
- Data forms
- GPS data (a copy will be provided to SMR)
- Inspection or assessment reports and corrective action reports
- Field summary reports
- Interim progress reports
- Final reports
- Forms required by WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," and the master drilling contract

The following records are managed and maintained by SMR personnel:

- Field sampling logbooks
- Groundwater sample reports and field sample reports
- Chain-of-custody forms
- Sample receipt records
- Laboratory data packages

- Analytical data verification;, and validation reports, if any
- Analytical data "case file purges" (i.e., raw data purged from laboratory files) provided by the offsite analytical laboratories

**Table 2-3. Change Control for Sampling Projects**

| Type of Change[a] | Type of Change (TPA 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. Further, 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. | The field personnel recognizing the need for a field change will consult with the OU Project Manager (or designee) prior to implementing the field change. | Minor field changes will be documented in the field logbook. The logbook entry will 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 allows 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 OU Project Manager will inform the DOE-RL Project Manager and the regulatory lead of the change and seek concurrence at a Unit Manager's Meeting or comparable forum. The LRA determines if there is a need to revise the document. | Documentation of this change approval would be in the Unit Manager's Meeting minutes or comparable record such as a change notice.[c] |
| **Fundamental Change.** Change has a 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 sampling document. | **Revision Necessary.** LRA determines if changes to approved plans require revision to the document. | If it is anticipated that a fundamental change will require the approval of the regulatory lead, the applicable DOE-RL Project Manager will be notified by the OU Project Manager and will be involved in the decision prior to implementation of a fundamental change. The LRA determines if 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*.

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

c. The TPA 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
LRA = lead regulatory agency
OU = operable unit
SAP = sampling and analysis plan
TPA = Tri-Party Agreement

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

- 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 work requirements and processes to ensure that stored records are accurate and can be retrieved. Records required by the TPA (Ecology et al., 1989a) will be managed in accordance with the requirements therein.

## 2.2 Data Generation and Acquisition

The following sections present the requirements for analytical methods, measurement and analysis, data collection or generation, data handling, and field and laboratory QC. The requirements for instrument calibration and maintenance, supply inspections, and data management are also addressed.

### 2.2.1 Analytical Methods Requirements

The analytical performance requirements and QC standards presented here apply to work performed in the field and in the laboratory. Field sample analysis will be performed using the Brüel & Kjær 1302 photoacoustic multi-gas analyzer. Both field and laboratory analytical method performance requirements are presented in Table 2-4. In consultation with the laboratory and the OU Project Manager, SMR can approve changes to analytical methods as long as the new method is based upon a nationally recognized standard method (e.g., EPA or ASTM International, formerly the American Society for Testing and Materials [ASTM]), and the new method delivers analytical data that are comparable to those provided by the old method. The new method must achieve project DQOs as well or better than the replaced method and is required due to the nature of the sample (e.g., high radioactivity). The laboratory using the new method must be accredited by Ecology to perform that method. Issues that may affect analytical results are resolved by SMR in coordination with the OU Project Manager.

### 2.2.2 Field Analytical Methods

Chemical field screening and radiological field survey data used for site characteristics will be measured in accordance with HASQARD (DOE/RL-96-68) requirements, as applicable. Field analytical methods may also be performed in accordance with manufacturer manuals. Chapter 3 provides the parameters identified for field survey analyses.

### 2.2.3 Quality Control

QC requirements specified in the SAP must be followed in the field and analytical laboratory to ensure that reliable data are obtained. Field QC samples will be collected to evaluate the potential for cross-contamination and provide information pertinent to sampling variability. Laboratory QC samples estimate the precision, bias, and matrix effects of the analytical data. Field and laboratory QC sample requirements are summarized in Table 2-5. Acceptance criteria for field and laboratory QC elements are shown in Table 2-6. Data will be qualified and flagged in HEIS, as appropriate.

**Table 2-4. Performance Requirements for Soil Vapor**

| CAS Number | Analyte | Matrix | Analytical Method | Cleanup Level[a] (ppmv) | Required Detection Limit (ppmv) | Accuracy Requirement (% Recovery) | Precision Requirement (RPD) |
|---|---|---|---|---|---|---|---|
| **Field Analysis – Brüel and Kjær 1302 Photoacoustic Multi-gas Analyzer** | | | | | | | |
| 56-23-5 | Carbon Tetrachloride | Soil vapor | Photoacoustic spectroscopy | 100 | 1 | 80 to 120 | ± 20 |
| 75-09-2 | Methylene Chloride | Soil vapor | Photoacoustic spectroscopy | 50 | 1 | 80 to 120 | ± 20 |
| **Laboratory Analysis** | | | | | | | |
| 56-23-5 | Carbon Tetrachloride | Soil vapor | EPA Method TO-15[b] | 100 | 0.005 | 80 to 120 | ± 20 |
| 75-09-2 | Methylene Chloride | Soil vapor | EPA Method TO-15 | 50 | 0.005 | 80 to 120 | ± 20 |

a. Cleanup levels for carbon tetrachloride and methylene chloride are established in Table 35 of EPA et al., 2011, *Record of Decision Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*.
b. EPA/625/R-96/010b, *Compendium of Methods for Determination of Toxic Organic Compounds in Ambient Air Second Edition*.
CAS = Chemical Abstracts Service
EPA = Environmental Protection Agency
RPD = relative percent difference

**Table 2-5. Project QC Requirements**

| QC Sample Type | Characteristics Evaluated | Frequency |
|---|---|---|
| **Field QC** | | |
| FXRs | Contamination from sampling site | Minimum of one per day |
| Field Duplicates | Precision, including sampling and analytical variability | One per each batch of 20 or fewer samples collected, per day |
| SPLITs | Precision, including sampling, analytical, and interlaboratory | At a minimum, three split samples will be collected in Summa canisters. One will be collected in association with an early sample (possibly the 5th or 6th sample), one will be collected roughly midway through the sampling campaign, and one will be collected near the end of the sampling campaign. |
| **Analytical QC – Brüel & Kjær 1302 Photoacoustic Multi-gas Analyzer** | | |
| QC Level 2, in accordance with applicable procedures, QC standards, and analytical performance requirements | | |
| **Analytical QC – SPLITs for Laboratory Analysis** | | |
| MBs | Laboratory contamination | One per batch, 20 samples maximum or as identified by the method guidance per media sampled |
| MSs | Matrix effect/laboratory accuracy | When required by the method guidance, 1 per batch, 20 samples maximum or as identified by the method guidance per media sampled |

**Table 2-5. Project QC Requirements**

| QC Sample Type | Characteristics Evaluated | Frequency |
|---|---|---|
| MSDs | Laboratory accuracy and precision | When required by the method guidance, 1 per batch, 20 samples maximum or as identified by the method guidance per media sampled |
| LCSs | Evaluate laboratory accuracy | One per batch, 20 samples maximum or as identified by the method guidance per media sampled |
| SURs | Recovery/yield | When required by the method guidance, as identified by the method guidance |

FXR = field transfer blank
MB = method blank
MS = matrix spike
MSD = matrix spike duplicate
QC = quality control
SPLIT = field split
SUR = surrogate

**Table 2-6. Field and Laboratory QC Elements and Acceptance Criteria**

| Analyte | QC Element | Acceptance Criteria | Corrective Action |
|---|---|---|---|
| **VOCs** | | | |
| Volatiles by TO-15 (GC/MS) | MB | < MDL[a]<br>< 5% sample concentration | Flagged with "B" |
| | LCS | 80 to 120% | Data reviewed[b] |
| | SUR | Statistically derived[c] | Data reviewed[b] |
| | FTB | < 2 × MDL[a] | Flagged with "Q" |
| | Field duplicate | ≤ 20% RPD[d] | Flagged with "Q" |

a. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the acceptance criteria is < 5 times the MDL.

b. After review, corrective actions are determined on a case-by-case basis.

c. Determined by the laboratory based on historical data or statistically derived control limits. Limits are reported with the data. Where specific acceptance criteria are listed, those acceptance criteria may be used in place of statistically derived acceptance criteria.

d. Applies only in cases where both results are greater than 5 times the minimum detectable concentration.

Data flags:

B (organics)/C (inorganics/wetchem) = analyte was detected in both the associated QC blank and the sample)
T = VOA and semi-VOA GC/MS – matrix spike outlier
Q = associated QC sample is out of limits

FTB = full trip blank
GC/MS = gas chromatography–mass spectrometry
LCS = laboratory control sample
MB = method blank
MDL = method detection limit
QC = quality control
RPD = relative percent difference
SUR = surrogate
VOA = volatile organic analysis
VOC = volatile organic compound

#### 2.2.3.1 Field Quality Control Samples

Field QC samples are collected to evaluate the potential for cross-contamination and provide information pertinent to field sampling variability and laboratory performance to help ensure that reliable data are obtained. Field QC samples include field duplicates, field splits (SPLITs), and two types of field blanks (full trip and equipment). QC sample definitions and their required frequency for collection are described in this section.

**Field Duplicates:** independent samples collected as close as possible to the same time and same location as the schedule sample and intended to be identical. Field duplicates are placed in separate sample containers and analyzed independently. Field duplicates are used to determine precision for both sampling and laboratory measurements.

**SPLITs:** two samples collected as close as possible to the same time and same location and intended to be identical. SPLITs will be stored in separate containers and analyzed by different laboratories for the same analytes. SPLITs are interlaboratory comparison samples used to evaluate comparability between laboratories.

#### 2.2.3.2 Laboratory Quality Control Samples

Internal QA/QC programs are maintained by laboratories utilized by the project. Laboratory QA includes a comprehensive QC program that includes the use of matrix spikes (MSs), matrix duplicates, matrix spike duplicates (MSDs), laboratory control samples (LCSs), surrogates (SURs), tracers, and method blanks (MBs). These samples are recommended in the guidance documents, are required by EPA protocol (e.g., EPA-600/4-79-020, *Methods for Chemical Analysis of Water and Wastes*), and will be run at the frequency specified in the respective references unless superseded by agreement. QC checks outside of control limits are documented in analytical laboratory reports during DQAs, if performed. Laboratory QC and typical frequencies are listed in Table 2-5. The following text describes the various laboratory QC samples.

**Laboratory Duplicate:** an intralaboratory replicate sample that is used to evaluate the precision of a method in a given sample matrix.

**MS:** an aliquot of a sample spiked with a known concentration of target analyte(s). The MS is used to assess the bias of a method in a given sample matrix. Spiking occurs prior to sample preparation and analysis.

**Post-preparation Spike:** the same as an MS; however, spiking occurs after sample preparation.

**MSD:** a replicate spiked aliquot of a sample that is subjected to the entire sample preparation and analytical process. MSD results are used to determine the bias and precision of a method in a given sample matrix.

**LCS:** a control matrix (e.g., reagent water) spiked with analytes representative of the target analytes or a certified reference material that is used to evaluate laboratory accuracy.

**MB:** an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in the sample processing. The MB is carried through the complete sample preparations and analytical procedure. The MB is used to quantify contamination resulting from the analytical process.

**SUR:** a compound added to all samples in the analysis batch (field samples and QC samples) prior to preparation. The SUR is typically similar in chemical composition to the analyte being determined, yet it is not normally encountered. SURs are expected to respond to the preparation and measurement systems in a manner similar to the analytes of interest. Because SURs are added to all standards, samples, and QC

samples, they are used to evaluate overall method performance in a given matrix. SURs are used only in organic analyses.

**Tracer:** a tracer is a known quantity of radioactive isotope that is different from that of the isotope of interest but is expected to behave similarly and is added to an aliquot of sample. Sample results are generally corrected based on tracer recovery.

Laboratories are required to analyze samples within the holding time specified in Table 2-7. In some instances, constituents in the samples not analyzed within the holding times may be compromised by volatilizing, decomposing, or other chemical changes. Data from samples analyzed outside the holding times are flagged in the HEIS database with an "H."

### 2.2.4 Field Measurement Equipment

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

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

| Constituent/Parameter | Analysis Location | Container Type | Preservation | Holding Time |
|---|---|---|---|---|
| Carbon Tetrachloride<br>Methylene Chloride | Field analysis | Tedlar® bags | Ambient temperature | Within 6 hours of collection |
| | Laboratory analysis | Summa canisters | Ambient temperature | Within 14 days following collection |

® Tedlar is a registered trademark of DuPont, Wilmington, Delaware.

### 2.2.5 Instrument/Equipment Testing, Inspection, and Maintenance

Collection, measurement, and testing equipment should meet applicable standards (e.g., ASTM) or have been evaluated as acceptable and valid in accordance with instrument-specific 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 in the laboratory will be subject to preventive maintenance measures to ensure minimization of downtime. Laboratories 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

Specific field equipment calibration information is provided in Section 3.4. Analytical laboratory instruments are calibrated in accordance with the laboratory's QA plan and applicable Hanford Site requirements.

### 2.2.7 Inspection/Acceptance of Supplies and Consumables

Supplies and consumables used in support of sampling and analysis activities are procured in accordance with internal work requirements and processes. Responsibilities and interfaces must be in place to ensure that items procured/acquired for the contractor meet the specific technical and quality requirements. The procurement system ensures purchased items comply with applicable procurement specifications. Supplies and consumables are checked and accepted by users prior to use.

### 2.2.8 Nondirect Measurements

Data obtained from sources such as computer databases, programs, literature files, and historical databases will be technically reviewed to the same extent as the data generated as part of any sampling and analysis QA/QC effort. All data used in evaluations will be identified by source.

### 2.2.9 Data Management

The SMR organization, in coordination with the OU Project Manager, is responsible for ensuring that analytical data are appropriately reviewed, managed, and stored in accordance with applicable programmatic requirements governing data management methods.

Electronic data access, when appropriate, will be through a Hanford Site database (e.g., HEIS) or a project-specific database, whichever is applicable for the data being stored. Where electronic data are not available, hardcopies will be provided in accordance with Section 9.6 of the TPA 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 applicable methods. This process is used to document analytical errors and establish their resolution with the OU Project Manager. The sample issue resolution forms become a permanent part of the analytical data package for future reference and for records management.

## 2.3 Assessment and Oversight

The elements in assessment and oversight address 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

Random surveillances and assessments verify compliance with the requirements outlined in this SAP, project field instructions, the project quality management plan, methods, and regulatory requirements. 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 resolutions in accordance with the QA program, the corrective action management program, and associated methods implementing these programs. When appropriate, corrective actions will be taken by the OU Project Manager (or designee).

Oversight activities in the analytical laboratories, including corrective action management, are conducted in accordance with laboratory QA plans. The contractor oversees offsite analytical laboratories and verifies that they are qualified to perform Hanford Site analytical work.

### 2.3.2 Reports to Management

Management will be made aware of deficiencies identified by self-assessments, corrective actions from ECOs, and findings from QA assessments and surveillances. Issues reported by the laboratories are

communicated to the SMR organization, which then initiates a sample issue resolution form. This process is used to document analytical or sample issues and establish resolution with the OU Project Manager.

## 2.4 Data Review and Usability

This section addresses QA activities that occur after data collection. Implementation of these activities determines whether data conform to the specified criteria, thus satisfying the project objectives.

### 2.4.1 Data Review and Verification

Data review and verification are performed to confirm that sampling and chain-of-custody documentation are complete. This review includes linking sample numbers to specific sampling locations, reviewing sample collection dates and sample preparation and analysis dates to assess whether holding times, if any, have been met, and reviewing QC data to determine whether analyses have met the data quality requirements specified in this SAP.

The criteria for verification include but are not limited to review for contractual compliance (samples were analyzed as requested), use of the correct analytical method, transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight, and correct application of conversion factors.

Errors identified by laboratories are reported to the SMR organization's project coordinator, who initiates a sample issue resolution form. This process is used to document analytical errors and establish resolution with the OU Technical Lead.

Relative to analytical data in sample media, field screening results are of lesser importance in making inferences regarding risk. Field QA/QC results will be reviewed to ensure that they are usable.

The OU Technical Lead data review will help determine if observed changes reflect improved/degraded groundwater quality or potential data errors and may result in submittal of a request for data review (RDR) on questionable data. The laboratory may be asked to check calculations or reanalyze the sample, or the well may be resampled. Results of the RDR process are used to flag data appropriately in the HEIS database and/or to add comments.

### 2.4.2 Data Validation

Data validation is not typically performed on analytical results generated using the Brüel & Kjær 1302 photoacoustic multi-gas analyzer. Due to the small number (three) of split samples generated for laboratory analysis, associated data quality evaluation beyond that performed by laboratory personnel will be addressed through the DQA process.

### 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 DQA is to determine whether quantitative data are of the correct type and are of adequate quality and quantity to meet the project DQOs. DQAs will be performed at the discretion of the OU Project Manager and documented in a report overseen by SMR.

# 3 Field Sampling Plan

The purpose of the field sampling plan is to define project sampling and analytical requirements. These include defining the number and location of samples, sampling methods, and analyses that will be performed.

## 3.1 Site Background and Objectives

SVE was initiated at the 200-PW-1 OU in 1992 to mitigate volatile organic compound (VOC) contamination in the vadose zone. SVE was operated continuously through 1997 and then seasonally (typically April through October) from 1998 through October 2012. The SVE system has been shut down since that time.

The objective of the planned sampling and analysis is to assess the rebound of carbon tetrachloride and methylene chloride concentrations in soil vapor. The data will support decision making regarding permanently discontinuing operation of the SVE systems.

## 3.2 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. Logbook entries will be reviewed by the FWS, cognizant scientist/engineer, or other responsible manager; the review will be documented with a 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.

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, MSs, and blanks)
- Locations and types of samples
- Chain-of-custody details and variances relating to chain-of-custody
- Field measurements
- Field calibrations 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

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. The current practice is to enter data forms into the logbooks.

## 3.3 Sampling Design

The sampling design is judgmental sampling, wherein the selection of sampling units (i.e., the number and location and/or timing of collecting samples) is based on knowledge of the condition under investigation and on professional judgment. Judgmental sampling is distinguished from probability-based sampling in that inferences are based on professional judgment, not statistical scientific theory. Therefore, conclusions about the target population are limited and depend entirely on the validity and accuracy of professional judgment. Probabilistic statements about parameters are not possible. All soil vapor sampling locations were selected by knowledgeable and professionally trained staff using a judgmental sampling approach. Sample locations are listed in Table 3-1 and are shown in Figures 1-2 and 1-3.

## 3.4 Calibration of Field Equipment

Construction management, the BTR, or the FWS is responsible for ensuring that field equipment is calibrated appropriately. Onsite environmental instruments are calibrated in accordance with manufacturer operating instructions, internal work requirements and processes, and/or work packages that provide direction for equipment calibration or verification of accuracy by analytical methods. The results from all instrument calibration activities are recorded in logbooks and/or work packages. Either hardcopy or electronic calibration activity records are acceptable.

Field instrumentation, calibration, and QA checks will be performed in accordance with the following:

- Calibration of radiological field instruments on the Hanford Site is performed by MSA, as specified in its program documentation.
- 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 like the matrix under consideration for direct comparison of data. Analysis times will be sufficient to establish detection efficiency and resolution.
- Standards used for calibration will be traceable to a nationally or internationally recognized standard agency source or measurement system, if available.

The Brüel & Kjær 1302 photoacoustic multi-gas analyzer is field equipment that requires calibration.

## 3.5 Sample Location and Frequency

The planned sample locations are shown on Figures 1-2 and 1-3. (Note that some locations are sampled at more than one depth.) The sample locations and sample depths are listed in Table 3-1. Any deviations from the planned sample locations and depths must be documented, as discussed in Section 3.6.1. The current plan is to sample each location once.

Summa canister samples will be collected from 299-W18-165, CPT-28 (26.5 m [87 ft] bgs) and CPT-21A (26.5 m [86 ft] bgs) to confirm the carbon tetrachloride concentrations measured using the Brüel and Kjær; these three locations had the highest carbon tetrachloride concentrations measured in calendar year 2014. The Summa canister samples will be collected immediately after the Tedlar bag samples and will be analyzed at an offsite laboratory.

**Table 3-1. Sample Locations**

| Sample Location | Waste Site | Relative to CCU | Sample Depth[a] (m [ft] bgs) | Type | Prior Use |
|---|---|---|---|---|---|
| **Rebound Sample Locations** | | | | | |
| 299-W18-10L | 216-Z-1A Tile Field/216-Z-18 Crib | Below | 55.8 (183) | Vadose Well | Passive |
| 299-W18-11L | 216-Z-1A Tile Field/216-Z-18 Crib | Below | 60.7 (199) | Vadose Well | Passive |
| 299-W18-12 | 216-Z-1A Tile Field/216-Z-18 Crib | Below | 60.3 (198) | Vadose Well | Passive |
| 299-W18-152 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 30.8 (101) | Vadose Well | Active |
| 299-W18-165 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 33.2 (109) | Vadose Well | Active |
| 299-W18-167 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 32.3 (106) | Vadose Well | Active |
| 299-W18-246L | 216-Z-1A Tile Field/216-Z-18 Crib | Below | 51.8 (170) | Vadose Well | Passive |
| 299-W18-247L | 216-Z-1A Tile Field/216-Z-18 Crib | Below | 50.9 (167) | Vadose Well | Passive |
| 299-W18-248 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 39.9 (131) | Vadose Well | Active |
| 299-W18-249 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 39.6 (130) | Vadose Well | Active |
| 299-W18-252L | 216-Z-1A Tile Field/216-Z-18 Crib | Below | 53.3 (175) | Vadose Well | Passive |
| 299-W18-6L | 216-Z-1A Tile Field/216-Z-18 Crib | Below | 63.4 (208) | Groundwater Well | Passive |
| 299-W18-7 | 216-Z-1A Tile Field/216-Z-18 Crib | Below | 60 (197) | Groundwater Well | Passive |
| C3872 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 19.2 (63) | Vadose Well | Monitoring |
| CPT-13A | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 9.1 (30) | Soil Tube | Monitoring |
| CPT-1A | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 10.7 (35) | Soil Tube | Monitoring |
| CPT-1A | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 20.7 (68) | Soil Tube | Monitoring |
| CPT-1A | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 27.7 (91) | Soil Tube | Monitoring |
| CPT-30 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 14.6 (48) | Soil Tube | Monitoring |
| CPT-32 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 7.6 (25) | Soil Tube | Monitoring |
| CPT-32 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 21.3 (70) | Soil Tube | Monitoring |
| CPT-34 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 12.2 (40) | Soil Tube | Monitoring |
| CPT-4E | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 7.6 (25) | Soil Tube | Monitoring |
| CPT-4F | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 33.2 (109) | Soil Tube | Monitoring |
| CPT-7A | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 9.8 (32) | Soil Tube | Monitoring |
| 299-W15-217 | 216-Z-9 Trench | Above | 34.7 (114) | Vadose Well | Active |

**Table 3-1. Sample Locations**

| Sample Location | Waste Site | Relative to CCU | Sample Depth[a] (m [ft] bgs) | Type | Prior Use |
|---|---|---|---|---|---|
| 299-W15-82 | 216-Z-9 Trench | Above | 25.3 (83) | Vadose Well | Active |
| 299-W15-8L | 216-Z-9 Trench | Below | 54.9 (180) | Vadose Well | Active |
| 299-W15-8U | 216-Z-9 Trench | Above | 31.4 (103) | Vadose Well | Active |
| 299-W15-95L | 216-Z-9 Trench | Below | 43.9 (144) | Vadose Well | Active |
| 299-W15-9L | 216-Z-9 Trench | Below | 53.6 (176) | Vadose Well | Active |
| C4937 | 216-Z-9 Trench | Above | 19.54 (64.1) | Vadose Well | Active |
| C4938 | 216-Z-9 Trench | Above | 19.51 (64) | Vadose Well | Active |
| C5340 | 216-Z-9 Trench | Above | 19.7 (64.5) | Vadose Well | Active |
| CPT-16 | 216-Z-9 Trench | Above | 7.6 (25) | Soil Tube | Monitoring |
| CPT-16 | 216-Z-9 Trench | Above | 19.8 (65) | Soil Tube | Monitoring |
| CPT-17 | 216-Z-9 Trench | Above | 3 (10) | Soil Tube | Monitoring |
| CPT-18 | 216-Z-9 Trench | Above | 10.7 (35) | Soil Tube | Monitoring |
| CPT-18 | 216-Z-9 Trench | Above | 22.9 (75) | Soil Tube | Monitoring |
| CPT-21A | 216-Z-9 Trench | Above | 19.8 (65) | Soil Tube | Monitoring |
| CPT-21A | 216-Z-9 Trench | Above | 26.2 (86) | Soil Tube | Monitoring |
| CPT-24 | 216-Z-9 Trench | Above | 36 (118) | Soil Tube | Monitoring |
| CPT-27 | 216-Z-9 Trench | Above | 10.1 (33) | Soil Tube | Monitoring |
| CPT-28 | 216-Z-9 Trench | Above | 12.2 (40) | Soil Tube | Monitoring |
| CPT-28 | 216-Z-9 Trench | Above | 26.5 (87) | Soil Tube | Monitoring |
| CPT-9A[b] | 216-Z-9 Trench | Above | 15.2 (50) | Soil Tube | Monitoring |
| CPT-9A | 216-Z-9 Trench | Above | 18.3 (60) | Soil Tube | Monitoring |
| CPT-9A[b] | 216-Z-9 Trench | Above | 19.5 (64) | Soil Tube | Monitoring |
| 299-W18-1 | 216-Z-1A Tile Field/216-Z-18 Crib | Below | 64.3 (211) | Groundwater Well | N/A |
| CPT-13A | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 21.3 (70) | Soil Tube | N/A |
| CPT-2 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 12.2 (40) | Soil Tube | N/A |
| CPT-30 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 20.7 (68) | Soil Tube | N/A |

**Table 3-1. Sample Locations**

| Sample Location | Waste Site | Relative to CCU | Sample Depth[a] (m [ft] bgs) | Type | Prior Use |
|---|---|---|---|---|---|
| CPT-31 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 23.2 (76) | Soil Tube | N/A |
| CPT-33 | 216-Z-1A Tile Field/216-Z-18 Crib | Above | 24.4 (80) | Soil Tube | N/A |
| 299-W15-216U | 216-Z-9 Trench | Above | 22.9 (75) | Vadose Well | N/A |
| 299-W15-216L | 216-Z-9 Trench | Below | 54.9 (180) | Vadose Well | N/A |
| 299-W15-218U | 216-Z-9 Trench | Above | 32.3 (106) | Vadose Well | N/A |
| 299-W15-218L | 216-Z-9 Trench | Below | 57.3 (188) | Vadose Well | N/A |
| 299-W15-219U | 216-Z-9 Trench | Above | 29 (95) | Vadose Well | N/A |
| 299-W15-219L | 216-Z-9 Trench | Below | 53.3 (175) | Vadose Well | N/A |
| 299-W15-220U | 216-Z-9 Trench | Above | 26.8 (88) | Vadose Well | N/A |
| 299-W15-220L | 216-Z-9 Trench | Below | 49.7 (163) | Vadose Well | N/A |
| 299-W15-84 | 216-Z-9 Trench | Below | 54.9 (180) | Vadose Well | N/A |
| 299-W15-86 | 216-Z-9 Trench | Below | 37.2 (122) | Vadose Well | N/A |
| CPT-29 | 216-Z-9 Trench | Above | 140 (46) | Soil Tube | N/A |

a. Soil tubes (sample locations with CPT designation) employ in-place color-coded sample tubing for sample collection. Contact the project technical lead, as necessary, for current correlation between tubing color and sample depth.

b. May correlate to an actual sample depth of 21.3 or 27.7 m (70 or 91 ft) bgs; sample tubing at CPT-9A was cut by construction workers, leaving some doubt as to which tubing correlates with which depth.

CCU = Cold Creek unit
CPT = cone penetrometer
N/A = not applicable

## 3.6 Sampling Methods

Soil vapor sampling will be conducted in accordance with applicable CHPRC procedures. Field analysis of samples will be conducted by the Field Team Lead in accordance the applicable CHPRC procedure. Split sampling will be conducted for QA purposes.

Soil vapor monitoring will be conducted using sampling methods similar to those developed for the rebound study in 1997 (BHI-01105, *Rebound Study Report for the Carbon Tetrachloride Soil Vapor Extraction Site, Fiscal Year 1997*). A low-flow (0.8 lpm [0.2 gpm]) sampling pump will be used to draw soil vapor samples from wells and probes into a 1 L (0.3 gal) Tedlar bag for analysis using a Brüel & Kjær 1302 multi-gas analyzer. At wells, a tube will be lowered to the target depth where the casing is perforated to minimize the volume of air to be purged. A metal filter attached to the end of the tube also serves as a weight. Some of the wells included in this sampling campaign are already configured with tubing and metal filter and are sealed at the well head in a manner that will allow sampling. To the extent

practicable, remaining sampling locations should be configured in a similar manner. Passive wells, if still configured as passive wells, will be sampled as they have been historically.

Discrepancies in methylene chloride concentrations between the split samples analyzed by the laboratory and samples analyzed using the Brüel & Kjær 1302 multi-gas analyzer were noted in the 2014 dataset. All of the samples collected for analysis using the Brüel & Kjær 1302 multi-gas analyzer were collected in new Tedlar bags, and methylene chloride was detected in every sample, including field blanks. All of the samples collected for laboratory analysis were collected in Summa canisters. The laboratory detected no methylene chloride in any of the samples. Another compound present in the Tedlar bag samples appears to be interfering with the Brüel & Kjær 1302 analysis of methylene chloride, and the source of this compound is probably the new Tedlar bags.

To mitigate the interference, Tedlar bags will be filled with "zero air" (20.9 percent oxygen, 79.1 percent nitrogen) for at least 1 hour and then analyzed with the Brüel & Kjær 1302 multi-gas analyzer before samples are collected. If methylene chloride is detected in the Tedlar bags during zero air sampling, then data from these tests and the soil vapor sampling operation should be evaluated through the SMR group's RDR process. The RDR process would perform a comparison study between the zero air test results and soil vapor sampling results and include the results of field blanks and MBs to determine if field sampling data are significantly impacted by false positive interference or related complications. If the RDR investigation determines that data are significantly impacted by false positive interference, field data would either be flagged as suspect or rejected based on the outcome of the data review. This process is needed because blank correction of field data should not be performed in these situations. If it is determined that the effects of false positive interference on the field data are minimal, the data may be flagged as usable (G flag). The RDR report would contain explanations and comments for data flagging or unflagging as the case may be.

Sample preservation, containers, and holding times are presented in Table 2-6.

### 3.6.1 Corrective Actions and Deviations for Sampling Activities

The Project Manager, FWS, BTR, or designee must document deviations from protocols, problems pertaining to sample collection, chain-of-custody, target analytes, contaminants of potential concern, sample transport, or noncompliant monitoring. Examples of deviations include samples not collected because of field conditions, changes in sample locations because of physical obstructions, or additions of sample depth(s).

As appropriate, such deviations or problems will be documented in the field logbook or on nonconformance report forms in accordance with internal corrective action protocols. The OU Project Manager, FWS, BTR, or designee will be responsible for communicating field corrective action requirements and ensuring that immediate corrective actions are applied to field activities.

Changes in sample locations not affecting DQOs will require notification and approval of the OU Project Manager. Changes to sample locations affecting DQOs will require concurrence from DOE and the lead regulatory agency. Changes to the SAP will be documented, as noted, in Section 2.1.4.

### 3.6.2 Decontamination of Sampling Equipment

Any nondedicated sampling equipment will be decontaminated in accordance with the sampling equipment decontamination protocols. To prevent potential contamination of the 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 containers by setting them on or near potential contamination sources (e.g., uncovered ground)
- Handling sample containers or equipment with dirty hands or gloves
- Improperly decontaminating equipment before sampling or between sampling events

## 3.7 Sampling Handling

Sample packaging, labeling, custody, and transportation are described in the following subsections.

### 3.7.1 Packaging

All primary soil vapor samples will be collected in clean Tedlar bags. Three split samples, collected to corroborate in-field Brüel & Kjær 1302 analytical results, will be collected in Summa canisters. Container sizes may vary depending on laboratory-specific volumes/requirements for meeting analytical detection limits. The Radiological Engineering organization will measure both the contamination levels and 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 the laboratory, the FWS (in consultation with SMR) can send smaller volumes to the laboratory. Preliminary container types and volumes are identified in Table 3-2.

**Table 3-2. Sample Container Criteria**

| Sample Type | Container Type | Container Volume |
|---|---|---|
| Primary Soil Vapor Sample | Clean Tedlar Bag | 1 L |
| Field Duplicate Soil Vapor Samples | Clean Tedlar Bag | 1 L |
| SPLITs for Laboratory Analysis | Summa Canister | 6 L |

SPLIT = field split

### 3.7.2 Container Labeling

The sample location, depth, and corresponding HEIS numbers are documented in the sampler's field logbook. Each sample container will be labeled with the following information on firmly affixed, water-resistant labels:

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

Sample records must include the following information:

- Analysis required
- Source of sample
- Matrix (soil vapor)
- Field data (moisture content)

Custody seals are not required for samples collected in Tedlar bags because sampling personnel deliver samples directly to the analytical facility, so there is no intermediate transfer of custody. Custody seals will be applied to Summa canisters in accordance with applicable procedures.

### 3.7.3 Sample Custody

Sample custody will be maintained in accordance with existing Hanford Site protocols to ensure maintenance of sample integrity throughout the analytical process. Chain-of-custody protocols 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 transported 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 SMR 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

All Tedlar bag samples will be transported to an in-field location for analysis. Samples collected in Summa canisters will be transported or shipped to a selected offsite analytical laboratory for analysis. Offsite samples will be processed and transported in accordance with Table 2-6. All packaging and transportation instructions will be in compliance with applicable transportation regulations and DOE requirements. Regulations for classifying, describing, packaging, marking, labeling, and transporting hazardous materials, hazardous substances, and hazardous wastes are enforced by the U.S. Department of Transportation (DOT) as described in 49 CFR 171, “Transportation,” “General Information, Regulations, and Definitions,” through 49 CFR 177, “Carriage by Public Highway.” Carrier-specific requirements defined by the International Air Transportation Association (IATA) in IATA, 2013, *Dangerous Goods Regulations*, will also be used when preparing sample shipments conveyed by air freight providers.

Samples containing hazardous constituents will be considered hazardous material in transportation and transported according to DOT/IATA requirements. If the sample material is known or can be identified, then it will be packaged, marked, labeled, and shipped according to the specific instructions for that material.

Materials are classified by DOT/IATA as radioactive when the isotope-specific activity concentration and the exempt consignment limits described in 49 CFR 173, “Transportation,” “Shippers—General Requirements for Shipments and Packagings,” are exceeded. Samples will be screened, or relevant historical data will be used, to determine if these values are exceeded. When screening or historical data indicate that samples are radioactive, they will be properly classified, described, packaged, marked, labeled, and transported according to DOT/IATA requirements.

Prior to shipping radioactive samples to the laboratory, the organization responsible for shipping will notify the laboratory of the approximate number of and radiological levels of the samples. This notification is conducted through the SMR project coordinator. The laboratory is responsible for ensuring that applicable license limits are not exceeded. The laboratory will provide SMR with written acceptance for samples with elevated radioactive contamination or dose.

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# 4 Management of Waste

All waste (including unexpected waste) generated by sampling and field analysis activities will be managed in accordance with DOE/RL-2000-40, *Waste Management Plan for the Expedited Response Action for 200 West Area Carbon Tetrachloride Plume and the 200-ZP-1 and 200-PW-1 Operable Units*.

If offsite analytical laboratories are used, those laboratories are responsible for the disposal of unused sample quantities. On a monthly basis, the laboratory will coordinate sample disposal and status with SMR by providing a list of samples more than 90 days post-data delivery for which disposal is requested in the following month. The laboratory will also provide on a monthly basis a list of samples disposed of in the preceding month that includes disposal date and method or other relevant information. Signed chain-of-custody forms indicating sample disposal will be retained in laboratory case files pending return of case files to the contractor.

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# 5 Health and Safety

Field operations will be performed in accordance with 10 CFR 851, “Worker Safety and Health Program,” health and safety requirements and appropriate S&GRP requirements. Additionally, 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. Sampling and associated activities will implement ALARA practices to minimize radiation exposure to the sampling team and possible release of radiological contamination, consistent with the requirements defined in 10 CFR 835, “Occupational Radiation Protection.”

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