Plan

Project No. 23518

Groundwater Monitoring Plan for the Post-Closure Monitoring Network

CH2M • WG Idaho, LLC is the Idaho Cleanup Project contractor for the U.S. Department of Energy
ABSTRACT

This Groundwater Monitoring Plan, which also serves as the Sampling and Analysis Plan, establishes the procedures and requirements that will be used to perform (a) field sampling and analysis and (b) groundwater elevations and total well depth measurements, as well as minimizing health and safety risks to persons implementing groundwater monitoring for the former Waste Calcining Facility under the HWMA Post-Closure Permit for the Idaho Nuclear Technology and Engineering Center on the Idaho National Laboratory, Volume 21 – Waste Calcine Facility, CPP-601/627/640, EPA ID No. ID4890008952. This plan contains information about the characterization activity, analytical and quality assurance/quality control requirements, hazards involved in performing the task(s), and the specific actions and equipment that will be used to protect persons working at the task site. Field sampling activities are directed by Sampling Procedure (SPR)-162, “Measuring Groundwater Levels and Sampling Groundwater,” and hazards are mitigated by Job Safety Analysis (JSA)-6634, “Environmental and Regulatory Services Groundwater Monitoring.” Health and Safety aspects of this plan are addressed in Plan (PLN)-2128, “Environmental Restoration Project Health and Safety Plan.”
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<tr>
<td>COC</td>
<td>chain of custody</td>
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<tr>
<td>DEQ</td>
<td>Idaho Department of Environmental Quality</td>
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<tr>
<td>DOE</td>
<td>Department of Energy</td>
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<tr>
<td>DOE-ID</td>
<td>DOE Idaho Operations Office</td>
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<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
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<tr>
<td>ESH&amp;QA</td>
<td>environment, safety, health, and quality assurance</td>
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<td>FTL</td>
<td>field team leader</td>
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<td>HASP</td>
<td>Health and Safety Plan</td>
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<td>HWMA</td>
<td>Hazardous Waste Management Act</td>
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<td>ICDF</td>
<td>Idaho CERCLA Disposal Facility</td>
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<td>JSA</td>
<td>job safety analysis</td>
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<td>JSS</td>
<td>job site supervisor</td>
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<td>MCP</td>
<td>management control procedure</td>
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<td>NAPL</td>
<td>nonaqueous phase liquid</td>
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<tr>
<td>NWCF</td>
<td>New Waste Calcining Facility</td>
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<tr>
<td>ORT</td>
<td>operations-related task</td>
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<tr>
<td>PAH</td>
<td>polynuclear aromatic hydrocarbon</td>
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<tr>
<td>PE</td>
<td>project engineer</td>
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<tr>
<td>PLN</td>
<td>plan</td>
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<tr>
<td>PM</td>
<td>project manager</td>
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<td>PPE</td>
<td>personal protective equipment</td>
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QA  quality assurance
QC  quality control
RCRA  Resource Conservation and Recovery Act
RCT  radiological control technician
RWP  radiological work permit
SAM  Sample and Analysis Management
SPR  sampling procedure
SNF  spent nuclear fuel
TL  technical lead
TOS  task order statement
WCF  Waste Calcining Facility
WGS  Waste Generator Services
1. INTRODUCTION

This Groundwater Monitoring Plan, which also serves as the Sampling and Analysis Plan, was prepared for the post-closure permit groundwater monitoring project at the Waste Calcining Facility (WCF) and for the CPP-601/627/640 facility at the Idaho Nuclear Technology and Engineering Center (INTEC) at the Idaho National Laboratory (INL) Site. This plan incorporates requirements of the final Hazardous Waste Management Act (HWMA) Post-Closure Permit (DEQ 2014 [PER-112]), which has been renewed, with an effective date of March 14, 2014.

This Groundwater Monitoring Plan identifies the activities for the characterization projects, including the health and safety requirements to perform the work. Preparation of this document complied with requirements of relevant Idaho Cleanup Project (ICP) management control procedures (MCPs), i.e., MCP-9439, “Environmental Sampling Activities at the INL,” and MCP-3562, “Hazard Identification, Analysis, and Control of Operational Activities.” In addition, this plan also incorporates polynuclear aromatic hydrocarbon (PAH) sampling requirements by the Idaho Department of Environmental Quality (DEQ) Leaking Underground Storage Tank Program for the Corrective Action/Monitoring Plan for ICPP-2018 Petroleum Release at the Idaho Nuclear Technology and Engineering Center (ICP 2010) and as specified in IDAPA 58.01.02.852.05.

Environmental and Regulatory Services management has authorized this activity as an operations-related task (ORT). MCP-3562 defines ORT work control. All activity and facility hazards are mitigated by the training or qualification of the performer. This plan is to be used by personnel who are trained to the hazard controls listed in Job Safety Analysis (JSA)-6634, “Environmental and Regulatory Services Groundwater Monitoring” and who are performing the work described in Sampling Procedure (SPR)-162, “Measuring Groundwater Levels and Sampling Groundwater.”

1.1 Project Objectives

The objectives of this characterization activity are to continue ongoing collection of groundwater samples for analysis, groundwater elevations, and well depth measurements to meet the following:

- Idaho HWMA groundwater monitoring requirements of the HWMA Post-Closure Permit, which was renewed by DEQ, with an effective date of March 14, 2014 (DEQ 2014 [PER-112])


This document is implemented with the Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Removal Actions (DOE-ID 2009a). This document governs all work at the characterization task site performed by ICP employees, subcontractors, and employees of other companies or U.S. Department of Energy (DOE) laboratories. Field sampling activities are directed by SPR-162, and hazards are mitigated by JSA-6634. Health and Safety aspects of this plan are addressed in Plan (PLN)-2128.
1.2 Site Description

INTEC occupies an enclosed and secured area of approximately 250 acres (101 ha) situated on the south-central portion of the INL Site, northeast of the Central Facilities Area as shown in Figure 1. INTEC was initially constructed in the 1950s to reprocess spent nuclear fuel (SNF) from government naval ship reactors and has undergone continuous additions and improvements since that time. During the years that the WCF operated, the facility recovered more than $1 billion worth of highly enriched uranium that was returned to the government fuel cycle. In addition, an innovative high-level liquid waste treatment process known as calcination was developed at INTEC. Calcination was first conducted in the WCF from 1963 until 1981 and then continued in the New Waste Calcining Facility (NWCF) until 2000. Calcination reduced the volume of liquid radioactive waste generated during fuel reprocessing, while placing the waste in a safer, more stable, granular-solid form. Current work at INTEC includes receiving and storing SNF, environmental restoration, decontamination and decommissioning activities, and waste management and technology development. Other HWMA-regulated activities at INTEC include storage in tanks, evaporative treatment, satellite accumulation, container storage, debris treatment, distillation treatment, and tank treatment.

The WCF, located at INTEC (see Figure 2), evaporated and calcined aqueous wastes generated from the reprocessing of SNF. The Resource Conservation and Recovery Act (RCRA) interim status units at the WCF included the evaporator tank system and a high-efficiency particulate air filter waste pile storage area. The calciner itself operated and closed before being subject to HWMA/RCRA regulations as an operating thermal treatment unit. The calciner began operations in 1963 and solidified over 4 million gal (15 million L) of aqueous waste before it was shut down in 1981. Liquid waste containing dissolved metals, radionuclides, and nitrates was transferred through underground pipelines to the WCF. There, the waste was sprayed into a hot fluidized bed of granular solids in the calciner. The calcined solids were then transferred to the bin sets. Nine waste processing campaigns were conducted at the WCF. However, successive decontamination cycles led to progressive deterioration of the equipment. In 1981, the NWCF replaced the WCF. The WCF evaporator system continued to operate from 1983 until 1987, concentrating high-activity aqueous waste.

In 1988 in anticipation of future system use, the Department of Energy Idaho Operations Office (DOE-ID) requested and received RCRA interim status for the evaporator system. However, the system never operated after receiving interim status. Constructing a new evaporator system at the NWCF made the WCF evaporator system unnecessary, and a decision was made to close the WCF units. The units covered by the closure were the evaporator tank system and the high-efficiency particulate filter waste pile storage area. The WCF was closed by grouting and capping the waste lines, grouting the tanks, cells, and vaults, knocking down the aboveground portion of the facility to the belowgrade structure, and constructing a concrete cap over the WCF footprint in 1998.

Buildings CPP-601, -627, and -640 were part of the Fuel Reprocessing Complex at INTEC. The CPP-601 Fuel Reprocessing Facility was a building consisting of five levels with the primary portion located below ground. The facility was used for reprocessing spent nuclear fuel. Operations included separation, chemical makeup and transfer, and liquid waste receiving processes. The CPP-601 Deep Tanks System consisted of four 4,500-gal stainless-steel tanks located in two concrete vaults in the lowest level of CPP-601. This system collected liquid waste generated from separations processes performed in CPP-601. Process systems in CPP-627 and -640 could also send waste to these tanks. The CPP-627 Remote Analytical Facility was entirely above ground and was adjacent and attached to CPP-601. The building housed analytical, experimental, and decontamination facilities, including the Hot Chemistry Laboratory, the Old Shift Laboratory, the Multi-Curie Cell, the Emission Spectroscopy Laboratory, and
the Decontamination Development Laboratory. The CPP-640 Headend Processing Plant supported research and process development for the uranium reprocessing mission in CPP-601. Fuel processing at CPP-640 ended in June 1984 (DOE-ID 2008). The facility contained two shielded waste collection tank vaults at the lowest level of the building, five shielded test cells at the mid-level of the building, and an open crane loft with space for chemical makeup equipment and access to the cells through roof hatches at the upper level (DOE-ID 2013). A major modification in the late 1970s added the shielded mechanical handling cave within the crane loft. The CPP-640 Headend Storage Tank System received decontamination fluids generated in the plant. The tank system comprised two radiological waste tanks and a nonradiological waste tank.

The approach for the CPP-601/627/640 landfill closure consisted of three steps: Phase 1, the Phase 1 post-closure period, and Phase 2 (DOE-ID 2009b). Phase 1 landfill closure activities have been completed and included the decontamination and grouting of the CPP-601 Deep Tanks System components in accordance with *HWMA/RCRA Landfill Closure Plan for the CPP-601 Deep Tanks System Phase 1* (DOE-ID 2009b). The Phase 1 post-closure period of the landfill closure is the performance of HWMA/RCRA inspection, maintenance, and monitoring activities on the CPP-601/627/640 monolith, which will serve as an interim HWMA/RCRA cover over the landfill. The CPP-601/627/640 facility was closed by grouting and capping the waste lines, grouting the tanks, cells, and vaults, knocking down the aboveground portion of the facility to about 10 ft above grade, and construction of a concrete cap over the remaining CPP-601/627/640 building footprints in 2009. The inspection, maintenance, and monitoring activities will be performed in accordance with the CPP-601/627/640 post-closure permit.
Figure 1. Map of the INL Site, which shows the location of major facilities.
Figure 2. Map of INTEC and the post-closure groundwater monitoring network.
1.3 Scope

The scope of field activities is to measure groundwater levels semiannually, measure total well depths annually, perform well inspections, and collect representative groundwater samples semiannually from the wells identified in Figure 2 (and listed in the monitoring well network tables discussed in Section 4.1.2). The Post-Closure Permit (DEQ 2014 [PER-112]) and the Permit Implementation Matrix (PLN-4599) identify requirements to implement a detection monitoring program and compliance monitoring program. Section 2.2 identifies one of the tasks of the project engineer is to identify if and when a compliance monitoring program or a corrective action monitoring plan in accordance with Permit Conditions III.A.2 and III.A.3 shall be put into effect in coordination with DEQ. This determination is performed in consultation with DEQ based on monitoring results.

The following activities will be accomplished to meet the project objectives:

- Obtain pre-job paperwork, including sampling procedures, health and safety plans, and radiological work permits (RWPs)
- Obtain sampling tools and bottles needed
- Conduct pre-job briefing
- Perform preliminary radiological surveys, if required
- Perform sampling and water level measurements
- Decontaminate sampling tools, task site, and personnel, as necessary
- Prepare samples for storage and shipment
- Ship samples to the analytical laboratory(ies)
- Perform total well depth measurements annually
- Perform well inspections.

2. PROJECT ORGANIZATION AND RESPONSIBILITIES

The following sections describe the personnel associated with this characterization project.

2.1 Task Lead

The task lead is responsible for the overall work scope, schedule, and budget. The task lead tracks life-cycle baseline scope, trends, cost, and schedule while reporting project performance against expectations, for scope, schedule, and budget requirements. The task lead prepares reports, documents, and status information, including weekly and monthly status reports and Baseline Change Proposals, if necessary. The task lead serves as the point of contact with Planning and Controls to complete routine and nonroutine tasks. The task lead is responsible for the overall aspects of the project, including personnel assignment, task direction, and overall decision-making.

2.2 Project Engineer

The project engineer (PE) is responsible for the following management tasks: (1) directs the daily implementation of the HWMA Post-Closure Permit (DEQ 2014 [PER-112]); (2) coordinates with the task
lead and technical lead (TL) to ensure milestones are met; (3) supervises technical staff to ensure timely and cost-effective technical services are performed in accordance with high technical standards, sound engineering practices, good science, and customers’ orders and directives; (4) schedules integration and technical resources, ensures the scope of work to be performed is clear, concise, and executable by working with the customer and the primary owner to establish firm project/task requirements; (5) identifies problems to management and provides recommended suggestions or actions or both needed while ensuring cost-effective technical solutions are developed in accordance with safety, environmental, and quality objectives; (6) resolves conflicts regarding customer requirements and project team members’ comments on technical activities and defends and promotes technical positions to the customer or sponsor, project team, and DOE.

The PE serves as the primary point of contact with regulatory agencies (DOE, DEQ, and the Environmental Protection Agency [EPA]). The PE notifies and obtains approvals from DEQ for well installation and well maintenance in accordance with Permit Conditions III.C.2 and III.C.3. The PE is responsible for submitting an application for a permit modification in accordance with Permit Condition III.F.4.c.

The PE is responsible for the following documentation tasks: (1) ensures that field documents and planning and decision documents meet the appropriate technical quality requirements; (2) ensures that all project documentation is submitted to the ICP Deactivation, Decontamination, and Decommissioning Operational Review Board and other review boards as needed for review and that the documentation complies with MCP-101, “ICP Integrated Work Control Process,” and MCP-3562, “Hazard Identification, Analysis, and Control of Operational Activities,” before work begins.

The PE performs the following tasks: (1) identifies if and when a Compliance Monitoring Program or a Corrective Action Monitoring Plan in accordance with Permit Conditions III.A.2 and III.A.3 shall be put into effect in coordination with DEQ; (2) identifies if and when verification sampling or Appendix IX sampling is required, in accordance with Permit Condition III.F.4.a.1; (3) identifies if and when to resume detection monitoring and notifies DEQ; (4) communicates to project team members when the Snake River Plain Aquifer has been designated as the uppermost aquifer by DEQ in accordance with Permit Condition III.B.4. in the event the CERCLA efforts to de-water the perched zones results in the inability to sample at least one upgradient and three downgradient perched water wells for two consecutive sampling events.

### 2.3 Technical Lead

The TL ensures that all activities conducted during the project comply with ICP MCPs and program requirements documents and with applicable requirements of the Occupational Safety and Health Administration, EPA, DOE, U.S. Department of Transportation, and State of Idaho.

The TL coordinates all document preparation, field and laboratory activities, data evaluation, laboratory quality assurance/quality control (QA/QC) data evaluation, risk assessment, dose assessment, and design activities.

The TL is responsible for the following field activities: (1) coordinates field work and all personnel (including craft personnel) assigned to work at the project location; (2) serves as the interface between operations and project personnel and works closely with the sampling team at the site to ensure that the objectives of the project are accomplished safely and efficiently; (3) works with all other identified project personnel to accomplish day-to-day operations, identify and obtain additional resources
needed at the site, and interact with Environment, Safety, Health, and Quality (ESH&QA) oversight personnel on matters regarding environment, health, safety, and quality.

The TL is responsible for determining and demonstrating if a source other than the regulated unit caused contamination, or if increased contamination resulted from an error in sampling, analysis, or evaluation. The TL obtains water-level data to determine groundwater flow gradients, direction, and rate of annual groundwater flow, and to generate potentiometric maps.

### 2.4 Sampling Coordinator

The ICP sampling coordinator is responsible to coordinate all sampling activities across the INL Site. Upon notification by the task lead, the sampling coordinator is responsible to obtain and schedule the necessary resources to complete the sampling task. The sampling coordinator will schedule sampling personnel to complete the task.

### 2.5 Field Team Leader/Job Site Supervisor

The field team leader (FTL) or job site supervisor (JSS) will be the ICP representative at the site with responsibility for the safe and successful collection of samples. The FTL/JSS acts as the team leader and works with ICP facility personnel, ESH&QA personnel, and the field sampling team to manage field-sampling operations and to execute the characterization plan. The FTL/JSS enforces site control, documents activities, and may conduct the daily safety briefings at the start of the shift. Health and safety issues may be brought to the attention of the FTL. The FTL is responsible for proper completion of the field logbook entries and for obtaining sampling supplies and tools needed to complete the task. The FTL also is responsible for coordinating waste disposal efforts with the Waste Generator Services (WGS) and the radiological control technician (RCT) when at the job site. The FTL will also ensure that sampling activities are on the INTEC plan of the day.

If the FTL/JSS leaves the site during sampling operations, an alternate will be appointed to act as the FTL/JSS. The identity of the acting FTL/JSS will be conveyed to sampling personnel at the sampling location, recorded in the logbook, and communicated to the facility representative when appropriate.

### 2.6 Samplers

Samplers include all task site personnel assigned to the characterization project to obtain samples for analytical purposes. All samplers, including ICP, DOE-ID, and subcontractor personnel, must understand and comply with the requirements of this document and other applicable documentation. Sampling personnel will be briefed at the start of each shift by the FTL/JSS, or designee, regarding the tasks to be performed and the applicable health and safety requirements. During the pre-job briefing, work tasks, associated hazards, engineering and administrative controls, required personal protective equipment (PPE), work control documents, and radiological and emergency action response will be discussed.

Samplers are responsible for identifying any potentially unsafe situations or conditions to the FTL/JSS and applicable ESH&QA representatives for corrective action. If it is perceived that an unsafe condition poses an imminent danger, sampling personnel are authorized to either or both step back or stop work immediately and notify the FTL/JSS of the potentially unsafe condition.
2.7 Waste Generator Services Waste Technical Specialist

The ICP WGS waste technical specialist will ensure disposition of waste material complies with approved ICP waste management procedures. WGS personnel have the responsibility to help solve waste management issues at the task site. WGS personnel also prepare the appropriate documentation for waste disposal and make the proper notifications, as required.

2.8 ICP Sample and Analysis Management Technical Representative

The ICP Sample and Analysis Management (SAM) technical representative is responsible to help define the analytical project, generate the sampling and analysis plan table used to record all pertinent information (well designation, media, date, etc.) associated with each sample ID code, and generate and issue sample labels. The SAM representative will determine which laboratory will provide analytical services based on established policies and contracts and will prepare the task order statement (TOS) of work. The SAM representative also will track analytical progress and perform cursory review of the final data packages. The SAM representative will obtain independent validation of the data results as project requirements dictate.

2.9 ESH&QA Support

ESH&QA personnel are assigned to the job site to provide resources and expertise to resolve ESH&QA issues. Personnel assigned to provide ESH&QA support must be qualified to recognize and evaluate hazards, environmental concerns, or quality issues according to his or her expertise and will be given the authority to take or direct immediate actions to ensure compliance and protection. ESH&QA personnel assess and ensure compliance with applicable ICP procedures.

2.10 Project Manager, Well Services and Surveillance

The project manager (PM), Well Services and Surveillance, is responsible for providing maintenance of the post-closure groundwater monitoring well network (see Figure 2). This includes repairing or implementing corrective actions in a timely manner to correct any discrepancies identified during groundwater monitoring well inspections. The PM is responsible for ensuring that any modifications made to the well, wellhead, or down-hole equipment are properly documented on well monitoring forms or field logbooks or both.

2.11 Radiological Control Support

Radiological control support personnel are the source for information, guidance, and requirements concerning radiological hazards at the task site. Radiological support personnel may include the radiological control supervisor, RCTs, or radiological engineers. The RCT is responsible to survey the task site, equipment, and samples and to provide guidance, direction, and requirements to ensure work activities comply with the “Radiological Control Manual” (PRD-183). The radiological engineer provides information and guidance relative to the evaluation and control of radioactive hazards at the task site, including performing radiation exposure estimates and as-low-as-reasonably-achievable evaluations, identifying the type(s) of radiological monitoring equipment necessary for the work, and advising personnel of changes in monitoring and PPE.
3. DATA REQUIREMENTS

Data requirements for these sampling tasks are established in the following:

- **HWMA Post-Closure Permit for the Idaho Nuclear Technology and Engineering Center on the Idaho National Laboratory**, which was issued by the DEQ February 12, 2014, and effective on March 14, 2014 (DEQ 2014 [(PER-112)],
- **HWMA/RCRA Post-Closure Plan for the CPP-601/627/640 Landfill (DOE-ID 2009b)**
- **Corrective Action/Monitoring Plan for ICPP-2018 Petroleum Release at the Idaho Nuclear Technology and Engineering Center (ICP 2010).**

4. SAMPLE COLLECTION, ANALYSIS, AND DATA MANAGEMENT

The following sections describe the process for sample collection, including information about the type of equipment needed, sample analysis, quality assurance/quality control (QA/QC) requirements, and the post-closure monitoring well network. As a separate activity, all monitoring wells included in the post-closure monitoring well network are inspected semiannually, have water level measurements performed semiannually, and have total well depths measured and recorded annually. Total well depths are not required for monitoring wells with dedicated downhole equipment (e.g., pump) that interferes with the ability to measure total depth. Total well depths for wells with dedicated downhole equipment will be determined whenever the dedicated equipment is removed (but is not required more often than annually).

The HWMA Post-closure Permit (DEQ 2014 [PER-112]) specifies that wells must be sampled during the weeks of the first Mondays of February and August. Water level measurements for all the post-closure wells will be completed within a 24-hour time span and prior to the initiation of any sampling.

If water levels in the existing well network decline, wells between WCF and CPP-601/627/640 may be used as dual-purpose wells.

4.1 Sample Collection

This section describes the steps, equipment, and other relevant information for sample collection.

4.1.1 Presampling Meeting

Before sampling takes place, project personnel will meet to ensure the sampling and analysis can be performed safely and that the sampling and analysis will provide the project with usable data. Personnel at the meeting will ensure that all necessary equipment and documentation are present and that all personnel understand the project scope and objectives.

4.1.2 Sampling and Analysis Requirements

Tables 1 through 6 summarize the analytical methods to be used, analytes and required detection limits by analyte, monitoring network and frequency, and QA/QC samples to be collected under this sampling task. The data in these tables can be found in DEQ (2014). Post-closure monitoring well samples will be analyzed for constituents listed in Table 2 semiannually and for all constituents listed in
IDAPA 58.01.05.008 (40 CFR 264, Appendix IX) when directed. Any newly identified compounds will be added to the list of analytes.

Table 5 identifies the Snake River Plain Aquifer wells that will be sampled for the post-closure permit contingent monitoring plan (Hutchison 2013). This contingent monitoring plan will be implemented when there is no longer at least one upgradient perched water well and three downgradient (point of compliance) perched water wells that have at least 1 foot of water in each well available for sampling for two consecutive semiannual sampling events. When this occurs, samples will be collected from the perched wells that contain sufficient water for sampling and from the four Snake River Plain Aquifer wells listed in Table 5 during the next semiannual sampling event. Aquifer well purging will be similar to purging performed for the perched water wells. Sampling the Snake River Plain Aquifer will continue semiannually and will be reported semiannually per Permit Condition I.P.8.

The SAM is responsible to obtain laboratory analytical services for the required analyses per MCP-9439. The SAM will prepare TOS documents if needed for laboratory services.

Maximum sample holding times are listed in Table 1 and are defined from the date of sample collection to the date of sample preparation or analysis. Samplers will coordinate with the analytical laboratory to ensure that samples arrive at the laboratory in order to meet holding time limits.

Samples are preserved to minimize any chemical or physical changes that might occur between the time of sample collection and analysis. Preservation can be by physical means (e.g., kept at a certain temperature) or chemical means (e.g., by adding chemical preservatives). Typical sample preservation activities include the addition of acids or cooling the samples to a designated temperature. Applicable preservation requirements followed for these sampling activities, container types, and sample holding times are identified in Table 1.

As required, quality control samples will be taken throughout this project. Quality control samples are included and explained in Table 6.

If a sample is lost, containers are broken, or the sample is in some way unusable, the sample will be retaken, unless adequate sample volume can be obtained from other similarly preserved sample bottles from the same well. The sampling FTL will ensure that any changes to this document regarding sampling frequency, location, and/or analysis are documented in the sample logbook. The task lead is responsible to ensure that a Document Revision Form is written and approved for any changes to this document.

A sampling logbook will be prepared containing a written record for all field data gathered, field observations, field equipment calibrations, samples collected for analysis, and sample custody. Field logbooks are legal documents and are maintained to ensure that field activities are properly documented as they relate to site safety meetings and that site work is conducted in accordance with the health and safety procedures. Field logbooks will be bound, and they will contain consecutively numbered pages. All entries in field logbooks will be made using permanent ink pens or markers. All mistakes made as entries will be amended by drawing a single line through the entry, and the person making the correction will initial and date the correction. Copies of the field logbook entries will be provided to the TL and SAM technical representative upon completion of the sampling event.
Table 1. Summary of sampling analyses, holding times, and preservation requirements (from Sample and Analysis Management).

<table>
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<tr>
<th>Location</th>
<th>Sample Medium</th>
<th>Analysis</th>
<th>Minimum Volume Required</th>
<th>Container Type</th>
<th>Holding Time</th>
<th>Preservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>All wells that are required to be sampled</td>
<td>Groundwater</td>
<td>Metals (filtered; SW 846 Methods 6010B, 6020A, 7470A, [EPA 1986], and EPA 335.2)</td>
<td>500 mL</td>
<td>Plastic</td>
<td>28 days</td>
<td>HNO$_3$, pH &lt; 2</td>
</tr>
<tr>
<td>All wells that are required to be sampled</td>
<td>Groundwater</td>
<td>VOCs (SW-846 Method 8260B)</td>
<td>3 × 40 mL vials</td>
<td>Glass vials</td>
<td>14 days</td>
<td>H$_2$SO$_4$, pH &lt; 2, cool to 4˚C</td>
</tr>
<tr>
<td>All wells that are required to be sampled</td>
<td>Groundwater</td>
<td>SVOCs (SW-846 Method 8270)</td>
<td>1,000 mL</td>
<td>Amber glass</td>
<td>7 days from sampling to extraction 40 days from extraction to analysis</td>
<td>Cool to 4˚C</td>
</tr>
<tr>
<td>Purge water</td>
<td>Groundwater</td>
<td>Gamma screen</td>
<td>500 mL</td>
<td>HDPE or lab-supplied</td>
<td>30 days</td>
<td>No preservative</td>
</tr>
<tr>
<td>All wells that are required to be sampled</td>
<td>Groundwater</td>
<td>PAH (SW-846 Method 8310)</td>
<td>1,000 mL</td>
<td>Amber glass</td>
<td>7 days from sampling to extraction 40 days from extraction to analysis</td>
<td>Cool to 4˚C</td>
</tr>
</tbody>
</table>

VOCs = volatile organic compounds.  
SVOCs = semivolatile organic compounds.  
HDPE = high-density polyethylene.  
PAH = polynuclear aromatic hydrocarbon.
Table 2. Constituent analyte list and associated estimated quantitation limits (EQLS) and groundwater protection standards (GPSs) (DEQ 2014).

<table>
<thead>
<tr>
<th>Constituent</th>
<th>EQL (µg/L)</th>
<th>GPS (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Barium</td>
<td>20</td>
<td>4,000</td>
</tr>
<tr>
<td>Cadmium</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Chromium</td>
<td>10</td>
<td>200</td>
</tr>
<tr>
<td>Lead</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.2</td>
<td>4</td>
</tr>
<tr>
<td>Selenium</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Silver</td>
<td>10</td>
<td>200</td>
</tr>
<tr>
<td>1,1,1-trichloroethane</td>
<td>1</td>
<td>400</td>
</tr>
<tr>
<td>Carbon tetrachloride</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Trichloroethene</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Tetrachloroethene</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Carbon disulfide</td>
<td>1</td>
<td>2,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>1</td>
<td>2,000</td>
</tr>
<tr>
<td>Pyridine</td>
<td>5</td>
<td>720</td>
</tr>
<tr>
<td>Methyl ethyl ketone</td>
<td>5</td>
<td>38,000</td>
</tr>
<tr>
<td>Benzene</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Chloroform</td>
<td>1</td>
<td>200</td>
</tr>
<tr>
<td>Methylene chloride</td>
<td>1</td>
<td>86</td>
</tr>
</tbody>
</table>
Table 3. Polynuclear aromatic hydrocarbon target analyte list with Chemical Abstract Service (CAS) numbers and contract laboratory detection limit.

<table>
<thead>
<tr>
<th>Constituent</th>
<th>CAS</th>
<th>Detection Limit (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acenaphthene</td>
<td>83-32-9</td>
<td>18</td>
</tr>
<tr>
<td>Acenaphylene</td>
<td>208-96-8</td>
<td>23</td>
</tr>
<tr>
<td>Anthracene</td>
<td>120-12-7</td>
<td>6.6</td>
</tr>
<tr>
<td>Benzo(a)anthracene</td>
<td>56-55-3</td>
<td>0.13</td>
</tr>
<tr>
<td>Benzo(a)pyrene</td>
<td>50-32-8</td>
<td>0.23</td>
</tr>
<tr>
<td>Benzo(b)fluoranthene</td>
<td>205-99-2</td>
<td>0.18</td>
</tr>
<tr>
<td>Benzo(k)fluoranthene</td>
<td>207-08-9</td>
<td>0.17</td>
</tr>
<tr>
<td>Chrysene</td>
<td>218-01-9</td>
<td>1.5</td>
</tr>
<tr>
<td>Fluoranthene</td>
<td>206-44-0</td>
<td>2.1</td>
</tr>
<tr>
<td>Fluorene</td>
<td>86-73-7</td>
<td>2.1</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>91-20-3</td>
<td>18</td>
</tr>
<tr>
<td>Pyrene</td>
<td>129-00-0</td>
<td>2.7</td>
</tr>
</tbody>
</table>
Table 4. Post-closure monitoring well network (elevations are referenced to NGVD29 datum).

<table>
<thead>
<tr>
<th>Monitoring Well Name</th>
<th>Well Designation</th>
<th>Well Type</th>
<th>Monitoring Frequency</th>
<th>Brass Cap Elevation (ft asl)</th>
<th>Measuring Point (MP) Elevation (ft asl)</th>
<th>Depth to Screen Top and Bottom (ft bgs)</th>
<th>Elevation Screen Bottom (ft asl)</th>
<th>Well Depth from MP (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPP-33-1</td>
<td>Upgradient background</td>
<td>Water elevation/monitoring</td>
<td>Semiannually</td>
<td>4,914.33</td>
<td>4,916.82</td>
<td>89–99</td>
<td>4,815.33</td>
<td>102.56</td>
</tr>
<tr>
<td>CPP-33-2</td>
<td>Point of compliance</td>
<td>Water elevation/monitoring</td>
<td>Semiannually</td>
<td>4,913.29</td>
<td>4,915.11</td>
<td>85.8–105.8</td>
<td>4,807.49</td>
<td>107.90</td>
</tr>
<tr>
<td>CPP-33-4-1</td>
<td>Water elevation</td>
<td>Water elevation</td>
<td>Semiannually</td>
<td>4,911.02</td>
<td>4,913.22</td>
<td>98.2–118.25</td>
<td>4,792.77</td>
<td>117.47</td>
</tr>
<tr>
<td>CPP-37-4</td>
<td>Water elevation</td>
<td>Water elevation</td>
<td>Semiannually</td>
<td>4,910.13</td>
<td>4,912.02</td>
<td>99.6–110</td>
<td>4,800.23</td>
<td>112.68</td>
</tr>
<tr>
<td>CPP-55-06</td>
<td>Point of compliance</td>
<td>Water elevation/monitoring</td>
<td>Semiannually</td>
<td>4,911.61</td>
<td>4,913.59</td>
<td>93.1–113.1</td>
<td>4,798.51</td>
<td>115.32</td>
</tr>
<tr>
<td>MW-2</td>
<td>Upgradient background</td>
<td>Water elevation/monitoring</td>
<td>Semiannually</td>
<td>4,912.3</td>
<td>4,914.84</td>
<td>102–112</td>
<td>4,800.30</td>
<td>113.20</td>
</tr>
<tr>
<td>MW-5-2</td>
<td>Point of compliance</td>
<td>Water Elevation/monitoring</td>
<td>Semiannually</td>
<td>4,915.59</td>
<td>4,917.98</td>
<td>106.5–126.5</td>
<td>4,789.09</td>
<td>129.60</td>
</tr>
<tr>
<td>MW-6</td>
<td>Upgradient background</td>
<td>Water elevation/monitoring</td>
<td>Semiannually</td>
<td>4,915.73</td>
<td>4,918.44</td>
<td>117–137</td>
<td>4,778.73</td>
<td>140.63</td>
</tr>
<tr>
<td>MW-10-2</td>
<td>Upgradient background</td>
<td>Water elevation/monitoring</td>
<td>Semiannually</td>
<td>4,913.88</td>
<td>4,916.56</td>
<td>141–151</td>
<td>4,762.88</td>
<td>154.35</td>
</tr>
<tr>
<td>MW-12-2</td>
<td>Water elevation</td>
<td>Water elevation</td>
<td>Semiannually</td>
<td>4,912.14</td>
<td>4,915.12</td>
<td>109–119</td>
<td>4,793.14</td>
<td>122.00</td>
</tr>
<tr>
<td>MW-18-2</td>
<td>Water elevation</td>
<td>Water elevation</td>
<td>Semiannually</td>
<td>4,913.74</td>
<td>4,916.49</td>
<td>113.5–123.5</td>
<td>4,790.24</td>
<td>124.77</td>
</tr>
<tr>
<td>ICPP-2018</td>
<td>Point of compliance</td>
<td>Water elevation/monitoring</td>
<td>Semiannually</td>
<td>4,913.26</td>
<td>4,915.87</td>
<td>97.9–117.9</td>
<td>4,795.36</td>
<td>120.9</td>
</tr>
<tr>
<td>ICPP-2019</td>
<td>Point of compliance</td>
<td>Water elevation/monitoring</td>
<td>Semiannually</td>
<td>4,912.06</td>
<td>4,914.66</td>
<td>95.2–120.2</td>
<td>4,791.86</td>
<td>123.2</td>
</tr>
<tr>
<td>ICPP-2195</td>
<td>Point of compliance</td>
<td>Water elevation/monitoring</td>
<td>Semiannually</td>
<td>4,914.70</td>
<td>4,917.21</td>
<td>87–107</td>
<td>4,807.23</td>
<td>109.51</td>
</tr>
<tr>
<td>ICPP-2196</td>
<td>Point of compliance</td>
<td>Water elevation/monitoring</td>
<td>Semiannually</td>
<td>4,915.00</td>
<td>4,916.49</td>
<td>117–142</td>
<td>4,772.40</td>
<td>143.49</td>
</tr>
</tbody>
</table>
Table 4. (continued).

<table>
<thead>
<tr>
<th>Monitoring Well Name</th>
<th>Well Designation</th>
<th>Well Type</th>
<th>Monitoring Frequency</th>
<th>Brass Cap Elevation (ft asl)</th>
<th>Measuring Point (MP) Elevation (ft asl)</th>
<th>Depth to Screen Top and Bottom (ft bgs)</th>
<th>Elevation Screen Bottom (ft asl)</th>
<th>Well Depth from MP (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICPP-2205c</td>
<td>Point of compliance</td>
<td>Water elevation/monitoring</td>
<td>Semiannually</td>
<td>4,913.47</td>
<td>4,916.75</td>
<td>121–141</td>
<td>4,772.47</td>
<td>144.28b</td>
</tr>
</tbody>
</table>

a. Total well depths from measuring points measured in 2004, except for Wells ICPP-2018 and ICPP-2019, which were measured after construction in 2005, and Wells MW-2, MW-12-2, and MW-18-2, which were measured in 2010, and Well MW-5-2, which was measured in August 2011.

b. Well depths calculated by adding stickup to depth of bottom of screen, as shown on well completion diagrams.

c. Well information from well completion diagrams.

d. Wellhead was modified November 2011; elevations are new values.

ft asl = feet above sea level

ft bgs = feet below ground surface
<table>
<thead>
<tr>
<th>Monitoring Well Name</th>
<th>Well Designation</th>
<th>Well Type</th>
<th>Monitoring Frequency</th>
<th>Brass Cap Elevation (ft asl)</th>
<th>Measuring Point (MP) Elevation (ft asl)</th>
<th>Depth to Screen Top and Bottom (ft bgs)</th>
<th>Elevation Screen Bottom (ft asl)</th>
<th>Well Depth from MP^b (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICPP-MON-P-019 (MW-18-4)</td>
<td>Point of compliance</td>
<td>Water Elevation/Monitoring</td>
<td>Semiannually</td>
<td>4,913.74</td>
<td>4,918.19c</td>
<td>458.5–478.5</td>
<td>4,435.24</td>
<td>481.50</td>
</tr>
<tr>
<td>ICPP-2020</td>
<td>Point of compliance</td>
<td>Water Elevation/Monitoring</td>
<td>Semiannually</td>
<td>4,914.36</td>
<td>4,916.92</td>
<td>455–495</td>
<td>4,419.36</td>
<td>498.0</td>
</tr>
<tr>
<td>ICPP-2021</td>
<td>Point of compliance</td>
<td>Water Elevation/Monitoring</td>
<td>Semiannually</td>
<td>4,912.14</td>
<td>4,914.70</td>
<td>453–493.4</td>
<td>4,418.74</td>
<td>496.4</td>
</tr>
</tbody>
</table>

a. Well information from well completion diagrams.
b. Well depths calculated by adding stickup to depth of bottom of screen, as shown on well completion diagrams.
c. Measuring point elevation measured September 2013.

^b ft asl = feet above sea level
^b ft bgs = feet below ground surface
Table 6. QA/QC samples for groundwater sampling (DEQ 2014).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perched groundwater sampling</td>
<td>Duplicate</td>
<td>Field duplicates will be collected at a frequency of 1 per 20 samples per sampling event or 1 per 4 sampling days, whichever is more frequent.</td>
</tr>
<tr>
<td>Field blank</td>
<td>Field blank</td>
<td>Field blanks will be collected at a frequency of 1 per 20 samples per sampling event or 1 per 4 sampling days, whichever is more frequent.</td>
</tr>
<tr>
<td>Trip blank</td>
<td>Trip blank</td>
<td>Trip blanks will be collected when volatile organic compound samples are taken to include one in every cooler shipped.</td>
</tr>
<tr>
<td>Equipment rinsate</td>
<td>Equipment rinsate</td>
<td>Equipment rinsate samples will be collected a minimum of 1 rinsate sample per sampling event, or 1 per 20 samples per sampling event, or 1 per 4 sampling days, whichever is more frequent. Equipment rinsate samples are not required for wells with a dedicated pump or when sampling equipment is used to sample a single well (e.g., disposable bailers that are used to sample one well and then disposed of instead of reused to sample a second well).</td>
</tr>
</tbody>
</table>

4.1.3 Sampling Equipment and Documentation

A list of equipment and supplies anticipated to be needed for sampling is provided below:

- Sample labels
- Field logbook
- Bailers
- 150-lb Dacron line used for bailing
- Peristaltic pump to filter the metal samples in the field
- Filters
- Tygon tubing
- 6-kW generator (or larger)
- Electric drill with stainless-steel reel for bailing
- Nitrile gloves
- Nonphosphate detergent
- Absorbent towels
- Tap water
- Deionized water
- Blue Ice
- Ice chest(s)
- Adhesive tape (clear, duct, and strapping)
- Aluminum foil
• Dark, indelible ink pens and markers
• Waste containers
• Appropriate sample containers per TOS(s)
• Custody seals
• Parafilm
• Appropriate preservatives per TOS(s)
• Nonaqueous phase liquid (NAPL)/water interface probe
• Water level meter
• Containment for purge water
• Water hose for purging and sampling
• Water quality multiprobe, such as a Hydrolab or YSI instrument
• Bucket
• Secondary containment to place the water quality multiprobe in
• Engineering-grade tape measure
• Sampling manifold
• Battery pack for dedicated monsoon pumps
• Controller for monsoon pumps
• Variable flow control box for Redi-flo pumps
• 50-kW generator
• Calculator
• Scissors and/or knife
• Bag or box to contain waste
• Wadding or bubble wrap for glass samples
• Reagent-grade water for trip blanks
• Sealable bags
• Chain of Custody
• Other PPE, as required.

4.1.3.1 Field Equipment Calibration and Set-Up. The FTL will work closely with sampling personnel to ensure that sampling equipment is operating as recommended by the manufacturer and/or according to design specifications. Presampling inspections of equipment will be performed to ensure the equipment is functioning properly. Corrective actions for the repair or maintenance of any sampling equipment will be immediate and will be confirmed by the FTL or task lead before proceeding with sampling.
The overall condition of each monitoring well will be observed and noted in the field logbook prior to sampling. Maintenance problems encountered at any well location are reported immediately to the PM, Well Services and Surveillance, and will be addressed as they occur.

Radiological control personnel are responsible for the calibration of radiological monitoring equipment and the placement and handling of telemetry dosimeters. The industrial hygienist will be responsible for the measurement and evaluation of other chemical hazards. All calibrations will be documented in calibration logbooks. Calibration logbooks are maintained by sampling personnel.

4.1.4 Sample Designation and Labeling

Each sample bottle will contain a label identifying the field sample number, the analyses requested, the sample date, time, and location, the sampler name, and preservative used (if any). Labels will be secured on the sample using clear plastic tape.

Uniqueness is required for maintaining consistency and preventing the same identification code from being assigned to more than one sample. A systematic character code may be used to uniquely identify all samples.

4.1.5 Chain of Custody

Chain-of-custody (COC) procedures will begin immediately after collection of the first sample. The COC information in the sample logbook serves as the record of COC until completion of the COC form at the time of sample packaging for shipment. All samples collected will then remain in the custody of a member of the sampling team until the custody is transferred to the analytical laboratory sample custodian. Upon receipt at the laboratory, the sample custodian will review the sample labels and the COC form to ensure completeness and accuracy. If discrepancies are noted during this review, immediate corrective action will be sought with the sampling team member(s) identified on the COC relinquishing custody. Pending successful corrective action, the laboratory sample custodian will sign and date the COC signifying acceptance of delivery and custody of the samples.

4.1.6 Sample Collection and Water Level Measurement Procedures

4.1.6.1 Wellhead Inspections. Prior to groundwater sampling, the overall condition of each well should be visually inspected and noted in the field logbook. As a separate activity, all monitoring wells in the post-closure monitoring network are formally inspected semiannually, and the inspections are documented on the well inspection checklist included in Attachment 2 of the HWMA Post-Closure Permit (DEQ 2014 [PER-112]).

4.1.6.2 Groundwater Elevations. SPR-162, “Measuring Groundwater Levels and Sampling Groundwater” is the general procedure for measuring groundwater levels. The presence of a nonaqueous phase liquid (NAPL) has been detected in one network well (ICPP-2018), and DEQ has required that, for future sampling events (Bullock 2007), all wells in the monitoring network must be checked for light NAPL before groundwater samples are collected. A NAPL/water interface probe will be used to measure NAPL thickness in all WCF wells on the same day as and immediately before water samples are obtained from wells. This requirement was originally written for sampling WCF wells and is applicable to all post-closure wells. All groundwater elevations are measured using an electronic water level indicator, weighted measuring tape, or continuous recorder method from the reference marker. Depth to water measurements are recorded to an accuracy of ±0.01 ft (0.003 m). When purging and/or sampling, groundwater levels are measured both prior to and on the same day that purging and/or sampling activities take place.
As a separate activity from the sampling events, semiannual water level measurements must be completed for all wells, including post-closure groundwater monitoring wells that are not sampled (see Table 4). All post-closure monitoring well water level measurements must be obtained within a single 24-hour period and prior to the initiation of any sampling. In addition, the total depth for each well in the post-closure monitoring network must be measured and recorded annually and recorded in the field logbook, with the exception of wells with dedicated down-hole equipment that may interfere with the ability to obtain a total well depth measurement. In the latter situation, total depth measurements will be taken whenever a pump or other dedicated downhole equipment is pulled, but no more often than once a year.

4.1.6.3 Groundwater Sample Collection. SPR-162 is the general procedure for sampling groundwater. Water level is measured as described in Section 4.1.6.2 both prior to and on the same day of purging and/or sampling to determine the static well volume purge volume. All perched water wells will be purged prior to sample collection in an effort to obtain a representative sample from the perched water zone. Prior to purging, the static water level in each well scheduled for sampling is measured and a static well casing volume is calculated. Wells that contain 1 ft of water column, or less, will be considered to have insufficient water for sampling and are not required to be sampled.

Post-closure wells are purged using low-flows at 0.5 to 2 L/min to minimize drawdown and formation disruption while obtaining a representative sample from the perched water zone. During purging, measurements will be made to determine specific conductance and pH. These parameters may be measured either with probes located downhole or at the ground surface. Purging consists of removing one to three well volumes while measuring these parameters. Samples for water quality analysis can be collected after a minimum of one well casing volume of water has been purged from the well, and as soon as two consecutive measurements of pH and specific conductance are within the limits (pH: ± 0.2 standard units, specific conductance: ± 5% of reading). Purged water from the aquifer wells will be collected and managed in accordance with the appropriate HWMA/RCRA and radiological requirements.

If a well is bailed, the sampler records the following information as field notes on the purge form (Bullock 2013):

- Bailing start time and stop time
- If a well is bailed to dryness
- Status of sampling when the well went dry.

If pH and specific conductance fail to stabilize within the limits (pH: ± 0.2 standard units, specific conductance: ± 5% of reading), purging will continue until a maximum of three well casing volumes of water have been purged from the well, at which point sampling will begin regardless of parameter
stabilization. Water temperature, dissolved oxygen, and turbidity also will be measured and recorded during well purging. Stabilization of temperature or turbidity is influenced by the volume of water in the well and the rate of recharge; thus, they are not appropriate stability parameters for these low-yielding wells. Stable pH and specific conductance parameters will be used as criteria for sampling.

In accordance with DEQ (Bullock 2012), if a water temperature differs significantly from others, this difference is recorded on the purge form sampling log, especially if the sampler believes such a difference is due to well yield/dewatering of the well. In accordance with DEQ (Bullock 2013), if the Hydrolab screen goes blank during purging for any parameters, including dissolved oxygen, turbidity, or water temperature, this shall be noted on the purge form. The resolution of the problem, such as if the problem was self-rectifying or if the meter was rebooted and recalibrated or if a second meter was used, shall also be noted in the purge form observation notes.

When purging a well, if insufficient water is available to complete the purging, as described above, the well should be purged to dryness and sampled the next working day, at which point no additional purging or stable parameters are required at the well, and the samplers will collect the available water for analysis. Sampling at the well will then be considered complete.

The following is the preferred order for sample collection:

1. Metals (filtered)
2. Volatile organic compounds
3. Semivolatile organic compounds

Sample bottles are protected from contamination by the sampler using clean, waterproof gloves. The identification label is placed on the bottle with the appropriate information, such as sample ID number, name of project area/well, type of analysis, date, sampler, preservative, and collection time. Enough water is collected from the well to fill the required number of bottles. Water is transferred from the sampling equipment directly to the sample bottle. The bottle is filled to the neck. For samples that require volatile organic analysis, the bottle is filled until no air bubbles or headspace are left.

Duplicate samples will be collected at a minimum frequency of one duplicate for at least one of the wells sampled each event. The location from which duplicate samples are obtained will be rotated among WCF wells and among CPP-601/627/640 wells to the extent possible over the project life given availability of water, the presence of radionuclides in the wells, and other factors.

The contingent monitoring plan to sample the Snake River Plain Aquifer wells will be implemented when there is no longer at least one upgradient perched water well and three downgradient (point of compliance) perched water wells that have at least 1 foot each of water available for sampling for two consecutive semiannual sampling events. When implementing the contingent monitoring plan, aquifer well purging will be similar to purging performed for the perched water wells and will be calculated as the water column within the screened interval.

4.1.7 Equipment Decontamination Procedures

SPR-162 contains procedures for decontaminating equipment in the field. Following sampling, all nondedicated equipment that contacts well water is decontaminated using deionized water. Because the media sampled is suspected of containing RCRA-listed hazardous waste, the solution used to
decontaminate the equipment is contained, managed, and disposed of in accordance with appropriate HWMA/RCRA and radiological requirements. Wastes from decontamination procedures will be handled as described in Section 4.1.9.

4.1.8 Sample Transport

Following sample collection and before shipping, samples are surveyed for external contamination and field screened for radiation levels. If necessary, a gamma-screening sample will be collected and submitted to the INTEC shipping screen laboratory for a 20-minute gamma screen analysis before shipment off-Site. Determination of the need for radiological screening is made by the RCT in the field. A gamma shipping screen should be performed on samples where the RCT detects radiological activity on the outside of the sample that is above background levels and/or if the well has historical radiological issues.

All samples collected from a well known to be radiologically contaminated, labeled as possibly radiologically contaminated, or located in a radiological area will be surveyed by a RCT. Once screening analysis results are obtained, a qualified shipper is contacted to determine that proper shipping requirements are met. Historically, for the Post-Closure Monitoring Project, a gross alpha/beta on-site analysis was run at each sampling location at the request of Radiological Engineering. No historical results have ever resulted in surpassing radiological shipping requirements. Samples will be shipped to the off-Site analytical laboratory based on the best information available from acceptable knowledge and the gamma screen.

Samples (e.g., semivolatile organic compound) with short holding times (i.e., 7 days or less) are required to be shipped to the off-Site laboratory immediately after sample collection (i.e., no later than the following day).

Following radiation screening, the samples are prepared for transport by securing the labels using clear tape, placing Parafilm on the bottles to secure the lids, and placing the bottles in sealed bags. The samples are wrapped in plastic bubble wrap and placed in the sample cooler. Blue Ice is placed in the cooler to maintain the required temperature. The completed and signed COC form are placed in the cooler, and the cooler is taped shut. COC seals are placed on the cooler to prevent tampering. MCP-9228, “Handling Nonhazardous Samples” contains specific shipping procedures.

The applicable shipping papers are completed, and address labels are secured to the cooler with the address of the analytical laboratory. The coolers are delivered to the shipping authority for transport.

4.1.9 Waste Management

Wastes generated during groundwater monitoring will include purge water, sampling equipment, and PPE. Purge water has been disposed of to the Process Equipment Waste Evaporator in the past. Purge water may be sent to the evaporation pond at the Idaho CERCLA Disposal Facility (ICDF), provided it meets the ICDF Complex Waste Acceptance Criteria (DOE-ID 2013). Management of purge water shall be coordinated through the appropriate WGS and ICDF project personnel.

The sampling equipment and PPE will be handled, characterized, and disposed of as RCRA wastes in accordance with ICP Waste Acceptance Requirements (DOE-ID 2014). Personnel from WGS will coordinate waste disposal activities in accordance with ICP procedures. Waste will be bagged, placed in containers, labeled, and stored in an approved storage area pending disposition. The task lead, with
assistance from WGS, will prepare waste determination and disposition forms for determining the disposition routes for all waste generated during sampling and analysis.

The analytical laboratory will dispose of samples submitted to them for analyses or return them to the requestor as stated in the applicable TOS(s). Samples returned from the laboratory will be accepted only if the original label is intact and legible. If the samples are returned, the task lead is responsible to properly disposition the sample with the assistance of WGS personnel. All waste must be characterized, and disposal must be preapproved and documented by WGS personnel.

4.2 Sample Analysis

Laboratories selected by the SAM from the ICP Qualified Suppliers List will perform sample analysis. These laboratories will analyze the samples in accordance with project requirements, including the current statement of work (SOW) on file with the SAM organization.

Project-specific requests for analyses forms or TOS(s) identify additional requirements for laboratory analysis. The following sections identify analysis requirements for the characterization project.

4.2.1 Analytical Methods

To ensure that data of acceptable quality are obtained from the characterization project, standard EPA laboratory methods or technically appropriate methods for analytical determinations will be used to obtain sample data. Analytical methods to be used for this characterization activity are identified in Table 1. Any deviations from this information will be fully documented, and the laboratory will inform the task lead of the deviations.

4.2.2 Instrument Calibration Procedures

Laboratory instrumentation will be calibrated in accordance with each of the specified analytical methods. The laboratory quality assurance plan shall include requirements for calibrations when specifications are not listed in analytical methods. Calibrations that are typically not specified in analytical methods include ancillary laboratory equipment and verification of reference standards used for calibration and standard preparation. Laboratory documentation will include calibration techniques and sequential calibration actions, performance tolerances provided by the specific analytical method, and calibration dates and frequency. All analytical methods have specifications for equipment checks and instrument calibrations. The laboratory will comply with all method-specific calibration requirements for all requested parameters. If a failure of instrument calibration or equipment is detected, the instrument will be recalibrated, and all affected samples will be reanalyzed using an acceptable calibration.

4.2.3 Laboratory Records

Laboratory records are required to document all activities involved in sample receipt, processing, analysis, and data reporting. Sample management records document sample receipt, handling and storage, and the sample analysis schedule. The records verify that the COC and proper preservation were maintained, reflect any anomalies in the samples, note proper log-in of samples into the laboratory, and address procedures used to prioritize received samples to ensure that the holding time requirements are met.

The laboratory is responsible to maintain documentation demonstrating laboratory proficiency with each method as prescribed in standard operating procedures. Laboratory documentation will include
sample preparation and analysis details, instrument standardization, detection and reporting limits, and test-specific QC criteria. Any deviations from prescribed methods must be properly recorded. QA/QC reports will include general QC records, such as analyst training, instrument calibration, routine monitoring of analytical performance, and calibration verification. Project-specific tasks and information, such as blanks, spikes, calibration check samples, replicates, and splits performed per project requirements, may be performed and documented. Specific requirements for the quantity and types of QA/QC monitoring and associated reporting formats will be specified in the task-specific laboratory statement of work.

### 4.3 Data Management and Document Control

This section covers data reporting, validation, and quality assessment; reporting; and document control.

#### 4.3.1 Data Reporting

A standard deliverable plus raw data will be required for all data reported by the analytical laboratory for this characterization project. The final data package documentation will conform to the criteria specified in the current SOW on file with the SAM organization.

The ICP statement of work prepared by the SAM organization is the standard by which analytical data deliverable requirements are defined by ICP projects to laboratories used by the ICP. All laboratories used by this project will adhere to the document used to establish technical and reporting standards.

#### 4.3.2 Data Validation

Analytical data validation is the comparison of analytical results versus the requirements established by the analytical method. Validation involves evaluation of all sample-specific information generated from sample collection to receipt of the final data package. Data validation is used to determine whether analytical data are technically and legally defensible and reliable. The final product of the validation process is the validation report. The validation report communicates the quality and usability of the data to the decision-makers.

All data generated for this project will undergo independent validation. The SAM will arrange for validation. Level A validation is requested for all sample data reports generated during this project. The validation report will contain an itemized discussion of the validation process and results. Copies of the data forms annotated for qualification will be attached to the report. Field-generated data (e.g., water levels and water meter data) will be validated using properly calibrated instrumentation (to manufacturer’s guidelines), comparing and cross-checking current data with historical and independently gathered data, and recording data collection activities in a logbook.

#### 4.3.3 Data Quality Assessment

The data quality assessment process is used to determine whether the data meet the project data quality objectives. Additional steps of the data quality assessment process may involve data plotting, testing for outlying data points, and other statistical analysis relative to the characterization project data quality objectives.

The completeness of the data is the number of samples collected and analyzed compared to the number of samples planned. For this characterization plan, a 95% completeness objective for all analyses
has been established because some sample locations may not contain enough material for all analyses requested.

Precision is a measure of agreement among replicate measurements of the same property. Accuracy is a measure of the closeness of an individual measurement to the true value. Field and laboratory precision and accuracy should be within the limits and goals mentioned in the Quality Assurance Project Plan (DOE-ID 2009a). Data results will be evaluated upon completion of the project to determine whether precision and accuracy goals were met.

### 4.3.4 Required Reporting and Notifications

Reporting of validated data results will be in accordance with the HWMA Post-Closure Permit (DEQ 2014 [PER-112]), specifically, Permit Conditions I.P.8. (for each sampling event), and III.H. (semiannual reports). DEQ will be notified in accordance with the following Permit Conditions:

- III.B.3 (deviations from sampling during the weeks of the first Monday of February and August)
- II.C.3 (installation of replacement well)
- III.D.5 (problems with laboratory QA/QC or field sampling problems)
- III.F.4 (response to exceedance of detection monitoring criteria)
- III.G (compliance monitoring).

Data collected from these sampling events will also be used to support Comprehensive Environmental Response, Compensation and Liability Act activities.

### 4.3.5 Document Control

Document control consists of the clear identification of all project-specific documents in an orderly form, secure storage of all project information, and controlled distribution of all project information. Document control ensures controlled documents of all types related to the project will receive appropriate levels of review, comment, and revision as necessary. The task lead is responsible for ensuring the proper maintenance of project documents according to ICP document control requirements. Upon completion of the characterization project, all project documentation and information will be transferred to compliant storage according to project, program, and company requirements. This information may include field logbooks, COC forms, laboratory data reports, engineering calculations and drawings, and final technical reports. ICP maintains a HWMA/RCRA operating record.

### 5. HEALTH AND SAFETY REQUIREMENTS

Per MCP-101, “ICP Integrated Work Control Process” and MCP-3562, “Hazard Identification, Analysis, and Control of Operational Activities,” a Hazard Profile Screening Checklist was completed for this characterization to identify the hazards associated with the project. While the Health and Safety Plan (HASP) for the Environmental Restoration Project (PLN-2128) does not direct work, it establishes procedures and requirements used to eliminate or minimize personnel risks while conducting work. Hazards identified on the checklist along with corresponding mitigation requirements are documented on a job safety analysis (JSA) form per MCP-3450, “Developing and Using Job Safety Analysis.” In
completing the JSA, technical input and approval are obtained by assigned ESH&QA personnel. The JSA identifies the potential hazards associated with the project work scope.

Sampling personnel must abide by all the health and safety requirements in the JSA(s). The hazard identification and hazard mitigation for the project work scope are provided in JSA-6634, “Environmental and Regulatory Services Groundwater Monitoring.” Environmental Project Support management has authorized this activity as an operations-related task (ORT). MCP-3562 defines ORT work control. All activity and facility hazards are mitigated by the training or qualification of the performer. This plan is to be used by personnel trained to the hazard controls listed in JSA-6634 and perform the work described in SPR-162, “Measuring Groundwater Levels and Sampling Groundwater.”

5.1 Industrial Hygiene/RCT Monitoring Action Levels

Personnel working at the task site may be exposed to hazardous materials or hazardous physical agents, as already described. Industrial safety hazards and other physical hazards will be monitored and controlled. Specific hazardous agent exposures that may be monitored are identified in the project HASP (PLN-2128). Radiological hazards are also addressed in the project HASP and will be identified and mitigated on the RWP by the project radiological engineer/RCT.

5.2 Personal Protective Equipment Selection

The PPE requirements for this WCF post-closure groundwater monitoring project are specified in the project HASP, JSAs, and the project RWP. Modified Level D PPE is anticipated for this project, with the addition of nitrile gloves while handling samples. Samplers will follow additional requirements specified on the RWP. Section 8, “Personal Protective Equipment,” of the project HASP (PLN-2128) specifically addresses project PPE requirements.

6. TRAINING

Training requirements for personnel covered by this plan are shown in the project HASP, Table 6-1 (PLN-2128). The FTL will verify through the electronic Training Records and Information Network System that each assigned project person has completed the training identified in the Environmental Restoration Project HASP before allowing that individual to perform project work. A hard copy of individual training records should be maintained with the project paperwork. Initial training will include a briefing of the job work scope and briefing on the project HASP. The FTL and/or health and safety officer will conduct the required safety briefing each day before work begins.

7. SITE CONTROL AND SECURITY

Site control and security will be maintained at the project site during all activities to prevent unauthorized personnel from entering the work area. Based on the expected levels of contamination and work-activity hazard anticipated for each task, levels of work zones/radiation areas are limited in extent for these characterization activities. Entry into task site work zones will be controlled through the appropriate use of barriers, signs, and other measures, which will be described by the accompanying RWPs and managed by the FTL and health and safety officer. Personnel not directly involved with the activity shall be excluded from entering work zones. Nonworkers, such as inspectors, may be admitted to the task site provided they are on official business and have demonstrated compliance with the training requirements. Section 5 of the project HASP, “Site Control and Security,” identifies the specific requirements to be followed during work scope tasks.
Entry into and exit out of radiological areas will be controlled through the appropriate use of barriers, signs, and other measures in accordance with applicable company policies and procedures. PRD-183, “Radiological Control Manual,” and MCP-187, “Posting Radiological Control Areas,” will be complied with for posting and controlling access to radiological controlled areas.

### 7.1 Designated Eating and Smoking Area

Ingestion of hazardous substances is likely when workers do not practice good personal hygiene habits. It is important to wash hands, face, and other exposed skin thoroughly after completing work and before smoking, eating, drinking, and chewing gum or tobacco. No smoking, chewing, eating, applying lip balm, or drinking are allowed within the exclusion zone, contamination reduction zone, or contamination reduction corridor. Only approved smoking areas will be used by project personnel. All smoking policies will be complied with, including disposing of smoking materials in the proper receptacle.
8. REFERENCES


MCP-9228, Current revision, “Managing Nonhazardous Samples,” Idaho Cleanup Project.

MCP-9439, Current revision, “Environmental Sampling Activities at the INL,” Idaho Cleanup Project.


