Appendix I

Storm Water Pollution Prevention Plan

STORM WATER POLLUTION PREVENTION PLAN FOR CONSTRUCTION ACTIVITIES (SWPPP-CA) LONG-FORM PROJECT

JJECT TITLE: OU 3-13 Group 4 Perched Water Drilling Project

Facility or Location: INTEC   Environmental Checklist No.: ____________

Project Description:

The objective of the project is to monitor the expected drainout of the perched water beneath INTEC that is projected to occur as a result of the relocation of the existing percolation ponds now in use at INTEC. The project involves the drilling of 21 new vadose zone wells and the moisture monitoring of those wells and approximately 40 existing wells located inside the INTEC fence. The project will be conducted in phases. Phase I consists of a Tracer Study- the injection of dye tracers into the Big Lost River (BLR)and the Percolation Ponds, the drilling of 15 new wells and the sampling of 40 existing wells. Phase II will consist of an additional 6 new wells and the continuation of the monitoring of the wells from Phase I. Phase III, if required, could consist of remedial actions, such as the lining of the Big Lost River, necessary to effect the drain out of the perched water bodies.

Monitoring and sampling will be conducted for a mininmum of 20 years following the relocation of the INTEC percolation ponds.

Project Construction Date/Duration: 3 months

Area of Site to be disturbed: approximately 6 acres (mol)

Standard requirements:

- ☐ Post SWPPP-CA notice near main entrance of construction site.
- Spill prevention measures and prompt cleanup of any liquid or dry material spills.
- ☐ Minimize offsite tracking of sediments from vehicles.
- ☐ Minimize area of disturbance and preserve vegetation.
- ☒ Good Housekeeping procedures:
  - ☒ Proper and orderly storage of chemicals, pesticides, fertilizers, fuel, and other hazardous materials.
  - ☒ Proper and regular disposal of sanitary, construction, and hazardous wastes.
- ☒ Fugitive dust control measures.
- ☒ Perform inspections monthly, after storms, and prior to project close-out.
- ☒ Attach a site map which indicates drainage patterns, discharge locations, potential pollution sources (equipment and material storage areas including soil piles), areas of soil disturbance, erosion and sediment controls, storm water control measures, and stabilization practices.

Erosion and Sediment Controls: (Describe controls to divert storm water from exposed soil and retain sediments on site, such as diversion structures, silt fences, and sediment basins. Identify the entities responsible for implementation and maintenance.)

Inside the INTEC, ground preparation will not be performed. For drilling outside the INTEC, vegetation will be preserved wherever practicle. The well sites outside INTEC are located on flat terrain, an existing dike will divert storm water, and a buffer zone of vegetation will be maintained to filter sediment. Temporary piles of topsoil will be covered by a secured tarp. Bladed areas will be covered with wood chips to control dust.

STORM WATER POLLUTION PREVENTION PLAN FOR CONSTRUCTION ACTIVITIES (SWPPP-CA) LONG-FORM PROJECT

Sequence: (Describe the sequence of major activities, control measure implementation, and control measure removal.)

Drilling outside INTEC: The well sites and laydown areas will be bladed. Vegetation and topsoil will be temporarily stockpiled and covered with a secure tarps. Bladed areas will be or covered with wood chips to control dust. Containment pads will be used beneath the drill rigs. The three holes will be cored. All three will be instrumented with moisture monitoring equipment. All borings will have a concrete pad and brass marker for identification. Equipment and materials will be removed. The seedbed will be prepared and seeding performed. After seeding, barriers will be maintained and vehicular traffic will be prohibited until vegetation is well established and final stabilization is successful. Reseeding will be performed as necessary.

Drilling inside INTEC: No blading will be performed. Containment pads will be used beneath the drill rigs. During Phase I there will be four 45' cored holes, five 110'-140' coreholes, five 350'-400' coreholes, and one 460' aquifer skimmer well drilled and instrumented with moisture monitoring equipment. These vadose zone wells will be completed for perched water monitoring. Drilling equipment and materials will be removed after the completion of the drilling operations.

The State of Idaho Catalog of Storm Water Best Practices will be consulted regarding guidance and selection of BMPs related to major activities and implementation of control measures.

Runoff Coefficient and Storm Water Management: (Calculate runoff coefficients and explain the technical basis for permanent storm water management measures if the coefficient after construction is greater than before.)

There will be no impact to existing INTEC runoff coefficients. The concrete pads around the wells will not significantly increase the amount of impervious surface at INTEC.

Final Stabilization: (Identify soil stabilization measures and describe scheduling. Identify the entities responsible for implementatic maintenance.)

The area inside INTEC is covered with gravel and the gravel cover will be maintained. The area outside INTEC is covered with vegetation and disturbed areas will be revegetated. Weeds will be controlled. Seedbed preparation, fertilizing, and seeding will be performed according to the Guidelines for Revegetation of Disturbed Sites at the INEEL or as recommended by the Environmental Science and Research Foundation.

Industrial Activities: (Identify industrial sources of pollutants such as asphalt and concrete plants and describe pollution prevention measures.)

None

Allowable Non-Storm Water Discharge: (Identify type of discharge and describe pollution prevention measures.)

There will be some development water and limited amounts of purge water as a result of the activities. All water will be containerized and managed according to the project Waste Management Plan. There is a potential for groundwater from outside INTEC to be discharged to the ground if it is uncontaminated (meets requirements of the Groundwater Protection Management Plan, DOE/ID-10274).

Material Inventory: (Identify construction materials and wastes.)

Construction Materials: Drill rigs with associated drill pipe, casing, moisture monitoring equipment, and support vehicles. Wastes will include residual soils and core samples, personal protective equipment, contaminated equipment, and purge water. Any dust from drilling will go through either a vacuum excavator or cyclone separator with a high-efficiency particulate air filter. Wastes will be managed according to the project Waste Management Plan. All wastes will be containerized and removed from the project site, with the possible exception of uncontaminated groundwater.

STORM WATER POLLUTION PREVENTION PLAN FOR CONSTRUCTION ACTIVITIES (SWPPP-CA) LONG-FORM PROJECT

_ıdangered Species: (Identify listed species or critical habitat in proximity to the construction activity. Describe any adverse impact and mitigative measures.)

There are no adverse impacts on endangered species as a result of this project. Special mitigative measures are not required. Roger Blew, Plant Ecologist, Environmental Science and Research Foundation, Inc. is providing a review of the project as a part of the Environmental Checklist.

I have evaluated and identified controls adequate to meet the requirements of the INEEL Storm Water Pollution Prevention Plan for Construction Activities.

Project Manager

Signature ______________________ Date ______

Carlton J. Roberts — (208) 526-1605
Name (Please Print) — Phone Number

I am in agreement with the provisions set forth in this plan.

INEEL SWPPP Coordinator: DeAnna Braun Date:

ꓤTIFICATION:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based upon my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: ______________________ Date: ______

Title: ESH&QA General Manager
For: Idaho National Engineering and Environmental Laboratory
Reference: Transfer Signature Authority Letter – PHD-34-00

Signature: ______________________ Date: ______

Title: Environmental Technical Support Division Director
For: DOE-Idaho Operations Office
Reference: Transfer Signature Authority Letter – OPE-EP&SA-98-091

Worksheet must be appended to the Generic Plan or Facility SWPPP-CA.

Appendix J

Data Management Plan for Field and Nonchemical Data from the Operable Unit 3-13, Group 4 and Group 5, Well Installation and Monitoring Projects

DOE/ID-10768
Revision 0

[The document that is the subject of this appendix was provided as an attachment to the original deliverable.]

Appendix K

Procedures Relevant to RA Activities

Note about two of the Procedures Relevant to RA Activities

This list includes two technical procedures referenced in the Field Sampling Plan, **TPR-EM-GW-56,** *Sampling Groundwater,* and **TPR-EM-GW-97,** *Installing Lysimeters and Sampling Pore Water,* that were not referenced in our Draft submittal. These technical procedures are expected to be finalized later this calendar year. A current draft of each is included here for your review and files.

Procedures Relevant to RA Activities

INEEL, 2000, "Environmental Instructions for Facilities, Processes, Materials, and Equipment," **MCP-3480**, current issue.

INEEL, 2000b, "Installing Lysimeters and Sampling Soil Pore Water," **TPR-EM-GW-97**, current issue.

INEEL, "Soil Sampling," **TPR-61**, current revision.

INEEL, **Manual 18**, *Closure Management*, current issue.

INEEL, **MCP-1141**, "Waste Stream Approval Process," current revision.

INEEL, **MCP-121**, "Radioactive Material Areas for Storage," current revision.

INEEL, **MCP-293**, "Section 12: Nuclear Material Control and Accountability" current revision.

INEEL, **MCP-3472**, "Identification and Characterization of Environmentally Regulated Wastes," current revision.

INEEL, **MCP-3475**, "Temporary Storage of CERCLA Waste at the INEEL," current revision.

INEEL, **MCP-451**, "Generator Treatment Plans," current revision.

INEEL, **MCP-475**, "Survey of Materials for Unrestricted Release and Control of Contaminated Material," current revision.

INEEL, **MCP-62**, "Waste Generator Services-Low- Level Waste Management," current revision.

INEEL, **MCP-63**, "Waste Generator Services-Conditional Industrial Waste Management," current revision.

INEEL, **MCP-69**, "Hazardous Waste Characterization," current revision.

INEEL, **MCP-70**, "Waste Generator Services-Mixed Low- Level Waste Management," current revision.

INEEL, **MCP-83**, "Characterization of Low- Level Radioactive Wastes for Disposal at the INEEL," current revision.

INEEL, 1995, "Levels of Analytical Method Data Validation," **TPR-79**, current issue.

INEEL, 1996a, "Logbooks," **MCP-231**, current issue.

INEEL, 1996b, "Environmental Restoration Document Control Center Interface," **MCP-230**, current issue.

INEEL, 1997, "Reporting or Disturbance of Suspected Inactive Waste Sites", **MCP-3448**, current issue.

INEEL, 1997a, "Sampling and Analysis Process for Environmental Management Funded Activities," **MCP-227**, current issue.

INEEL, 1997b, "Chain of Custody, Sample Handling and Packaging," **MCP-244**, current issue.

INEEL, 1997c, "Sample Management," **MCP-2864**, current issue.

INEEL, 1997e, "Radiation Protection Manual," **Manual #15B**, current issue.

INEEL, 1998a, "Performing Pre-job Briefings and Post-job Reviews", **MCP-3003**, current issue.

INEEL, 1998b, "Maintenance Work Control," **MCP-2798**, current issue.

INEEL, 1998c, "Performing Safety Reviews," **MCP-2727**, current issue.

INEEL, 1998d, "Calibration Program," **MCP-2391**, current issue.

INEEL, 1998e, "Field Work at the INEEL," **MCP-2725**, current issue.

INEEL, 1999a, "Well Construction/Well Abandonment," **MCP-226**, current issue.

INEEL, 1999b, "Well Construction, Modifications, Compliance, and Management," **MCP-3653**, current issue.

INEEL, 1999c, "Deficiency Screening and Resolution," **MCP-598**, current issue.

INEEL, 1999d, "Design and Engineering Change Control," **MCP-2811**, current issue.

INEEL, 2000, "Managing Contaminated Soils" **MCP-3002,** current issue.

INEEL, 1994a, "Field Decontamination of Heavy Equipment, Drill Rigs, and Drilling Equipment," **SOP 11.4**, current issue.

INEEL, 1994b, "Field Decontamination of Sampling Equipment," **SOP 11.5**, current issue.

INEEL, 1994c, "Radiological Data Validation," **TPR-80**, current issue.

INEEL, 1999, "Assessment of Analytical Laboratories " **MCP-243,** current issue.

INEEL, 1999, "Obtaining Laboratory Services for Environmental Management Funded Activities" **MCP-242,** current issue.

INEEL, 1993, "Measurement of Groundwater Levels," **SOP-11.9**, current issue.

Document ID:	TPR-EM-GW-97
Revision ID:	0 DRAFT
Effective Date:	07-31-00

Technical Procedure

Installing Lysimeters and Sampling Soil Pore Water

INEEL
Idaho National Engineering & Environmental Laboratory
BECHTEL BWXT IDAHO, LLC

Form 412.14
10/05/99
Rev. 02

REVISION LOG

Rev.	Date	Affected Pages	Revision Description
0	07-31-00	All	Initial issue of site-wide TPR-EM-GW-97. Consolidated from ER PD 1.45.

CONTENTS

1. INTRODUCTION

1.1 Purpose

A vacuum pressure lysimeter is a device for collecting soil pore water samples from unsaturated geologic materials.

1.2 Scope and Applicability

The scope of this TPR covers collecting pore water samples using a lysimeter. It establishes uniform procedures for installing porous cup-style vacuum pressure lysimeters in unconsolidated and consolidated deposits, and subsequent sampling activities in support of environmental investigations conducted at the Idaho National Engineering and Environmental Laboratory (INEEL). Appendix A shows a typical arrangement of a porous cup style vacuum lysimeter and a typical vacuum lysimeter installation. Refer to Appendix B for additional material and installation information.

2. PRECAUTIONS AND LIMITATIONS

2.1 Installation methods and materials depend on types of native materials and depth of lysimeter installation.

2.2 The project manager and field team leader must alert all field team members to any exceptions, modifications, or requirements in applicable project plans that will take precedence over the minimum requirements of this TPR.

2.3 Cold weather conditions may clog extraction lines.

2.4 Pore-water samples collected with lysimeter may not be fully representative of soil water conditions because of potential sample contamination from materials used in the lysimeter, and disruption of "normal" drainage patterns due to suction-induced sampling or clogging of extraction lines.

2.5 Use caution and wear appropriate personal protection equipment (PPE) when handling and working with acids. Refer to site-specific health and safety documentation (Job Safety Analysis [JSA]).

3. PREREQUISITES

3.1 Planning and Coordination

3.1.1 Locate all utilities before drilling. Obtain an outage (MCP-2) permit, if necessary, and an excavation permit (PRD-22) prior to field work. Refer to MCP-151, Subsurface Investigations.

3.1.2 IF soil pore water samples require analysis,
THEN implement this procedure in conjunction with Statements of Work (SOW) for the analytical laboratory and/or Task Orders. Contact Sample Management Office for assistance.

3.1.3 Ensure the laboratories are prepared to dispose of samples, or the appropriate disposition for returned laboratory samples has been determined in accordance with MCP-2864, Sample Management.

3.1.4 Contact the laboratory prior to sampling to obtain the proper sample-handling specifications including, but not limited to, sample container requirements, preservatives, and laboratory capacity.

3.1.5 Make prior transportation arrangements for timely delivery of the samples to the analytical laboratory.

3.2 Performance Documents

3.2.1 Review, as necessary, the applicable sections of the following documents:

A. EMMCP-8.1, Environmental Monitoring Logkeeping Practices, *Environmental Monitoring Administration Manual*, Environmental Monitoring, current issue

B. governing data collection plans (such as ASAP, FSP, SAP, or equivalent)

C. health and safety documentation and Job Safety Analysis

D. MCP-2, Outages, Companywide Manual 6, *Maintenance*, current issue

E. MCP-151, Subsurface Investigations, Companywide Manual 6, *Maintenance*, current issue

F. MCP-2864, Sample Management, Companywide Manual 18, *Closure Management*, current issue

G. PRD-22, Excavation and Surface Penetration, Companywide Manual 14A – Safety and Health, Occupational Safety and Fire Protection, current issue.

3.2.2 The project manager or field team leader must review all applicable regulations prior to authorizing the start of drilling operations, if applicable. (Lysimeter installation may be regulated by state laws and guidelines that pertain to the drilling, installing and abandonment of boreholes).

3.3 Special Tools, Equipment, Parts, and Supplies

3.3.1 Obtain the following items, as necessary:

A. a suitable drill rig (usually auger, cable tool, or rotary)

B. steam cleaner

C. wash/rinse solutions

D. storage tanks

E. brushes

F. other equipment as necessary to capture and contain decontamination solutions

G. grout pump, mixer

H. clean tremie pipe

I. lysimeter. Porous cup-style lysimeters may be obtained through a number of different suppliers, but in general will conform to the typical arrangement shown in Figure A-1 (Appendix A). Dimensions and model numbers must be defined by the project manager/field team leader and governing data collection plans (such as Abbreviated Sampling Analysis Plans [ASAP], Field Sampling Plans [FSP], Sampling Analysis Plans [SAP], and Job Safety Analysis [JSA], or equivalent).

J. friction or bolt-on style polyvinyl chloride (PVC) plastic or stainless steel centralizers

K. lysimeter access tubing and valve arrangement

L. pressure-vacuum pump

M. silica-flour slurry and tracer

N. cement/bentonite grout

O. bentonite grout

P. Volclay™

Q. Pure Gold™

R. bentonite pellets/chips

S. concrete

T. field logbook

U. dark indelible ink pens

V. engineering pocket tape measure with 0.01 ft increments

W. weighted engineering tape for sounding borehole material depth, with a length suitable for the total anticipated borehole depth

X. cleaned and certified bottles for collecting samples of lysimeter installation materials

Y. sample containers for soil samples

Z. sample containers, cooler, and other materials necessary for collecting analytical laboratory samples (identified in Field Sampling Plan)

AA. distilled water

BB. deionized water

CC. potassium bromide

DD. pressure tank

EE. Neoprene or nitrile gloves

FF. safety glasses with side shields or safety goggles

GG. guide pipe to attach lysimeter to

HH. nylon sling to lower lysimeter

II. rope

JJ. PVC inner riser

KK. sieve.

3.4 Field Preparations

3.4.1 If suction lysimeters are to be cleaned prior to installation, perform the cleaning as follows.

NOTE: *Not all lysimeters can be disassembled.*

3.4.1.1 Disassemble the suction lysimeter. For lysimeters with internal check valves, remove the check valve for the lysimeter.

3.4.1.2 Follow manufacturer's instructions and refer to the governing data collection plans for cleaning specifications.

3.4.1.3 Wash all lysimeter components using warm water and a nonphosphate detergent. Rinse thoroughly with tap water and finish with a distilled water rinse.

NOTE: *Not all lysimeters have a porous ceramic cup (some may be nylon, Teflon, etc.).*

3.4.1.4 Refer to manufacturer's instructions for cleaning prior to installing.

3.4.1.5 Do not acid wash lysimeters that have any stainless steel parts.

3.4.1.6 If necessary, flush the porous ceramic cup of soluble salts and metals before installation. Prepare a 1 Normal solution of hydrochloric acid (HCL), and pass 30 pore volumes of the acid solution through the ceramic by gravity or slight pressure.

3.4.1.7 Pull at least 20 pore volumes of deionized or distilled water through the porous ceramic cup using gravity or slight pressure. It may take 10 to 20 liters of distilled water to remove all of the hydrochloric acid. Test the pH and specific conductance of the rinse water to determine when the cleaning solution has been flushed.

3.4.1.8 Reassemble the lysimeter. Apply a vacuum to ensure the lysimeter will hold a vacuum prior to installation.

3.4.1.9 Wrap in plastic, or equivalent for storage or until use in the field.

NOTE: *The field team leader or designee performs the steps of this TPR.*

4. INSTRUCTIONS

4.1 Evaluate the borehole prior to installing the lysimeter to determine depth of backfill and lysimeter installation.

4.2 Compare the anticipated design for lysimeter installation to the final completed borehole and the stratigraphic log of the samples or cuttings.

4.3 Verify that the borehole depth is adequate for lysimeter installation.

4.4 IF the desired monitoring interval is above the bottom of the borehole, THEN backfill borehole with a low permeability grout or bentonite seal.

4.4.1 Tremie the grout to 2 ft below the intended bottom of the installed lysimeter of the borehole.

4.4.2 Pull or hammer the auger flights or steel casing out of the hole in 5 ft increments until the bottom of the drive casing or auger flights and the top of the grout are equivalent to the bottom elevation of the desired monitoring interval.

4.4.3 Allow the grout to set to establish a solid foundation. Do not allow bentonite or cement grout to harden while the drive casing is in contact.

4.4.4 Add at least 1 ft of powdered bentonite. Hydrate and tamp as necessary.

4.5 Follow the lysimeter installation instructions cited below. See also Appendix B.

NOTE: *Installation methods and materials depend on types of native materials and depth of lysimeter installation.*

4.5.1 Verify that the lysimeter has been properly decontaminated, and connected to sufficient lengths of decontaminated polyethylene access tubing.

4.5.2 Soak the lysimeter unit (porous cup) in distilled water for 15 to 30 minutes prior to installation to ensure saturation of the porous material.

4.5.3 Thread or place a PVC inner riser on the upper end of the lysimeter, to protect the tubing connections during backfilling. Attach lysimeter to guide pipe, or lower lysimeter down hole using rope, keep air and water lines from kinking.

4.5.4 Add all additional sections of guide pipe as necessary based on the installation depth of the lysimeter, and attach tubing (air and water) to guide pipe.

4.5.5 Connect the access tubing to the surface valves, and attach the riser cap/valve assembly to the riser cap.

4.5.6 Prepare a silica flour slurry using a mixture of 150 mL of distilled water or equivalent as specified in governing data collection plans to 0.45 Kg 200 mesh pure silica flour.

4.5.7 Use sieved native soil, when possible, instead of silica flour slurry.

4.5.8 In fine-grained deposits, such as silty clay at the Subsurface Disposal Area (SDA), install the porous cup using a fine mud slurry. Sieve the native soil to remove coarse particles and add deionized water until the slurry can be poured through a tremie pipe. The material surrounding the lysimeter must be at least as fine as (or finer than) the native soil in which the lysimeter is installed.

NOTE: *Silica flour slurry is used for lysimeter installation in coarser materials such as alluvium found at Idaho Nuclear Technology and Engineering Center (INTEC)*

NOTE: *Use of a tracer is optional.*

4.5.9 Add laboratory-grade potassium bromide in sufficient quantities to result in a concentration of approximately 2 ppm; the bromide will serve as a tracer in order to permit confirmation that formation water is actually being sampled. Refer to governing data collection plans for use of a tracer.

4.5.10 Tremie approximately 1 ft of silica flour slurry (or substitute 100-mesh silica sand) on top of the powdered bentonite seal.

4.5.11 If lowering the lysimeter housing by a nylon sling, install stainless steel or PVC centralizers on the lysimeter housing, then lower the assembly until it contacts the slurry. If the lysimeter is attached to guide pipe, lower the guide pipe down the hole to sit on the silica flour slurry.

4.5.12 Tremie additional slurry around the lysimeter and to at least 1 ft above the porous ceramic cup of the lysimeter.

4.6 Placement of the Bentonite Seal

4.6.1 Place the bentonite seal above the slurry by preparing a volume of pellets or granular bentonite to create a seal 1.5 to 3 ft long at a minimum, and place into the annular space.

4.6.2 IF necessary to absorb excess water and prevent the bentonite moving into the slurry,
THEN add a layer of native soil above the slurry.

4.6.3 After bentonite seal is placed above the slurry, place backfill (or native soil) and tamp.

4.6.4 Record quantities and calculations in the field logbook. Refer to EMMCP-8.1, Environmental Monitoring Logkeeping.

4.6.5 Place the bentonite by either tremieing the bentonite to the required interval or hand pouring the bentonite into the annular space at the top of the well. Tremie the pellets on deeper installations. Exercise extreme care, and slowly introduce the pellets or chips into the annular space to prevent bridging above the level to be completed.

4.6.6 IF the bentonite seal is being constructed above the water level in the borehole,
THEN slowly pour 5 gallons of water per a 5-gallon bucket of pellets or bag of bentonite chips into the annular space to rehydrate the bentonite.

4.6.7 Lower a weighted seal tamper down the annulus to tamp the pellets or chips into a cohesive mass of clay.

4.7 Backfilling

4.7.1 Backfill the borehole in a manner that best approximates original conditions.

NOTE: *Various combinations of grouting, grout with bentonite seals or cutoffs, or backfilling with natural materials are possible. The combination to be used will be specified by the project manager, field team leader, or in the data collection plans.*

4.7.2 IF grouting is used,
THEN collect a sample of the final grout just prior to injection.

4.7.3 Prepare the volume of grout, either bentonite or cement/bentonite, required to completely fill the annular space between the seal and the ground surface in the specified proportions. Include sufficient volume to compensate for losses.

4.7.4 Ensure all hoses, tubes pipes, water swivels, drill rods, or other passageways through which the grout will be pumped have an inside diameter of at least 0.5 inches.

4.7.5 Inject all grout via a side discharge tremie pipe.

4.7.6 Remove any temporary casing or auger flights, prior to setting.

4.7.7 Remove casing and inject grout concurrently provided that the top of the column of grout is always at least 20 ft above the bottom of the casing and injection is not interrupted.

4.7.8 IF casing removal does not commence until grout injection is completed,
THEN periodically pour additional grout into the annular space to maintain a continuous column.

4.7.9 Do not disturb the installation for 48 hours to permit the grout to cure.

4.8 Site Cleanup

4.8.1 Restore the staging area, decontamination area, each well site, and any other areas used during the well installation program to previous condition. Remove all trash; place the 55-gallon drums of cuttings, if generated, into a temporary storage area.

4.9 Sample Acquisition

4.9.1 Put on nitrile or neoprene gloves and other PPE as required by JSA during sample collection.

4.9.2 Remove the protective cap on the installation monument.

4.9.3 Attach the pressure vacuum line from the hand pump (or portable tank) and the discharge line for the sample container to the appropriate valves attached to the PVC riser.

4.9.4 Close the discharge valve, and open the pressure-vacuum valve.

4.9.5 Operate the hand pump or open the tank valve until a vacuum of 50 to 85 centibars or 15 to 25 inches of mercury is reached, and close the pressure vacuum valve.

4.9.6 Record the time, vacuum applied, and allow the system to remain under vacuum until a sample accumulates in the lysimeter.

NOTE: R*equired time under vacuum will vary widely depending on the amount of moisture in the soil. Auxiliary indicator systems may be used to detect sample material within the lysimeter, as directed by the field team leader or governing data collection plans.*

4.9.7 Prior to collecting a sample, record the total time under vacuum and the amount of vacuum remaining in the field logbook.

4.9.8 Connect the pressure port of the hand pump to the pressure-vacuum valve.

4.9.9 Place the discharge line in the sample collection container, and slightly open both valves.

4.9.10 Operate the hand pump or connect a pressure tank as necessary to force the collected water out of the sampler and into the collection bottle. At the field team leaders' discretion, continue to evacuate the lysimeters.

4.9.11 Keep pressure below the maximum allowed for that lysimeter to prevent blowing out the pourous cup.

4.9.12 Record the total volume of fluid obtained in the field logbook.

4.9.13 Submit samples to analytical laboratory according to governing data collection plans.

4.10 Feedback and Continuous Improvement

4.10.1 Provide feedback on the adequacy of controls and opportunities for improvement to the Environmental Monitoring supervisor.

5. RECORDS

Records Description	Uniform File Code	Disposition Authority	Retention Period
Data collection records[a]	6502	ENV1-D-8-B	Pending
Data collection plans[b]	6502	ENV1-D-8-B	Pending

a. Records may include, but are not limited to: logbooks, analytical results, lysimeter installation details, borehole logs, instrument calibration logs, health and safety documentation, annual reports, internal correspondence, external correspondence.

b. May include ASAP, FSP, SAP, or equivalent.

6. REFERENCES

Step	Requirement	Source
4	Soil pore water samples shall be collected	Data collection plan
4	Requirements for surface penetration	PRD-22, Excavation and Surface Penetration.

7. APPENDICES

Appendix A, Figures

Appendix B, Materials and Installation Information

APPENDIX A

Figures

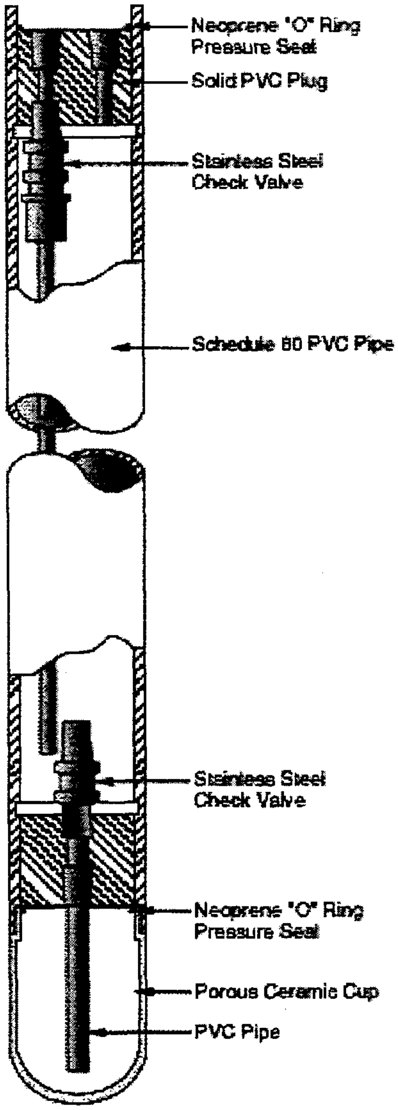

Figure A-1. Porous cup style vacuum lysimeter typical arrangement.

APPENDIX A

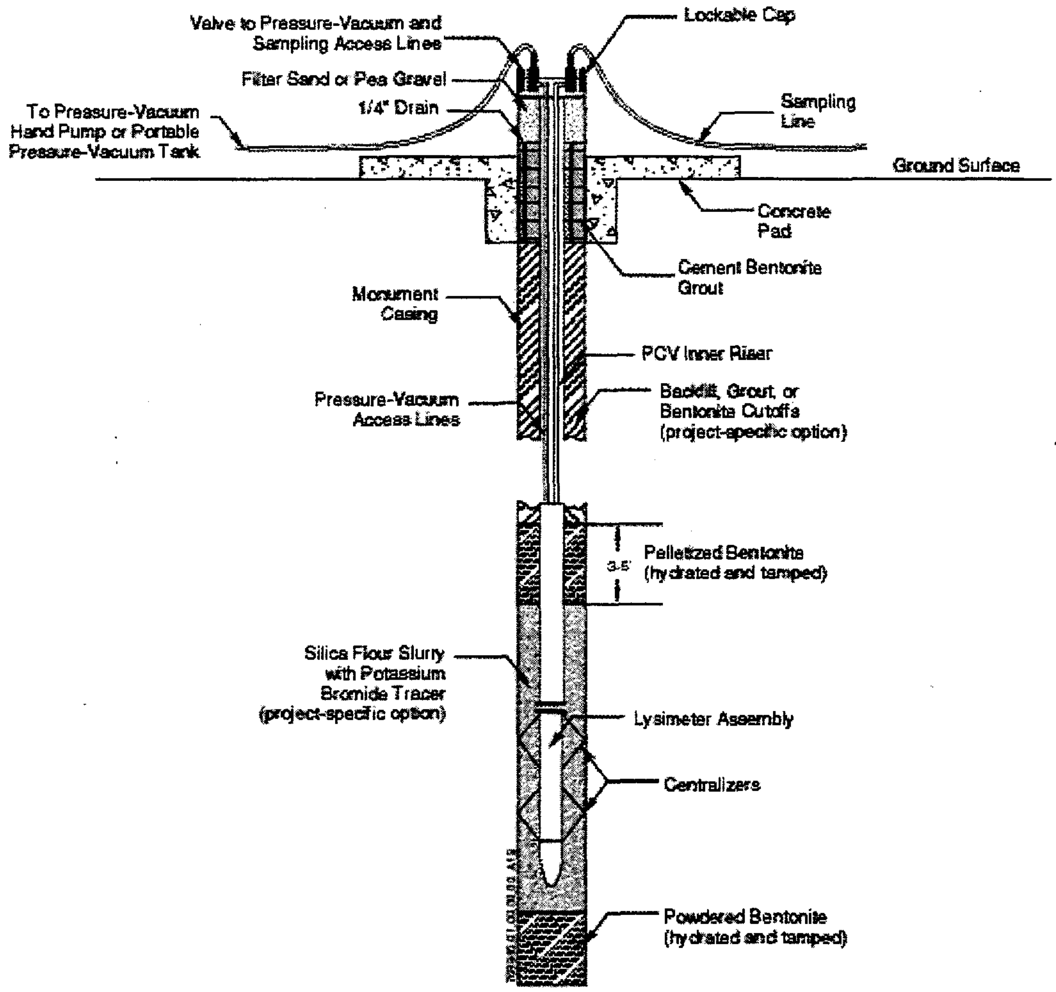

Figure A-2. Typical vacuum lysimeter installation.

APPENDIX B

Materials and Installation Information

A. Construct lysimeter access tubing and valve arrangement access tubing with polyethylene, stainless steel, or other materials appropriate for the purpose of the sampling investigation. Protect tubing and fittings with a PVC inner riser. Connect access tubing to permanently marked valves at the surface of the installation as shown in Figure 2 (Appendix A).

B. Use a manually operated pressure-vacuum pump with a suitable gauge arrangement to draw a vacuum within the lysimeter chamber, as well as to pressurize the sample chamber in order to deliver pore water to the surface. Manual pumps are generally suitable for depths of 50 ft or less. Portable vacuum or pressure tanks may be employed as an acceptable alternative to hand pumps.

NOTE: *Portable vacuum or pressure tanks may be used as an acceptable alternative for depths greater than 50 ft or per specification in governing data collection plans.*

C. As shown in Figure A-2 (Appendix A), a silica-flour slurry is used to embed the lysimeter and establish hydraulic communication with the formation. Prepare the slurry using pure 200 mesh silica flour and deionized water or equivalent as specified in governing data collection plans (in a ratio of 0.45 kg flour to 150 mL water). Add a potassium bromide tracer in sufficient quantities to result in a concentration of approximately 2 ppm; calculate tracer quantities based on probable slurry volume at the project manager/field team leaders' direction prior to mobilizing to the site.

NOTE: *Silica flour is optional (as needed). Use sieved native soil when possible. Refer to governing data collection plans.*

D. Cement/bentonite grout will consist of a mixture of Portland Cement with 3 to 5% bentonite by weight added to help expand the cement on setting, thus providing a tighter seal. No other additives to the cement are permitted. Use only Portland Cement Type I or Type II meeting ASTM C 150. The use of Hi Early Type III Cement is prohibited. Bentonite will be powdered sodium bentonite furnished in sacks without additives; calcium bentonite may be used in calcium-rich environments. Water used during the installation operation for mixing cement/bentonite grout will be obtained from a potable source of known chemical quality designated by the field team leader.

E. Mix cement with water in the proportions of 5 to 6 gallons of water per 94-lb sack of cement. Add three to five pounds of bentonite powder to the mix for each sack of cement used. Thoroughly mix the grout with a paddle-type mechanical mixer or by circulating the mix through a pump until all lumps are removed.

APPENDIX B

F. Make bentonite grout from bentonite powder and/or granules for use below the water table. The bentonite grout will have a specific gravity of 2.5, a dry bulk density of 55 lb/ft^3, and a pH of 9 to 10.5. Bentonite grout should have a thick batter-like consistency when mixed. Mix and use bentonite grout according to manufacturers' specifications and recommendations. Bentonite will be powdered or granular (8 to 20 mesh) sodium bentonite furnished in sacks without additives. Water used during installation operations for mixing bentonite grout will be obtained from a potable source of known chemical quality identified by the field team leader. Thoroughly mix the grout with a paddle type mechanical mixer or by circulating the mix through a pump until all lumps are removed.

NOTE: *Volclay™ is a trade name bentonite product that is modified with an initiator to increase the solids and set strength of the grout. The grout remains pumpable up to 2 hours but should be placed as soon after mixing is complete as possible. It sets up after 8 to 24 hours with final cure 24 to 72 hours after placement. The normal mix is 2.1 lbs of Volclay™ to 1 gallon of water. Mix 14.3 lbs of Volclay™ with 6.7 gallons of water to yield 1 cubic ft of grout. A 50-lb bag of Volclay™ with the 2-lb bag of initiator mixed with 24 gallons of water makes up about 3.5 cubic ft of grout. Because of potential desiccation and shrinkage, use Volclay™ for sealing within water-saturated environments.*

NOTE: *Pure Gold™ is a trade name bentonite product that is an organic-free high-solids bentonite clay grout that has been tested and is certified to be free of contaminants. A 5-lb bag of Pure Gold™ grout is mixed with 14 gallons of water to yield approximately 2.2 cubic ft of grout. The grout shall have density of 10.2 lbs/gal. Because of potential desiccation and shrinkage, use Pure Gold™ for sealing within water-saturated environments.*

G. The seal above the silica-flour slurry usually consists of bentonite pellets. Bentonite chips or pellets will usually be a nominal 1/4 to 3/8 inch diameter round or cylindrical pellets consisting of untreated sodium bentonite, packaged in plastic buckets or plastic lined sacks. Clearly label each sack or bucket with the pellet size. The dry bulk density shall be at least 80 lbs/ft^3. The diameter of the pellets or chips will be less than one-half the width of the annular space into which they are to be placed.

H. Concrete will be either premixed, bagged concrete, or a mix of six sacks of cement per cubic yard. Do not mix additives or borehole cuttings with the concrete. The concrete pad for the monument installation is not usually steel reinforced.

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Technical Procedure

Sampling Groundwater

Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho

INEEL
Idaho National Engineering & Environmental Laboratory
BECHTEL BWXT IDAHO, LLC

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REVISION LOG

Rev.	Date	Affected Pages	Revision Description
0	07-31-00	All	Initial issue of site-wide TPR-EM-GW-56. Consolidated from EIP-12, SOP-2.8, and ER&WM TPR-56.

CONTENTS

1. INTRODUCTION

1.1 Purpose

Groundwater samples are collected for geochemical and contaminant chemistry analyses.

1.2 Scope and Applicability

This technical procedure (TPR) provides general instructions for and applies to sampling groundwater in support of environmental investigations conducted at the Idaho National Engineering and Environmental Laboratory (INEEL).

2. PRECAUTIONS AND LIMITATIONS

2.1 Often the investigator will be evaluating contaminants at the parts per million (ppm) or parts per billion (ppb) concentration levels. Consequently, the possibilities of errors in data collection are enlarged. Therefore, extreme care and quality control must be used when obtaining samples. The governing data collection plan (such as Abbreviated Sampling Analysis Plans [ASAP], Field Sampling Plans [FSP], and Sampling Analysis Plans [SAP], or equivalent) document project specific objectives.

2.2 IF the Groundfos® Variable Frequency Drive Controller for micropurge sampling is required,
THEN use this procedure in conjunction with TPR-EM-GW-151, Groundwater Sampling Using the Micropurge Method.

2.3 Project manager or field team leader must alert field team members to any exceptions, modifications, or requirements in applicable project plans that will take precedence over the minimum requirements of this procedure.

3. PREREQUISITES

3.1 Planning and Coordination

3.1.1 Implement this procedure in conjunction with the Statements of Work (SOW) for the analytical laboratory and/or Task Order Statements of Work approved by the INEEL Sample Management Office (SMO).

3.1.2 Ensure the laboratories are prepared to dispose of samples, or the appropriate disposition for returned laboratory samples has been determined in accordance with MCP-2864, Sample Management.

3.1.3 Contact the laboratory prior to sampling to obtain the proper sample-handling specifications including, but not limited to, sample container requirements, preservatives, and laboratory capacity.

3.1.4 Make prior transportation arrangements for timely delivery of the samples to the analytical laboratory.

3.2 Performance Documents

3.2.1 Review, as necessary, the applicable sections of the following documents:

A. EMMCP-8.1, Environmental Monitoring Logkeeping Practices, *Environmental Monitoring Administration Manual*, Environmental Monitoring, current issue

B. EMMCP-8.3, Labeling Samples and Maintaining Chain of Custody, *Environmental Monitoring Administration Manual*, Environmental Monitoring, current issue

C. governing data collection plans (such as ASAP, FSP, SAP, or equivalent)

D. health and safety documentation

E. MCP-2669, Hazardous Material Shipping, Manual 17, *Waste Management*, current issue

F. MCP-2676, Shipping General Commodities, Packaging and Transportation Department, Manual 17, *Waste Management*, current issue

G. MCP-2864, Sample Management, Manual 18, *Closure Management*, current issue

H. TPR-EM-CM-4.1, Handling and Storing Samples, *Compliance Monitoring Handbook*, Environmental Monitoring, current issue

I. TPR-EM-GW-52, Decontaminating Sampling Equipment in the Field, *Compliance Monitoring Handbook*, Environmental Monitoring, current issue

J. TPR-EM-GW-58, Measuring Groundwater Levels, *Compliance Monitoring Handbook*, Environmental Monitoring, current issue

K. TPR-EM-GW-151, Groundwater Sampling Using the Micropurge Method, *Compliance Monitoring Handbook*, Environmental Monitoring, current issue

L. Statement of Work and Task Order Statement of Work.

3.3 Special Tools, Equipment, Parts, and Supplies

3.3.1 Obtain the following items, as necessary:

A. field logbooks

B. well purging data sheet and chain-of-custody forms

C. dark indelible ink pens

D. key or combination to unlock wellhead

E. calculator

F. watch with a second hand or stopwatch

G. electronic water-level measuring device or weighted steel tape marked in hundredths of feet (refer to TPR-EM-GW-58, Measuring Groundwater Levels)

H. chalk

I. personal protective equipment (PPE) as specified in the project health and safety documentation

J. flashlight

K. mirror

L. pump, bailer, bailer line

M. water hose for purging and sampling

N. bucket

O. specific conductance-dissolved oxygen-pH, and temperature-sensing devices, calibration buffer solutions

P. sampling manifold

Q. sample bottles, preservatives

R. sample bottle labels

S. custody seals

T. pipette or medicine dropper for dispensing preservatives

U. reagent grade water (such as deionized, organic-free, ASTM Type II, HPLC water)

V. tape (clear tape for bottles, parafilm, strapping tape, and duct tape)

W. sample packaging materials

X. address labels, informative labels ("This Side Up", arrows, etc.), and shipping forms and papers as necessary

Y. coolers and blue ice or equivalent

Z. Ziploc® sealable baggies, large plastic bags

AA. containers for purge water, as applicable

BB. scissors and/or knife

CC. paper towels, wipes

DD. nonphosphate detergent or equivalent

EE. filtering equipment (0.45 micron [μ] filters, or as required)

FF. waterproof gloves.

3.4 Field Preparations

3.4.1 Select sampling equipment so that disturbance of the actual concentrations of the chemical constituents of interest is minimized. The collection methods required for individual investigations will be as defined in the governing data collection plans (such as ASAP, FSP, SAP, or equivalent). Use bailers, low-volume suction pumps, or submersible pumps to remove water from the well.

NOTE: *Use of dedicated bailers or pumps for each well is desirable to avoid cross contamination.*

Appendix A describes suggested methods and equipment used to obtain groundwater samples.

3.4.2 Decontaminate sampling equipment prior to use in the field and after use according to the governing data collection plans and TPR-EM-GW-52. Do not place clean sampling equipment directly on the ground or other contaminated surfaces prior to insertion into the well. Nondedicated pumps and tubing must be thoroughly decontaminated between well sampling sites.

NOTE: *The field team leader or designee performs the steps of this TPR.*

4. INSTRUCTIONS

4.1 Measuring Static Water Level

WARNING

Beware of spiders (such as black widows) when removing well caps.

4.1.1 Remove well cap.

4.1.2 Measure the static water level in the well prior to bailing, purging and sampling of the well.

4.1.3 Measure water levels from the surveyed reference marker according to TPR-EM-GW-58. Record to the nearest 0.01 ft. Measure groundwater level again after sample collection, if necessary per governing data collection plans.

4.2 Purging the Well

4.2.1 Calculate the volume of standing water in a well using the following generalized equation:

$$V = (h_1 - h_2)r^2(0.163)$$

where

V = static well volume in gallons

h_1 = depth of the well in feet, from the top of the casing

h_2 = depth to water, in feet, from the top of the casing

r = inside radius of well casing in inches.

4.2.2 Purge standing water in the casing so that formation water replaces the stagnant water in the well and filter pack.

NOTE: *Typically three to five times the calculated volume of water in the well is removed in an effort to obtain a representative sample from the aquifer. The actual number of volumes to be removed are specified in governing data collection plans. The water standing in a well prior to sampling may not be representative of in-situ groundwater quality.*

4.2.3 Continue well purging until the volume specified in the governing data collection plan is removed and certain indicator parameters (such as pH, specific conductance, and temperature) are stabilized.

4.2.4 Take measurements periodically during purging to check the stability of the water sampled over time.

NOTE: *Stabilization of the indicator parameters is satisfied when successive readings meet the following criteria:*

- *pH: $\pm$ 0.1 standard units*
- *specific conductance: $\pm$ 10 micromhos/cm*
- *temperature: $\pm$ 0.5 °C.*

4.2.5 Document the readings of the indicator parameters on the Well Purging Data Sheet.

NOTE: *An example of a typical Well Purging Data Sheet can be found in Appendix B.*

4.2.6 After purging the well, record the amount of water removed on the Well Purging Data Sheet.

4.3 Low-Yield Formations

4.3.1 When purging a low-yield well (a well that is incapable of yielding three casing volumes), purge the well dry once.

4.3.2 As soon as the well recovers sufficiently (ample water for collection), test the first sample for pH, specific conductance, and temperature.

4.3.3 Collect and bottle samples in the order of the parameters' volatilization sensitivity.

NOTE: *The note below section 4.5.12 of this TPR lists the preferred order of sample collection.*

4.3.4 If the well has very limited production, if possible, collect smaller volumes depending on the analysis required and after consultation with the analytical laboratory and/or SMO.

4.3.5 After the samples have been collected, remeasure for pH, specific conductance, and temperature as a measure of purging efficiency and as a check on the stability of the water samples over time.

4.4 Disposal of Purge Water

4.4.1 Properly discard the purge water removed from the well. Refer to the site-specific governing data collection plans for the proper handling of purge water.

4.4.2 When contamination is suspected, discharge the water to either a truck equipped with a liquid holding container or to portable containers for ultimate disposal at a waste water treatment facility.

4.4.3 If past sampling results at the well or sampling at surrounding wells suggest the water at this well site is clean, discharge the purge water to the ground with prior approval of the project manager and area landlord.

4.5 Filling the Sample Bottles

4.5.1 Remove an adequate volume of water from the well prior to sampling.

4.5.2 Wear clean, waterproof gloves to prevent skin oils, dust particles, or other contaminants from contaminating the sample. Change gloves between wells or discrete sampling zones.

NOTE: *Glove material may be specified in project health and safety documentation.*

4.5.3 Inspect the sample bottles to ensure an adequate supply of the type specified in the governing data collection plan, and that they are certified precleaned (if required).

4.5.4 Affix the waterproof gummed labels, which contain information about the sample ID number, name of project area/well, type of analysis, date, sampler, preservative and collection time, to the sample bottles.

4.5.5 After all the information has been recorded with permanent dark ink, place clear plastic tape over the label to protect it from damage.

4.5.6 Record the sample numbers and collection times in the field logbook.

4.5.7 Do not remove sample bottle caps until sample collection and then just long enough to fill the sample bottle.

4.5.8 Transfer water from the sampling equipment directly into the sample bottle that is specifically prepared for the required analysis.

NOTE: *It is not an acceptable practice for samples to be composited in a common container in the field and then split in the laboratory, or poured first into a wide mouth container and then transferred into smaller containers.*

4.5.9 Pour the water samples carefully into the sample bottles, avoiding agitation or turbulence, which might result in loss of volatile organics and/or excessive oxygenation of the samples.

4.5.10 Fill the sample bottles to the neck. For samples that require volatile organic analysis, minimize the possibility of volatization of the organic compounds by filling the bottle until no air bubbles or headspace is left.

4.5.11 Be careful to avoid breakage and to eliminate the entry of, or contact with, any substance other than the water sample being collected.

4.5.12 If the well could go dry, collect and bottle the parameters of interest by volatilization sensitivity.

NOTE: *A preferred collection order for some common groundwater parameters is as follows:*

A. volatile organics (VOA)

B. purgeable organic carbon (POC)

C. purgeable organic halogens (POX)

D. total organic halogens (TOX)

E. *total organic carbon (TOC)*

F. *extractable organics*

G. *total metals*

H. *dissolved metals*

I. *phenols*

J. *cyanide*

K. *sulfate and chloride*

L. *turbidity*

M. *nitrate and ammonia*

N. *radionuclides.*

4.6 Filtering

4.6.1 Check the governing data collection plans to determine whether or not filtering is required for individual parameters to meet the data needs of the investigation.

4.6.2 IF filtering is required,
THEN filter water samples through an in-line 0.45 μ pore-size filter to remove suspended particulate matter,
THEN preserve the samples as required.

4.6.3 Filter as soon as possible after a water sample is obtained, preferably simultaneously with the collection of the water.

4.7 Sample Preservation and Handling

4.7.1 Check statement of work for the analytical services or specific data collection plans for specific preservation methods for each constituent.

NOTE: *Sample preservation is required for many of the chemical constituents and physiochemical parameters that are not chemically stable but are measured or evaluated in a groundwater sampling program. Methods of sample preservation are generally intended to retard biological action, retard hydrolysis, and reduce sorption* *effects. Preservation methods usually include pH control, chemical addition, refrigeration, and protection from light.*

4.7.2 Refer to Appendix C for examples of appropriate sample container types and sample preservations.

4.7.3 Verify specific preservation methods for each analyte in the governing data collection plans prior to field work.

4.7.4 Preserve sample, and indicate the type and amount of preservation used in the field logbook.

4.8 Chain of Custody

4.8.1 Use a documented chain-of-custody program to identify and trace all samples from the point of collection to final analysis (see EMMCP-8.3). Document chain of custody and proper sample handling and packaging in the governing data collection plans.

4.9 Field Quality Control Samples

NOTE: *Governing data collection plans should provide for the routine collection and analysis of the following field quality control samples: trip blanks, field blanks, equipment blanks, and duplicate samples.*

4.9.1 Prepare quality assurance/quality control (QA/QC) samples per governing data collection plans.

4.9.2 Document any QA/QC preparation in the field logbook.

4.9.3 Use a trip blank for purgeable organic compounds only.

NOTE: *Trip blanks are typically prepared by the analytical laboratory and sent to the project site.*

4.9.4 Take trip blanks to sampling location, and treat like a sample accompanying the collected volatile organic analysis (VOA) samples. Do not open trip blanks and return the trip blanks to be analyzed with the project samples.

4.9.5 Prepare a field blank in the field with deionized water, or equivalent. Fill the appropriate containers with deionized water following all sampling and handling practices.

NOTE: *The field blank accompanies the project samples to the laboratory. It is analyzed for specific chemical parameters unique to the site and detects any contamination from conditions during the sampling.*

4.9.6 Collect the equipment blank from the field equipment rinsate water as a check for decontamination thoroughness. Pour deionized water, or equivalent, through or over the cleaned equipment and collect water in the appropriate sample bottle. Return equipment blank to the laboratory for analysis.

4.9.7 Collect duplicates as "second samples" from a selected well. Collect them as either split samples (collected from the same bailer volume or pumping discharge) or as second-run samples (separate bailer volumes or different pumping discharges) from the same well.

4.10 Transportation of Samples

4.10.1 Follow Department of Transportation (DOT) 49 Code of Federal Regulations (CFR) shipping requirements for all onsite and offsite shipments.

4.10.2 Complete Form 460.01, "Request for Shipment of Materials" for off-site shipments, and deliver forms and samples to the on-site Packaging and Transportation group.

4.10.3 Have all samples collected from a controlled radioactive shipment area surveyed by a radiological control technician (RCT). If the total activity level of the sample is above DOT 49 CFR standards of 0.002 microcuries per gram (2 nanocuries/ml), implement procedures for shipping radioactive materials. Contact a qualified shipper for instructions and procedures to ship radioactive materials.

4.10.4 Refer to MCP-2669, Hazardous Material Shipping for transportation of potentially hazardous material on the INEEL.

4.11 Departing from the Sampling Site

4.11.1 Turnoff the pump and power.

4.11.2 Verify that all sampling wastes have been properly stored or disposed of according to the governing data collection plans and Form 435.39, INEEL Waste Determination and Disposition Form.

4.11.3 Secure and lock the well.

4.11.4 Clear area of trash.

4.11.5 Return keys or any other facility-specific property.

4.11.6 Inform project manager or designee of any unusual circumstances and note in field logbook.

5. RECORDS

Records Description	Uniform File Code	Disposition Authority	Retention Period
Form 435.39, INEEL Waste Determination and Disposition Form	6502	ENV1-F-4	Pending
Data collection records[a]	6502	ENV1-D-8-B	Pending
Data collection plans[b]	6502	ENV1-D-8-B	Pending
Form 450.06, Chain of Custody Form	6502	ENV1-F-1	Pending
Form 460.01, Request for Shipment of Materials	6502	ENV1-F-2	Pending

a. Records may include, but are not limited to: logbooks, analytical results, well purging data sheet, instrument calibration logs, annual reports, internal correspondence, external correspondence.

b. May include ASAP, FSP, SAP, or equivalent.

6. REFERENCES

Step	Requirement	Source
4.10.1, 4.10.2	Shipping radioactive materials	DOT 49 CFR 173, Subpart I

DOE, 1989, *DOE Environmental Survey Manual, Appendix E*, "Field Sampling Protocols and Guidance." DOE Office of Environmental Audit.

Code of Federal Regulations, 49 CFR 173, "General Requirements for Shipments and Packagings," *Office of the Federal Register*, September 1995.

EPA, 1986, "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," Office of Waste Programs Enforcement, Office of Solid Waste and Emergency Response, Washington DC.

7. APPENDICES

Appendix A, Groundwater Sampling Methods and Equipment
Appendix B, Well Purging Data Sheet
Appendix C, Groundwater Sample Requirements Table

APPENDIX A

Groundwater Sampling Methods and Equipment

Production Well Pumps

Many of the production wells at the INEEL have dedicated high capacity turbine pumps. Dedicated pumps provide an efficient manner for sample collection, and ensure that cross-contamination between wells does not occur. However, the high flow rates may impact the volatile(s) present in the water due to agitation of the water.

Bailer

A decontaminated bottom-filling bailer constructed of Teflon or stainless steel can be used to remove the stagnant water in monitoring wells and obtain samples. The bailer is preferred when volatile stripping is of concern or the well casing diameter is too narrow to accept a submersible pump. However, this method can be very time-consuming and is recommended for shallow wells only. The bailer should not come in contact with any materials outside of the well casing. Wear clean disposable gloves during sampling, and change between each well. Keep the bailer cord (Teflon coated) clean, and change the cord after each well sampling. Sample from 5 to 10 ft below water level or as the governing data collection plan specifies. Lower the bailer slowly until it contacts the water surface, and allow the bailer to sink and fill with a minimum of surface disturbance. Slowly raise the bailer to the surface. Tip the bailer to allow slow discharge from the top of the bailer to the sample bottle, allowing the water sample to flow gently down the side of the sample bottle with minimum entry disturbance. Bottom discharging bailers may also be used.

Electric Submersible Pumps

Submersible pumps are used for both purging and collecting samples from depths which often exceed the limitations of other sampling equipment and can be used to sample several monitoring wells in a brief period of time. Before lowering into the well, the discharge tubing is rolled out and cleaned using a cloth and nonphosphate detergent followed by a distilled water rinse. Lower the pump slowly into the well with the safety line. All tubing and cord is gently wiped clean with cloth as the pump is lowered. Ideally,the pump is set just below the dynamic water level and above the screened section of the well. The pump should not be set on the bottom.

Positive Displacement Pumps

Positive displacement pumps blow compressed air or an inert gas into a sample chamber. The gas displaces the water in the chamber and forces it up an evacuation tube. The gas is forced in intermittently, using a pressure-controlled regulator, to allow for recovery. Water returns to the sample chamber from the well through the bottom of the sampler, and is then prevented from

APPENDIX A

leaving the bottom by a ball check valve. Although the sampler is in contact with compressed air or inert gas, there is no violent introduction of gas into the sample, so the sample water is unaltered. Some pumps have a bladder that prevents water/air contact. All downhole parts must be disassembled and cleaned with a nonphosphate detergent and rinsed before use in each well.

Air-Lift Pumps

Air-lift pumps are useful for evacuation of the well or as skimmers, separating liquid from solid, but not for sampling. The violent introduction of air into the water changes its chemical characteristics. These pumps may be used when samples are to be analyzed for constituents that are not volatile, are not effected by aeration, and are not effected by changes in pH.

Lysimeters

Lysimeters are used for sampling water in the unsaturated zone. They induce the collection of soil moisture through negative pressure. A vacuum is put on the chamber, which is buried in the unsaturated zone, and moisture is drawn into the sample chamber through a porous-filter intake. Depending on soil texture and moisture content, as much as several hours or days under vacuum may be required.

APPENDIX B

Well Purging Data Sheet

WELL PURGING DATA SHEET Well Number: ____________________

Start Date __________ Time __________ Development Team ____________________

End Date __________ Time __________ ____________________

Total Well Depth ____________________ ____________________

Well Diameter ____________________ ____________________

Sample #	Time	Temperature	pH	Specific Conductance	Dissolved Oxygen

EXAMPLE

Pre-Purge Water Level Reading ____________________ (ft below level surface)

Post-Purge Water Level Reading ____________________ (ft bls)

Calculated Purge Volume ____________________ (gallons)

Actual Purge Volume ____________________ (gallons)

Pump Flow Rate (gpm)

bls = below level surface.

gpm = gallons per minute.

APPENDIX C

Groundwater Sample Requirements Table

Analytical Parameter	Container[a] Size	Container[a] Type	Preservative[a]	Holding Time[b]	Sample Volume
Volatile organics	40 ml	Glass vial or amber glass	4°C 0.079 ml/vial H_2SO_4	14 days	80 ml/2 × 40 ml (6 × 40 ml for full QC)[c]
Semivolatile organics PCBs/pesticides organophosphorus pesticides/ organochlorine herbicides	1 L per analysis	Amber glass jugs	4°C	Extract 7 days, analyze 40 days	1 L per analysis (pest., herb., etc.) 3 × 1L (for full QC)[c]
Nitrate	1,000 ml	HDPE	4°C pH <2 H_2SO_4	14 days	1,000 ml
Anions	125 ml	HDPE (NM)	4°C	28 days 48 hrs NO_3, PO_4	125 ml
All metals/cations	1,000 ml	HDPE (NM)	pH <2 HNO_3	6 months Hg 28 days	1 L
Cr^{6+}	500 ml	HDPE (NM)	4°C	24 hrs	500 ml
Cyanide	1,000 ml	HDPE (NM)	pH >12 NaOH .6g ascorbic acid	14 days	2 × 1L (for full QC)[c]
Sulfide	500 ml	Glass (NM)	pH >9 NaOH/zinc acetate	7 days	3 × 500 ml (for full QC)[c]
Alkalinity	500 ml	HDPE (NM)	4°C	14 days	500 ml
Suspended particles	500 ml	HDPE (WM)	4°C	7 days	500 ml
Gross alpha, beta screen	125 ml	HDPE (NM)	pH <2 HNO_3	Screen immediately	100 ml
Gamma analysis or screen	540 ml	Plastic	pH <2 HNO_3	1 year	500 ml
Rad. analysis/Total U	1-1/2 gal	Plastic	pH <2 HNO_3	1 year	4 L
Sr-90	1,000 ml	HDPE (NM)	pH <2 HNO_3	1 year	1,000 ml
Tritium	125 ml	HDPE (NM)	None	1 year	100 ml

a. Additional guidance on sample bottle and preservative requirements can be obtained from the INEEL SMO.

b. Holding times are from the date of collection as referred to in Federal Register Vol. 49, No. 209, October 26, 1984.

c. Collection frequency of QC samples will be specified in governing data collection plans.