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Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites

U.S. Department of Energy

Office of Legacy Management

Work Performed Under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management.
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Sampling and Analysis Plan
for
U.S. Department of Energy Office of Legacy Management Sites

Work Performed by S.M. Stoller Corporation under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado

Summary of Changes

Section 3.1.1.2 and Section 3.1.2 were updated to include additional information on sample filtration.

A Job Safety Analysis regarding routine sampling activities was inserted into Appendix C.

Appendix D was updated to include sampling information for the Nevada Offsites. The sampling frequency and analyte lists were updated for each site. Program directives were added for 2008.

End of current text

Summary of Changes

Section 2.0 was changed from "Access" to "Pre-Trip Planning" to include meeting with the appropriate manager prior to a sampling event in response to a management assessment.

The LM-wide JSA was added as an appendix to address 10 CFR 851 requirements. Appendix references changed throughout the document.

The requirement to remove one pump/tubing volume prior to making water quality measurements was added to reflect a process improvement.

The option to navigate to a surface water location with a GPS unit in lieu of a marked post was added to reflect a process improvement.

Changes were made to Section 6.0, "Health and Safety," to reflect the new safety program under 10 CFR 851.

A log of current Program Directives was added to Appendix D.

Program Directives for Fernald and Moab were added to address site-specific requirements.

End of current text

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Appendix A	Procedures Used for Ground Water and Surface Water Sampling and Analysis		
	Standard Practice for Preparing or Revising Procedures for the *Environmental Procedures Catalog* (STO 6) [GA−1(P)]	04/05	1
	Standard Practice for Sample Submittal to Contract Analytical Laboratories [(GA−9(P)]	04/05	0
	Standard Practice for Field Documentation Processes [GT−1(P)]	04/05	1
	Standard Practice for Sample Labeling [GT−2(P)]	04/05	1
	Standard Practice for Chain-of-Custody Control and Physical Security of Samples [GT−3(P)]	04/05	1
	Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites [GT−7(T)]	04/05	1
	General Considerations for the Sampling of Liquids [LQ−1(G)]	04/05	1
	Standard Test Method for the Measurement of Water Levels in Ground Water Monitoring Wells [LQ−2(T)]	04/05	1
	Standard Practice for Purging of Monitoring Wells [LQ−3(P)]	04/05	1
	Standard Test Method for the Field Measurement of pH [LQ−4(T)]	04/05	1
	Standard Test Method for the Field Measurement of Specific Conductance [LQ−5(T)]	04/05	1
	Standard Test Method for the Field Measurement of the Oxidation-Reduction Potential for Calculation of Eh (ORP) [LQ−6(T)]	04/05	1
	Standard Test Method for the Field Measurement of Alkalinity [LQ−7(T)]	04/05	1
	Standard Test Method for the Measurement of Temperature [LQ−8(T)]	04/05	1
	Standard Test Method for the Measurement of Dissolved Oxygen [LQ−9(T)]	04/05	1
	Standard Practice for the Use of a Flow Cell for Field Measurements [LQ−10(P)]	04/05	1
	Standard Practice for the Sampling of Liquids [LQ−11(P)]	04/05	1
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	Standard Practice for the Inspection and Maintenance of Ground Water Monitoring Wells [LQ−18(P)]	04/05	1
	Standard Test Method for Turbidity in Water [LQ−24(T)]	04/05	1
Appendix B	Data Validation Guidance	05/31/06	0
Appendix C	Job Safety Analysis		
Appendix D	Site Specific Information and Program Directives		

Approval Signature:

signature on original

Sam Campbell, Manager Environmental Monitoring/Field Services

Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
BOA	Basic Ordering Agreement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
Ft	foot or feet
ICPT	Integrated Contractor Purchasing Team
LM	Office of Legacy Management
mg/L	milligram(s) per liter
mL	milliliter(s)
mL/min	milliliter(s) per minute
NTU	nephelometric turbidity units
NIST	National Institute of Standards and Technology
PCB	polychlorinated biphenyls
pCi/L	picocuries per liter
QA	quality assurance
QC	quality control
QSAS	Quality Systems for Analytical Services
SOP	standard operating procedures
TLD	thermoluminescent dosimeter
VOC	volatile organic compound

End of current text

1.0 Introduction

This plan incorporates U.S. Department of Energy (DOE) Office of Legacy Management (LM) standard operating procedures (SOPs) into environmental monitoring activities and will be implemented at all sites managed by DOE−LM, except the Pinellas Environmental Restoration Project, which has its own plan that specifies state of Florida requirements. This document provides detailed procedures to the field sampling teams so that samples are collected in a consistent and technically defensible manner. Site-specific planning documents (e.g., long-term surveillance and maintenance plans, environmental monitoring plans) document background information and establish the basis for sampling and monitoring activities. Information will be included in site-specific tabbed sections to this plan that identifies sample locations, sample frequencies, types of samples, field measurements, and associated analytes for each site. Additionally within the tabbed section, Program Directives will be included, when developed, to establish additional site-specific requirements to modify or add clarification to requirements in this plan as they apply to the site. A flowchart detailing project tasks required to accomplish routine sampling is displayed on Figure 1–1.

LM SOPs are contained in the *Environmental Procedures Catalog* (STO 6), which incorporates American Society for Testing and Materials (ASTM), DOE, and U.S. Environmental Protection Agency (EPA) guidance. Specific SOPs used for ground water and surface water monitoring are included in Appendix A. Some SOPs have been revised in this plan to reflect current industry practices. If monitoring of other environmental media is required, SOPs used for air, soil/sediment, and biota monitoring can be found behind the site–specific tabbed section in Appendix D.

The procedures in the *Environmental Procedures Catalog* (STO 6) are intended as general guidance and require additional detail from project planning documents in order to be complete; the following sections fulfill that function and specify additional procedural requirements. If a discrepancy exists between a SOP (STO 6) and an instruction in this plan, then the instruction in this plan takes precedence over the procedure.

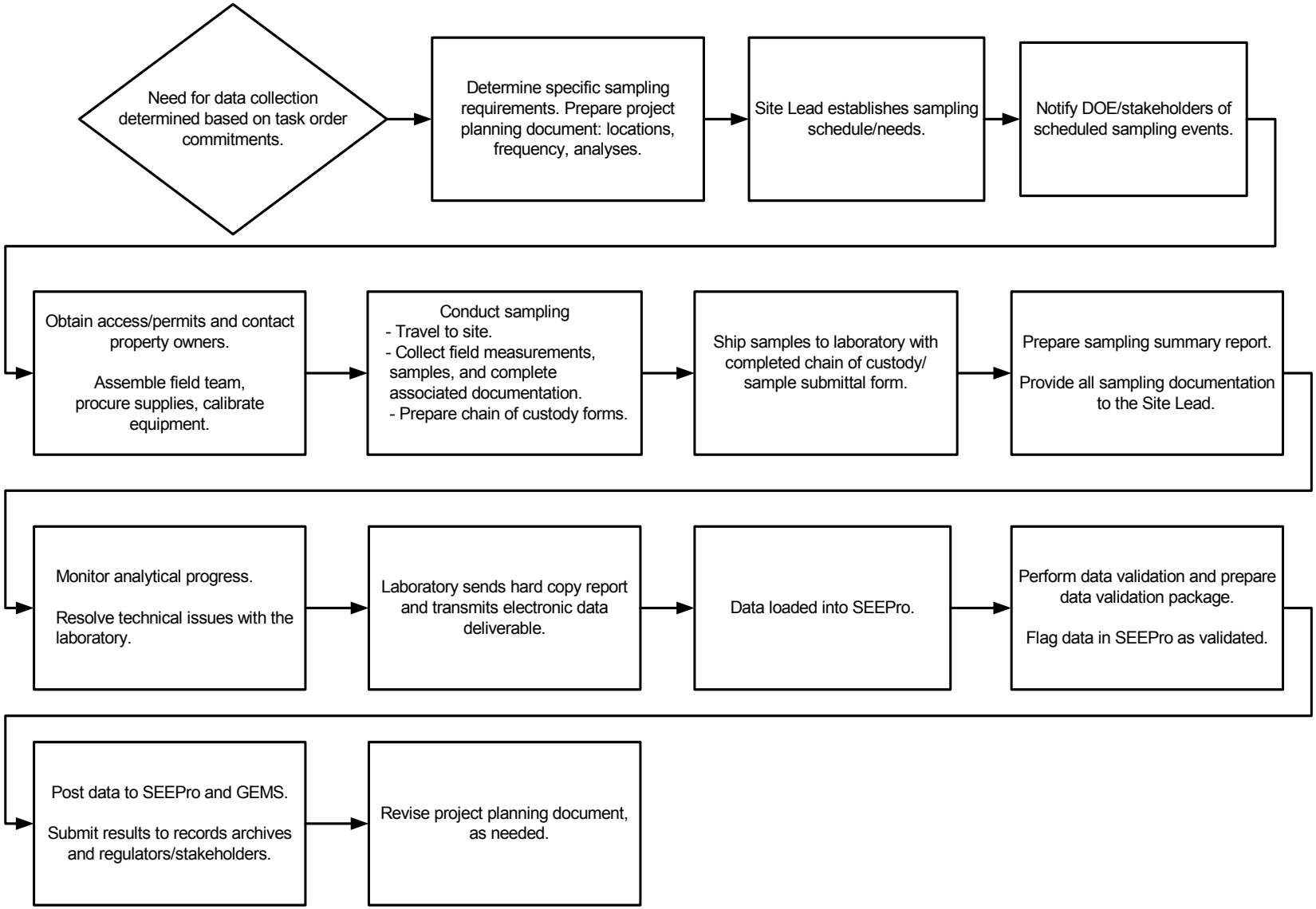

Figure 1–1. Sampling Flowchart

2.0 Pre-Trip Planning

Sampling personnel will meet with the Site Lead or appropriate manager prior to each sampling event. The purpose of the meeting is to:

- Discuss any new site issues involving safety, access to locations, or land owner concerns.
- Identify tasks that can be completed by the sampling team while at the site, which may include well maintenance, collection of global positioning satellite data, downloading of data loggers, and pump repair or replacement, sign replacement, fence repair, and telemetry support.
- Capture changes to sampling locations and/or required analyses.

The Site Lead is responsible for ensuring that valid access agreements are in place and landowner notifications are made prior to a sampling event. The Real and Personal Property group will assist the Site Lead by managing the access agreement process, including drafting access agreements, obtaining the required approvals, tracking expiration dates, and processing renewals. The Real and Personal Property group also will notify landowners of the upcoming sampling event. Any property damage that occurs as a result of the sampling event must be reported immediately to the Site Lead.

End of current text

3.0 Sampling Protocol

3.1 Water

3.1.1 Ground Water

3.1.1.1 Well Classification

Ground water sampling protocol will vary based on the classification of the well. Wells will be classified according to their hydraulic properties or use as follows:

Classification	Properties/Use
Category I	Wells that produce a minimum of 100 milliliters per minute (mL/min).
Category II	Wells that produce less than 100 mL/min and have an initial water level above the top of the screened interval.
Category III	Wells that produce less than 100 mL/min and have an initial water level within the screened interval.
Category IV	Domestic and flowing wells.

Category I Protocol

Purging and sampling of Category I wells will be accomplished using a low-flow method that involves pumping at a low-flow rate. In theory, the slow pumping rate will allow water to flow directly from the formation to the pump intake. The slow pumping rate will result in minimal mixing with the stagnant water column above the pump intake, minimal pumping-induced turbidity, and minimal disturbance of sediment accumulated in the end cap of the well. Using the Category I sampling protocol will provide the highest quality sample (Korte 2001).

Category I wells will be purged using the following guidelines:

- The intake of the portable pump, dedicated pump, or dedicated tubing should be placed in the approximate middle of the screened interval.
- If a portable pump is used, a minimum of 4 hours after installation is required before purging and sampling can commence.

As described in procedure LQ−2 (T), “Standard Test Method for the Measurement of Water Levels in Ground Water Monitoring Wells” (STO 6), depth to water will be measured with an electric sounder immediately prior to purging. The initial pumping rate should not exceed 500 milliliters per minute (mL/min). At the start of pumping, the water level should be monitored continuously to determine if drawdown is occurring. If drawdown is occurring at the initial pumping rate, the pump rate should be decreased until the drawdown stops or a pump rate of 100 mL/min is obtained. If the water level stabilizes (essentially no drawdown), then purging and sampling may continue at that flow rate. Water levels in the well will be measured and recorded at regular intervals (minimum of 3 minutes apart) on the Water Sampling Field Data Sheet during the purging process to document that drawdown was not occurring during the purge. If the water level does not stabilize at the minimum flow rate of 100 mL/min, then the well will be classified as a Category II or Category III well.

After one pump/tubing volume has been purged, pH, specific conductance, and turbidity will be measured at regular intervals based on volume purged or time, with measurements recorded a minimum of 3 minutes apart. Sample collection will begin as soon as pH, specific conductance, and turbidity measurements stabilize and one pump/tubing volume has been removed. Specific conductance and pH will be considered stable when the three most current consecutive readings are within 10 percent and 0.2 pH unit, respectively; turbidity measurements will be considered stable when the most current reading is less than 10 nephelometric turbidity units (NTU). Criteria for purging a Category I well are summarized in Table 3−1.

Table 3–1. Summary of Ground Water Sampling Protocol

Well Classification	Parameter	Purge Criteria	Qualification
Category I	Purge volume	1 pump/tubing volume	No qualification of results required
	Flow rate	>100 mL/min and <500 mL/min	
	Water level	<0.05 ft drop[a]	
	PH	± 0.2 pH units[a]	
	Specific conductance	± 10 percent[a]	
	Turbidity	< 10 NTUs	
Category II	Purge volume	1 pump/tubing volume	Qualify results (see Section 7.2)
	Flow rate	<500 mL/min	
	Water level	None	
	PH	None	
	Specific conductance	None	
	Turbidity	None	
Category III	All parameters	No purge required	Qualify results (see Section 7.2)
Category IV	All parameters	No purge required	No qualification of results required

[a]Criterion is for the three most current consecutive readings.

Purge water will be disposed of according to site-specific or program-specific documents, which may include one or more of the following: *Technical Approach for the Management of UMTRA Ground Water Investigation-Derived Wastes* (DOE 1994); *Management Plan for Field-Generated Investigation Derived Waste* (DOE 1997); *Site Generated Waste Management for the Weldon Spring Site* (Morrison Knudsen Corporation 2001); *Monticello Mill Tailings Site Operable Unit III Post-Record of Decision Monitoring Plan* (DOE 2004); or Program Directives included in this plan.

Category II Protocol

The following protocol will apply to wells that are classified as Category II. A maximum flow rate of 500 mL/min will be used to purge and sample wells in this category. There are no stabilization or drawdown criteria for Category II wells. Sampling can occur as soon as one pump/tubing volume is removed. Recording of water levels and flow rates will be used to initially document that the well is a Category II well using the criteria stated in Sections 3.1.1.1 and 3.1.1.2. Criteria for purging a Category II well are summarized in Table 3−1.

Category III Protocol

The following protocol will apply to wells that are classified as Category III. There are no stabilization, drawdown, or purge volume criteria for Category III wells. If a bailer is used to sample, it must be lowered very slowly into the water column in order to minimize sampling-related turbidity. Only the first bailer of water will be used for the sample. Subsequent bailers introduced into the water column increase turbidity and reduce sample quality. Because the volume of water will be limited using a bailer, prioritization of analytes will be required. This will require an estimation of sample volume prior to the sampling event. The volume estimate will be discussed with the Site Lead and the analytical laboratory to determine which constituents will be analyzed. If a sufficient volume of water cannot be obtained from the first bailer, then the well cannot be sampled. If there is a sufficient column of water in the well to utilize a dedicated pump or dedicated tubing, then the entire water volume available can be sampled. Recording of water levels and flow rates will be used to initially document that the well is a Category III well using the criteria stated in Sections 3.1.1.1 and 3.1.1.2.

Because obtaining a representative sample from a low-producing well (Category II and Category III) is problematic (Korte 2001), and there is not adequate guidance for sampling wells completed in low permeability formations (EPA 1995), there may be site-specific documents that require an alternate method for sampling low-producing wells. This may include purging a well dry and sampling when sufficient recovery has occurred, purging without dewatering the screen, or passive diffusive sampling.

Category IV Protocol

With domestic and flowing wells, it is assumed that formation water continually flows from the well, eliminating stagnant water and the need to purge. These wells will be sampled by filling bottles at the discharge point and filtering if required.

3.1.1.2 Sample Collection

Ground water samples can be collected with a peristaltic pump, bladder pump, submersible pump, or a bailer. The specific method used for withdrawing water from the well will be determined in the field on the basis of site-specific conditions and the category of the well. Sample collection will be conducted using the same flow rate used during the purging of the well. Generally, sampling will be conducted proceeding from the least to most contaminated areas of the site, as access allows, unless dedicated pumps or dedicated down-hole tubing are used.

Samples collected for metals, cations, anions, inorganic, and radiological analyses will be filtered if sample turbidity is greater than or equal to 10 NTUs; no sample filtration is required if turbidity is less than 10 NTUs. Alternate sample filtration protocol may be specified in a site specific planning document or Program Directive. Samples requiring filtration will use a 0.45-micron filter, and samples requiring cooling will be stored in a cooler with ice immediately after sample collection. For samples preserved with acid or sodium hydroxide, the pH will be checked (with pH paper) on selected samples to establish the volume of preservative required and to verify the proper pH level has been obtained. Only commercially supplied and certified solutions will be used for sample preservation. Sample container and preservation requirements are shown in Table 3–2.

Table 3–2. Water Sample Collection Requirements

Analytical Parameter	Container Type[b]/Size	Preservation	Holding Time
Metals and Cations (Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Hg, Pb, Li, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, Tl, Sn, U, V, Zn)	Amber HDPE/500 mL	Filtered[c](0.45 µm), HNO_3 pH<2	6 months
Tc-99	HDPE/1L	Filtered[c](0.45 µm), HNO_3 pH<2	6 months
Am-241	HDPE/500 mL[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Ra-226, Ra-228	HDPE/2 @ 1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Th-230	HDPE/1L	Filtered[c](0.45 µm), HNO_3 pH<2	6 months
U-234, U-238	HDPE/1L	Filtered[c](0.45 µm), HNO_3 pH<2	6 months
Pb-210, Po-210	HDPE/1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Gross α, Gross β	HDPE/1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Gamma Spectrometry	HDPE/1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Ne-237, Pu-238, Pu-239, Pu-240	HDPE/1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Ni-63	HDPE/1L[d]	Filtered[c] (0.45 µm), HNO_3 pH<2	6 months
Tritium	HDPE/1L[d]	No preservative	6 months
Anions (Br, Cl, F, SO_4, SiO_2)	HDPE/125 mL	Filtered[c] (0.45 µm), Cool 0–4˚ C	28 days
Chemical oxygen demand	HDPE/125 mL	H_2SO_4 pH<2, Cool 0 °C to 4 °C	28 days
Nitrate plus nitrite as N, Ammonia as N, Phosphate	HDPE/125 mL	Filtered[c] (0.45 µm), H_2SO_4 pH<2, Cool 0 °C to 4 ˚C	28 days
Nitroaromatics	Amber glass/1L[e]	Cool 0 °C to 4 ˚C	7 days
Total dissolved solids	HDPE/125 mL	Filtered[c] (0.45 µm), Cool 0 °C to 4 ˚C	7 days
Total organic carbon	HDPE/125 mL	H_2SO_4 pH<2, Cool 0 °C to 4 ˚C	28 days
Total suspended solids	HDPE/1 L	Cool 0 °C to 4 ˚C	7 days
Sulfide	HDPE/1L[d]	Filtered[c] (0.45 µm), NaOH pH >9, 2 mL of 2 N zinc acetate, Cool 0 °C to 4 ˚C, no headspace	7 days
Cyanide	HDPE/1L	Filtered[c] (0.45 µm), NaOH pH > 12, 0.6 g ascorbic acid if Cl_2 present, Cool 0 °C to 4 ˚C	14 days
Polynuclear aromatic hydrocarbons	Glass/3 @ 40 mL	Cool 0 °C to 4 ˚C, HCl pH<2, 0.008 % $Na_2S_2O_3$, no headspace	14 days
PCBs	Amber glass/1L[e]	Cool 0 °C to 4 ˚C	7 days
TPH	Amber glass/1L[e]	Cool 0 °C to 4 ˚C	14 days
VOCs/BTEX	Amber glass/3 @ 40 mL	Cool 0 °C to 4 ˚C, HCl pH<2, no headspace	14 days
SemiVOCs	Amber glass/1L[e]	Cool 0 °C to 4 ˚C	7 days
Rn-222	Glass/3 @ 40 mL	Cool 0 °C to 4 ˚C, no headspace	Not Established

[a]This table incorporates the majority of analyses conducted for LM projects; consult the site-specific environmental planning document for the analyses required at a particular site.
[b]HDPE=high density polyethylene. Amber is required only if light sensitive analysis [e.g., for silver (Ag] is conducted.
[c]Filtration of samples may not be required on all samples and/or all projects; collection of unfiltered samples will be specified in other project planning documents.
[d]Collection of sample volume in duplicate for every 20 samples collected is required for laboratory quality control.
[e]Collection of sample volume in triplicate for every 20 samples collected is required for laboratory quality control.

3.1.2 Surface Water

For purposes of this plan, surface water may include contained water within any natural or man made surface water feature (e.g., ponds, lakes, seeps, rivers, ditches, drainages), as well as effluent from passive treatment systems, leachate collection systems, or water treatment plants.

Surface water sampling will be conducted according to the following protocol unless an alternate protocol is specified in a project planning document, permit, or in the appropriate site–specific tabbed section in Appendix D. Specifically, surface water grab samples will be collected as follows:

- Surface water samples will be collected using a stainless steel weight attached to the intake tubing of the peristaltic pump. The stainless steel weight has an intake port approximately 2 inches above the base of the weight, which will allow the sample to be collected near the bottom of the surface water feature.
- For surface water features less than 6 feet (ft) wide, the sample will be collected from approximately the middle.
- For surface water features greater than 6 ft wide, the sample will be collected 1 to 3 ft from the shore. Samples collected in flowing surface water features greater than 6 ft wide (e.g., rivers, streams, ditches) will be collected within the main current and not in stagnant or back eddy areas.
- If stagnant or back eddy areas extend greater than 3 ft from the shore, then the sample will be collected at the nearest downstream location where the main current is within 3 ft of the shore. This approach can be modified to meet special data quality objectives, such as sampling fish habitats, and will be specified in a project-planning document.
- All surface locations will be designated by a wooden lath or metal post inscribed with the location identification so that samples from subsequent rounds may be collected from approximately the same location, or navigation to the location can be accomplished using a global-positioning satellite device.
- Sample location data should be collected using a global positioning satellite device and downloaded into SEEPro database. Any departure from collecting a sample at the normal location must be documented on the Water Sampling Field Data form.

Samples collected for metals, cations, anions, inorganic, and radiological analyses will be filtered if sample turbidity is greater than or equal to 10 NTUs; no sample filtration is required if turbidity is less than 10 NTUs. Alternate sample filtration protocol may be specified in a site specific planning document or Program Directive. Samples requiring filtration will use a 0.45-micron filter, and samples requiring cooling will be stored in a cooler with ice immediately after sample collection. For samples preserved with acid or sodium hydroxide, the pH will be checked (with pH paper) on selected samples to establish the volume of preservative required and to verify the proper pH level has been obtained. Only commercially supplied and certified solutions will be used for sample preservation. Sample container and preservation requirements are shown in Table 3–2.

If unfiltered surface water samples are collected, the sample may be collected by container immersion as described in procedure LQ-11(P), “Standard Practice for the Sampling of Liquids” (STO 6), Appendix A.

3.1.3 Field Measurements and Calibration

Field measurements of alkalinity, dissolved oxygen, oxidation-reduction potential, and temperature may be required on a site-specific basis. Specific conductance, pH, and turbidity are considered stabilization parameters when purging a well and are required measurements at all wells. General procedures for field measurements are in Appendix A. Calibration of field instrumentation will be conducted according to manufacturer's recommendations. Calibration and operational check requirements for field instrumentation are shown in Table 3−3. If the acceptance criteria are not met during the operational check, then a primary calibration of the affected probe(s) and instrument(s) must be conducted. Probe replacement or cleaning also may be required if the operational acceptance criteria are not met.

Table 3–3. Calibration and Operational Check Requirements for Field Instrumentation

Parameter	Requirement	Frequency	Operational Check Criteria
pH	3-point calibration	Prior to start of sampling event	NA[a]
	1-point check with pH 4, 7, or 10 buffer	Twice daily	± 0.2 pH unit
Specific conductance	1-point calibration	Prior to start of sampling event	NA
	1-point operational check	Twice daily	± 10 percent of standard
Oxidation-reduction potential	1-point calibration	Prior to start of sampling event	NA
	1-point operational check	Twice daily	± 10 percent of standard
Dissolved Oxygen	Calibration in water saturated air	Twice daily	NA
Turbidity	4-point calibration	Every 6 months	NA
	3-point operational check	Twice daily	± 10 percent of standard
Temperature	Operational check	Prior to start of sampling event	± 1.5 ºC compared to NIST[b] traceable thermometer

[a]NA = Not applicable.
[b]NIST = National Institute of Standards and Technology.

3.1.4 Sample Identification and Handling Procedures

Each sample will be assigned a unique sample number and a site identification number corresponding to each well or surface sample location. Quality control (QC) samples will be assigned a fictitious site identification number and submitted to the laboratory without identifying them as QC samples. The true site identification number and the type of QC sample will be documented on the QC Sample Cross-Reference Log.

Immediately upon collection, samples requiring refrigeration will be placed in ice chests containing an ice and water bath. An ice and water bath will be maintained within the ice chests at all times and will be checked and documented on the Water Sampling Field Data form after each location is sampled.

Sample bottles used for water sampling will be pre-cleaned to guidelines established by EPA in *Specification and Guidance for Contaminant-Free Sample Containers* (EPA 1992).

To ensure the integrity of the sample, the Sampling Lead, or designee, is responsible for the care, packaging, and custody of the samples until they are dispatched to the laboratory. Procedure GT-3(P), "Standard Practice for Chain-of-Custody Control and Physical Security of Samples" (STO 6), will be implemented to provide security and document sample custody, and procedure GA-9(P), "Standard Practice for Sample Submittal to Contract Analytical Laboratories" (STO 6), will be implemented to transfer samples to the designated laboratory.

Custody seals and/or evidence tape will be placed on each ice chest or storage/shipping container that is not in direct control of a sampling team member (e.g., when temporarily stored in a motel room) to maintain physical security of the samples from time of collection to analysis. Samples locked in the sampling vehicle are considered in direct control of the sampling team. Samples not in direct control of a sampling team member will be stored in a secured (locked) location. Ice chests, cartons, and trays used for temporary sample storage that are not custody sealed must be in direct control of a field team member.

If samples are transported by subcontract employees or commercial carrier, the shipping container will have custody seals and/or evidence tape placed over the container opening before shipment to ensure that the integrity of the samples is not compromised during transportation. The Sampling Lead will be responsible for ensuring that the samples are transferred to the laboratory in sufficient time for the laboratory to complete extraction/analysis prior to the expiration of sample holding times.

If a commercial carrier sends the packages, receipts, and any other shipping–related documents are retained as part of the chain-of-custody documentation. The Laboratory Services Coordinator will retain carrier and shipping receipts as long as they have value associated with the laboratory sample receiving activities.

Chain-of-custody records document all transfers of sample possession, and show that the samples were in constant custody between collection and analysis. A Chain-of-Custody form will accompany samples sent or transported to an analytical laboratory by individuals other than a member of the field sampling team, with a copy retained by the originator.

3.1.5 Decontamination of Sampling Equipment

Decontamination of non-dedicated sampling equipment will be accomplished by rinsing all equipment surfaces with diluted detergent followed by deionized water as described in the procedure GT−7(T), "Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites" (STO 6). If non-dedicated sampling equipment is used to collect samples for organic analyses, then an additional rinse with an organic desorbing agent (e.g., isopropanol) will be used followed by a final deionized-water rinse. Decontamination of non-dedicated sampling equipment will be conducted immediately after use at a sampling location. Between samplings or until further use, decontaminated equipment will be stored in protective containers or plastic bags.

3.2 Air

Air monitoring may include sampling air particulates, radon, tritium, gamma radiation, or meteorological monitoring. Air monitoring procedures, if required, will be included in Program Directives located following the appropriate site-specific tabbed section in Appendix D.

3.3 Soil and Sediment

Soil and sediment sampling generally will be conducted according to procedures listed in the solids section of the *Environmental Procedures Catalog* (STO 6). Soil sampling associated with drilling activities will be specified in a statement of work. If site-specific procedures are required, they will be included in Program Directives following the appropriate site-specific tabbed section in Appendix D.

3.4 Ecological

Ecological monitoring may include sampling biota or vegetation, monitoring of vegetation, controlling noxious weeds, or monitoring animal populations. Ecological procedures, if required, will be included in Program Directives located following the appropriate site-specific tabbed section in Appendix D.

4.0 Analytical Program

Analytical services are procured under the DOE Integrated Contractor Purchasing Team (ICPT) Basic Ordering Agreement (BOA) (DOE 2003a) as modified by the *Grand Junction Site Statement of Work for Analytical Laboratory Services* (DOE 2003b). The ICPT BOA provides a standardized system for procuring analytical services from commercial laboratories and includes a Statement of Work for Analytical Services and provisions for laboratory audits.

The constituents analyzed at each site are specified in the site-specific environmental planning document. A comprehensive list of analytes, along with the required analytical methods and required detection limits, are listed in Attachment K of the ICPT BOA (DOE 2003a). The analytical methods used for ground water and surface water analyses as specified in Attachment K are typically from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846) (EPA 1996) or *Methods for Chemical Analysis of Water and Wastes* (EPA 1983). Analytes typically requested for a water matrix, along with required detection limits and analytical methods, are included in Table 4−1.

Commercial laboratories provide these analytical services in accordance with the *DOE Quality Systems for Analytical Services* (QSAS) (DOE 2005b) to ensure data of known, documented quality. The QSAS provides specific technical requirements, clarification of DOE requirements, and conforms to DOE Order 414.1C, *Quality Assurance* (DOE 2005a). The QSAS is based on EPA's National Environmental Laboratory Accreditation Conference, Chapter 5, "Quality Systems" (EPA 2000), and provides a framework for performing, controlling, documenting, and reporting laboratory analyses. Validation of field and analytical data will be accomplished according to the guidance in Appendix B.

Table 4–1. Typical DOE–LM Analyte List with Associated Analytical Specifications for a Water Matrix

Analyte[a]	Required Detection Limit (mg/L)[b]	Analytical Technique[c]	EPA Analytical Method
Al	0.2	ICP-AES	SW-846 6010B
Am-241	0.03	AS	NA
NH_4	0.10	Colorimetric	EPA 350.1
Sb	0.003	ICP-MS	SW-846 6020
As	0.0001	ICP-MS	SW-846 6020
Ba	0.10	ICP-AES	SW-846 6010B
Be	0.008	ICP-AES	SW-846 6010B
Br	0.5	IC	SW-846 9056
Cd	0.001	ICP-MS, ICP-AES	SW-846 6020, SW-846 6010B
Ca	5.0	ICP-AES	SW-846 6010B
COD	5	Colorimetric	EPA 410
Cl	0.5	IC	SW-846 9056
Cr	0.002	ICP-MS	SW-846 6020
Co	0.05	ICP-AES	SW-846 6010B
Cu	0.025	ICP-AES	SW-846 6010B
Cyanide	0.005	Colorimetric	NA
F	0.5	IC	SW-846 9056
Gross Alpha	2.0	PC	SW-846 9310
Gross Beta	4.0	PC	SW-846 9310
Fe	0.05	ICP-AES	SW-846 6010B
Hg	0.001	CVAAS	SW-846 7470
Li	0.1	ICP-AES	SW-846 6010B
Pb	0.002	ICP-MS	SW-846 6020
Pb-210	1.0	LSC	NA
Mg	5	ICP-AES	SW-846 6010B
Mn	0.005	ICP-AES	SW-846 6010B
Mo	0.003	ICP-MS	SW-846 6020
Ni	0.04	ICP-AES	SW-846 6010B
Np-237	0.1	AS	NA
NO_3-N	0.05	Colorimetric	EPA 353.2
PCBs	0.00025	GC	SW-846 8082
2,4-DNT	0.00003	HPLC	EPA 8330
2,6-DNT	0.00001	HPLC	EPA 8330
2,4,6-TNT	0.00003	HPLC	EPA 8330
1,3,5-TNB	0.00003	HPLC	EPA 8330
1,3-DNB	0.00009	HPLC	EPA 8330
Nitrobenzene	0.00003	HPLC	EPA 8330
Pesticides	0.00025	GC	8081A
PAH	0.005	HPLC	SW-846 8310
PO_4	0.5	IC	SW-846 9056
Po-210	1.0	AS	NA
Pu-238, Pu-239+Pu-240	0.1	AS	NA
K	5.0	ICP-AES	SW-846 6010B
Ra-226	1.0	RE	EPA 903.1, modified

Table 4−1 (continued). Typical DOE–LM Analyte List with Associated Analytical Specifications for a Water Matrix

Analyte[a]	Required Detection Limit (mg/L)[b]	Analytical Technique[c]	EPA Analytical Method
Ra-228	1.0	PC	SW-846 9320, modified
Se	0.0001	ICP-MS	SW-846 6020
Semivolatiles	0.01	GC-MS	SW-846 8270C
SiO_2	0.10	ICP-AES	SW-846 6010B
Ag	0.001	ICP-MS	SW-846 6020
Na	5.0	ICP-AES	SW-846 6010B
Sr	0.2	ICP-AES	SW-846 6010B
SO_4	1.0	IC	SW-846 9056
Sulfide	0.002	Titrimetry	EPA 376.1
Total organic carbon	0.3	IR	EPA 415.1
Tc-99	1.0	PC	NA
Tl	0.004	ICP-MS	SW-846 6020
Th-228, Th-230, Th-232	1	AS	NA
Sn	0.2	ICP-AES	SW-846 6010B
Total dissolved solids	10	Gravimetric	EPA 160.1
Total petroleum hydrocarbon	1.0	IR Spectrometry	EPA 418.1
Total suspended solids	5	Gravimetric	EPA 160.2
U	0.0001	ICP-MS	SW-846 6020
U-234, U-235, U-238	0.1	AS	NA
V	0.003	ICP-MS	SW-846 6020
VOCs	0.005	GC-MS	SW-846 8260B
Zn	0.02	ICP-AES	SW-846 6010B

[a]This table contains the majority of analyses conducted for LM ground water projects. Additional analyses may be required for future projects or other media.
[b]Units are in milligrams per liter (mg/L). Radiological detection limits are in units of picocuries per liter (pCi/L). The required detection limit is typically set an order of magnitude less than the standard.
[c]The primary technique is listed first. Laboratory technique acronyms and abbreviations are defined below.

AS	Alpha Spectrometry
COD	Chemical Oxygen Demand
CVAAS	Cold Vapor Atomic Absorption Spectroscopy
GC	Gas Chromatography
GC-MS	Gas Chromatograph - Mass Spectrometry
HPLC	High Performance Liquid Chromatography
IC	Ion Chromatography
ICP-AES	Inductively Coupled Plasma - Atomic Emission Spectrometry
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry
IR	Infrared
LSC	Liquid Scintillation Counting
NA	Not Applicable
PAH	Polynuclear Aromatic Hydrocarbons
PC	Proportional Counting
RE	Radon Emanation

End of current text

5.0 Quality Assurance

The Quality Assurance (QA) Program requirements and guidance documented in GA–3(P) "Standard Practice for Quality Assurance" (STO 6) should be used in implementing all environmental sampling and monitoring programs. This procedure addresses the requirements necessary for planning, implementing, documenting, and reviewing the activities, equipment, and records resulting from using this sampling and analysis plan. Additional QA requirements and guidance for LM Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites (i.e., Monticello, Fernald, Mound, and Rocky Flats) is contained in the *Legacy Management CERCLA Sites Quality Assurance Project Plan* (DOE 2006a).

5.1 Field Quality Assurance

Field quality assurance procedures include following the standard operating procedures discussed in this document and collection and analysis of QC samples. The types of QC samples collected include field duplicates, equipment blanks, and trip blanks. QC samples will be submitted to the laboratory under a fictitious identifier.

5.1.1 Field Duplicates

Duplicate water samples will be collected in the field on a frequency of one duplicate sample per 20 water samples for each analytical parameter. If less than 20 water samples are collected during a sampling event, one field duplicate will be required. Duplicate water samples will be collected by alternately filling the original and duplicate sample containers per analytical parameter. Frequency of duplicate samples for other matricies are specified in the site-specific procedure located behind the appropriate tabbed section in Appendix D.

5.1.2 Equipment Blanks

Equipment blanks provide a check for cross-contamination of samples from ineffective equipment decontamination. One equipment blank sample will be prepared in the field for every 20 water samples that are collected with non-dedicated equipment. If less than 20 (and at least one) samples are collected with non-dedicated equipment, then one equipment blank will be required. Equipment blanks will be prepared by collecting a sample of the final deionized rinse water (rinsate) used to decontaminate non-dedicated sampling equipment. Collection and frequency of equipment blanks for other matrices or filter blanks (air) are specified in the site-specific procedure located in Appendix D.

5.1.3 Trip Blanks

Trip blanks will be prepared using organic-free water obtained from a certified source and taken to the field by the sampling team. Trip blank samples will be prepared prior to the sampling trip when collection of water samples for volatile organic compound (VOC) analyses is required. Trip blanks subsequently will be handled as all other water samples collected for analysis of VOCs. Each ice chest in which VOC samples are stored or shipped will have an accompanying trip blank, which will be analyzed for VOCs only.

5.2 Data Qualification and Validation

Data obtained from ground water samples collected from Category II and Category III wells will be qualified with a "Q" flag indicating the data are qualitative due to sampling technique. This qualification will occur during the data validation process when "Q" flags will be entered into the SEEPro database. The "Q" flag will be displayed in the data validation column of the SEEPro database reports to provide notification to the data user. Data obtained from samples collected at Category I and Category IV wells are considered to be the highest quality, and qualification is not required.

Following a sampling event or period of ongoing monitoring, field and laboratory data will be validated and documented in summary reports. Data validation guidance is addressed in Appendix B.

5.3 Training

Personnel participating in sampling activities and the use of SOPs addressed in this plan will be proficient in the procedures for the work that they perform. Specific requirements for training, documentation, and associated tracking systems are found in the *Training Manual* (STO 4). An example of a form used to document training is shown in Figure 5−1.

5.4 Program Directives

Program Directives are used to document and authorize interim or site-specific changes to project documents. The procedures and format used for preparing Program Directives are found in Quality Assurance Instruction 1.5, "Program Directives" within the *Quality Assurance Manual* (STO 1). When needed, site-specific changes to this plan will be documented and approved through the use of a Program Directive. Program Directives that affect changes to this plan are prepared by the Environmental Monitoring/Field Services Lead and approved by the Site Task Order Manager. Program Directives will be managed as controlled documents and issued to all copyholders for inclusion in the appropriate tabbed section following the appendices to this plan. Guidelines, tracking logs, directive templates, and PDF files of approved directives are managed by the Environmental Monitoring/Field Services Lead on the 'condor' server, 'projects' share directory as follows: \LM\Overall Prog\SamplingProg\ProgDir.

5.5 Documentation

After the completion of a sampling event or period, the Sampling Lead will prepare a summary report that will document the specifics of the sampling event. Items that will be documented in the report may include

- Dates of the sampling event
- Team members
- Number of locations sampled
- Field variances
- Site disturbances
- Air sampler volume
- Air sampler flow rate
- QC samples
- Analytical report identification number(s)
- Equipment problems
- Required action items
- Well inspection summary
- Dates of deployment (TLDs, passive radon)
- Weight of particulates

Water Sampling Qualification Form

Completion of this form documents the training and qualification necessary to perform routine water sampling activities at the U.S. Department of Energy's Office of Legacy Management (DOE-LM) Sites.

Sampling and Analysis Plan Acknowledgement

I, _____, have read and understood the latest version of the Sampling and Analysis Plan entitled *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (May 2006, Rev. 0), which is used to guide routine water sampling activities at sites managed by DOE–LM.

_____ _____
Signature Date

Water Sampling Equipment/Procedures Proficiency

I certify that _____ has received on-the-job training in ground water and surface water monitoring at the _____ site. This person has demonstrated proficiency in: (1) the operation of specific monitoring equipment required for water sampling activities; and (2) the following specific procedures listed in the *Environmental Procedures Catalog*, which are required for routine water sampling activities:

GA-9(P),GT-1(P), GT-2(P), GT-3(P), GT-7(P), GT-8(P), LQ-1(G). LQ-2(T), LQ-3(P), LQ-4(T), LQ-5(T), LQ-6(T), LQ-7(T), LQ-8(T), LQ-9(T), LQ-10(P), LQ-11(P), LQ-12(P), LQ-18(P), and LQ-24(T).

_____ _____
Ground Water Monitoring Lead Date

_____ _____
Surface Water Monitoring Lead Date

Figure 5–1. Example Water Sampling Qualification and Proficiency Documentation Form

The Water Sampling Field Data form will be used at each water sampling location to record and document sample collection and identification, purge volume calculations, field measurement data, sampling equipment used, and instrument calibration information. The form will be completed following the protocol specified in procedure GT-1(P), "Standard Practice for Field Documentation Processes" (STO 6). Deviations from the procedures specified in this plan will be documented as a field variance on the Water Sampling Field Data form and, as appropriate, in the sampling summary report.

5.6 Records

Records associated with or generated through sampling activities include, but are not limited to:

- The *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*.
- Program Directives.
- Water Sampling Field Data form.
- Chain-of-Sample Custody forms.
- Sampling Summary Reports.
- Laboratory Analytical Data Reports.
- Field and Laboratory Data Validation Summary Reports.
- Air monitoring logs.
- Calibration logs.
- Soil sample collection logs and field maps.

6.0 Health and Safety

Sampling activities will be conducted according to the health and safety requirements specified in the *Health and Safety Manual* (STO 2). At some sites that have a higher complexity of site conditions (e.g., Tuba City, Arizona, Disposal Site), site access training will be specified in a formal site briefing. Task-specific health and safety requirements (including personal protective equipment needs) are addressed in Job Safety Analysis for sampling activities (Appendix C). Non-routine activities not specified in the Job Safety Analysis for sampling will be addressed in additional health and safety documents such as an additional Job Safety Analysis, Safe Work Permit, Radiological Work Permit, or Confined Space Evaluation.

End of current text

7.0 References

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DOE (U.S. Department of Energy), 1997. *Management Plan for Field-Generated Investigation Derived Waste*, MAC−GWADM 11.8, U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado.

DOE (U.S. Department of Energy), 2003a. *DOE Integrated Contractor Purchasing Team (ICPT) Basic Ordering Agreement* (BOA) U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

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EPA (U.S. Environmental Protection Agency), 1992. *Specification and Guidance for Contaminant-Free Sample Containers*, Directive 9240.0-05A, Office of Solid Waste and Emergency Response, Washington D.C.

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Korte, N., 2001. *Application of Low-Flow Purging to the UMTRA Ground Water Project*, Grand Junction, Colorado.

Morrison Knudsen Corporation, 2001. *Environmental Compliance Department Instruction 29*, Revision 5, "Site Generated Waste Management for the Weldon Spring Site," Weldon Spring, Missouri.

STO 1. *Quality Assurance Manual*, (continuously updated), prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

STO 2. *Health and Safety Manual*, (continuously updated), prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

STO 4. *Training Manual*, (continuously updated), prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

STO 6. *Environmental Procedures Catalog*, (continuously updated), prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

Appendix A

Procedures Used for
Ground Water and Surface Water Sampling and Analysis

Standard Practice for Preparing or Revising Procedures for the *Environmental Procedures Catalog*

1. Scope

1.1 This practice describes the preparation, review, approval, and distribution of procedures in the *Environmental Procedures Catalog* (STO 6).

1.2 The procedures in this catalog are not intended to address all of the details and variations that might apply to an individual project. Therefore, a site-specific plan or other project-specific document will describe in detail the work that will be performed and will identify procedures from the *Environmental Procedures Catalog* (STO 6) that will be used.

2. Hazard Analysis

2.1 No hazards requiring controls have been identified. Site-specific controls are available in the Health and Safety Plan for a particular project.

3. Referenced Documents

3.1 American Society for Testing and Materials (ASTM), *Form and Style for ASTM Standards*, March 2001

3.2 *Environmental Procedures Catalog* (STO 6):

Standard Practice for Quality Assurance [GA-3(P)].

3.3 *Training Manual* (STO 4): Section 8.0, "Environmental Qualification Procedure"

4. Responsibilities

4.1 The designated Technical Lead has overall responsibility for the *Environmental Procedures Catalog* (STO 6) which includes management of the catalog and implementation of the qualification system as defined in Section 8.0 of STO 4.

4.2 Environmental Procedures Advisory Committee (EPAC)—A group of professionals with expertise in particular areas who serve as advisors to address questions and problems relevant to the *Environmental Procedures Catalog* (STO 6) and the associated training.

4.3 EPAC Catalog/Training Coordinator is the point of contact for procedure revisions and distribution. The current electronic and paper versions of each procedure are maintained by the catalog coordinator. The coordinator also maintains the training qualifications and provides input to the Training Information System.

4.4 EPAC Technical Leads manage a section of the catalog. Their duties include assigning a key proficient person to each of the procedures, oversight for revisions to and reviews of procedures, and approval of project-specific changes to procedures.

5. Terminology

5.1 *Acceptance criteria*—Specified limits, requirements, or tolerances placed on the variation permitted in the characteristics of an item, process, report, data, or service as defined in codes, standards, drawings, specifications, procurement documents, or other requirements documents. The criteria must be definitive for decision-making purposes, but might not be related to instruments or measurements.

5.2 *Environmental Procedures Advisory Committee (EPAC)*—See paragraph 4.2.

5.3 *Guide*—A procedure that outlines a suggested approach through a series of options or instructions, but does not recommend a specific course of action.

5.4 *May*—In procedures, a suggestion only.

5.5 *Must*—In procedures, a required action. Synonymous with "shall" and "will."

5.6 *Planning document*—A document prepared to guide a project or task. These documents may be called Work Plans, Sample and Analysis Plans, project plans, task plans, or other names, depending on sponsor requirements.

5.7 *Practice*—A definitive procedure for performing one or more specific operations or functions that does not produce a test result.

5.8 *Procedure*—Steps to perform, explain, or accomplish a task. As used in this catalog, a procedure may be a practice, guide, or test method.

5.9 *Qualified*—An employee who has met the requirements for a specific position or task.

5.10 *Shall*—In procedures, a required action. Synonymous with "must" and "will."

5.11 *Should*—In procedures, a recommendation.

5.12 *Test method*—A definitive procedure for the identification, measurement, and evaluation of one or more characteristics of a material, product, system, or service that produces a test result.

5.13 *Training Information System*—A central database providing an electronic record of personnel training.

5.14 *Will*—In procedures, a required action. Synonymous with "must" and "shall."

6. Significance and Use

6.1 The catalog is intended to be a source of information that may be used with the minimum administrative burden that is consistent with control of activities. The procedures may be used as written or they may be modified by the method discussed in Section 8 "Changes to Procedures."

6.2 This practice is for use by any personnel preparing procedures for the *Environmental Procedures Catalog* (STO 6). From the standpoint of technical accuracy, this practice will ensure that procedures are complete and scientifically sound. From the standpoint of usability, the practice will ensure that procedures are uniform and will help the user find information easily and understand it quickly.

6.3 All new, revised, or adopted procedures in this catalog will adhere to this practice.

7. New Procedures

7.1 New procedures may be needed to support new work, changes in work scope, new technology or instruments, or improved methods. When the need for a procedure to be added to the catalog is known, the EPAC or management will review the suggested procedure to determine if it is appropriate for inclusion.

7.2 *Types of Procedures*—Three categories of procedures are defined for this catalog on the basis of ASTM guidelines. These categories are practices, test methods, and guides. Development of the text will be based on the determination of which of these three categories best describes the procedure being prepared. Other types of procedures defined in ASTM may be used, if more appropriate. See reference in 3.1, for more information.

7.2.1 Examples of practices include selection, preparation, application, inspection, necessary precautions for use or disposal, installation, maintenance, and operation of testing apparatus. Examples of guides include reference lists, general considerations, and glossaries. The following list (slightly modified from ASTM) describes headings to be included in a practice or guide. See reference 3.1, for more detailed information on practices and guides.

Title (mandatory)
Scope (mandatory)
Hazard Analysis (mandatory)
Referenced Documents
Terminology
Summary of Practice (or Guide)

Significance and Use (mandatory)
Reagents (including materials or equipment)
Procedure (mandatory)
Report
Precision and Bias (for included tests and analyses)
Keywords (mandatory)
Annexes and Appendices

7.2.2 Examples of test methods include determination of fundamental properties of materials and a variety of field and laboratory analytical or measurement procedures. The following list (slightly modified from ASTM) describes headings to be included in a test method. See reference in 3.1, for more detailed information on test methods.

Title (mandatory)
Introduction
Scope (mandatory)
Hazard Analysis (mandatory)
Referenced Documents
Terminology
Summary of Test Method
Significance and Use (mandatory)
Interferences
Apparatus (includes equipment)
Reagents and Materials
Sampling, Test Specimens, and Test Units
Preparation of Apparatus
Calibration and Standardization
Conditioning
Procedure (mandatory)
Calculation or Interpretation of Results
Report
Precision and Bias (mandatory)
Keywords (mandatory)
Annexes and Appendices

7.3 Procedures will adequately describe the work so that a qualified person could use the procedure to perform work. The procedure will describe responsibilities and interfaces, delineate the method and sequence, and provide a means of recording data when appropriate. Acceptance criteria will be identified when applicable.

7.3.1 Additional quality assurance concerns for procedures are available in Standard Practice for Quality Assurance [GA–3(P)].

7.4 Each procedure shall contain a section titled "Hazard Analysis," that identifies each potential hazard inherent to performance of the procedure.

7.4.1 Each procedure shall identify the potential hazards on a Hazards Identification Chart (Figure 1) by marking those hazards with a "Y" in the "Y/N" column. Hazard evaluation should not include site-specific hazards such as heat stress or contamination; these hazards are addressed in site-specific Health and Safety Plans.

7.4.1.1 For each hazard, the need for controls and the level of risk involved in performing the procedure shall be evaluated. Each hazard and any action necessary to implement a control shall be specified as a separate paragraph in this section.

7.4.2 The completed Hazards Identification Chart will be included in the procedure review package. The chart should not be included as part of the procedure. The chart is intended to assist reviewers in independently evaluating the procedure.

7.4.3 If no hazards requiring controls are identified, the Hazard Analysis section should contain the following text: "No hazards requiring controls have been identified. Site-specific controls are available in the Health and Safety Plan for a particular project."

7.5 *Procedure Format*—The format of procedures will follow the *Form and Style for American Society for Testing and Materials (ASTM) Standards*, reference in 3.1, as amended by this procedure. When preparing procedures, the modified decimal numbering system (see reference in 3.1) will be used to number divisions in the text. The divisions are numbered to show subordination of items within a section (e.g., 1., 1.1, 1.1.1, and 1.1.1.1 show the order of subordination).

7.5.1 ASTM Procedure Numbering System—Procedures purchased from ASTM are identified within the procedure title by a procedure number with the last two digits indicating the year the procedure was last revised. A year within

Hazard Identification Chart

Procedure No._____ Date _____ Performed By _____

The following hazards shall be considered. The list may not be complete. Add any other identified hazard to the list. On an attached page describe each identified hazard along with controls needed.

Potential Hazard	Y/N
Electrical Sources	
Capacitors	_____
Transformers	_____
Batteries	_____
Exposed Conductors	_____
Static Electricity	_____
Underground Utilities	_____
Other High Voltage	_____
Motion Sources	
Pulley Belt	_____
Gear	_____
Shears	_____
Sharp Edges	_____
Pinch Points	_____
Vehicles	_____
Mass in Motion	_____
Rotating Equipment	_____
Gravity-Mass Sources	
Personnel Falling	_____
Falling Object	_____
Lifting	_____
Tripping, Slipping	_____
Earthquake	_____
Pressure Sources	
Confined Gases	_____
Explosives	_____
Noise	_____
Chemical Reactions	_____
Stressed Mechanical System	_____
Chemical Sources	
Corrosive Materials	_____
Flammable Materials	_____
Toxic Materials	_____
Radioactive Materials	_____
Pathogenic Materials	_____
Oxygen Deficiency	_____
Carcinogenic Materials	_____

Potential Hazard	Y/N
Heat Sources	
Electrical	_____
Steam	_____
Flames	_____
Solar	_____
Friction	_____
Spontaneous Combustion	_____
Cold Sources	
Cryogenic Materials	_____
Ice, Snow, Wind, Rain	_____
Radiant Sources	
Intense Light	_____
Lasers	_____
Ultraviolet (UV)	_____
X-rays, Ionizing Radiation	_____
Infrared Sources	_____
Electron Beams	_____
Magnetic Fields	_____
RF Fields, Microwave, Radar	_____
Other Hazards	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	
_____	

Figure 1. Example of Hazards Identification Chart

parentheses indicates when the procedure was last reviewed by an ASTM committee, but no revisions took place. An epsilon superscript indicates that an editorial change has been made since the last revision (ε for last change, etc.)

7.6 *Miscellaneous Points of Style*

7.6.1 *Units of Measure*—Consistent units of measure will be used throughout the procedure. Units of measure are always spelled out the first time they appear in the text and any time they are not preceded by a value.

7.6.2 *Uppercase Letters*—***Do not*** use uppercase letters when writing text or numbered text headings (e.g., "5.5.9 *Uppercase Letters*," not "5.5.9 UPPERCASE LETTERS"). Use of all uppercase letters is acceptable in trade names, equations, etc.

7.7 Text should be provided to the coordinator of the catalog on disk or by e-mail. The disk should be accompanied by a printed copy of the text and all figures or forms to be included in the procedure. The coordinator will ensure that the procedure is in the proper format, assign the procedure number, coordinate reviews, and assist in comment resolution.

7.8 *Procedure Numbering*—Procedures in this catalog will be assigned a number in the following format: XX–N(A)

where:

XX = GA (General Administrative chapter)
GT (General Technical chapter)
SL (Solids chapter)
LQ (Liquids chapter)
GS (Gases chapter)
GP (Geophysical Measurements chapter)
RD (Radiological Measurements chapter)

N = The sequential number of the procedure within the chapter

(A) = Type of procedure: Practice (P), Guide (G), or Test Method (T)

7.8.1 For example, General Considerations for the Sampling of Liquids is the first procedure in the Liquids chapter and is numbered LQ–1(G).

7.8.2 The procedure number is indicated on the upper right-hand corner of each odd-numbered page. (This position is reversed on even-numbered pages.)

7.9 *Procedure Date and Revision*—The date and revision number of the procedure are indicated immediately below the procedure number. The date will appear in month and year format with the revision number directly following. For example, 1/91 Rev. 0 was issued in January 1991 and is the initial version. (This position is reversed on even-numbered pages.)

7.10 The catalog coordinator should be contacted for questions regarding new procedures.

8. Changes to Procedures

8.1 *Changes to Existing Catalog Procedures*—When changes to a procedure are required, the originator shall submit a hard copy and/or electronic copy of the proposed revision to the catalog coordinator. For questions, contact the catalog coordinator.

8.1.1 If only editorial changes are needed, and the changes do not affect the safety or the quality of work performed or data generated, the changes may be made without going through the formal reviews that are required for technical changes; however, the changes must be approved by the EPAC Chair. A procedure for which only editorial changes are implemented will be given a new revision number and a new date. When such a procedure is distributed, it should be accompanied by a statement that the changes are editorial only.

8.2 *Project-Specific Changes to Procedures*—Changes to a procedure might become necessary during project planning or during field operations. Records of review and approval for these changes will be included in the project records. These changes should be considered for incorporation in the *Environmental Procedures*

Catalog (STO 6) if the same changes are made repeatedly.

8.2.1 Procedures from this catalog that will be used on a specific project in planning documents should be identified in those documents. Modification of a catalog procedure made during planning for the project will be through an addendum that is documented on the Document Addition/Revision form (Figure 2) and approved by the Project Manager.

8.2.2 Changes that are needed during field operations will be documented in the field log and on the Document Addition/Revision form. The documented changes and a copy of the procedure will be given to the Project Manager or designee for review and approval. The review must include a technical review by the original author or reviewers who have comparable technical knowledge. The approval will be documented on the Document Addition/Revision form and appended to the procedures that are used in the field.

8.2.3 The Project Manager is responsible for evaluating each revision of a catalog procedure included as part of the project documents to determine if the revised procedure should replace the version that is currently in use for that project.

8.3 *Adopting Industry-Recognized Procedures*—When possible, programs should use existing industry-recognized procedures with an addendum rather than write new procedures for the catalog. The addendum will be titled "Technical Comments on (industry procedure number and title)" and shall include references to the numbered sections in the existing procedure that are being modified. A separate Hazard Analysis section and, as appropriate, specific sources of required equipment or supplies and quality assurance requirements should be added to the addendum. Any added sections will be numbered sequentially starting with the number following the last section of the industry procedure.

8.3.1 Industry-recognized procedures from source documents published by the U.S. Environmental Protection Agency, ASTM, U.S. Department of the Interior, National Water Well Association, American Petroleum Institute, or other recognized organizations should be used, if possible. Permission from the sponsoring agency, such as ASTM, may be required to reproduce and distribute the procedure.

9. Procedure Review, Publication, Approval, and Distribution

9.1 *Procedure Review*—Each new, revised, or adopted procedure in this catalog will be sent to qualified technical individuals and personnel from environmental, safety, and quality groups for review. Editorial changes, as described in Section 8.1.1 require review only by the EPAC Chair.

9.1.1 The catalog coordinator sends a copy of the procedure along with a Record of Review form (see Figure 3 for front page) and Hazards Identification Chart (for new procedures) to each reviewer. Comments must be resolved by the author and/or coordinator before submitting the procedure for publication.

9.2 *Publication of Procedures*—The catalog coordinator arranges for production of additions or changes to the catalog.

9.2.1 Release of each revision to the catalog will require issuing a new table of contents. The table of contents lists each procedure within a chapter and the current date and revision number.

9.2.2 Highlighted text indicates revised material in the procedures and table of contents.

9.3 *Procedure Approval*—A copy of the final procedure along with a completed Document Addition/Revision form is submitted to the EPAC Chair for approval before the procedure is released and distributed. A record of the approval will be maintained by the catalog coordinator.

Environmental Procedures Catalog
Document Addition/Revision

Procedure Title GA-1(P), Standard Practice for Preparing or Revising Procedures for the GJO Environmental Procedures Catalog

Requester Earlie Pearl

Justification

To update the Document Addition/Revision form referenced in the text + shown in Figure 2. The editorial changes made in this form to the headings in Sections 2+3 provide clearer information on the intended use of the areas + required signatures.

Proposed Changes (list here or attach copies)

Amend current form.

Authorization for Changes to Catalog Procedures

☐ New Document ☒ Change to Existing Procedure ☐ Adopt Procedure

Procedure Number Assigned GA-1(P)

Procedure Title Standard Practice for Preparing or Revising Procedures for the GJO Environmental Procedures Catalog

Approval for Inclusion in *Environmental Procedures Catalog*

Will Lee — *Environmental Procedures Advisory Committee Chair* — 7/1/99 *Date*

Authorization for Project-Specific Modification to Existing Catalog Procedures

Project-Specific Change for _____

Effective Date _____

Reviewed by _____ *Technical Author or Proficient Designee* _____ *Date* Approved by _____ *Manager or Designee* _____ *Date*

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6/99

Figure 2. Example of a Document Addition/Revision Form

Record of Review

Due Date	Review No.	Project	Type of Review: Internal	Page ___1___ of ___1___
Document Title and/or Number and Revision			Reviewer's Recommendation ___ Release Without Comment ___ Consider Comments ___ Resolve Comments and Reroute for Review _____ **Signature of Reviewer and Date**	
Author:				
Author's Organization		Author's Phone	___ Comments Have Been Addressed _____ **Signature of Author and Date**	
Reviewer(s):			___Comment Resolution Satisfactory ___ Comment Resolution Unsatisfactory	
Reviewer's Organization		Reviewer's Phone	**Signature of Reviewer and Date**	

Item No.	Reviewer's Comments and Recommendations	Reqd. (Y/N)	Item No.	Author's Response (if required)	Author's Initials

GJO 1696e
4/97

Figure 3. Example of a Record of Review

9.4 *Distribution of Procedures*—The catalog coordinator, in cooperation with the Contractor Document Control Specialist, will distribute copies of the catalog to library locations on the distribution list.

10. Procedure Access

10.1 Procedures may be copied directly from the catalog, marked as "*Uncontrolled Copy*", and inserted into other documents, such as Sampling and Analysis Plans. Catalog procedures may be identified in the documents by reference only; however, it is recommended that they be physically attached to the documents.

11. Records

11.1 A historical hard copy of each version (revision) of each procedure will be maintained by the EPAC Catalog/Training Coordinator.

11.2 An electronic copy of the current version shall be retained with the hardcopy master.

11.3 Records of review and comment resolution will be maintained for the current version of each procedure; such records of previous versions may be destroyed.

12. Keywords

12.1 ASTM, guide, hazard analysis, practice, procedure, review, revisions, and test method.

End of current text

Standard Practice for Sample Submittal to Contract Analytical Laboratories

1. Scope

1.1 This standard practice describes the process for submitting samples to contracted analytical laboratories. This practice applies to the submittal of samples to laboratories that provide services procured under the Integrated Contractor Purchasing Team Basic Ordering Agreement (ICPT BOA) as modified by the Grand Junction Site Statement of Work for Analytical Laboratory Services.

1.2 This practice applies to the submittal of all sample types including samples of ground water, surface water, soil, vegetation, biota, wastes, and other types of samples collected for analysis within the scope of the BOA.

2. Hazard Analysis

2.1 There are no identified hazards that are specific to the sample submittal process. Refer to individual procedures that cover the collection, preservation, and shipment of specific sample types for hazard analysis of those activities.

2.2 All sample shipments must comply with U.S. Department of Transportation (DOT) regulations (49 *Code of Federal Regulations* [CFR] 171–179) that govern the transportation of hazardous materials and hazardous substances. Individual sampling plans or work plans should identify samples that must be shipped as DOT-regulated material.

2.3 This procedure must be used in conjunction with any site-specific controls and Radiological Work Permit (RWP). Refer to Standard Practice for Health and Safety [GA-4(P)]. Consult the relevant documents for information on and use of all personal protective equipment.

3. Referenced Documents

3.1 *Environmental Procedures Catalog* (Manual STO 6)

Standard Practice for Quality Assurance [GA-3(P)]

Standard Practice for Health and Safety [GA-4(P)]

Standard Practice for Field Documentation Processes [GT-1(P)]

Standard Practice for Sample Labeling [GT-2(P)]

Standard Practice for Chain-of-Custody Control and Physical Security of Samples [GT-3(P)]

General Considerations for the Sampling of Solids [SL-1(P)]

General Considerations for the Sampling of Liquids [LQ-1(G)]

3.2 *Code of Federal Regulations* Title 49 CFR Parts 171–179, U.S. Department of Transportation, October 1, 2003. U.S. Government Printing Office, Washington, DC, 2003.

4. Terminology

4.1 *Basic Ordering Agreement (BOA)*—The ICPT BOA provides a standardized system for procuring analytical services from commercial laboratories, including a Statement of Work (SOW) for Analytical Services and provisions for laboratory audits.

4.2 *Environmental samples*—Air, soil, water, or other media samples that are collected from surface waters, wells, soils, or other locations and are not expected to exhibit properties classified by DOT as hazardous.

4.3 *DOT-regulated samples*—Samples of on-site air particulates, soil, or water and materials collected at waste sites that are known or thought to meet the definition of a hazardous material as

defined in 49 CFR 171.8. In this procedure "hazardous" does not refer to Resource Conservation Recovery Act (RCRA) hazardous wastes unless so stated.

4.4 *Integrated Contractor Purchasing Team (ICPT)*—The ICPT was established by the U.S. Department of Energy (DOE) to provide a vehicle for communication of procurement-related issues of the prime contractor community. The ICPT provides BOAs negotiated by or in support of ICPT for use by DOE and its eligible subcontractors.

4.5 *Line item code*—A cost code used to specify analytes or analyte groups. Line item codes are defined in the BOA based on sample matrix, analytes(s), analytical methods, and required detection limits.

4.6 *Radioactive material*—Any material having an activity greater than 2,000 picocuries per gram (pCi/g) and the radionuclide is evenly distributed.

4.7 *Report identification number (RIN)*—A unique eight-digit number that identifies a group of samples that are submitted, analyzed, and reported together.

5. Significance and Use

5.1 This practice provides an organized, documented sample submittal process when requesting analytical services and will be used for all sample submittals to commercial laboratories contracted under the BOA.

5.2 This practice complements procedures for the collection, preservation, and shipment of samples as documented elsewhere (see Referenced Documents).

6. Procedure

Note: Deviations from procedures are made in accord with Standard Practice for Quality Assurance [GA-3(P)].

6.1 *Sample Type Classification*—In general, samples collected are expected to have a low concentration of potential contaminants, although higher concentrations will be present in some cases. These low-concentration samples are classified as environmental samples because they do not meet the DOT hazard-class definitions and are not subject to DOT regulations. Historical data, knowledge of process, and field screening results will assist in classification of samples as "environmental" or as a DOT-regulated material.

The classification of sample types to be collected must be made as part of the planning process to comply with DOT shipping requirements. See Section 12 in General Considerations for the Sampling of Liquids [LQ-1(G)] and in General Considerations When Sampling Solids [SL-1(P)].

6.2 *Laboratory Coordinator Notification*—The Laboratory Coordinator is responsible for scheduling chemical analyses with contracted analytical laboratories. The Laboratory Coordinator must be notified of upcoming sampling events in advance (usually 5 days or more) to arrange sample analyses. More lead time may be needed when a large number of samples are planned or if unusual analyses are requested. The following information is needed:

6.2.1 Number and types of samples

6.2.2 Analytes requested

6.2.3 Special requirements, regulatory methods, detection limits, etc.

6.2.4 Turn around time requirements

6.2.5 Reporting requirements

6.2.6 The Laboratory Coordinator assigns a unique RIN to the sample event and selects the line item codes to specify the analyses to be performed. RINs are generated using the Sample Management Office Sample Tracking System application or the LabCoord Access module. The Sample Tracking System application is also used to produce a Sample Submittal Form and a Chain of Custody form or, in the case where the forms are to be generated at the remote site, a database file is used to produce the forms.

6.3 *Laboratory Notification*—The Laboratory Coordinator prepares an Analysis Confirmation Form listing the number and types of samples, line item codes, required turnaround times, and expected delivery date and sends it to a selected laboratory. A laboratory representative will sign and return the Analysis Confirmation form to indicate that the laboratory can provide the requested services. Figure 1 is an example of the Analysis Confirmation Form.

6.4 *Sample Collection and Documentation*—Samples are collected, preserved, and packaged in accord with the appropriate procedures; refer to General Considerations for the Sampling of Liquids [LQ-1(G)], General Considerations When Sampling Solids [SL-1(P)], and related procedures.

Field activities and all comments or deviations from procedures are documented on the Water Sampling Field Data form or Trip Report in accord with Standard Practice for Field Documentation Processes [GT-1(P)].

6.4.1 Samples are sealed and labeled for shipment; refer to Standard Practice for Sample Labeling [GT-2(P)].

6.4.2 Sample integrity must be maintained (samples must be locked and/or under constant supervision, and protected from tampering) and documented on a Chain of Custody form. Refer to Standard Practice for Chain-of-Custody Control and Physical Security of Samples [GT-3(P)] for guidance on protecting sample chain-of-custody. See Figure 2 for an example of a Chain of Custody form.

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

SAMPLE MANAGEMENT OFFICE ANALYSIS CONFIRMATION FORM

Sample Management Office - E-mail to Steve Donivan at SDonivan@gjo.doe.gov

Date of request: 8/6/2004

RIN: 04050065

Turnaround Time 28 day full

Expected arrival date at lab: 8/10/2004

Other Instructions:

Requesting Project: SHP

CTR acknowledgement: Steve Donivan

Qty	Matrix	Analysis	Line Item Code	Turnaround Time
4	Aqueous	Uranium	GJO-01	28dF
4	Aqueous	Selenium	GJO-14	28dF
4	Aqueous	Chloride	MIS-A-036	28dF
4	Aqueous	Sulfate	MIS-A-044	28dF
4	Aqueous	Ammonia as N	WCH-A-005	28dF
4	Aqueous	NO2+NO3-N	WCH-A-022	28dF

Note: If the expected sample arrival date becomes more than 7 days from the indicated date above, then reconfirmation with the laboratory should be made to check on the labs capacity and ability to accommodate the samples.

PLEASE NOTE THIS IS AN APPROXIMATE SAMPLE COUNT. MORE SAMPLES MAY BE ADDED TO THE FINAL COC UPON SHIPMENT. PLEASE RETURN ALL BLUE ICE AND COOLERS.

Accepted by: _____
Laboratory Representative Date

Not accepted: _____ Reason: _____
Laboratory Representative Date

Figure 1. Analysis Confirmation Form

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

CHAIN OF CUSTODY

RIN: 04050065 Shipment # 1

Sampler(s): _____

Site Name: SHIPROCK

Site Code: SHP01

Cost Number: 05-100-1-06-1-1-03

Purchase Order: 24314

Sample Matrix: WATER

Process history demonstrates that the activity concentrations (or activity limit) of these samples are below the values listed in 49 CFR 173.436 allowing shipment as an exempt consignment.

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	REMARKS
NDW853	0937	06/10/2004		2	1	0	0	0	0	
NDW854	0938	06/10/2004		2	1	0	0	0	0	
NDW855	0939	06/10/2004		2	1	0	0	0	0	
NDW856	0959	06/10/2004		2	1	0	0	0	0	
			Sum	8	4	0	0	0	0	

Relinquished by (signature)	Date	Time	Relinquished by (signature)	Date	Time	Relinquished by (signature)	Date	Time

Received by (signature)	Date	Time	Received by (signature)	Date	Time	Received by (signature)	Date	Time

04/11/200

Page 1 of 1

Figure 2. Chain of Custody Form

6.5 *Sample Shipment*—The samples are shipped in compliance with DOT regulations. The shipment must include copies of sample tickets (if used), a signed Chain of Custody form and a Sample Submittal Form. The Sample Submittal Form can be obtained from the Laboratory Coordinator and completed during sample collection, generated locally using a database file produced at the time of RIN generation, or sent directly to the laboratory by the Laboratory Coordinator. See Figure 3 for an example of the Sample Submittal Form.

6.6 *Sample Receipt*—Upon sample receipt, the contracted analytical laboratory is required to:

6.6.1 Sign and date/time the Chain of Custody form indicating sample receipt.

6.6.2 Assign unique laboratory identification numbers to the samples.

6.6.3 Measure the pH and/or temperature of each sample or cooler, as appropriate, to verify that the sample has been preserved correctly. (In the case of volatile analysis, measure pH at time of analysis to avoid contamination and record in lab notebook if Chain of Custody form has already been returned to Laboratory Coordinator).

6.6.4 Record the pH and/or temperature on the Chain of Custody form or sample receiving report.

6.6.5 Contact the Laboratory Coordinator to resolve any discrepancies in documentation or samples received.

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Sample Submittal Form

RIN: 04050065
PO #: 24314

Laboratory: Paragon Analytics, Inc.
Address: 225 Commerce Dr.
Ft. Collins, CO 80524
Phone: 970.490.1511
Fax: 970.490.1522

Ticket No.	Date	Site	Location	Container	Preservation	Analysis
NDW853	06/10/2004	SHP01	0937	HDPE 500 mL	HNO3	U,Se
NDW853	06/10/2004	SHP01	0937	HDPE 125 mL	4 C	Cl,SO4
NDW853	06/10/2004	SHP01	0937	HDPE 125 mL	4 C, H2SO4	NH3-N,NO3NO2-N
NDW854	06/10/2004	SHP01	0938	HDPE 500 mL	HNO3	U,Se
NDW854	06/10/2004	SHP01	0938	HDPE 125 mL	4 C	Cl,SO4
NDW854	06/10/2004	SHP01	0938	HDPE 125 mL	4 C, H2SO4	NH3-N,NO3NO2-N
NDW855	06/10/2004	SHP01	0939	HDPE 500 mL	HNO3	U,Se
NDW855	06/10/2004	SHP01	0939	HDPE 125 mL	4 C	Cl,SO4
NDW855	06/10/2004	SHP01	0939	HDPE 125 mL	4 C, H2SO4	NH3-N,NO3NO2-N
NDW856	06/10/2004	SHP01	0959	HDPE 500 mL	HNO3	U,Se
NDW856	06/10/2004	SHP01	0959	HDPE 125 mL	4 C	Cl,SO4
NDW856	06/10/2004	SHP01	0959	HDPE 125 mL	4 C, H2SO4	NH3-N,NO3NO2-N

Figure 3. Sample Submittal Form

6.6.6 Return a copy of the Chain of Custody form and, if applicable, a copy of the Sample Receiving Report to the Laboratory Coordinator.

6.6.7 The laboratory shall notify the Laboratory Coordinator within 24 hours of discovery of lost, damaged, or destroyed samples.

6.6.8 The laboratory shall provide a Sample Condition Upon Receipt report to the Laboratory Coordinator within 24 hours of receipt.

It is the responsibility of the Laboratory Coordinator to ensure that the laboratory complies with these requirements.

6.7 *Analytical Reports*—The laboratory sends an analytical report to the Laboratory Coordinator at the completion of sample analysis. Other deliverables are provided as specified in the Grand Junction Site Statement of Work for Analytical Laboratory Services. The Laboratory Coordinator then initiates data review and validation.

6.8 *Records*—Records generated during the sample submittal process are identifiable by a Site Code. Records are managed as defined in site-specific indexes.

7. Keywords

7.1 Basic Ordering Agreement, Chain of Custody, chemical analyses, contract analytical laboratories, environmental samples, sample submittal.

End of current text

Standard Practice for Field Documentation Processes

1. Scope

1.1 This standard practice covers reproducibility, legibility, accuracy, completeness, protection, identification, and error correction of records. The practice describes the control, data entry, content, review, and storage of field documents such as logbooks, field notebooks, data sheets, and other records.

2. Hazard Analysis

2.1 No hazards requiring controls have been identified. Site-specific controls are available in the Health and Safety Plan for a particular project.

3. Referenced Documents

3.1 *General Administrative Procedures Manual* (STO 100), Section 3, "Records Management Plan."

3.2 *Quality Assurance Manual* (STO 1) Criterion 4, "Documents and Records."

3.3 U.S. Environmental Protection Agency, *Test Methods for Evaluating Solid Waste, Vol. II, Field Manual, Physical/Chemical Methods*, SW-846, Office of Solid Waste and Emergency Response, November 1986, 3rd Edition.

4. Terminology

4.1 *Records*—Information or data on a specific subject collected and preserved in writing or other permanent form that has been verified and authenticated as technically complete and correct. Records may but are not limited to include data sheets, logbooks, field notebooks, maps, drawings, photographs, and electronic data-recording media.

4.2 *Technical record books*—For purposes of this practice, technical record books will refer to logbooks and field notebooks. These books are to be bound and the pages consecutively numbered.

5. Significance and Use

5.1 This practice will be used to document results of tasks performed using the *Environmental Procedures Catalog* (STO 6), unless the project Work Plan provides an alternate practice.

5.2 This practice includes the use of technical record books for direct data entry or as journals referring to the location of associated supporting documents for activities.

5.3 Documentation of the results produced from performing tasks is necessary to provide adequate evidence of compliance with requirements, provide an adequate basis for design decisions, and document techniques and conditions of sample collection.

6. General Procedures for Records

6.1 All records produced from work performed according to procedures in the *Environmental Procedures Catalog* (STO 6) must meet the following requirements:

6.1.1 Records must clearly describe the work performed. Enough detail must be provided to enable someone of equivalent skill and experience in the technology to repeat the work as originally performed.

6.1.2 Records must be clear, legible, and reproducible. Black ink is preferred. Reproducible photocopies of penciled documents are acceptable as records.

6.1.3 Errors will be corrected by lining through the incorrect entry with a single line, making the correction, and initialing and dating the correction. The erroneous information must not be obliterated or erased.

6.1.4 Records must specify the activity conducted, the program sponsor, and the method used, if applicable. The signature of the person who performed the work and the date it was

performed must appear on each page of a record and on any attached sheets. (Initials are acceptable if an initials log identifies the person.)

6.1.5 For short-term tasks, the Work Plan will define the records to be maintained for each task conducted and the disposition of the records. The following are suggested records of a short-term task:

6.1.5.1 Operational check data.

6.1.5.2 Data sheets.

6.1.5.3 Technical record books.

6.1.5.4 Official correspondence.

6.1.5.5 Planning documents.

6.1.5.6 Electronically or magnetically stored data.

6.1.6 For ongoing programs, a Working Records File Index defines what records will be generated, how long they will be retained, and the disposition of the records (see Reference 3.1).

6.1.7 Records must be protected against damage, deterioration, and loss while in the field, during data review, and until they are submitted to a storage facility. Records must be isolated from any source of contamination.

6.1.8 An independent reviewer will review data sheets or data contained in technical record books, as well as electronic data collection and data entry, as described in Section 7.5.

6.1.9 All data will be reviewed before personnel leave a remote site. The review will ensure that no additional sampling or data acquisition is required before departure.

6.1.10 When the procedure specifies compilation of data sheets, the data must be legible and traceable to the activity, project, and method used. The person completing the data sheet will sign and date the sheet and ensure that applicable spaces are completed.

7. Procedures for Technical Record Books

7.1 Technical record books will be bound books with sequentially numbered pages. Each book will be given a unique identifier.

7.2 *Issue and Control of Technical Record Books*—A technical record book will be assigned to an activity or a person for use on a project. The technical record book will be transmitted to the Project Manager or designee upon completion. If a technical record book contains information on more than one activity or project, the technical record book will clearly identify the portion associated with each activity or project. Reproducible copies of applicable sections of these books may be submitted to the Project Manager or designee as records.

7.2.1 The Project Manager shall determine the following and make a written record of the decisions:

7.2.1.1 Who will issue technical record books.

7.2.1.2 The number of each technical record book and the person to whom the book is issued.

7.2.1.3 The expected location for each technical record book when not in use (building and room number).

7.2.1.4 The reviewer of each technical record book and the frequency of reviews.

7.2.1.5 Whether support organizations are to use technical record books dedicated to the project or whether they will be required to furnish copies of applicable pages from technical record books supporting several projects.

7.2.2 The person to whom a technical record book is issued shall take the following steps upon receipt of a new technical record book:

7.2.2.1 Review general information on maintenance of the technical record book.

7.2.2.2 Complete the information block (if any) on the first sheet inside the front cover.

7.2.2.3 Identify the technical record book by entering the project number and title and the applicable task or subtask numbers as appropriate.

7.2.2.4 Determine whether to reserve specific pages for a Table of Contents and for the names of people who make entries and who will review the technical record book.

7.2.2.5 The first entry in the book shall describe the work covered and, as appropriate, the name of the sponsor, the Work Order or Statement of Work number, and the objectives of the work.

7.2.2.6 Prepare and maintain a list of the printed name, written signature, and initials used by each person who is authorized to make entries, including review entries.

7.3 *Rules for Data Entry*

7.3.1 Pages shall be kept intact. No page is to be left completely blank or removed from the book.

7.3.2 Use pages consecutively. If a page has entries from more than 1 day, each entry shall be signed and dated. If a page or part of a page must be left blank, it must be ruled across, signed, and dated. If entries for a given subject are made on two or more pages that are not consecutive, each page must be cross referenced to the previous and following entries.

7.3.3 Record all data as required by procedures for the activity being performed. Enter all data directly in a technical record book when practical. If loose sheets, such as test data sheets, photocopies, or photographs must be added to a technical record book, proceed as follows:

7.3.3.1 Glue, tape, or staple each sheet or part of a sheet to the next blank page or blank space, according to the amount of space needed.

7.3.3.2 Enter on the page of the technical record book a description of the material that is attached, and enter on each attachment the technical record book number and page number. This information will allow identification of the attachment if it comes loose.

7.3.4 Describe or reference in the technical record book any other permanent written or visual records generated for the project and not readily available in the open literature or that cannot be directly inserted because of size or bulk (e.g., data sheets, computer printouts, films, or magnetic media). Any project records that are cited must be filed and controlled as records. Records that are readily available in the open literature need only be referenced. The purpose is to provide a clear, complete record of activities and supporting documents.

7.3.5 The last entry in a technical record book shall be either a statement that the work was concluded or a reference to a sequential technical record book.

7.4 *Content of Technical Record Books*—The following information may be entered in technical record books, as applicable:

7.4.1 Table of Contents, consisting of pages with continuing entries.

7.4.2 What work was done and how it was done, including such information as a description of the facility, test design, measuring and test equipment (by serial number), and a reference by number and title to any standard procedure used.

7.4.3 Instrument numbers or equipment used, if not specified in a referenced procedure.

7.4.4 Field checks or calibrations that are not documented elsewhere.

7.4.5 Identification of personnel and responsibilities or duties of each person.

7.4.6 Why the work was done, including any Statement of Work under which the work was done and with what objective.

7.4.7 What results were obtained. Observations made, the review of the results, and nonconformances and deficiency reports may be included.

7.4.8 Temperature, weather, humidity, wind speed and direction, or other environmental influences that might affect the results.

7.4.9 Documentation of variances from planned activities. A variance is considered to be a deviation from "shall", "must", or "will" statements of a procedure.

7.4.10 Location of the activity, including site and sample or test location.

7.4.11 Name and address of field contact.

7.4.12 Sampling entries:

7.4.12.1 Purpose of sampling.

7.4.12.2 Description of sampling point and sampling methodology.

7.4.12.3 Number of samples taken and volume.

7.4.12.4 Date and time of sample collection.

7.4.12.5 Sample destination (name of laboratory) and how transported (hand carried or name of carrier, such as United Parcel Service or Federal Express).

7.4.12.6 References such as maps or photographs of the sampling site.

7.4.13 Entries relating to waste:

7.4.13.1 Producer of waste and address, if different for that location.

7.4.13.2 Type of process (if known) that produced the waste.

7.4.13.3 Type of waste (e.g., sludge, wastewater).

7.4.13.4 Suspected composition and concentrations of waste.

7.4.14 Other appropriate entries such as calculations, problems encountered and actions taken to resolve them, or interfaces with agencies.

7.5 *Review of Technical Record Books*—An independent reviewer will review technical record books for content, accuracy, legibility, calculations, error correction, and reproducibility (see Reference 3.2).

7.5.1 A reviewer will review electronic data collection or data entry for correctness and accuracy by comparison of originals with printed data or by review of the graphic representation of the data.

7.5.2 The reviewer will check for completeness, validity of data, and traceability between each page and the items or activities to which it applies. The reviewer will take action to correct any deficiencies.

7.5.3 When the reviewer is satisfied that the recorded information is complete and correct, the reviewer will sign and date the technical record book and indicate the pages and supporting documents that were reviewed.

7.5.4 Written comments by a reviewer that are clearly identified as review comments will not require review by a second reviewer.

7.6 *Storage of Technical Record Books*—Technical record books shall be stored in fire-resistant metal file cabinets or otherwise protected from damage when not directly in use. Records shall not be left unprotected overnight or on holidays, vacations, or weekends (see Reference 3.2).

8. Keywords

8.1 Data sheets, documentation, field documentation, field notebooks, logbooks, records, and technical records books.

Standard Practice for Sample Labeling

1. Scope

1.1 This procedure addresses labeling requirements and recommended practices for labeling samples that are collected in the field and intended for analysis at a later time. The materials sampled may include, but are not limited to, solids such as soils and cores, liquids and sludges, and gases.

1.1.1 This procedure does not address labeling practices for any in situ measurements.

1.2 This procedure is intended for use with a variety of sample types, including grab samples, composite samples, duplicate samples, and split samples.

1.3 All samples collected by Contractor personnel shall have a sample label and a Contractor-generated sample number.

2. Hazard Analysis

2.1 No hazards requiring controls have been identified. Site-specific controls are available in the Health and Safety Plan for a particular project.

3. Referenced Documents

3.1 *Environmental Procedures Catalog* (STO 6)

Standard Practice for Field Documentation Processes [GT–1(P)].

Standard Practice for Chain-of-Custody Control and Physical Security of Samples [GT–3(P)].

4. Terminology

4.1 *Chain-of-Custody Form*—A form used to document sample custody and receipt. It also may contain other information, such as the sample analyses required and traceability.

4.2 *Field*—Any place where the material for analyses or testing is collected.

4.3 *Duplicate samples*—More than one sample collected from the same source location, but placed in separate containers, also called multiple samples.

4.4 *In situ*—In place; not removed from the point of original deposition.

4.5 *Sample* (n)—A portion of material collected from a larger mass that represents the characteristics of that mass.

4.6 *Sample* (v)—To select and collect a sample.

4.7 *Sample label*—The documentation attached to the sample or sample container and marked with required information about the sample. An example is shown in Figure 1.

U.S. Department of Energy
2597 B 3/4 Road
Grand Junction, CO 81503
(970) 248–6000

Sample No. _____

Project _____

Date _____ Time _____

Sampler _____ Location _____

Analysis _____

Filtered ☐ Cooled ☐ Other ☐ _____

Preservative: HCl ☐ H_2SO_4 ☐ HNO_3 ☐ pH ☐

Comments _____

Figure 1. Example of a Sample Label

4.8 *Sample log*—A document that lists all samples collected during a field visit or visits. A Chain-of-Custody form or sample ticket book are examples of sample logs.

4.9 *Sample number*—The unique identification number assigned by the Contractor to each sample and attached to, or written on, the sample label or sample container. The sample number will normally consist of three alpha and three numeric characters.

4.10 *Sample ticket book*—A soft-bound book consisting of 25 sample numbers, one number per page. Each page is backed by two duplicating no-carbon-required (NCR) sheets. For each sample number, a separate page containing 27 duplicate numbers is included. The duplicate number labels are self-adhesive.

4.11 *Split sample*—A sample that has been subdivided into two or more parts, each representative of the original sample.

5. Significance and Use

5.1 All Contractor personnel shall use this procedure for sample identification unless an approved alternate procedure is included or referenced in the official project records. Alternate procedures shall include the minimum information identified in Section 8.4.

6. Materials

6.1 Preprinted Contractor sample labels with adhesive backing.

6.2 Ballpoint pen with reproducible, waterproof ink.

6.3 Sample log or chain of custody.

7. Procedure for Obtaining Sample Numbers

7.1 Sample numbers are provided by using sample ticket booklets. These provide unique sample numbers that may be used to log various sample media.

7.2 The originator will maintain a record of sample numbers (ticked booklets) issued, the user's name, and date of issue.

8. Procedure for Using Sample Labels

8.1 Complete the sample label before or after attachment to the sample container. If labels are not available, write the required information directly onto the sample or sample container. Never write directly on a sample that is to be chemically analyzed.

8.2 Use waterproof, reproducible ink to complete the required label information.

8.3 Normally, the sampler will complete the entire label. If some of the requested information is not relevant, write "NA" for "not applicable" in that space.

8.4 The minimum information required on the sample label shall include

8.4.1 *Sample number.*

8.4.2 *Date*—The date the sample was collected.

8.4.3 *Sampler identification*—The name or initials of the person who collected the sample.

8.4.4 *Project site*—The area or property defined in project documents containing one or more sample locations. The property may be identified by a number.

8.4.5 *Sample location*—The location at which the sample was collected. Examples of sample locations include well numbers, grid locations, or surveyed coordinates.

8.5 Additional information that may be appropriate on the label includes

8.5.1 *Time*—The time at which the sample was collected.

8.5.2 *Sample type (matrix)*—One or more terms that describe the type of sample. This description may cover sample material such as soil, water, sludge, air, or core. It may also include the type of sample, such as composite, grab, or wipe.

8.6 Attach the preprinted sample number to the sample label. If the preprinted number is illegible or does not adhere to the label, the sampler may write the sample number on the sample, sample label, or sample container. The sampler also may write the number on tape and attach it to the sample.

8.7 Maintain a record of sample numbers and other pertinent information on a sample log. See Standard Practice for Field Documentation Processes [GT–1(P)] and Standard Practice for

Chain-of-Custody Control and Physical Security of Samples [GT–3(P)], reference 3.1.

8.8 When needed, protect the completed sample labels from moisture and abrasion by placing a piece of clear plastic tape over the label.

9. Procedure for Using Sample Ticket Books

9.1 Sample ticket books contain preprinted numbers for labeling multiple sample fractions (e.g., water samples from one well) or split samples. A copy of a page from a sample ticket book is shown in Figure 2.

9.2 If multiple sample fractions or duplicate samples are taken at the same location or if split samples are made in the field, the sampler shall identify each sample by removing an adhesive-backed sample number from the book and attaching it to the sample label or container. The sample number shall be identical for each sample in the entire group of duplicates or splits.

9.3 Duplicate samples or split samples each may be assigned a unique sample number for purposes of documenting the precision of the sampling and analysis process. These samples are commonly referred to as "blind duplicates" or "field duplicates."

9.4 The information required on the sample ticket is summarized on the inside flap cover of the ticket book, as shown in Figure 3. When completing the ticket, the cardboard cover should be inserted after the pink page of the current ticket to prevent copying information onto the next ticket. A ballpoint pen should be used with sufficient pressure to ensure duplication onto all copies of the NCR sheets.

9.5 Normally, the white copy of the ticket is retained by the project manager, the canary copy is forwarded to the Sample Plant or analytical laboratory with the samples, and the pink copy remains in the ticket book. This distribution may vary depending upon the needs of the project.

10. Keywords

10.1 Label, sample, sample labeling, sample log, sample number, and ticket book.

NDX 651

Project _____

Site _____ Location _____

Date _____ Time _____ Matrix _____

Interval _____ Sampler _____

Comments _____

Analyte(s)	Container Type	Number Collected	Filtered	Preservative

GJ 1854
5/2005

White copy to Project Manager; canary to laboratory; pink remains in ticket book

Figure 2. Example of a Sample Ticket

Required Information

Project:	Name of Project or Project Number: "GJ–12345."
Site:	Site location: "Landfill 3," "Unit 6."
Location:	Exact location of sample such as borehole number, monitor well number, or distance to permanent landmarks: "MW–018."
Date:	Date sample was collected.
Time:	Time sample was collected: "1420" or "2:20 p.m."
Interval:	Beginning and ending depth interval of sample or time duration of sample: "2 feet to 3.8 feet," or "0800 to 1622" — dependent on sample type.
Matrix:	Type of sample: soil, water, air, product, tissue, etc.
Sampler:	Name(s)/initials of sampling personnel. Initials should be listed in project file for identification.

Optional Information

Project documentation may replace optional information to avoid unnecessary writing in the field. For example, a Sampling Plan may state "all VOC samples will be collected in 40 mL glass vials" thus avoiding the need to write this for each sample. If all filtered samples use a 40 micron filter, simply put a "Y" in the filtered field. Only variances from the Sampling Plan would need to be noted on the ticket. Information duplicated on many samples may be completed on the first ticket of the series and referred to subsequently: "Same as PNN 230" or "PNN 230"

Comments:	Area weather conditions, radiation levels, composite sample/ grab sample, reason for sample, additional location information, or any factors that may affect analysis. Brief location maps with a scale and north indicator are useful.
Analyte:	Type of analysis to be performed: "KUT," "VOCs," "Metals," "Asbestos."
Type/Size:	Describe type of container: Glass, HDPE, Amber; "LDPE/500 mL," "1 L NM Glass," "WMG/250 mL."

NM	Narrow Mouth	A	Amber Glass or Plastic
WM	Wide Mouth	G	Glass
HDPE	High-Density Polyethylene	P	Plastic
LDPE	Low-Density Polyethylene		

Number Collected:	Number of containers of each analyte.
Filtered:	Was sample filtered/size: Y/"0.45 micron fiber."
Preservative:	Cool, HCL, HNO_3, Frozen, etc.
Completion of Sample Label:	Complete sample label as required. Remove label from ticket book and cover the "Sample Number" area on the sample label.

Figure 3. Example of a Sample Ticket

Standard Practice for Chain-of-Custody Control and Physical Security of Samples

1. Scope

1.1 This procedure describes the documentation required for tracing sample custody and the requirements for maintaining physical security of samples.

1.2 Control, storage, and disposal of samples should be addressed in the Work Plan for a particular project.

2. Hazard Analysis

2.1 No hazards requiring controls have been identified. Site-specific controls are available in the Health and Safety Plan for a particular project.

3. Referenced Documents

3.1 *Environmental Procedures Catalog* (STO 6):

Standard Practice for Sample Labeling [GT–2(P)].

4. Terminology

4.1 *Chain-of-custody record*—A form such as the Chain of Custody (Figure 1), or equivalent, used to document sample custody and receipt.

4.2 *Custody*—To maintain a sample in sight, immediate possession, or locked under one's personal control.

4.3 *Custody seals or tags*—Adhesive-backed strips, or metal or plastic tags, fastened to the sample container or the shipping container in such a way as to demonstrate that no tampering with the sample has occurred. Custody seals also may be manufactured in the field by using paper strips and clear plastic tape.

4.4 *Duplicate samples*—More than one sample collected from the same source location but placed in separate containers. Also called multiple samples.

4.5 *Physical security*—Synonymous with custody but emphasizes the measures taken to prevent tampering with the samples or sampling process.

4.6 *Sample* (n)—A portion of material collected from a larger mass.

4.7 *Sample* (v)—To select and collect a sample.

4.8 *Sample number*—The unique identification number assigned by the Contractor to each sample and attached to, or written on, the sample label or sample container. The sample number will normally consist of three alpha and three numeric characters. See Standard Practice for Sample Labeling [GT–2(P)], Section 7, on how to obtain sample numbers.

4.9 *Split sample*—A sample that has been subdivided into two or more parts, each part representative of the original sample.

5. Significance and Use

5.1 All contractor personnel shall use this procedure for chain-of-custody control and physical security of samples unless an approved alternate procedure is included or referenced in the official project records.

5.2 Projects that do not require sample custody documentation may use other types of sample logs for documenting sample information.

6. Materials

6.1 Chain of Custody form or equivalent.

6.2 Ballpoint pen with waterproof, reproducible ink.

6.3 Custody seals or tags.

6.4 Clear plastic tape (normally 2 inches wide).

U.S. Department of Energy at Grand Junction

2597 B 3/4 Road, Grand Junction, CO 81503 (970) 248-6000

CHAIN OF CUSTODY

RIN: 04050065 Shipment # 1

Sampler(s): _____

Site Name: SHIPROCK

Site Code: SHP01

Cost Number: 05-100-1-06-1-1-03

Purchase Order: 24314

Sample Matrix: WATER

Process history demonstrates that the activity concentrations (or activity limit) of these samples are below the values listed in 49 CFR 173.436 allowing shipment as an exempt consignment

Ticket No.	Location	Sample Date	Time	HDPE 125 mL	HDPE 500 mL	HDPE 1 L	Glass 40 mL	Glass 1 L	Other	REMARKS
NDW853	0937	06/10/2004		2	1	0	0	0	0	
NDW854	0938	06/10/2004		2	1	0	0	0	0	
NDW855	0939	06/10/2004		2	1	0	0	0	0	
NDW856	0959	06/10/2004		2	1	0	0	0	0	
			Sum	8	4	0	0	0	0	

Reliquished by (signature)	Date	Time	Reliquished by (signature)	Date	Time	Reliquished by (signature)	Date	Time

Received by (signature)	Date	Time	Received by (signature)	Date	Time	Received by (signature)	Date	Time

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Figure 1. Chain of Custody Form

6.5 Padlocks, receptacles, containers, and/or enclosures as appropriate to provide physical security of the samples.

7. Chain-of-Custody Procedure

7.1 The sampler shall complete the chain-of-custody record during or after sample collection.

7.2 Use waterproof, reproducible ink to complete the form.

7.3 The initiator of the form is responsible for legibility of all entries other than signatures.

7.4 *Relinquished by/Received by*—When the samples are physically transferred from one person to another, or from a person to a shipper, the relinquisher and receiver shall sign the appropriate block, with the date and time of sample transfer. The relinquishers, by signing, verify that the samples have been within their custody.

7.4.1 It is each signatory's responsibility to write the signature legibly.

7.4.2 The relinquisher retains a copy of the form.

7.4.3 Noncontractor employees are not required to sign the form (e.g., employees of shipping companies).

7.5 The following is the minimum information required on the form to ensure sample identification:

7.5.1 Date chain-of-custody form was prepared;

7.5.2 Site name;

7.5.3 Sampler's printed name; and

7.5.4 Sample location and ticket number, if used.

7.5.5 Date and time of sample collection.

7.5.6 Number and types of sample bottles.

7.6 Complete all information blocks or label the blocks "NA" for "not applicable."

7.7 When samples will be transported by a non-Contractor shipper, use custody seals or tags to seal the individual sample containers or the inner or outer shipping carton.

7.7.1 When seals are applied to the sample container, they must not obscure the information on the sample label.

7.7.2 Securely wrap or fasten shipping containers prior to application of the custody seals. The seals are inherently fragile and will not withstand pressure from an inadequately packaged container. Seal all possible access flaps or lids of the shipping container.

7.7.3 Enter the date the samples are sealed and sign the custody seals or tags as shown below. Clear plastic tape may be applied over the seals for protection.

CUSTODY SEAL

Date_____

Signature_____

Example of Custody Seal

7.8 The original chain-of-custody record shall accompany the samples until they are received by the laboratory.

7.9 Unless otherwise specified by the project, the chain-of-custody record shall be maintained as part of the project records.

8. Physical Security of Samples and Sampling Process

8.1 The sampler must maintain physical security of the samples, sampling process, and equipment by physical possession, visual contact, or seals or locks to prevent tampering. Because the procedures for physical security are unique to each sampling situation, only guidelines can be given.

8.1.1 Lock the sampling device when unattended. For example, when using an unattended autosampler to collect samples for a period of time, the device must be locked or secured to maintain physical security.

8.1.2 Store samples in a locked storage area. For example, when collecting samples for a period of time before transporting to the laboratory, lock the samples in a secure storage area or in an area with controlled access such as a locked vehicle or locked field office.

8.1.3 Use security seals where appropriate. Although security seals do not provide physical security, the seals are evidence that the samples or sampling process was not tampered with while unattended.

8.1.4 Use best professional judgment when providing physical security of the samples or sampling process. The sampler should be knowledgeable of the programmatic requirements for the samples and provide the appropriate degree of physical security.

8.2 Document in field logs, or other project documents, the type of physical security used.

9. Keywords

9.1 Chain-of-custody record, form, laboratory, physical security, samples, and shipper.

End of current text

Technical Comments on ASTM D 5088-02

Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites

Summary of ASTM D 5088-02

The purpose of this practice is to provide guidance for the decontamination of field equipment used in the sampling of soils, soil gas, sludges, surface water, and ground water at nonradioactive waste sites.

Additions Applicable to the Operating Contractor and its Subcontractors

This standard guide shall be referenced when preparing sampling and analysis plans for site investigation activities. The guidance provided may be superseded by other project documents, such as Project Safety Plans or Project Quality Assurance Plans.

The following sections shall be interpreted in conjunction with the current published version of the ASTM guide. The sections shall be interpreted in numerical order, using the published version as the base document for reference.

4. Summary of Practice

4.1.1 Some nonsample contacting equipment may not require decontamination due to limited use and/or site conditions that do not pose a risk.

4.2.8 The information included in an equipment decontamination protocol, as well as how the information is presented in site plans should be determined on a site specific basis.

7. Procedure for Sample Contacting Equipment

7.2.9 When samples will undergo inorganic analyses, the use of an inorganic desorbing agent may not be required if the Quality Assurance/Quality Control (QA/QC) program documents that the decontamination protocol is sufficient for the sampling methods being used.

8. Quality Assurance/Quality Control

8.1.4 The frequency for the minimum number of samples to demonstrate completeness of decontamination for QA/QC purposes may be either increased or decreased on a site specific basis based on an evaluation of QA/QC samples and project specific objectives.

9. Report

9.1.9 The activities associated with reporting equipment decontamination should be determined on a site specific basis based on the specific objectives of each project.

11. Hazard Analysis

11.1 Exposure to hazardous substances and chemicals is possible during performance of this task. The applicable site Health and Safety Plan or Project Safety Plan shall be used for all decontamination work.

End of current text

General Considerations for the Sampling of Liquids

Introduction

The importance of proper sampling techniques for liquids cannot be overemphasized. Many factors shall be considered to obtain a sample that is (1) representative of the population being sampled, (2) collected in a manner that does not compromise the sample, (3) preserved properly until it can be analyzed in the laboratory, and (4) documented so that it can be properly traced. Accurate sampling shall be responsive to all of these considerations and to other items discussed in this procedure.

1. Scope

1.1 Because the objective of most liquid sampling is to obtain a sample that is representative of the population being sampled and retains the physical and chemical properties of the population, the sampler shall make decisions concerning sample types, equipment to be used, quality control, decontamination, etc., that will greatly affect the results obtained from the sampling event. The information provided in this procedure will guide the sampler and provide the necessary background for the proper collection of liquid samples. The 10 items that shall be considered before collecting a sample are

	Section
Material Considerations	5
Equipment Selection Considerations	6
Well-Purging Strategies	7
Sample Preservation and Filtration Considerations	8
Decontamination	9
Quality-Control Considerations	10
Documentation	11
Shipping and Handling	12
Sampling Plan	13
Health, Safety, Environmental Sciences and Quality Assurance (QA) Considerations	14

2. Hazard Analysis

2.1 Specific hazards requiring controls are identified in the individual procedures. Site-specific controls are available in the planning documents for a particular project.

3. Referenced Documents

3.1 American Public Health Association, American Water Works Association, and Water Pollution Control Federation, *Standard Methods for the Examination of Water and Wastewater: American Public Health Association*, Washington, D.C., 1995.

3.2 American Society for Testing and Materials, *2004 Annual Book of ASTM Standards*, Section 11, "Water and Environmental Technology," Volumes 11.01, Water (I), and 11.02, Water (II).

3.3 *Environmental Procedures Catalog*, (STO 6):

Standard Practice for Field Documentation Processes [GT–1(P)].

Standard Practice for Sample Labeling [GT–2(P)].

Standard Practice for Chain-of-Custody Control and Physical Security of Samples [GT–3(P)].

Technical Comments on ASTM D 5088-02—Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites [GT–7(P)].

Standard Practice for Decontamination of Field Equipment Used at Low Level Radioactive Waste Sites [GT–8(P)].

Standard Practice for Purging of Monitoring Wells [LQ–3(P)].

Standard Practice for the Collection, Filtration, and Preservation of Liquid Samples [LQ–12(P)].

3.4 Korte, N., and D. Ealey, *Procedures for Field Chemical Analyses of Water Samples*, Technical Measurements Center, U.S. Department of Energy, Grand Junction Area Office, GJ/TMC-07(83), 1983.

3.5 U.S. Department of Energy, *The Environmental Survey Manual*, Appendix E, Volume 4, DOE/EH-0053, 1987.

3.6 U.S. Environmental Protection Agency, *Handbook of Groundwater*, EPA/625/6-87/016, 1987.

3.7 U.S. Environmental Protection Agency, *Practical Guide for Groundwater Sampling*, EPA/600/2-85/104, 1985.

3.8 U.S. Environmental Protection Agency, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, PB-87-107-751 (NTIS).

3.9 U.S. Environmental Protection Agency, *SW-846, Test Methods for Evaluating Solid Waste, Vol. II, Field Manual, Physical/Chemical Methods*, Office of Solid Waste and Emergency Response, November 1986, Third Edition.

3.10 Wood, W.W., "Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents," *Techniques of Water-Resources Investigations of the United States Geological Survey*, Chapter D2, Book 1: U.S. Government Printing Office, Washington, D.C., Stock Number 024-001002879-4, 1976.

4. Significance and Use

4.1 The two general sample types are grab samples and composite samples.

4.1.1 Grab samples are the most widely used type. They provide a sample that represents the characteristics of the liquid being sampled at a particular point in space and time. Grab samples are used where

4.1.1.1 The flow of liquid is not continuous (e.g., batch discharges or intermittent flows).

4.1.1.2 The characteristics of the liquid are known to be fairly constant.

4.1.1.3 The samples are to be used for parameters with characteristics that are likely to change significantly with time (e.g., dissolved gases, bacterial decay, hydrolysis reactions, oxidation/reduction reactions, etc.).

4.1.1.4 The compositing process would significantly affect the concentration of an analyte.

4.1.2 Composite samples are composed of small aliquots of constant volume collected at constant time intervals or flow increments. Composite samples are used to generate data that describe average characteristics. Composite samples are collected in several ways depending upon the particular variability being studied. The five types of composite samples are

4.1.2.1 Simple composite samples consist of small aliquots of constant volume collected at constant time intervals.

4.1.2.2 Flow-proportional composite samples are collected by varying the time intervals with flow or by proportionally varying the volume collected with flow. Flow-proportional sampling is used where the liquid flow is highly variable.

4.1.2.3 Sequential composite samples require a series of individual samples collected per container with each container representing a specific time period. This sampling technique is used where the liquid being sampled varies significantly over short periods.

4.1.2.4 Continuous composite samples are collected by extracting a small continuously flowing stream from the bulk source and directing it into the sample container.

4.1.2.5 Areal composite samples are a composite of individual grab samples collected on an areal or cross-sectional basis. Areal composite samples are generally used to collect a sample from a lake or stream.

4.1.3 Interpretation of results depends upon knowledge of ground water-flow direction and formation transmissivity, lithology sampled, and a properly collected, preserved, and uncontaminated sample.

4.1.4 See Table 1 through Table 5 for advantages and disadvantages of different sampling devices. A description of the depth of monitoring wells and a depth to the sample interval is necessary before proper sampling strategies can be chosen.

5. Material Considerations

5.1 The quality of the analytical data can be greatly affected by interactions between the sample and the sampling device. These interactions include chemical attack, microbial colonization, sorption, and leaching effects. To ensure the integrity of the sample and maximize the analytical quality, the sampling device shall be constructed of a nonreactive material.

5.2 The following materials are generally used in construction of sampling devices and sampling containers. They are listed in order of preference (least reactive to most reactive).

5.2.1 Rigid materials.

a. Teflon.
b. Stainless steel.
c. Polyvinyl chloride (PVC).
d. Low-carbon steel.
e. Galvanized steel.
f. Carbon steel.

5.2.2 Flexible materials.

a. Teflon.
b. Polypropylene.
c. Linear polyethylene.
d. Flexible PVC.
e. Viton
f. Conventional polyethylene.
g. Tygon.
h. Silicone/neoprene.

5.3 The choice of materials used shall be considered with respect to the parameter being sampled. The factors to be considered are

5.3.1 *Negative Contamination*—The potential for the measured analyte concentration to be artificially low because of losses that are due to precipitation, volatilization, or absorption.

5.3.2 *Positive Contamination*—The potential for the measured analyte to be artificially high because of leaching or introduction of foreign matter into the sample by particle fallout or gaseous air contaminants.

5.3.3 *Cross-contamination*—A type of contamination caused by the introduction of part of one sample into a second sample.

6. Equipment Selection Considerations

6.1 Because each sampling situation is unique, the sampler may have to modify equipment and applications to ensure that a representative sample is collected and to maintain the sample's physical and chemical integrity. No one particular device will fit every situation. The sampler shall understand the various sampling devices and their advantages and disadvantages to effectively use them to collect samples. The following items shall be considered when selecting a sampling device.

6.1.1 Potential impact of the device on sample integrity.

6.1.2 Method of sample delivery.

6.1.3 Flow controllability.

6.1.4 Depth of sampling interval.

6.1.5 Ease of operation, cleaning, and maintenance.

6.1.6 Reliability and durability.

6.1.7 Portability of the device.

6.1.8 Initial cost and operational cost.

6.2 There are basically four types of sampling devices: (1) grab mechanisms, (2) suction-lift mechanisms, (3) positive-displacement mechanisms, and (4) submersible pumps. -

Discussion of the uses, advantages, and disadvantages of these devices follow.

6.2.1 *Grab mechanisms* consist of bailers and dip-type samplers. These devices are the oldest and simplest for collection of liquid samples. They can be made of virtually any material and can be used to collect liquid samples from almost any source. Table 1 presents the advantages and disadvantages of a grab-type mechanism.

Table 1. Grab-Type Mechanism

Advantage	Disadvantage
Virtually any material can be used for construction. Device is inexpensive. No external power source is required. Mechanism can be constructed in any size and shape. Device is easy to use and easily cleaned; requires little training for operation and little maintenance.	Sampling is labor intensive and time consuming. Aeration, degasing, and turbulence occur during sampling. Sampler is susceptible to exposure to any contaminants in the sample. Device does not provide a continuous supply of sample.

6.2.2 *Suction-lift mechanisms* consist of peristaltic-type pumps and centrifugal pumps that apply a vacuum, which causes the liquid to be drawn upward through a suction line. Their use is generally limited to purging wells of stagnant water and sampling for inorganic analytes. Table 2 presents the advantages and disadvantages of a suction-lift mechanism.

Table 2. Suction-Lift Mechanism

Advantage	Disadvantage
Flow rates are easily adjustable. Device has no contact with the sample. Device can be used in wells of any diameter. High flow rates are obtainable for well purging. Only the tubing requires cleaning (peristaltic pumps only).	Use is limited to situation where the liquid level is less than 25 feet below the surface. Drop in pressure of suction-lift mechanism causes degasing of the sample and loss of volatiles. Choice of construction material is limited. Centrifugal pumps need to be primed, resulting in possible sample contamination. Several aeration and turbulence occur with centrifugal pump.

6.2.3 *Positive-displacement mechanisms* consist of gas-driven devices and gas-operated bladder pumps. These devices are generally used to sample ground water when the liquid must be pumped to the surface. Positive-displacement devices can be constructed of a variety of materials to fit most sampling situations. Tables 3 and 4 present the advantages and disadvantages of positive-displacement mechanisms.

6.2.4 *Submersible pumps* are generally not used for sample collection. They are useful in purging large-volume wells of stagnant water; however, severe aeration and turbulence of the sample occur because of their method of sample delivery. Table 5 lists the advantages and disadvantages of using a submersible pump.

Table 3. Gas-Driven Device

Advantage	Disadvantage
Device can be used in wells of 1.5-inch inside diameter. Device is inexpensive and highly portable for most sampling applications. Permanent installation is possible in boreholes without casing. Inert materials can be used for construction of device. Sample delivery rate can be controlled. Burst strength of the materials used to make device and tubing is only limiting factor in determining sampling depth.	Oxidation and gas-stripping of volatiles may occur if air or oxygen is used as the driving gas. Requires air compressor or large compressed-air tanks. Application of excessive air pressure can rupture the gas entry or discharge tubing. Difficult to retrieve for repair, cleaning, and maintenance when installed permanently in boreholes without casing.

Table 4. Gas-Operated Bladder Pumps

Advantage	Disadvantage
Pump is constructed of inert materials; most pumps are designed specifically to sample for low levels of contaminants. Driving gas does not contact the sample, thus minimizing sample aeration and gas stripping. Pump is portable, though accessory equipment may be cumberson. Relatively high pumping rate allows well evacuation and collection of large sample volumes. Sample delivery rate can be controlled easily on some models. Most models are capable of pumping lifts in excess of 200 feet. Pump diameters are variable, depending on the application. Pump is easily disassembled for cleaning.	Deep sampling requires large volumes of gas and longer cycles, thus increasing operating time and expense and reducing portability. Check valves in some models are subject to failure in water and high solids content. Most available models are expensive. Minimum rate of sample discharge of some models may be higher than ideal for sampling of volatile compounds.

Table 5. Submersible Pump

Advantage	Disadvantage
High pumping rates are possible for well purging. Pump can be used at depths of more than 200 feet.	Sampler has little control of flow rates; not possible to adjust from a high rate for purging to a low rate for sampling. Severe aeration and degassing of sample occurs, thus volatilizing organics and other sensitive compounds. Pump has limited portability and requires a power source for operation. Pump is not easily disassembled for cleaning.

7. Well-Purging Strategies

7.1 To obtain a representative ground water sample, it is necessary to remove the stagnant water from the well casing. The water within the well casing and in proximity to the well is probably not representative of the overall ground water at the sampling site. Drilling contaminants may be near the well; and important environmental conditions, such as the oxidation/reduction potential, may differ drastically near the well from the conditions in the surrounding water-bearing formation. The recommended amount of water to be purged from the well prior to sampling varies on a case-by-case basis. The amount of water to be purged is based on the hydraulic properties of the geologic materials surrounding the well,

well-construction parameters, desired pumping rates, and sampling methodology employed. There is no one single number of well volumes to be pumped that is best or fits all situations. The goal is to obtain water from the well that is representative of the ground water, while minimizing the disturbance of the regional flow system and the collected sample.

7.2 The most common procedure is to pump or bail the well until three to five casing volumes of water have been removed. This requirement is stated in references 3.8 and 3.9. The sampler shall use the following guidelines to determine when sufficient water has been removed from the well prior to sampling.

7.3 Standard Practice for Purging of Monitoring Wells [LQ–3(P)].

7.3.1 Purging accomplished by pumping from near the water surface within the well casing is the most reliable way to ensure removal of stagnant water within the well casing.

7.3.2 Removal of three to five casing volumes by surface pumping is sufficient to remove virtually all stagnant water within the well.

7.3.3 Monitoring pH, conductivity, and temperature during purging is an indicator that when stabilized (± 10 percent), the well is providing formation water.

7.3.4 Pumping or bailing a well dry and allowing it to recover is sufficient to remove the stagnant water within the well.

7.3.5 Documentation of the purging process should be provided so that the data user can assess the quality of the data.

8. Sample Preservation and Filtration Considerations

8.1 *Sample Preservation Consideration*— Preservation of samples is necessary to stabilize specific parameters during shipment to a laboratory and while the samples are being held for analysis. Preservation is intended to (1) retard biological effects, (2) retard hydrolysis, (3) reduce sorption, and (4) reduce volatility of constituents.

Preservation techniques are parameter-specific and include many different methods. Generally, the Sampling and Analysis Plan and/or the laboratory performing the analysis will determine the specific requirements. Guidelines for preservation requirements, container types and sizes, and holding times, are provided in Procedure LQ–12(P), Table 1. Volume may vary based on the analytical method. The laboratory should be consulted to ensure the correct containers and preservation are used.

8.2 *Sample Filtration Considerations*— Predictions of contaminant migration, whether made empirically or with a computer model, require that a distinction be made between soluble species and suspended matter. Determining the soluble species requires the samples to be filtered prior to analysis. A filter pore size of 0.45 micrometer (μm) has been accepted as the cutoff size to be used for determining dissolved versus suspended matter. Samples requiring filtration shall be filtered as soon after collection as possible, preferably at the time of collection. Many devices are available to filter the sample and include large and small disposable cartridges and large and small filter holders with replaceable filters. The device chosen will vary depending upon the amount of suspended matter in the sample, amount of sample requiring filtration, and equipment available to filter the sample. Many different types of filter media are available (including cellulose nitrate, cellulose acetate, Teflon, nylon, and polycarbonate) in a 0.45-μm filter pore size. The choice of filter media will depend on the constituents being analyzed and the amount and size of the suspended matter in the sample. The following guidelines will be helpful in the choice of sampling device and filter media.

8.2.1 The preferred device is an in-line filtration module that operates from sampling pump pressure.

8.2.2 The required filter pore size is 0.45 μm.

8.2.3 Samples containing high suspended solids or large volumes can be best filtered using a high-capacity cartridge filter.

8.2.4 Clear samples or samples requiring small volumes can be filtered using small cartridge filters or filtration devices with replaceable filter media.

8.2.5 Thoroughly clean all devices that use replaceable filters and discard the initial 50 to 100 milliliters (mL) of sample as a rinse prior to sample collection.

9. Decontamination

9.1 A major part of the work effort and cost spent during an investigation is associated with collecting and analyzing samples. To that end, effective decontamination of reusable equipment is critical to the credibility of the data generated during the investigation. No universal standards exist for equipment decontamination, but most State and Federal regulatory agencies have established guidelines that should be considered when developing decontamination protocols. Therefore, the individuals conducting the sampling shall develop protocols that will best fit the requirements of the investigation being conducted. Standard Practice for Equipment Decontamination [GT–7(P) or GT–8(P)] may be consulted.

9.2 Decontamination consists of a physical cleaning of the equipment followed by a chemical cleaning. The process shall be designed to minimize the spread of contaminants to clean areas and to minimize the cross contamination of sampling sites. The following general guidelines provide a basis for achieving this goal.

9.2.1 Physical decontamination methods consist of cleaning with brushes, clean rags, and high-pressure water to physically remove the contamination. This is followed by a distilled or deionized water rinse and drying with lint-free tissues.

9.2.2 Chemical decontamination methods shall depend on the nature and extent of contamination. At a minimum, chemical cleaning would consist of washing the contaminated equipment in a soap solution, rinsing with tap water, rinsing with distilled or deionized water, and air drying or wiping dry with lint-free tissues. Some situations might call for a chemical cleaning with acids such as HNO_3 or HCl or organic solvents such as methanol, acetone, or hexane.

10. Quality-Control Considerations

10.1 The fundamental goal of field quality control is to ensure that the sampling protocol is being executed faithfully and that situations leading to error are recognized before they seriously impact the data. This goal can be achieved only through knowledge, training, experience, and continued refinement of procedures. The use of field quality-control samples such as blanks, standards, and spiked samples can account only for changes that occur after sample collection. The following guidelines are quality-control measures that are generally used by the sampler in the field.

10.1.1 *Field blanks* are used to enable quantitative correction for bias that arises because of handling, storage, transport, and laboratory procedures. They can also detect problems in inadequate field decontamination procedures or potential cross-contamination problems in field procedures or both. Field blanks consist of water which is metal-free or organic-free, or both, that contacts the sampling equipment under field conditions. Field blanks are also considered equipment blanks.

10.1.2 *Trip blanks* are used to detect any contamination or cross contamination resulting from handling and transportation. They consist of water that is metal-free or organic-free, or both, which is placed in the sampling containers that accompany the samples to and from the field.

10.1.3 *Field duplicates* are actual samples collected in the field in duplicate and sent to the laboratory. They are used to document the precision of the sampling and analytical technique.

10.1.4 *Field spikes* are actual samples collected in the field and spiked with a known amount of analyte. They are used to determine the loss of analytes of interest during sampling and shipment. They are not generally used because

they are susceptible to errors that are difficult to control in a field situation.

10.1.5 *Control samples* are samples of known analyte concentration prepared in a laboratory and then submitted with the field samples as a field sample. They are used to document the accuracy of the analytical technique.

11. Documentation

11.1 The documentation of the field activities and sample collection activities shall contain the information necessary for reconstruction of the sampling event at a later date. This documentation process consists of (1) field logbooks, (2) sample identification forms, (3) documentation of sample collection forms, (4) sample labels, and (5) chain-of-custody forms. Keep in mind that the documentation process should be able to provide answers to the questions who, why, what, when, where, and how.

11.1.1 *Field logbooks* are used to record the activities of the field team and to record information about the sampling event that is not contained on other forms. The logbook shall be bound and have consecutively numbered pages. The field team leader shall maintain the logbook. Items that would normally be recorded in the field logbook are (1) names and signatures of sampling team members; (2) equipment used on the sampling event; (3) source and expiration date of calibrating solutions used; (4) date, time, and sample number of samples collected; (5) weather conditions, if they are important to understanding the data; and (6) other quantitative information or measurements that are important to the data reviewer.

11.1.2 *Sample identification forms* may vary from project to project but all are designed to provide information about where the sample was collected, who collected the sample, date of collection, and comments by the sampler to document other important information.

11.1.3 *Sample labels* are necessary to prevent misidentification of the samples. Each label shall include, at a minimum, (1) sample number, (2) name of sampler, (3) date and time of collection, (4) place of collection, and (5) name and address of organization collecting the sample. Standard Practice for Sample Labeling [GT–2(P)] provides a method for sample labeling.

11.1.4 *Chain of custody* is an essential part of the sampling scheme to ensure the integrity of the sample from collection to data reporting. The possession and handling of the samples should be traceable from the time of collection through analysis and final disposition. This documentation is known as the chain of custody. A sample is considered to be under a person's custody if it is (1) in a person's physical possession, (2) in view of the person after taking possession, and (3) secured by that person so that no one can tamper with it or secured by that person in an area that is restricted to authorized personnel. The chain-of-custody form shall accompany the samples and each person relinquishing or receiving the samples shall sign and date the form and retain a copy for the records. Consult Standard Practice for Chain-of-Custody Control and Physical Security of Samples [GT–3(P)] for more information.

11.1.5 *Custody seals* are used to detect tampering with samples. They shall be affixed to the shipping container in such a way that, if the shipping container is properly secured and arrives at the laboratory with the custody seals intact, the integrity of the sample can be demonstrated. Custody seals can also be placed directly over the lid of the sample container to further ensure that there has been no tampering with the sample. Custody seals may also be placed on the door of the sample storage area to document that no unauthorized entry was made while the sample was stored. Consult Standard Practice for Chain-of-Custody Control and Physical Security of Samples [GT–3(P)] for more information.

12. Shipping and Handling

12.1 The storage and transport of samples are often the most neglected elements of a sampling program. Samples shall be stored in a manner that does not compromise the sample integrity and shall be shipped to the laboratory in a timely manner to satisfy holding times. In addition, all shipments shall comply with the Department of Transportation (DOT) regulations governing

shipment of hazardous materials and substances. Coordination with the laboratory is critical to ensure that samples will arrive in a timely manner and the laboratory can meet the required holding times. This may require adjustment to sampling schedules.

12.2 The DOT regulations governing shipment of hazardous materials and substances are available in Hazardous Materials regulations (49 CFR 171–179). The sampler should be familiar with and shall comply with these regulations. The regulations describe proper marking, labeling, packaging, documentation, and shipping procedures. Samples of a substance listed in the Hazardous Materials Table (49 CFR 172.101) shall be identified, packaged, marked, labeled, documented, and shipped according to the regulations listed for that material. However, if the composition of the sample is unknown, the shipper shall select the appropriate transportation category in accordance with 49 CFR 172.402(h). A material for which reasonable doubt exists as to its class and labeling requirements, and for which a sample must be transported for laboratory analysis, may be labeled according to the shipper's tentative class assignment based upon (1) defining criteria (i.e., definitions of the hazard classes), (2) hazard precedence prescribed in 49 CFR 173.2, and (3) shipper's knowledge of the material.

12.3 The hazards listed in 49 CFR 173.2 fall into five classes: (1) flammable liquids, (2) radioactive materials, (3) oxidizers, (4) flammable solids, and (5) corrosives. The sampler should be familiar with the definitions of these classes to properly ship the samples.

13. Sampling Plan

13.1 A sampling plan shall be prepared after all the previous items have been properly considered. The sampling plan is the road map that should be followed during sample collection. It is a collection of separate steps arranged in a specific order that, when properly followed, results in a unique sample being obtained. It shall be flexible enough to allow for changes in data-quality objectives, information needs, and the variety of situations found at a particular site. The generalized plan presented in this section describes the steps and the goal each step is to accomplish. The steps are arranged in the order in which they should be executed, but some steps may be executed concurrently. However, some steps are not applicable to all liquid types and can be eliminated. For example, the hydrologic measurement and the well-purging steps are not applicable to surface or containerized liquids.

13.1.1 *Identify Sampling Site*—Consult the planning documents, maps, and other instructions to identify the sampling site. Review the documents for the specific site and determine the sampling requirements (i.e., samples to be collected, analyte requirements, required field measurements, and any personal protective equipment that might be necessary).

13.1.2 *Determine Equipment Requirements*—After reviewing the documents described in Section 13.1.1, select the appropriate equipment. The appropriate procedures in this catalog or other referenced documents should also be reviewed. Select equipment that has the least potential of affecting the sample and yet can provide the necessary volume required for the purging and sampling steps.

13.1.3 *Establish Documentation Requirements*—At a minimum, each sample requires a sample label and an entry in the field logbook. See Standard Practice for Field Documentation Processes [GT–1(P)] and review the planning documents for site-specific requirements.

13.1.4 *Inspect the Site*—Inspect the sampling site to identify any health and safety problems, verify the sample collection point, and identify any conditions that could affect the quality of the sample. If the site is a monitoring well, examine the condition of the surface seal and well protector to determine if there is any evidence of frost-heaving, cracks, or vandalism. Record this inspection in the field logbook.

13.1.5 *Take Appropriate Protective Measures and Conduct Area Monitoring*—Monitor the area with an organic vapor meter (OVM) and an

explosivity meter to determine if special personal protective equipment will be necessary. Consult the planning documents for details of monitoring and personal protective equipment requirements. Record these monitoring results in the field logbook.

13.1.6 *Prepare the Area for Sampling*—Clear the area around the sampling point of weeds and other materials prior to beginning sampling activities. Sampling equipment shall not be placed on the ground. Place sampling equipment on a card table or drop cloth on the ground.

13.1.7 *Take Water-Level Measurements and Determine Purging Requirements*—This step is only applicable when sampling monitoring wells. Unlock the well protector, remove the cap from the well, and take OVM and water-level measurements.

13.1.8 *Calibrate Monitoring Equipment*—Calibrate or check the equipment to be used for making field measurements. Record this information in the field logbook or document the information on the sample collection form.

13.1.9 *Assemble Equipment*—Assemble the equipment to be used according to the operating manual for each piece of equipment.

13.1.10 *Purge Stagnant Water and Monitor pH, Temperature, Conductivity, and Other Parameters*—Stagnant water in the well shall be removed prior to sampling. Monitoring of pH, conductivity, and temperature is used to determine if stagnant water has been removed. These parameters should stabilize to ±10 percent prior to sampling.

13.1.11 *Label Sample Bottles and Collect and Preserve Samples*—Label the sample bottles and collect and preserve the samples. Consult the planning documents or the appropriate procedures in this catalog for requirements.

13.1.12 *Record Field Measurements and Perform any Field Analysis*—Record the field monitoring parameters and conduct the field analyses at this time. Consult the planning documents for requirements at the site.

13.1.13 *Clean Equipment*—Clean and decontaminate the equipment according to the decontamination procedure in this catalog [GT-7(P) or GT-8(P)]. Planning documents for each site will describe site-specific decontamination procedures.

13.1.14 *Review Documents and Prepare for the Next Sample*—Review the field logbook and other records such as sample labels and field documentation forms for completeness and accuracy. Clean up the site and put away any equipment that was used for sampling. Prepare for collection of the next sample.

13.1.15 *Storage and Transport of Samples*—Place samples in secure storage and prepare the sample for transport. The samples that require storing at 4° C shall be placed in an ice chest with ice and kept cool until shipment to the laboratory.

14. Health, Safety, Environmental Sciences and Quality Assurance (QA) Considerations

14.1 The sampling of liquids comprises numerous activities that involve the consideration of health, safety, and Environmental Sciences and QA issues. Site-specific planning documents and procedures shall address these issues. Where appropriate, include these issues in procedures. However, many of these issues are site specific and should be thoroughly covered in planning documents. Health, Safety, Environmental Sciences and QA Specialists shall review all procedures, planning documents, and activities to verify that all items have been adequately addressed. Items that are to be considered include, but are not limited to, the following.

14.1.1 Assignment of responsibilities.

14.1.2 Medical program requirements.

14.1.3 Training program requirements.

14.1.4 Personal protective equipment requirements.

14.1.5 Personal decontamination requirements.

14.1.6 Emergency procedures.

14.1.7 Disposal of contaminated wastes.

14.1.8 Compliance with environmental regulations.

14.1.9 Compliance with hazardous materials transportation.

14.1.10 Documentation and records requirements.

15. Keywords

15.1 Composite samples, grab samples, sample filtering, sample preservation, sampling plan, and well purging.

End of current text

Standard Test Method for the Measurement of Water Levels in Ground Water Monitoring Wells

Introduction

Water-level measurements shall be taken prior to any sampling or well purging. These measurements are needed to determine the casing volume of water in the well; the data are used to interpret the monitoring results. High water levels could indicate recent recharge to the system, which would dilute the sample. Low water levels could reflect the influence of nearby production wells. Documentation of nonpumping water levels also provides historical information on the hydraulic conditions at the site (see reference 3.7).

1. Scope

1.1 Water levels shall be measured from the top of the well casing and, for consistency, shall always be made from the same spot on the well casing. If the planning documents do not specify a reference point, and other reference points do not exist, the measurement shall be made on the north side of the well casing.

1.2 Three methods are provided in this test method for water level measurement.

1.2.1 The first method uses an electric water-level sounder with a conductivity cell. When the cell contacts water, it completes an electrical circuit, activating an audio and/or visual alarm.

1.2.2 The second method uses an interface probe. This instrument has an optical liquid sensor and a conductivity cell and can distinguish between the presence of a nonconductive layer and a conductive layer. For example, oils, fuels, and many organics are nonconductive and are immiscible with water. With an interface probe, the sampler can measure the thickness of a light non-aqueous-phase liquid (LNAPL) layer, which floats on the water's surface, or a dense non-aqueous-phase liquid (DNAPL) layer, which sinks to the bottom of the well.

1.2.3 The third method uses an electronic/pneumatic water-level meter in conjunction with a dedicated water-level probe. The water-level meter measures the pressure it takes to force the water out of the dedicated water-level probe and converts that pressure to the submersion depth of the probe. This depth is then subtracted from the total probe length (obtained during installation), giving the depth to water.

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2. Hazard Analysis

2.1 Site-specific controls (e.g., radiological controls in a contaminated area, respirators, personal protective equipment, and decontamination) are available in the planning documents, such as the Health and Safety Plan, for a particular project. These documents should be consulted before beginning work on a project.

2.2 This test method uses methanol for decontaminating the apparatus. Methanol is a Department of Transportation (DOT)-regulated material; its hazard class is Flammable Liquid. Methanol has an Occupational and Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL)–Time-Weighted Average (TWA) of 200 parts per million (ppm) and a PEL-Short Term Exposure Limit (STEL) of 250 ppm (see reference 3.2). Methanol can also potentially enter the body through the skin.

2.2.1 Some of the effects of methanol by inhalation or skin absorption include dizziness, nausea, weakness, shooting pain in the arms or legs, gastric pain, blurred vision, changes in color perception, double vision, and blindness (see reference 3.3).

2.2.2 Avoid eye and skin contact by wearing eye protection and nitrile (including thin Best N-Dex), butyl, or neoprene gloves. Avoid breathing vapors by using only in a well-ventilated area. Keep away from heat, sparks, and flames.

2.3 Method C involves use of an air compressor to charge the internal tank of the water-level meter. Safety precautions include:

2.3.1 Air compressors that are belt-driven shall have a belt guard in place.

2.3.2 Air compressors shall not be operated above the rated capacities and shall be configured to avoid having any dead-end fittings above 20 pounds per square inch (psi). Carefully check for loose connections before operating.

2.3.3 Use proper lifting techniques when lifting air compressors.

2.3.4 Ensure that the air compressor is equipped with an over-pressure relief valve and regulator.

2.3.5 The air compressors used for Method C are gasoline-powered.

2.3.5.1 Gasoline is a DOT-regulated material; its hazard class is Flammable Liquid. Gasoline has an OSHA PEL–TWA of 300 ppm and a PEL-STEL of 500 ppm (see reference 3.2).

2.3.5.2 Avoid eye and skin contact by wearing eye protection and nitrile or butyl gloves. Avoid breathing vapors by using only in a well-ventilated area. Keep away from heat, sparks, and flames.

2.3.5.3 Some of the symptoms of gasoline exposure include dizziness, intoxication, blurred vision, headache, skin irritation, and flushed facial skin tone (see reference 3.3).

2.3.5.4 Gasoline shall be stored in Factory Mutual–approved safety cans. Safety cans shall be well secured in the vehicle during transport. Gasoline-powered compressors must be cool before filling, and care shall be taken to avoid spilling any gasoline.

2.3.5.5 A 10-pound dry chemical fire extinguisher should be available when fueling the compressor.

3. Referenced Documents

3.1 American Society for Testing and Materials, *2004 Annual Book of ASTM Standards*, Section 11, "Water and Environmental Technology," Vol. 11.04, Environmental Assessment; Hazardous Substances and Oil Spill Responses; Waste Management:

ASTM D 4448-01—Standard Guide for Sampling Groundwater Monitoring Wells.

3.2 *Code of Federal Regulations* (CFR), Title 29, "Labor":

29 CFR 1910, Occupational Safety and Health Standards.

3.3 Micromedex, Inc., *TOMES Plus*, CD-ROM Database, Vol. 13, Chicago, IL, 1992.

3.4 QED Environmental Systems, Inc. *Well Wizard Model 6010E Electronic/Pneumatic Water Level Meter Installation and Operation Instructions*. Ann Arbor, MI, 1991.

3.5 U.S. Department of Energy, *The Environmental Survey Manual*, Appendix E, "Field Sampling Protocols and Guidance," Office of the Assistant Secretary, Environment, Safety and Health, Vol. 4, DOE/EH–0053, 1987.

3.6 U.S. Environmental Protection Agency, *Handbook of Groundwater*, EPA/625/6–87/016, 1987.

3.7 U.S. Environmental Protection Agency, *Practical Guide for Groundwater Sampling*, EPA/600/ 2–85/104, 1985.

4. Terminology

4.1 *Conductivity cell*—A simple electrical circuit that, when completed, causes electrical current to flow.

4.2 *Dedicated water-level probe*—A stainless steel probe permanently attached with polyethylene tubing to the cap of a well and used to obtain water-level information.

4.3 *Electric water-level sounder*—An electronic probe that uses a conductivity cell to activate an alarm when it contacts a conductive liquid.

4.4 *Electronic/pneumatic water-level meter*—A device that uses an internal compressed air source (pneumatic) to force air down the dedicated water-level probe. The meter senses the amount of pressure needed to push the water out of the dedicated water-level probe using a pressure transducer and associated circuitry and software (electronic). The meter converts this pressure to the depth of submersion of the probe.

4.5 *Interface probe*—A probe designed to detect conductive and nonconductive layers in a well.

4.6 *Monitoring well*—A well installed for the purposes of obtaining water quality data, hydrogeologic information, and/or water-level data.

5. Significance and Use

5.1 Accurate measurements of water depth are necessary in the calculation of well bore volumes; measurements to the nearest 0.01 foot (ft) are routine.

Method A
Water-Level Measurements Using an Electric Sounder

6. Apparatus

6.1 Electric sounder. (There are many adequate electric sounders available. This procedure covers most models.)

6.2 Kimwipes or equivalent lint-free tissue.

6.3 Distilled or deionized water in a squeeze wash bottle.

6.4 Measuring tape with an engineering scale.

7. Procedure

7.1 The following procedure is supplemental to the instruction found in the instrument-specific operating manual:

7.1.1 Check the sounder to ensure the batteries are charged.

7.1.2 Clean the probe of the sounder with distilled or deionized water and wipe dry with a lintfree tissue.

7.1.3 Slowly lower the probe into the well until the indicator sounds.

7.1.4 Raise the probe slightly until the indicator stops sounding.

7.1.5 Carefully lower the probe until the indicator sounds again and read the depth to water to the nearest 0.01 ft, using a measuring tape with an engineering scale if necessary.

7.1.6 Repeat Steps 7.1.4 and 7.1.5 until a repeatable measurement is achieved.

7.1.7 Record the depth to water to the nearest 0.01 ft.

7.1.8 Slowly withdraw the probe from the well while wiping the cable with a lint-free tissue moistened with distilled or deionized water.

7.1.9 Clean the probe with distilled or deionized water and wipe dry with a lint-free tissue.

8. Procedure Bias

8.1 With this method, water-level measurements must be repeatable to ± 0.01 ft. The accuracy of the probe shall be routinely checked against a steel measuring tape to ensure that the cable has not stretched or twisted.

Method B
Water-Level Measurements Using an Interface Probe

9. Apparatus

9.1 Soiltest Model 447–000 Interface Probe or equivalent.

9.2 Kimwipes or equivalent lint-free tissue.

9.3 Distilled or deionized water in a squeeze wash bottle.

9.4 Methanol

10. Procedure

10.1 The following procedure is supplemental to the instruction found in the instrument-specific operating manual:

10.1.1 Clean the probe with methanol, followed by a distilled or deionized water rinse, and wipe dry with a lint-free tissue.

10.1.2 Check the battery level and replace if low.

10.1.3 Slowly lower the probe into the well until the probe comes in contact with liquid. A steady audible alarm indicates an immiscible, nonconductive liquid, while an oscillating alarm indicates a conductive liquid (water).

10.1.4 When the alarm sounds, raise the probe slightly until the alarm stops. Carefully lower until the alarm sounds again and note the depth. Repeat as necessary until a repeatable measurement of ± 0.01 ft is achieved. Record this measurement.

10.1.5 If a LNAPL layer is present as indicated by a steady audible alarm, the thickness can be measured by recording the point at which the steady alarm begins and the point at which the oscillating alarm begins. The difference between the two measurements is the thickness of the LNAPL layer.

10.1.6 If a DNAPL layer is suspected, it can be measured by slowly lowering the probe to the bottom of the well. If a DNAPL layer is present, the thickness can be measured by recording the difference between the point at which the steady alarm begins and the point at which the probe reaches the bottom of the well.

10.1.7 Carefully withdraw the probe from the well while wiping the cable with a lint-free tissue moistened with distilled or deionized water. If the well contained any LNAPL layers, the cable shall be rinsed with methanol followed by a distilled or deionized water rinse and wiped dry with a lint-free tissue as it is being removed from the well.

10.1.8 Clean the probe with methanol, followed by a distilled or deionized water rinse, and dry with a lint-free tissue.

11. Procedure Bias

11.1 When using the interface probe for liquid level measurements, readings of ± 0.01 ft can be achieved. The accuracy shall be routinely checked using a steel measuring tape to determine if the cable has stretched or twisted.

Method C
Water-Level Measurements Using a Well Wizard Model 6010E Electronic/Pneumatic Water-Level Meter with a Dedicated Water-Level Probe

12. Apparatus

12.1 Well Wizard Model 6010E electronic/ pneumatic water-level meter.

12.2 Well Wizard Model 6111 stainless steel water-level probe and associated polyethylene tubing, fittings, and cap assembly.

12.3 Well Wizard Model 6015 calibration assembly.

12.4 Well Wizard 41000 series oil-free compressor or equivalent.

13. Procedure

13.1 The following procedure is supplemental to the instruction found in the instrument-specific operating manual (see reference 3.4):

13.1.1 Rapid temperature changes will adversely affect the water-level meter operation. The meter must equilibrate to ambient temperature conditions for a minimum of 45 minutes before use.

13.1.2 Charge the internal tank of the water-level meter to 100 psi by attaching an oil-free air supply to the fitting marked "TANK RECHARGE."

13.1.3 Move the "SENSOR" switch to the "ON" position.

13.1.4 Wait for the liquid crystal display (LCD) message to read "ATTACH TO WELL."

13.1.5 Attach the meter air tubing from the water-level meter fitting marked "TO AIR PROBE" to the white air fitting on the well cap.

13.1.6 Move the "AIR" switch forward to the "ON" position.

13.1.7 Press the "START" button once.

13.1.8 Press the "AIR PRECHARGE" until the LCD display shows the highest reading.

13.1.9 Leave the "AIR" switch in the "ON" position. The LCD message will read "PROBE SUBMERSION DEPTH B," and the reading shall be recorded when the depth stabilizes.

13.1.10 Move the "AIR" and "SENSOR" switches back to the "OFF" position.

13.1.11 To determine the depth to water, subtract the probe submersion depth from the probe length determined during installation.

13.1.12 When the batteries begin to get low, the LCD message will read "WARNING! LOW BATTERIES" after pressing the "START" button. Pressing the "START" button again will allow additional limited use, but the batteries must be replaced soon.

13.1.13 If the LCD message reads "BATTERY TOO LOW! TURN SYSTEM OFF," the meter shall not be used until the batteries are replaced.

14. Calibration

14.1 This calibration procedure shall be performed before each round of water-level measurements.

14.1.1 Place water in the calibration test tube to a convenient level on the scale marked on the side of the tube.

14.1.2 Charge the internal tank of the water-level meter to 100 psi by attaching an oil-free air supply to the fitting marked "TANK RECHARGE."

14.1.3 Move the "SENSOR" switch to the "ON" position.

14.1.4 Wait for the LCD message to read "ATTACH TO WELL."

14.1.5 Attach the meter air tubing from the water-level meter fitting marked "TO AIR PROBE" to the air fitting on the top of the calibration test tube.

14.1.6 Move the "AIR" switch forward to the "ON" position.

14.1.7 Press the "START" button once.

14.1.8 Press the "AIR PRECHARGE" button until the LCD display reads the highest number.

14.1.9 Move the "AIR" switch back to the "OFF" position.

14.1.10 Wait for the LCD message to read "PROBE SUBMERSION DEPTH" and for the depth reading to stabilize.

14.1.11 Compare the meter reading to the actual water level in the calibration test tube. If the meter does not read the actual water level observed in the calibration test tube, remove the

"CALIBRATION" panel screw and the epoxy seal from the internal calibration screw.

14.1.12 Slowly adjust the internal calibration screw until the meter reading matches the actual water level observed in the calibration test tube.
14.1.13 Repeat Steps 14.1.3 through 14.1.11 to check the calibration.

14.1.14 Apply a small amount of epoxy or a similar locking compound to the calibration screw to lock it into position.

14.1.15 Reinstall the meter "CALIBRATION" panel screw.

15. Procedure Bias

15.1 The accuracy of this system of water-level measurements is ± 0.01 ft between 40 °F and 120 °F, and ± 0.02 ft between –20 °F and 40 °F.

16. Quality Assurance

16.1 The following information shall be logged when taking water-level measurements:

16.1.1 Date and time of measurements.

16.1.2 Well identification and site.

16.1.3 Name of person performing the measurement.

16.1.4 Reference point if not top of casing.

16.1.5 Remarks if necessary, e.g., wells pumping nearby, recent heavy rains, ice in well.

16.1.6 Depth to water.

16.1.7 Depths to top of LNAPLs and DNAPLs and thicknesss of layers (Method B only).

16.1.8 Length of dedicated water-level probe (Method C only).

16.1.9 Depth of submersion of water-level probe (Method C only).

16.1.10 Date and time of calibration and any calibration adjustments made (Method C only).

17. Keywords

17.1 Calibration test tube, conductivity cell, dedicated water-level probe, electric sounder, electronic/pneumatic water-level meter, interface probe, monitoring well, and probe submersion depth.

Standard Practice for Purging of Monitoring Wells

Introduction

To obtain a representative ground water sample, the stagnant water in the well casing shall be removed. The recommended amount of purging depends on many factors such as the hydrogeological nature of the aquifer, the characteristics of the well, the type of sampling equipment to be used, and the parameters to be sampled. There is no one standard that will fit all situations. The general rule-of-thumb is to monitor the purge water using an in-line flow cell for pH, conductivity, and temperature. When these parameters stabilize to ± 10 percent for two successive well volumes, the sampler can be reasonably assured that the stagnant water has been removed from the well casing.

1. Scope

1.1 The four methods provided here are representative of those generally used to purge monitoring wells. Each method has advantages and disadvantages that must be considered. A review of Section 7, "Well Purging Strategies," General Considerations for the Sampling of Liquids [LQ–1(G)] (reference 3.2), provides guidance for selecting the proper method.

	Section
Method A—Well Purging Using a Peristaltic-Type Pump	6–8
Method B—Well Purging Using a Bladder-Type Pump	9–11
Method C—Well Purging Using a Bailer	12–14
Method D—Well Purging Using a Submersible Pump	15–17

2. Hazard Analysis

2.1 These procedures use gasoline-powered electric generators, gasoline-powered air compressors, and battery-powered pumps and accessories. The following safety precautions shall be followed.

2.1.1 Air compressors that are belt driven shall have a belt guard in place.

2.1.2 Care shall be taken when connecting and disconnecting equipment powered by lead-acid batteries to avoid generating sparks that have the potential of creating an explosive hazard.

2.1.3 Gasoline shall be stored in Factory Mutual-approved safety cans. Safety cans shall be well secured in the vehicle during transport. Gasoline-powered equipment shall be cool before filling and care shall be taken not to spill any gasoline.

2.1.4 Air compressors shall not be operated above rated capacities and shall be configured to avoid having any dead end fittings above 20 pounds per square inch (psi). Carefully check for loose connections before operating.

2.1.5 Gasoline is a Department of Transportation (DOT)-regulated material; its hazard class is Flammable Liquid. Avoid eye and skin contact by wearing eye protection and disposable gloves. Avoid breathing vapors. Use only in a well-ventilated area and keep away from heat, sparks, and flames.

2.1.6 Gasoline-powered generators shall not be operated above their rated capacity.

2.1.7 Care shall be used when lifting generators and air compressors. Proper lifting techniques shall be used when lifting heavy equipment.

2.1.8 Site-specific controls are available in the planning documents for a particular project.

3. Referenced Documents

3.1 American Society for Testing and Materials, *2004 Annual Book of ASTM Standards*, Section 11, "Water and Environmental Technology," Vol. 11.04, Environmental Assessment; Hazardous

Substances and Oil Spill Responses; Waste Management:

ASTM D 4448-01—Standard Guide for Sampling Ground-Water Monitoring Wells.

3.2 *Environmental Procedures Catalog* (STO 6):

General Considerations for the Sampling of Liquids [LQ–1(G)].

Standard Test Method for the Measurement of Water Levels in Ground Water Monitoring Wells (LQ–2(T)].

Standard Practice for the Use of a Flow Cell for Field Measurements [LQ–10(P)].

3.3 U.S. Department of Energy, *The Environmental Survey Manual*, Appendix E, Volume 4, DOE/EH–0053 1987.

3.4 U.S. Environmental Protection Agency, *Practical Guide for Groundwater Sampling*, EPA/600/2–85/104, 1985.

3.5 U.S. Environmental Protection Agency, *Handbook of Groundwater*, EPA/625/6–87/016, 1987.

4. Significance and Use

4.1 Water may become stagnant in a well and will not reflect the local resident water's chemical and physical properties. The purging of a well can reduce this bias. Care shall be taken to allow screened intervals to come to equilibrium before sampling is performed.

5. Calculation of Volume of Standing Water in a Well

5.1 Calculations are performed for the amount of water in the well with the following formula:

$$r^2 \times \pi \times (h1 - h2) \times 7.48 = \text{gallons per casing volume}$$

where

r = radius of well casing (feet) (the radius of the well is obtained from the well completion logs or can be measured with a tape measure),

h1 = depth of well (feet) from the top of the well casing (the depth of the well is obtained from the well completion logs), and

h2 = depth to water (feet) measured from the top of the well casing (the depth of water is measured using the Standard Test Method for the Measurement of Water Levels in Ground Water Monitoring Wells [LQ–2(T)]).

Method A
Well Purging Using a Peristaltic-Type Pump

6. Apparatus

6.1 Peristaltic-type pump.

6.2 Silicone, C-FLEX, or neoprene tubing for the pump head.

6.3 Silicone, Teflon, polyethylene, or vinyl tubing for placing in the well.

6.4 Generator or other source of electricity.

6.5 Gasoline for generator. (Gasoline is a DOT-regulated material; its hazard class is Flammable Liquid.)

7. Procedure

7.1 The following procedure is supplemental to the instruction in the instrument-specific operating manual.

7.1.1 Place the suction line in the well so it is just below the liquid surface.

7.1.2 Connect the suction line to the pump.

7.1.3 Connect the pump outlet to the in-line flow cell, see reference 3.2, or place the pump outlet hose into an open container to be used to make the field measurements.

7.1.4 Place calibrated pH, conductivity, and temperature electrodes into the in-line flow cell or the open container.

7.1.5 Initiate pumping and follow the water level down the well bore if the recovery rate of the well is below the pumping rate.

NOTE: Purge water may have to be contained and properly disposed of. Consult the site-specific planning documents for requirements.

7.1.6 Routinely monitor and record the volumes purged and the readings for the pH, conductivity, and temperature.

7.1.7 When these readings have stabilized to ± 10 percent for two successive well volumes, sampling can begin.

7.1.8 Remove the suction line from the well, and clean and decontaminate the suction line and pump tubing, as required.

8. Procedure Bias

8.1 The advantages of purging with a peristaltic pump are that (1) a peristaltic pump is relatively portable, inexpensive, and convenient; (2) it requires a minimum of down-hole equipment; and (3) it can be cleaned easily or the entire tubing can be changed between wells.

8.2 The disadvantages of purging with a peristaltic pump are that (1) purging is limited to situations where the water levels are less than about 25 feet and (2) degasing occurs whenever there is a head difference between the pump and the water level.

Method B
Well Purging Using a Bladder-Type Pump

9. Apparatus

9.1 Bladder-type pump.

9.2 Air compressor.

9.3 Teflon, polyethylene, or vinyl tubing for the air and sample lines.

9.4 Gasoline for the air compressor. (Gasoline is a DOT-regulated material; its hazard class is Flammable Liquid.)

10. Procedure

The following procedure is supplemental to the instruction found in the instrument-specific operating manual.

10.1 Lower the pump gently to a position just above the screened interval.

10.2 Connect the air line to the pump controller.

10.3 Connect the pump outlet to an in-line flow cell; see Standard Practice for the Use of a Flow Cell for Field Measurements [LQ–10(P)].

10.4 Place calibrated pH, conductivity, and temperature electrodes in the flow cell or the open container.

10.5 Initiate pumping and routinely monitor and record the volume purged and the pH, conductivity, and temperature measurements.

NOTE: Purge water may have to be contained and properly disposed of. Consult the site-specific planning documents for requirements.

10.6 When these readings have stabilized to ± 10 percent for two successive well volumes, sampling can begin.

10.7 Remove the pump from the well; clean and decontaminate as required.

11. Procedure Bias

11.1 The advantages of using a bladder-type pump for purging are that (1) the system is not damaged by dry pumping, (2) there is no air/water contact, and (3) the entire assembly can be made of Teflon or stainless steel.

11.2 The disadvantages of using a bladder-type pump are that (1) pumping rates are relatively slow, (2) there is a high rate of air consumption during prolonged pumping, and (3) cleaning and decontamination are more difficult than with the apparatus used in methods A or C.

Method C
Well Purging Using a Bailer

12. Apparatus

12.1 Teflon or stainless steel bailer.

12.2 Teflon or stainless steel cable or line.

12.3 Bailer reel.

13. Procedure

13.1 Attach the bailer to the cable or line.

13.2 Lower the bailer slowly until it contacts the liquid.

13.3 Allow the bailer to sink until it is totally submerged.

13.4 Slowly raise the bailer to the surface.

13.5 Tip the bailer or use a bottom-emptying device and fill a container in which calibrated pH, conductivity, and temperature probes have been placed.

NOTE: Purge water may have to be contained and properly disposed of. Consult the site-specific planning documents for requirements.

13.6 Routinely monitor and record the pH, conductivity, temperature, and volume purged.

13.7 When the readings have stabilized to ± 10 percent for two successive well volumes, sampling can begin.

13.8 Clean and decontaminate the bailer, as required.

14. Procedure Bias

14.1 The advantages of using bailers for well purging are that (1) bailers can be constructed of a variety of materials, (2) external power sources are not needed, (3) bailers are inexpensive, (4) bailers are easily cleaned and decontaminated, and (5) bailers can be used in wells of virtually any depth.

14.2 The disadvantages of using bailers are that (1) evacuating large amounts of stagnant water is labor intensive; (2) aeration, degasing, and turbulence will occur; (3) it is difficult to determine the depth to which the bailer has been submerged; and (4) bailer check valves may not operate properly under conditions of high suspended solids.

Method D
Well Purging Using a Submersible Pump

15. Apparatus

15.1 Submersible-type pump.

15.2 Discharge tubing of vinyl, polyethylene, polyvinyl chloride, or Teflon.

15.3 Power source of generator or batteries.

15.4 Gasoline for generator. (Gasoline is a DOT-regulated material; its hazard class is Flammable Liquid.)

16. Procedure

16.1 The following procedure is supplemental to the instructions provided in the instrument-specific operating manual.

16.2 Set up the pump according to the operating manual.

16.3 Gently lower the pump down the well so that the pump head is submerged sufficiently and will not run dry.

CAUTION: Submersible pumps cannot be allowed to run dry.

16.4 Connect the pump outlet to an in-line flow cell; see Standard Practice for the Use of a Flow Cell for Field Measurements [LQ–10(P)].

16.5 Place calibrated pH, conductivity, and temperature electrodes in the flow cell or the open container.

16.6 Initiate pumping, and monitor and record the volumes purged and the pH, conductivity, and temperature measurements.

NOTE: Purge water may have to be contained and properly disposed of. Consult the site-specific planning documents for requirements.

16.7 When pH, conductivity, and temperature have stabilized for two successive well volumes, sampling can begin.

16.8 Remove the pump from the well; clean and decontaminate.

17. Procedure Bias

17.1 The advantages of using a submersible pump for well purging are that (1) relatively high pumping rates are possible, (2) some designs are relatively portable and easy to use, and (3) these pumps can pump from greater depths than the pumps used in methods A or B.

17.2 The disadvantages of using a submersible pump are that (1) high pumping rates and the mechanical actions cause turbulence, aeration, and degasing of the water; (2) pumps are easily damaged by dry pumping; and (3) these pumps can be difficult to clean and decontaminate.

18. Quality Assurance

18.1 All of the methods listed above require the following information to be logged for quality-assurance documentation.

18.1.1 Depth to water.

18.1.2 Depth of well.

18.1.3 Well diameter or radius.

18.1.4 Depth of water.

18.1.5 Calculated water volume.

18.1.6 Type of mechanism used to evacuate the well.

18.1.7 Date.

18.1.8 Well identification.

18.1.9 Name of person performing the purging.

18.1.10 Volume purged.

18.1.11 Conductivity, pH, and temperature measurements.

19. Keywords

19.1 Bailer, bladder-type pump, peristaltic-type pump, submersible pump, and well purging.

End of current text

Standard Test Method for the Field Measurement of pH

Introduction

Perhaps no water-quality parameter is measured as frequently as pH. The pH measurement is so easily made that the attention given to it is often inadequate. An accurate pH is critical for the prediction and interpretation of the reactions and migration of dissolved species. This procedure provides a useful pH measurement under most field situations.

1. Scope

1.1 This is the procedure for the measurement of pH in an aqueous solution. The pH is determined using a glass hydrogen-ion electrode compared against a reference electrode of known potential by means of a pH meter.

2. Hazard Analysis

2.1 No hazards requiring controls have been identified. Site-specific controls are available in the planning documents of a particular project.

3. Referenced Documents

3.1 American Society for Testing and Materials, *2004 Annual Book of ASTM Standards*, Section 11, "Water and Environmental Technology," Vol. 11.01, Water (I): ASTM D 1293-99, Standard Test Methods for pH of Water.

3.2 American Public Health Association, American Water Works Association, and Water Pollution Control Federation, *Standard Methods for the Examination of Water and Wastewater: American Public Health Association*, Washington, D.C., 1980.

3.3 Environmental Procedures Catalog, (STO 6):

Standard Practice for the Use of a Flow Cell for Field Measurements [LQ–10(P)].

3.4 Korte, N., and D. Ealey, *Procedures for Field Chemical Analyses of Water Samples*, Technical Measurements Center, U.S. Department of Energy, Grand Junction Area Office, GJ/TMC–07(83), 1983.

3.5 Wood, W.W., "Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents," *Techniques of Water-Resources Investigations of the United States Geological Survey*, Chapter D2, Book 1: U.S. Government Printing Office, Washington, D.C., Stock Number 024–001–02879–4, 1976.

4. Significance and Use

4.1 The pH of a solution is defined as the negative logarithm to the base 10 of the hydrogen-ion activity in moles per liter: $pH = -\log [H^+]$. Because pH is exponentially related to concentration, great care shall be taken in making the measurement.

4.2 Natural waters usually have pH values in the range of 4 to 9. The primary control over pH in natural waters is the carbonate system, including gaseous and dissolved carbon dioxide, bicarbonate, and carbonate ions.

5. Interferences

5.1 Temperature, atmospheric contamination, and ionic strength are factors that affect pH measurements. The pH measurement is relatively free from interference from color, turbidity, colloidal matter, oxidants, or reductants.

5.1.1 *Temperature*—The temperature compensation on a pH meter only permits adjustment of the electrode slope. It does not compensate for changes in the potential of the reference electrode, the asymmetry potential of the glass electrode, or the liquid-junction potential. Nor does it compensate for changes in pH due to temperature. Thus, the temperature of

the buffer and the unknown shall be recorded at the time of measurement. Ideally, their temperatures shall be within 10 °C.

5.1.2 *Atmospheric Contamination*—Atmospheric contamination can be a significant problem for ground water samples. Dissolved oxygen and carbon dioxide can be evolved or dissolved when the sample is exposed to air, and a considerable change in pH may result. In situ measurements should be taken where possible but, for ground water that must be pumped, the use of a flow cell gives the best results. See Standard Practice for the Use of a Flow Cell for Field Measurements [LQ–10(P)].

5.1.3 *Ionic Strength*—Because of errors due to ionic strength (which are not worth correcting in the field), pH measurements shall be accompanied by a measurement of the specific conductance. The pH is a measurement of the hydrogen-ion activity. An ideal solution is assumed in which other ions do not affect the hydrogen activity. This assumption deteriorates if the ionic strength is too high. Similarly, samples with low ionic strength will cause difficulties because the resistance of the sample approaches that of the glass electrode. For best results, samples with very low ionic strength should be stirred for a few seconds prior to the reading. Even then, it may require several minutes for the reading to stabilize.

5.1.4 *High Sodium and Alkalinity*—High sodium and alkalinity may also produce errors in the pH measurement. For pH 9 and a sodium concentration of 10 moles per liter, a special electrode is needed. Similarly, any pH value that is less than 1 or greater than 9 will have a greater uncertainty associated with it because the electrode response is non-Nernstian in these regions.

6. Apparatus

6.1 Numerous pH meters are available; the meter used should have a temperature-compensating device, have a slope adjustment, and be capable of reading pH to ± 0.01 units.

6.2 A flow cell to be used for continuous-flow measurements.

6.3 Standard pH-buffer solutions of 4.00, 7.00, and 9.00 or 10.00.

6.4 Combination pH electrode.

6.5 Temperature-measuring device capable of reading temperatures to ± 0.1 °C.

6.6 Distilled or deionized water in a squeeze wash bottle.

6.7 Kimwipes or equivalent lint-free tissue.

6.8 Disposable beakers, test tubes, or centrifuge tubes.

7. Calibration

7.1 In each case, samplers shall follow the manufacturer's instructions for the pH meter and electrode used. Electrodes shall be kept wet when not in use. Recommended solutions for storage are the pH 4.00 or pH 7.00 buffer.

7.2 Before use, remove the electrode from the storage solution, rinse with distilled water, and blot dry with a lint-free tissue.

7.3 Adjust buffer solution and electrode to ± 10 °C of the sample temperature. This can be done by storing the buffer solutions and electrode in an ice chest or by letting sample water run over the buffer bottles and electrode until the temperatures have equilibrated.

7.4 Place the electrode in the pH 7.00 buffer, adjust the temperature compensation control to the temperature of the buffer (or use an automatic temperature compensator), and adjust the calibration control to read the pH of the buffer. The pH of the buffer is equal to 7.00 only at 25 °C; therefore, it is necessary to use the temperature-correction curve supplied by the manufacturer of the buffer.

7.5 Remove the electrode from the 7.00 buffer, rinse with distilled water, and blot dry. Place the electrode in either pH 4.00 or pH 10.00 buffer,

bracketing the expected pH of the sample. Allow the reading to stabilize before making adjustments. Adjust the slope control to read the correct pH, again consulting the temperature-correction curve supplied by the manufacturer.

7.6 Rinse the electrode with distilled water and blot dry. Recheck value of the pH 7.00 buffer. The value shall be within ± 0.02 pH of the correct value. If not, repeat Steps 7.4, 7.5, and 7.6.

8. Procedure

8.1 The following general procedure supplements the instruction in the instrument-specific operating manual.

8.1.1 Rinse the calibrated electrode (see Section 7) with distilled water, blot dry, and immerse electrode in the solution.

8.1.2 Use of a flow cell is recommended for making pH measurements; this reduces the interferences that are due to atmospheric contamination. If possible, in situ measurements are the best.

8.1.3 Allow the measurement to stabilize and record the reading.

8.1.4 Remove the electrode from the solution, rinse with distilled water, blot dry, and store in pH 4.00 or pH 7.00 buffer solution.

9. Quality Assurance

9.1 The following information about the field measurement of pH shall be logged for quality-assurance documentation.

9.1.1 Time of the last two-buffer calibration. The two-buffer calibration shall be performed a minimum of once each hour.

9.1.2 Buffer temperature at time of calibration.

9.1.3 Sample temperature at time of measurement.

9.1.4 Measurement conditions (i.e., in situ, open container, or air-exclusion container).

9.1.5 Source and expiration date of buffers used.

9.1.6 Instrument manufacturer and model number.

9.1.7 Name of person performing the measurement.

10. Precision and Bias

10.1 Precision of ± 0.02 pH units and an accuracy of ± 0.05 pH units can be achieved. However, ± 0.1 pH units represent the limit of accuracy under normal conditions.

11. Keywords

11.1 Electrode, flow cell, pH, and pH meter.

End of current text

Standard Test Method for the Field Measurement of Specific Conductance

Introduction

Specific conductance is a widely used indicator of water quality. It measures the ability of water to carry an electrical current under specific conditions. This ability depends on the presence of ions and their total concentration, mobility, and temperature. Specific conductance is a simple indicator of change within a system and is used as an aid in evaluating whether a sample is representative of the water in the system.

1. Scope

1.1 This procedure describes the field measurement of the specific conductance of an aqueous sample. The specific conductance is measured using a conductance meter and a platinum or stainless steel electrode.

2. Hazard Analysis

2.1 No hazards requiring controls have been identified. Site-specific controls are available in the planning documents for a particular project.

3. Referenced Documents

3.1 American Public Health Association, American Water Works Association, and Water Pollution Control Federation, *Standard Methods for the Examination of Water and Wastewater: American Public Health Association*, Washington, D.C., 1980.

3.2 Korte, N. and D. Ealey, *Procedures for Field Chemical Analyses of Water Samples*, Technical Measurements Center, U.S. Department of Energy, Grand Junction Area Office, GJ/TMC–07(83), 1983.

3.3 Wood, W.W., "Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents," *Techniques of Water-Resources Investigations of the United States Geological Survey*, Chapter D2, Book 1: U.S. Government Printing Office, Washington, D.C., Stock Number 024–001–02879–4, 1976.

4. Significance and Use

4.1 The specific conductance or conductivity of a sample is defined as the conductance of the sample between opposite sides of a cube, 1 centimeter (cm) in each direction. Because it is impractical to build electrodes with these characteristics, electrodes are manufactured in various forms. A cell constant is determined by measuring a solution of known conductivity. Solutions of known conductivity are purchased or can be made from reagent-grade KCl. Samplers shall consult operating instructions for the specific instrument used for the determination of the cell constant. This conductivity is expressed in micromhos per centimeter (μmhos/cm).

5. Interferences

5.1 Temperature, ionic strength, and the determination of the cell constant are features that affect the measurement of conductivity.

5.1.1 *Temperature*—The conductivity of a solution increases with temperature at approximately 2 percent per degree celsius. Significant errors can result from inaccurate temperature measurements.

5.1.1.1 If the conductivity meter does not have automatic temperature correction, the sampler can use the following formula to correct the conductivity reading for temperature:

$$K = \frac{Em}{1 + 0.0191(t - 25)}$$

where

K = corrected conductivity in μmhos/cm,

Em = measured conductivity in μmhos/cm, and

t = temperature in °C.

5.1.2 *Ionic Strength*—The conductivity of a solution is a function of the concentration and charge of the ions in solution and of the rate at which the ions move under the influence of an electrical potential. As the ionic strength increases, the rate at which the individual ions move decreases. Conductivity varies linearly with ionic strength for values below 1,000 μmhos/cm. As conductivity increases above 5,000 μmhos/cm, the line curves significantly; beyond 50,000 μmhos/cm, the conductivity is an unsatisfactory index of ionic concentration.

5.1.3 *Cell Constant*—The cell constant shall be checked and verified on a regular basis. A significant change in the cell constant indicates that the electrode needs cleaning or changing. Consult the instrument operating manual for procedures to check the cell constant, or see Section 7 of this procedure.

6. Apparatus

6.1 Specific conductance meter capable of measuring conductivity in the range of 0 to 100,000 μmhos/cm. This meter should also measure temperatures in the range of −5 °C to 50 °C.

6.2 Conductivity check solutions. Normally, 0.001 N, 0.01 N, and 0.1 N KCl solutions will cover the range of expected sample conductivity.

6.3 Distilled or deionized water in a squeeze bottle.

6.4 Disposable beakers, test tubes, or centrifuge tubes.

6.5 Kimwipes or equivalent lint-free tissue.

7. Calibration

7.1 An actual calibration of the instrument is not performed. The cell/instrument calibration is confirmed by use of standard check solutions as described below.

7.1.1 Connect the temperature probe and conductivity cell to the instrument.

7.1.2 Rinse the temperature probe and conductivity cell with distilled water and blot dry with a lint-free tissue.

7.1.3 Place the temperature probe and conductivity cell in the 0.001 N KCl standard and allow the readings to stabilize. Record the temperature and conductivity reading in the field logbook.

7.1.4 Repeat Steps 7.1.2 and 7.1.3 for the 0.01 N and the 0.1 N KCl standards.

7.1.5 Correct the readings to 25 °C using the formula in Section 5.1.1.1 and compare these readings to the standard values. If these readings are within ± 10 percent of the accepted value, the cell instrument-calibration check is acceptable.

7.1.6 If the cell/instrument calibration check is unacceptable, consult the instrument operation manual for cell cleaning and instrument trouble-shooting procedures.

8. Procedure

8.1 The following general procedure is supplemental to the instructions in the instrument-specific operating manual.

8.1.1 Rinse the conductivity cell and temperature probe with several volumes of sample water.

8.1.2 Immerse the probe and cell in the sample.

8.1.3 Allow the readings to stabilize and record the temperature and conductivity readings on the field log form.

8.1.4 Remove the probes from the solution, rinse with distilled water, blot dry, and store according to the manufacturer's recommended procedures.

9. Quality Assurance

9.1 The following information about the field measurement of specific conductance shall be logged for quality-assurance documentation.

9.1.1 Source and expiration date of standards.

9.1.2 Instrument manufacturer and model number.

9.1.3 Date and time of calibration check.

9.1.4 Temperature and conductivity of standards used to check calibration.

9.1.5 Sample temperature and conductivity reading.

9.1.6 Name of person performing the measurement.

10. Precision and Bias

10.1 Precision and accuracy of ± 5 percent can be achieved with this procedure at conductivity readings between 100 and 5,000 µmhos/cm. Readings between 0 and 100 µmhos/cm and above 5,000 µmhos/cm should provide ± 10 percent precision and accuracy. Readings above 20,000 µmhos/cm shall not be attempted with this procedure.

11. Keywords

11.1 Conductivity, ionic strength, and specific conductance.

End of current text

Standard Test Method for the Field Measurement of the Oxidation-Reduction Potential (ORP) for Calculation of Eh

Introduction

Knowledge of the Eh of a system is useful for predicting the migration or attenuation of contaminants in ground water or surface water. However, the oxidation-reduction potential (ORP) measurement should be used with caution. Only under certain conditions are ORP measurements, from which the Eh is calculated, reliable. Therefore, the resulting Eh value is primarily used as a descriptive tool.

1. Scope

1.1 This method describes the procedure for the measurement of ORP in aqueous samples and calculation of Eh. It does not address the theoretical interpretation of ORP. This procedure has been designed for routine field measurements.

2. Hazard Analysis

2.1 This test method uses a ZoBell solution for an Eh reference. This solution contains small concentrations of potassium cyanide. Potassium cyanide is a poison and should be handled with care. Samplers shall wear eye protection and disposable gloves to avoid eye and skin contact and shall keep the solution away from strong acids that will liberate hydrogen cyanide gas, which is extremely toxic.

2.2 Site-specific controls are available in the planning documents for a particular project.

3. Referenced Documents

3.1 American Society for Testing and Materials, *2004 Annual Book of ASTM Standards*, Section 11, "Water and Environmental Technology," Vol. 11.01, Water (I): ASTM D 1498-00, Standard Practice for Oxidation-Reduction Potential of Water.

3.2 Korte, N., and D. Ealey, *Procedures for Field Chemical Analyses of Water Samples*, Technical Measurements Center, U.S. Department of Energy, Grand Junction Area Office, GJ/TMC-07(83), 1983.

3.3 "Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents," in *Techniques of Water-Resources Investigations of the United States Geological Survey*, Chapter D2, Book 1, U.S. Government Printing Office, Washington, D.C., Stock Number 024-001-02879-4, 1976.

4. Significance and Use

4.1 ORP is defined as the electromotive force developed when a noble metal electrode and a reference electrode are placed in an aqueous sample. This potential, sometimes referred to as the redox potential, is related to the standard potential by the Nernst equation:

$$Eh = E^{\circ} + \frac{RT}{nF} \ln \frac{\text{oxidized state}}{\text{reduced state}}$$

where

E = standard potential of the reaction,

R = gas constant,

T = absolute temperature,

n = number of electrons involved in the half-cell reaction, and

F = Faraday constant.

The potential is reported as volts (V) or millivolts (mV) relative to the standard hydrogen electrode taken as zero.

5. Interferences

5.1 ORP measurements are sensitive to temperature change of the solution. Because the reference-electrode potential and the liquid-junction potential also vary with temperature,

instrumental compensation is not possible. Reference solutions used to check the accuracy of the electrode system should be within ± 10 °C of the sample temperature for the readings to be valid.

5.2 Reproducible ORP measurements cannot be obtained for chemical systems that are not reversible. Samples containing dissolved oxygen above 0.01 part per million (ppm) are essentially irreversible, and ORP measurements of these samples are not recommended. Because exposure to the atmosphere can cause rapid changes in dissolved oxygen, all sample measurements shall be taken in a closed, flow-through container or in situ.

5.3 Samples containing hydrogen sulfide will poison the electrode as will other ions that are stronger reducing agents than platinum.

5.4 ORP measurements are relatively free from interferences from color, turbidity, colloidal matter, and suspended matter.

6. Apparatus

6.1 Most field pH meters have the capability of measuring ORP by substitution of an appropriate set of electrodes. The meter should be capable of measuring ORP to ± 1 mV.

6.2 Combination ORP (Eh) electrode.

6.3 ZoBell reference solution.

Caution: This solution is poisonous and shall be handled with care.

6.4 Temperature-measuring device capable of reading temperatures to ± 0.1 °C.

6.5 A flow cell. See "Standard Practice for the Use of a Flow Cell for Field Measurements," [LQ-10(P)].

6.6 Distilled or deionized water in a squeeze wash bottle.

6.7 Kimwipes or equivalent lint-free tissue.

6.8 Disposable beakers, test tubes, or centrifuge tubes.

7. Calibration

7.1 An actual calibration of the ORP electrode system is not performed. Instead, samplers shall make a performance check to determine if the electrode and meter are functioning properly. The performance check is as follows:

7.1.1 Record temperature of ZoBell solution. This solution should be within ± 10 °C of sample temperature.

7.1.2 Place electrode in the ZoBell solution and compare the reading with the theoretical value for the ZoBell solution (see Figure 1). The reading should be within ± 10 mV of the theoretical value.

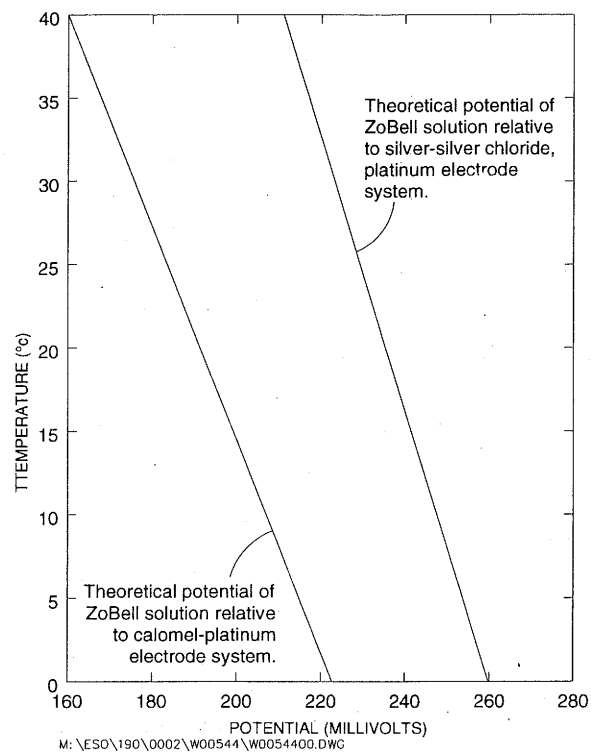

Figure 1. The Potential of ZoBell Solution Relative to Reference-Electrode Systems at Various Temperatures

7.1.3 If the reading is not within ± 10 mV, one of the following steps will usually solve the problem.

7.1.3.1 Check reference-electrode filling solution; fill or replace.

7.1.3.2 Polish the platinum end of the electrode (see manufacturer's instructions).

7.1.3.3 Replace electrode.

7.1.4 Rinse electrode with distilled water, blot dry, and store according to manufacturer's suggestions.

8. Procedure

8.1 Check electrode performance according to Section 7.1.2.

8.2 Rinse electrode with distilled water and blot dry with a lint-free tissue.

8.3 Place electrode in flow-through cell and pump sample through cell for several minutes to exclude air.

8.4 Turn function switch on meter to the millivolt mode.

8.5 Allow the readings to stabilize. Stabilization should occur within 20 minutes. Turn off sample flow to prevent any streaming potential.

8.6 Record the ORP reading and temperature.

8.7 Remove the electrode from the cell, rinse with distilled water, blot dry, and store according to manufacturer's suggestion.

9. Quality Assurance

9.1 The following information about the ORP measurement shall be logged for quality-assurance documentation.

9.1.1 Temperature of sample.

9.1.2 Temperature of ZoBell solution.

9.1.3 ORP of ZoBell solution.

9.1.4 Name of person performing the measurement.

10. Calculation

10.1 The Eh of the sample is calculated relative to the standard hydrogen electrode as follows:

$$D = A - B + C,$$

where

D = Eh of sample relative to the standard hydrogen electrode,

A = Observed ORP of sample,

B = Observed ORP of ZoBell solution, and

C = Theoretical Eh of ZoBell solution relative to the standard hydrogen electrode (Figure 2).

Report D to the nearest ± 10 mV.

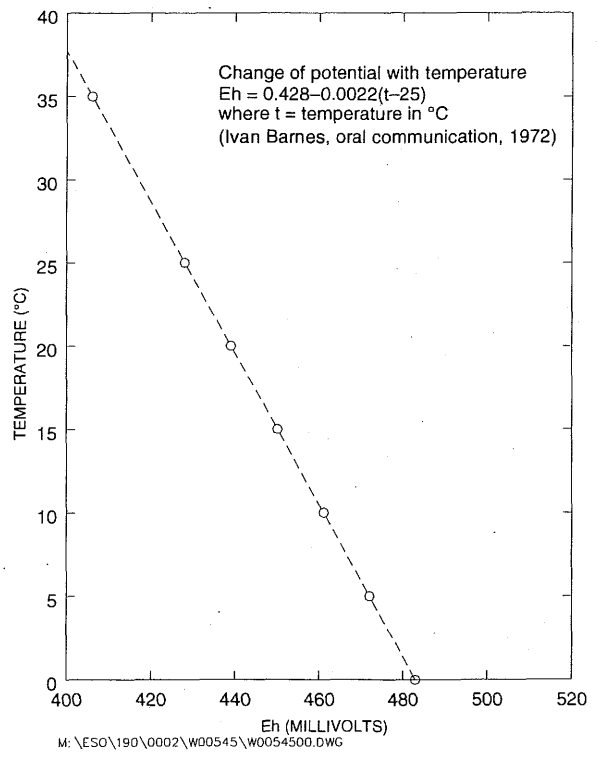

Figure 2. The Eh of ZoBell Solution, Relative to the Standard Hydrogen Electrode at Various Temperatures

11. Precision and Bias

11.1 Precision and accuracy of the measurement depend largely on the condition of the electrode system and the degree to which the sample fits the interference problems mentioned in Section 5. In the absence of substances that coat or poison the electrode, the precision is ± 10 mV.

12. Keywords

12.1 Eh, flow cell, oxidation-reduction potential, and ZoBell solution

Standard Test Method for the Field Measurement of Alkalinity

Introduction

The alkalinity of a water sample is a quantitative measurement of the ability of the sample to react with a strong acid to a designated pH. The alkalinity of natural waters is primarily a measure of the carbonate, bicarbonate, and hydroxide content. It is also a general indicator of ground water quality.

1. Scope

1.1 This method describes the field measurement of alkalinity of aqueous samples. It is a measure of the aggregate property of the sample and can be interpreted in the terms of specific substances, such as carbonate and bicarbonate, only when the chemical composition of the sample is known.

1.2 The sample is titrated with a standard acid solution to a designated pH, and the end point is determined by a color change of an internal indicator.

2. Hazard Analysis

2.1 This test procedure uses sulfuric acid (H_2SO_4). Sulfuric acid is a corrosive material and is a Department of Transportation (DOT)-regulated material; its hazard class is Corrosive Liquid. Avoid contact with eyes, skin, and clothing. Adequate ventilation, eye protection, and disposable gloves are required. First aid for eye and skin contact is to immediately flush with water for 15 minutes, remove contaminated clothing, and call a physician.

2.2 Site-specific controls are available in the planning documents for a particular project.

3. Referenced Documents

3.1 American Public Health Association, *Standard Methods for the Examination of Water and Wastewater*, American Water Works Association, and Water Pollution Control Federation, Washington, D.C., 1980.

3.2 American Society for Testing and Materials, *2004 Annual Book of ASTM Standards*, Section 11, "Water and Environmental Technology," Vol. 11.01, Water (I).

3.3 *Environmental Procedures Catalog* (STO 6):

> Standard Test Method for the Field Measurement of pH [LQ–4(T)].

3.4 Korte, N., and D. Ealey, *Procedures for Field Chemical Analyses of Water Samples*, Technical Measurements Center, U.S. Department of Energy, Grand Junction Area Office, GJ/TMC–07(83), 1983.

3.5 Wood, W. W., "Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents," *Techniques of Water-Resources Investigations of the United States Geological Survey*, Chapter D2, Book 1: U.S. Government Printing Office, Washington, D.C., Stock Number 024–001–02879–4, 1976.

4. Significance and Use

4.1 The alkalinity of natural water is commonly used to obtain a value for the carbonate and bicarbonate concentrations. Carbonate and bicarbonate determinations shall be made in the field at the time of sampling if the concentrations are to accurately reflect those concentrations originally present in the sample.

4.2 The following equations govern the reactions involved:

$CO_3^{2-} + H^+ = HCO_3^-$ (this reaction is complete near pH 8.3),

$HCO_3^- + H^+ = H_2O + CO_2$ (this reaction is complete near pH 4.5).

The end point of pH 8.3 is determined by the color change of the phenolphthalein indicator, and the end point of pH 4.5 is determined by the color change of the bromocresol green-methyl red indicator.

NOTE: If the measured pH of the sample is less than 4.5, there is no carbonate or bicarbonate alkalinity and this test method is not applicable.

5. Interferences

5.1 The measured values may include contributions from borates, phosphates, or silicates if these are present in the sample.

5.2 Natural color or the formation of precipitate while titrating the sample may mask the color change of the indicator, or waste materials may interfere chemically with the color change by destroying the indicator.

5.3 Varying results may be experienced with samples containing oxidizing or reducing substances.

6. Apparatus

6.1 Hach alkalinity test kit Model AL–DT. (This kit contains sulfuric acid, which is a DOT-regulated material; its hazard class is Corrosive Liquid.)

6.2 Distilled or deionized water in a squeeze bottle.

6.3 Kimwipes or equivalent lint-free tissue.

7. Procedure

7.1 Attach a clean, straight-stem delivery tube to a sulfuric acid titration cartridge. If the expected alkalinity is below 100 milligrams per liter (mg/L) as $CaCO_3$, use a 0.16 N H_2SO_4 cartridge; if it is above 100 mg/L as $CaCO_3$, use a 1.6 N H_2SO_4 cartridge; or if it is above 1,000 mg/L, use an 8.0 N H_2SO_4 cartridge. Twist the cartridge onto the titrator body.

7.2 Flush out the delivery tube by turning the small knob until a few drops of titrant are ejected from the tube. Wipe the tip and reset the counter to zero. Ensure that there are no air bubbles in the cartridge.

7.3 Take a sample by filling a clean 100-mL graduated cylinder to the 100-mL mark with water that has been filtered through a 0.45 micrometer (μm) filter. Pour the sample into a clean 250-mL Erlenmeyer flask.

7.4 Measure the pH of the sample; see Standard Test Method for the Field Measurement of pH [LQ–4(T)]. If the pH of the sample is less than 8.3, proceed to Step 7.8; if the pH of the sample is greater than 8.3, proceed to Step 7.5.

7.5 Add the contents of one phenolphthalein indicator Powder Pillow and swirl to mix.

7.6 If the color turns pink, titrate with the sulfuric acid standard solution to a colorless end point. If the pink color does not develop, proceed with Step 7.8.

7.7 Read and record the amount of acid used. This is the amount of carbonate alkalinity, sometimes referred to as phenolphthalein alkalinity. See Section 8 for calculations.

7.8 Add the contents of one bromocresol green-methyl red indicator Powder Pillow to the sample and swirl to mix.

7.9 Titrate the sample with the sulfuric acid standard solution until a light pink color is obtained. Read and record the amount of acid used. This is the amount of total alkalinity. See Section 8 for calculations.

7.10 Pour the titrated sample into a properly labeled disposal container, rinse the Erlenmeyer flask and the graduated cylinder with distilled or deionized water, and place the items back in the kit.

8. Calculations

8.1 The results are reported in mg/L as $CaCO_3$. The calculation depends on the normality of the

sulfuric acid titration cartridge used. The calculations are performed as follows.

8.1.1 When using the 0.16 N H_2SO_4 titration cartridge, the digital readout from the titrator is multiplied by 0.1 to obtain alkalinity results in mg/L as $CaCO_3$.

8.1.2 When using the 1.6 N H_2SO_4 titration cartridge, the results from the digital readout of the titrator are equivalent to mg/L as $CaCO_3$.

8.1.3 When using the 8.0 N H_2SO_4 titration cartridge, the results from the digital readout of the titrator are multiplied by 5.0 to obtain alkalinity in mg/L as $CaCO_3$.

9. Quality Assurance

9.1 The following information about the field measurement of alkalinity shall be logged for quality-assurance documentation.

9.1.1 Normality of the titration cartridge.

9.1.2 Phenolphthalein alkalinity.

9.1.3 Total alkalinity.

9.1.4 Name of person performing the measurement.

10. Precision and Bias

10.1 Under normal conditions, precision and accuracy of ± 15 percent can be expected from this procedure.

11. Keywords

11.1 Alkalinity, bicarbonate, carbonate, and titration.

End of current text

Standard Test Method for the Field Measurement of Temperature

Introduction

Temperature readings are important for numerous applications. They are used in the measurement of Eh, pH, conductivity, and dissolved oxygen and in saturation and stability studies. It is important to know the temperature of surface waters and ground waters for the accurate geochemical evaluation of equilibrium thermodynamics. Temperature readings of ± 1 °C are necessary for the above applications.

1. Scope

1.1 This procedure gives general guidance and recommendations that shall be considered when taking a temperature measurement. There are numerous instruments on the market that can provide adequate temperature measurements. Each instrument-operating manual shall be consulted for detailed procedures.

2. Hazard Analysis

2.1 No hazards requiring controls have been identified. Site-specific controls are available in the planning documents for a particular project.

3. Referenced Documents

3.1 American Public Health Association, American Water Works Association, and Water Pollution Control Federation, *Standard Methods for the Examination of Water and Wastewater*, Washington, D.C., 1980.

3.2 Wood, W.W., "Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents," *Techniques of Water-Resources Investigations of the United States Geological Survey*, Chapter D2, Book 1: U.S. Government Printing Office, Washington, D. C., Stock Number 024–001–02879–4, 1976.

4. Significance and Use

4.1 Temperature is a basic physical property that is measured by the response of matter to heat. There are many devices that, once calibrated, are acceptable for taking temperature measurements. These devices include liquid in glass (mercury in glass), thermocouples, bimetallic, and electrical-resistance thermometers. At a minimum, the device should measure temperature to ± 0.1 °C readability.

5. Interferences

5.1 The instrument-operating manual shall be consulted to identify any interferences particular to the device being used.

5.2 In general, the true sample temperature is affected by the atmospheric temperature of the surroundings and the temperature of the devices used to collect the sample.

6. Apparatus

6.1 Temperature-measuring device.

6.2 Distilled or deionized water in a squeeze wash bottle.

6.3 Kimwipes or equivalent lint-free tissue.

7. Calibration

7.1 The instrument-operating manual shall be consulted for specific calibrating procedures.

8. Procedure

8.1 Rinse the thermometer with distilled or deionized water and blot dry.

8.2 Immerse the thermometer in the sample.

8.3 Allow the reading to stabilize and record the temperature.

9. Quality Assurance

9.1 The following information about the temperature measurement shall be logged for quality-assurance documentation.

9.1.1 Instrument used.

9.1.2 Temperature of sample.

9.1.3 Name of person performing the measurement.

10. Precision and Bias

10.1 Precision is instrument dependent. Most measurement devices for field use are accurate to ± 0.1 °C.

11. Keywords

11.1 Temperature and thermometer.

Standard Test Method for the Field Measurement of Dissolved Oxygen

Introduction

Dissolved oxygen (DO) is required for the survival and growth of many aquatic organisms and the absence of dissolved oxygen may permit anaerobic decay of organic matter and the production of toxic and esthetically undesirable materials in the water. The measurement of dissolved oxygen is needed to accurately characterize the oxidation-reduction potential of a hydrologic system and can be an indicator of atmospheric contact of water before recharge to an aquifer.

1. Scope

1.1 This method contains the field procedures used to determine dissolved oxygen in aqueous samples using a polarographic technique with a membrane-covered electrode. The probe method is much more rapid and efficient than other methods, has fewer interferences, and can be used for continuous monitoring.

2. Hazard Analysis

2.1 This test method uses sodium sulfite and cobaltous chloride for the preparation of the zero-oxygen check solution. These chemicals are toxic in the concentrated form and the following precautions must be taken in the preparation of this solution. Avoid contact with the eyes and skin. Avoid breathing suspended particles. Adequate ventilation, eye protection, and disposable gloves are required. First aid for eye contact is to flush the eyes with water for 15 minutes and contact a physician. First aid for skin contact is to wash the area thoroughly with soap and water.

2.2 Site-specific controls are available in the planning documents for a particular project.

3. Referenced Documents

3.1 American Public Health Association, American Water Works Association, and Water Pollution Control Federation, *Standard Methods for the Examination of Water and Wastewater: American Public Health Association*, Washington, D.C., 1980.

3.2 American Society for Testing and Materials, *2004 Annual Book of ASTM Standards*, Section 11, "Water and Environmental Technology," Vol. 11.01, Water (I).

3.3 *Environmental Procedures Catalog*, (STO 6):

Standard Practice for the Use of a Flow Cell for Field Measurements [LQ–10(T)].

3.4 Korte, N., and D. Ealey, *Procedures for Field Chemical Analyses for Water Samples*, Technical Measurements Center, U.S. Department of Energy, Grand Junction Area Office, GJ/TMC–07(83), 1983.

3.5 Wood, W.W., "Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents," *Techniques of Water-Resources Investigations of the United States Geological Survey*, Chapter D2, Book 1: U.S. Government Printing Office, Washington, D. C., Stock Number 024–001–02879–4, 1976.

4. Significance and Use

4.1 Oxygen-sensitive membrane electrodes are composed of two solid metal electrodes separated from the sample by an oxygen-permeable membrane. The membrane serves as a diffusion barrier against impurities. The rate of oxygen diffusion across the membrane creates a current that is directly proportional to the amount of dissolved oxygen in the sample. This current is converted to concentration units during the calibration.

5. Interferences

5.1 Membrane electrodes are sensitive to temperature variations. Most DO meters have automatic temperature compensators that correct for these variations. If not, thermal equilibrium must be established between the sample being measured and the calibrating solution.

5.2 Oxygen-permeable membranes are also permeable to other gases that can affect the measurement. Chlorine and hydrogen sulfide will eventually desensitize the probe during long-term exposures. These gases are not normally found in ground water samples, or their concentrations are too small to cause significant problems.

5.3 Because atmospheric oxygen is rapidly absorbed by water samples, use of an air-exclusion chamber is required if in situ measurements cannot be made.

6. Apparatus

6.1 Dissolved oxygen meter, Yellow Springs Instruments (YSI) Model 57.

6.2 Yellow Springs Instruments (YSI) 5739 dissolved-oxygen probe.

6.3 Bottle of electrolyte and extra membranes for probe.

6.4 Sodium sulfite and cobaltous chloride.

6.5 Distilled or deionized water in a squeeze wash bottle.

6.6 Kimwipes or equivalent lint-free tissue.

6.7 Flow cell; see Standard Practice for the Use of a Flow Cell for Field Measurements [LQ–10(T)].

7. Calibration

7.1 The following steps describe the calibration of the YSI Model 57 meter and the YSI 5739 probe in water-saturated air.

7.1.1 Adjust the mechanical ZERO with the instrument turned OFF.

7.1.2 Turn the control knob to the "red line" position and adjust if necessary.

7.1.3 Plug probe into instrument and wait about 15 minutes for the probe to polarize.

7.1.4 Turn the control knob to ZERO and adjust if necessary.

7.1.5 Turn the salinity knob to FRESH. A salinity correction will not be needed because the calibration is performed with distilled water.

7.1.6 Insert the probe about 4 centimeters (cm) into the open end of the bottomless plastic storage bottle containing a small sponge soaked with deionized water. Ensure that there is a tight fit between the probe and bottle and that there are no droplets of water on the probe membrane.

7.1.7 Allow at least 10 minutes for the system to reach constant temperature and 100 percent relative humidity. Be careful that this step is carried out in a constant temperature environment. Typically, bathe the bottle in a stream of the water to be tested or at least keep the bottle in the shade during equilibration.

7.1.8 Turn the meter control knob to TEMP position and read the temperature inside the bottle to the nearest 0.5 °C.

7.1.9 Determine the DO saturation value in parts per million (ppm) for that temperature from Table 1.

7.1.10 Determine the correction factor from Table 2 on the basis of either the atmospheric pressure (most accurate method) or the altitude above sea level. (Tables 1 and 2 are also available on the back of the YSI 57).

7.1.11 Multiply the correction factor by the saturation value to obtain the calibration value.

7.1.12 Turn the meter control knob to the desired range and adjust the calibration knob to set the meter to the calibration value.

Table 1. Dissolved Oxygen Saturation Values at Various Temperatures

Temp (°C)	Sat. Value (ppm)	Temp (°C)	Sat. Value (ppm)	Temp (°C)	Sat. Value (ppm)	Temp (°C)	Sat. Value (ppm)
0	14.6	12	10.8	24	8.5	36	7.0
1	14.2	13	10.6	25	8.6	37	6.8
2	13.9	14	10.4	26	8.2	38	6.7
3	13.5	15	10.2	27	8.1	39	6.6
4	13.2	16	9.9	28	7.9	40	6.5
5	12.8	17	9.7	29	7.8	41	6.4
6	12.5	18	9.5	30	7.7	42	6.3
7	12.2	19	9.3	31	7.5	43	6.2
8	11.9	20	9.2	32	7.4	44	6.1
9	11.6	21	9.0	33	7.3	45	6.0
10	11.3	22	8.8	34	7.2		
11	11.1	23	8.7	35	7.1		

Table 2. Correction Factors for Dissolved Oxygen Saturation Values as Determined by Pressure or Altitude

Pressure (mm)	Altitude (ft)	Correction Factor
775	–540	1.02
760	0	1.00
745	542	0.98
730	1,094	0.96
714	1,688	0.94
699	2,274	0.92
684	2,864	0.90
669	3,466	0.88
654	4,082	0.86
638	4,756	0.84
623	5,403	0.82
608	6,065	0.80
593	6,744	0.78
578	7,440	0.76
562	8,204	0.74
547	8,939	0.72
532	9,694	0.70
517	10,472	0.68
502	11,272	0.66

7.1.13 Perform zero oxygen check as follows. Prepare a solution containing 1 gram of sodium sulfite (Na_2SO_3) and about 1 milligram of cobaltous chloride ($CoCl_2$) in 1 liter of deionized water. Insert the probe into this solution and measure the dissolved oxygen. The instrument will read less than 0.2 milligram per liter (mg/L) if the probe is functioning properly.

Caution: These chemicals are toxic in the concentrated form. Avoid eye and skin contact by wearing eye protection and disposable gloves.

7.1.14 Leave the meter turned on during the entire day on which measurements are being taken.

8. Procedure

8.1 The following steps outline the field measurement of dissolved oxygen using the YSI Model 57.

8.1.1 Remove the probe from the storage bottle and place it in the solution to be measured. An in situ measurement is preferred. If the sample is being pumped from a well, the measurement shall be made in an air-exclusion cell.

8.1.2 Move the probe through the water or pump through a flow cell to ensure a velocity of at least 1 foot per second past the probe. This prevents depletion of oxygen at the membrane-water interface.

8.1.3 Turn the meter control knob to TEMP position and record the temperature to the nearest 0.5 °C.

8.1.4 Turn the meter control knob to the proper DO scale; after the meter reading has stabilized, record DO concentration to the nearest 0.1 mg/L.

8.1.5 Remove the probe, rinse with distilled water, blot dry, and return the probe to the storage bottle.

9. Quality Assurance

9.1 The following information about the field measurement of dissolved oxygen shall be logged for quality-assurance documentation:

9.1.1 Date and time zero check was last performed.

9.1.2 Atmospheric pressure or altitude.

9.1.3 Temperature of calibration chamber.

9.1.4 DO saturation from table.

9.1.5 Correction factor used for altitude or pressure.

9.1.6 Calibration value.

9.1.7 Sample temperature.

9.1.8 Measured DO.

9.1.9 Instrument manufacturer and model number.

9.1.10 Name of person performing the measurement.

10. Precision and Bias

10.1 Under normal conditions, precision and accuracy of ± 0.5 mg/L can be expected from this procedure.

11. Keywords

11.1 Altitude, atmospheric pressure, and dissolved oxygen.

Standard Practice for the Use of a Flow Cell for Field Measurements

Introduction

Reliable field measurements are an essential part of a ground water sampling program. Some properties or constituents in ground water may change considerably within a few minutes of collection. These changes are caused by turbulence, heating or cooling, depressurization, and gas exchange with the atmosphere. Use of a closed flow-through cell will minimize these changes.

1. Scope

1.1 This procedure describes the use of a closed flow-through cell for monitoring selected chemical parameters in ground water. The cell is used when monitoring the purging of stagnant water from monitor wells before sample collection and for the measurement of pH, oxidation-reduction potential, conductivity, temperature, and dissolved oxygen under conditions as close to in situ as practical. A flow-through cell can be purchased from various suppliers or can be constructed as described in references 3.1 and 3.2.

2. Hazard Analysis

2.1 Refer to project safety plan for site- or task-specific hazards and control methods.

3. Referenced Documents

3.1 Garske, E., and R. Schock, "An Inexpensive Flow-Through Cell and Measurement System for Monitoring Selected Chemical Parameters in Ground Water", *Ground Water Monitoring Review*, Summer 1986.

3.2 Korte, N., and D. Ealey, *Procedures for Field Chemical Analyses of Water Samples*, Technical Measurements Center, U.S. Department of Energy, Grand Junction Area Office, GJ/TMC–07(83), 1983.

3.3 Wood, W.W., "Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents", Chapter D2 in *Techniques of Water-Resources Investigations of the United States Geological Survey*, Book 1, 1976.

4. Significance and Use

Flow cells allow the sampler to obtain test results that are more representative of conditions present in the water when it resided in the ground. That is, fewer chemical and physical changes occur if the test is made immediately through a flow cell than if the water is exposed to air and to a longer period of time before measurements are made.

5. Apparatus

5.1 Flow-through cell.

5.2 Stoppers, fittings, valves, and tubing, as required.

6. Procedure

6.1 Establish temperature equilibrium between the sample water and calibration solutions (solutions must be within ± 10° C of the sample temperature).

6.2 Calibrate the electrodes.

6.3 Connect the pump outlet to the inlet of the flow cell.

6.4 Insert the calibrated electrodes into the flow cell and connect tubing to the outlet of the flow cell.

6.5 Recheck electrode calibration as necessary during the purging of the well and just before sampling.

6.6 Turn off the pump, disconnect the tubing, and remove the electrodes from the flow cell.

6.7 Clean the flow cell with distilled water and prepare for sample collection.

7. Procedure Bias

7.1 The flow rate through the cell shall not be more than 1 liter per minute (L/m). If flow rates exceed 1 L/m, streaming potentials could occur. Streaming potentials are caused by the static-charge effect of water moving through small openings. These potentials can cause erroneous pH readings. If necessary, reduce the flow rate or stop pumping to take readings.

7.2 The cell assembly, electrodes, and hoses should be insulated or kept out of direct sunlight to reduce the effect of temperature changes on the readings.

8. Quality Assurance

8.1 The use of a closed flow-through cell should be noted on the sample documentation form or in the field logbook.

9. Keywords

9.1 Chemical parameters, conductivity, dissolved oxygen, oxidation-reduction potential, flow cell, temperature, and pH.

Standard Practice for the Sampling of Liquids

Introduction

The type of sampling equipment shall depend on the sample to be collected, which analytes the sample is being collected for, and the site-specific requirements such as depth to water or depth of well. Because each sampling situation is unique, the equipment used and its application may have to be modified to ensure that a representative sample is collected and its physical and chemical integrity is maintained.

1. Scope

1.1 The procedures listed here are used to collect liquid samples. There are eight methods that can be used to collect liquid samples. Some sampling situations use a combination of these methods. For example, a peristaltic pump could be used to collect the inorganic samples and a bailer used to collect the organic samples. The eight methods are

	Section
Method A—Well Purging Using a Peristaltic Pump	5–7
Method B—Sampling with a Bladder Pump	8–10
Method C—Sampling with a Bailer	11–13
Method D—Sampling with a Submersible Pump	14–16
Method E—Sampling with a Composite Liquid Waste Sampler (Coliwasa)	17–19
Method F—Sampling with a Dip-Type Sampler	20–22
Method G—Sampling by Container Immersion	23–25
Method H—Sampling from Taps, Valves, or Faucets	26–28

2. Hazard Analysis

2.1 These procedures use gasoline-powered electric generators, gasoline-powered air compressors, and battery-powered pumps and accessories. The following safety precautions shall be followed.

2.1.1 Air compressors that are belt driven shall have a belt guard in place.

2.1.2 Care shall be taken when connecting and disconnecting equipment powered by lead-acid batteries to avoid generating sparks that have the potential of creating an explosive hazard.

2.1.3 Gasoline is a Department of Transportation-regulated material; its hazard class is Flammable Liquid. Gasoline shall be stored in Factory Mutual-approved safety cans. Safety cans shall be well secured in the vehicle during transport. Gasoline-powered equipment shall be cool before filling, and care should be taken not to spill any gasoline.

2.1.4 Air compressors shall not be operated above rated capacities and shall be configured to avoid having any dead-end fittings above 20 pounds per square inch (psi).

2.1.5 Care shall be taken when lifting heavy equipment; proper lifting techniques shall be used.

2.1.6 Site-specific controls are available in the planning documents for a particular site.

3. Referenced Documents

3.1 American Society for Testing and Materials, *2004 Annual Book of ASTM Standards*, Section 11, "Water and Environmental Technology," Vol. 11.04, Environmental Assessment; Hazardous Substances and Oil Spill Responses; Waste Management: ASTM D 4448-01—Standard Guide for Sampling Ground-Water Monitoring Wells.

3.2 *Environmental Procedures Catalog*, (STO 6):

Standard Practice for Sample Labeling [GT–2(P)].

Technical Comments on ASTM D 5088-02—Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites [GT–7(P)].

General Considerations for the Sampling of Liquids [LQ–1(G)].

3.3 U.S. Department of Energy, *The Environmental Survey Manual*, Appendix E, Volume 4, DOE/EH–0053 1987.

3.4 U.S. Environmental Protection Agency, *Handbook of Groundwater*, EPA/625/6–87/016, 1987.

3.5 U.S. Environmental Protection Agency, *Practical Guide for Groundwater Sampling*, EPA/600/2–85/104, 1985.

3.6 U.S. Environmental Protection Agency, *SW–846, Test Methods for Evaluating Solid Waste*, Volume 2, 1986.

4. Significance and Use

4.1 The usefulness and limitations for each of the first four sampling methods are listed in General Considerations for the Sampling of Liquids [LQ–1(G)], Table 1 through Table 5. Coliwasa samplers are useful to obtain representative samples of multiphase materials from drums or other containerized vessels. Limitations are their relative high costs and the difficulty of decontaminating the sampler. Dip samplers only collect grab samples with a limited vertical extent. The sampler must be aware of this limitation and also exclude surface debris or films from liquid surfaces if this is not desired. Contamination from plumbing is a primary concern when sampling taps, valves, or faucets.

Method A
Sampling With a Peristaltic Pump

5. Apparatus

5.1 Peristaltic-type pump.

5.2 Silicone, C-FLEX, or Norprene tubing for the pump head.

5.3 Silicone, Teflon, polyethylene, or vinyl tubing for placing in the liquid to be sampled (suction line).

5.4 Generator or other source of electricity.

6. Procedure

6.1 The following procedure supplements the instruction in the instrument-specific operating manual.

6.1.1 Place the suction line in the liquid to be sampled. If sampling a monitoring well, place the tubing inlet just above the screened interval.

6.1.2 Connect the suction line to the pump.

6.1.3 Turn on the pump and adjust the flow rate so sample turbulence is at a minimum. Allow several liters to flow and recheck stability parameters (i.e., pH, conductivity, and temperature).

6.1.4 Fill the necessary sample bottles by allowing the pump discharge to flow gently down the side of the bottle with minimal turbulence.

6.1.5 Label, preserve, and document the samples as required by Standard Practice for Sample Labeling [GT–2(P)].

6.1.6 Remove the tubing from the liquid and clean and decontaminate as required by Technical Comments on ASTM D 5088-02—Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites [GT–7(P)].

7. Procedure Bias

7.1 Sampling organics using a peristaltic pump is not recommended. The suction lift action will strip volatiles and degas the sample. The silicone tubing tends to absorb some organics and slowly release them, contaminating subsequent samples.

Method B
Sampling With a Bladder Pump

8. Apparatus

8.1 Bladder-type pump.

8.2 Air compressor.

8.3 Teflon, polyethylene, or vinyl tubing for the air and sample line.

9. Procedure

9.1 The following procedure is supplemental to the instruction in the instrument-specific operating manual.

9.1.1 Lower the pump gently to a position just above the screened interval.

9.1.2 Connect the air line to the pump controller.

9.1.3 Initiate pumping and allow several liters of water to be pumped prior to sample collection (recheck stability parameters, i.e., pH, conductivity, and temperature).

9.1.4 Fill the necessary sample bottles by allowing the pump discharge to flow gently down the side of the bottle with minimal turbulence.

9.1.5 Label, preserve, and document the samples as required by Standard Practice for Sample Labeling [GT–2(P)].

9.1.6 Remove the pump from the well and clean and decontaminate as required by Technical Comments on ASTM D 5088-02—Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites [GT–7(P)].

10. Procedure Bias

10.1 Bladder-type pumps constructed of stainless steel, Teflon, or both provide superior performance for most applications. The use of Teflon sample- and air-line tubing allows the bladder pump to be used for the collection of organics. The main disadvantage is the slow pumping rate, large consumption of compressed air, and difficulty in cleaning and decontaminating.

Method C
Sampling With a Bailer

11. Apparatus

11.1 Teflon or stainless steel bailer.

11.2 Teflon or stainless steel cable or line.

11.3 Bailer reel.

12. Procedure

12.1 Attach a properly cleaned bailer to the cable or line.

12.2 Lower the bailer slowly until it contacts the liquid.

12.3 Allow the bailer to sink until it reaches the screened interval of the well or the desired sampling point.

12.4 Slowly raise the bailer to the surface.

12.5 Tip the bailer or use a bottom-emptying device and fill a container to recheck the stability parameters (i.e., pH, conductivity, and temperature).

12.6 Repeat Steps 12.2 through 12.5 as many times as necessary to fill the sample bottles.

12.7 Label, preserve, and document the samples as required by Standard Practice for Sample Labeling [GT–2(P)].

12.8 Clean and decontaminate the bailer as required by Technical Comments on ASTM D 5088-02—Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites [GT–7(P)].

13. Procedure Bias

13.1 Bailers constructed of Teflon, stainless steel, or both provide adequate performance for most applications. Bailers expose part of the sample to the atmosphere during sample withdrawal and should not be used to collect samples where contact with the atmosphere is important (i.e., field measurement of dissolved oxygen and Eh). A bottom-emptying device is recommended for the collection of volatile organics using a bailer.

Method D
Sampling With a Submersible Pump

14. Apparatus

14.1 Submersible-type pump.

14.2 Discharge tubing of vinyl, polyethylene, or Teflon.

14.3 Power source of generator or batteries.

15. Procedure

15.1 The following procedure is supplemental to the instructions provided in the instrument-specific operating manual.

15.1.1 Set up the pump according to the operating manual.

15.1.2 Gently lower the pump to a position just above the screened interval.

15.1.3 Initiate pumping and allow several tubing volumes of liquid to be pumped prior to sample collection. Recheck stability parameters, (i.e., pH, conductivity, and temperature).

15.1.4 Fill the necessary sample bottles by allowing the pump discharge to flow gently down the side of the bottle with minimal turbulence.

15.1.5 Label, preserve, and document the samples as required by Standard Practice for Sample Labeling [GT–2(P)].

15.1.6 Remove the pump and clean and decontaminate as required by Technical Comments on ASTM D 5088-02—Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites [GT–7(P)].

16. Procedure Bias

16.1 Considerable sample agitation results when using a submersible pump. Submersible pumps are not recommended for the collection of dissolved gases, organics, or oxidation/reduction-sensitive samples. They also have a higher potential of sample contamination because of the construction material.

Method E
Sampling With a Coliwasa Sampler

17. Apparatus

17.1 Coliwasa-type sampler constructed of stainless steel, Teflon, polyethylene, or glass.

17.2 Teflon, stainless steel, or nylon suspension line.

17.3 Disposable gloves.

17.4 Kimwipes or equivalent lint-free tissue.

18. Procedure

18.1 Slowly lower the sampler into the liquid to be sampled. Lower the sampler at a rate that permits the levels of liquid inside and outside the sample tube to be about the same.

18.2 When the sample interval has been reached, seat the bottom check valve.

18.3 Slowly withdraw the sampler with one hand while wiping the outside of the sampler using a disposable tissue.

18.4 Carefully discharge the sample into the sample container.

18.5 Repeat Steps 18.1 through 18.4 as many times as necessary to fill all the sample bottles.

18.6 Label, preserve, and document the samples as required by Standard Practice for Sample Labeling [GT–2(P)].

18.7 Clean and decontaminate the sampler as required by Technical Comments on ASTM D 5088-02—Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites [GT–7(P)].

19. Procedure Bias

19.1 The Coliwasa-type sampler is appropriate for collecting samples of containerized liquids. The material of construction should be considered for the particular type of liquid to be sampled. A Coliwasa sampler is also difficult to decontaminate adequately.

Method F
Sampling With a Dip-Type Sampler

20. Apparatus

20.1 Dip-type sampler constructed of Teflon, stainless steel, polyproplylene, or glass.

21. Procedure

21.1 Assemble the sampler.

21.2 Slowly submerge the sampler into the liquid to be sampled causing minimal surface disturbance.

21.3 Retrieve the sampler from the liquid causing minimal surface disturbance.

21.4 Slowly empty the sampler into the sample bottle allowing the sample to flow gently down the side of the bottle.

21.5 Repeat Steps 21.2 through 21.4 as many times as necessary to fill all of the sample bottles.

21.6 Label, preserve, and document the samples as required by Standard Practice for Sample Labeling [GT–2(P)].

21.7 Clean and decontaminate the sampler as required by Technical Comments on ASTM D 5088-02—Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites [GT–7(P)].

22. Procedure Bias

22.1 A dip-type sampler is appropriate for surface liquids such as ponds, open tanks, pits, lagoons, and sewers. It can only be used for a grab-type sample, and its material of construction shall be compatible with the liquid to be sampled and the analytes of interest.

Method G
Sampling by Container Immersion

23. Apparatus

23.1 Sample container.

23.2 Disposable gloves.

23.3 Distilled or deionized water in a squeeze bottle.

23.4 Kimwipes or equivalent lint-free tissue.

24. Procedure

24.1 After putting on the appropriate gloves, submerge the sample bottle below the liquid surface. If the liquid is flowing, point the bottle upstream.

24.2 Allow the container to fill to the desired volume.

24.3 Remove the container, cap and rinse the container's outside surface with clean water, and dry with a tissue.

24.4 Label, preserve and document the sample as required by Standard Practice for Sample Labeling [GT–2(P)].

25. Procedure Bias

25.1 The container-immersion method can only be used to collect samples from shallow streams,

near the shore of ponds or lakes, or from open-top containerized liquids. It can only be used for a grab-type sample and requires immersing the hands; it is not acceptable for highly polluted or hazardous liquids.

Method H
Sampling From Taps, Valves, or Faucets

26. Apparatus

26.1 Distilled or deionized water in a squeeze bottle.

26.2 Kimwipes or equivalent lint-free tissue.

26.3 If the sample bottle cannot be placed under the tap, valve, or faucet, a hose or other device shall be attached to the outlet to allow the sample to be collected.

27. Procedure

27.1 Turn on the tap, valve, or faucet and allow sufficient liquid to flow to ensure that any rust or residue is removed from the lines and that fresh liquid is flowing.

27.2 Remove the cap from the sample container and place the container under the source.

27.3 Fill the sample bottle to the desired volume.

27.4 Repeat Steps 27.2 and 27.3 as many times as necessary to fill all of the sample containers.

27.5 Shut off the tap, valve, or faucet; clean the outside of the sample container using clean water and wipe dry.

27.6 Label, preserve, and document the sample as required by Standard Practice for Sample Labeling [GT–2(P)].

28. Procedure Bias

28.1 This procedure is used to collect grab-type samples from piped systems. Strainers, aerators, and hose attachments should be removed prior to sample collection. The material of construction for the piping system influences sample impurities and should be documented in the field logbook.

29. Quality Assurance

29.1 All of the methods listed above require the following information to be logged for quality-assurance documentation.

29.1.1 Date of sample collection.

29.1.2 Location of sample.

29.1.3 Sample number.

29.1.4 Type of sampling mechanism used.

29.1.5 Container type, size, and number of samples collected.

29.1.6 Preservatives used.

29.1.7 Signature of sampler.

30. Keywords

30.1 Bailer, coliwasa, liquid samples, sampler, and sampling.

Standard Practice for the Collection, Filtration, and Preservation of Liquid Samples

1. Scope

1.1 This procedure addresses the collection, filtration, and preservation of liquid samples. Section 7 gives the general collection procedures. Sections 8 and 9 are specific to the collection of organics. Section 10 provides the procedure for sample filtration. Section 11 provides guidelines for sample preservation. Table 1 summarizes the generally accepted bottle types, volume requirements, preservatives, and holding times for most analytes.

1.1.1 Improper filtration, preservation, or residence time before analysis may compromise sample integrity.

1.2 Many factors should be considered during the sample collection phase: bottle type, bottle size, preservation, sample filtration, holding time, and order of sample collection.

2. Hazard Analysis

2.1 This procedure uses a variety of chemicals for preserving the samples. The sampler shall have a copy of and review the Material Safety Data Sheets (MSDS) for each of the chemicals that will be used at a particular site. Most of the preservatives can be categorized as strong acids or strong bases.

2.2 The personal protective measures for strong acids (hydrochloric [HCl], nitric [HNO_3], and sulfuric [H_2SO_4]) and strong bases (such as sodium hydroxide [NaOH]) are to avoid eye and skin contact and avoid breathing vapors by wearing eye protection and disposable gloves, providing adequate ventilation, and taking first aid measures to flush eyes or skin immediately with water for 15 minutes and contacting a physician.

2.3 Site-specific controls are available in the Health and Safety Plan for a particular project.

3. Referenced Documents

3.1 *Environmental Procedures Catalog*, (STO 6):

Standard Practice for Sample Labeling [GT-2(P)].

3.2 U.S. Environmental Protection Agency, *Specifications and Guidance for Contaminant-Free Sample Containers*, Office of Solid Waste and Emergency Response, Washington, D.C., EPA/540/R93/051, NTIS stock number PB93/963316, December 1992.

4. Terminology

4.1 *Meniscus*—The curved, upper surface of a liquid in a container.

4.2 *MSDS*—Material Safety Data Sheet. Printed material that provides descriptions of the properties, hazards, and health and safety considerations of a chemical or material; emergency measures in case of an accident; and instructions on the safe handling of the chemical or material.

4.3 *Organic*—A compound that contains carbon.

4.4 *Volatile*—A compound that readily evaporates at normal temperatures and pressures.

5. Significance and Use

5.1 The procedures listed here are general guidelines. Site-specific requirements vary and no one procedure will fit all situations. In many cases, the judgment of a well-trained, experienced team leader is required to make the necessary decisions in the field to obtain the best sample possible and meet all requirements.

Table 1. Guidelines for Preservation of Samples

Analytical Parameter	Container Type/Size[a]	Preservation	Holding Time
Inorganic Anions			
Chloride (Cl), sulfate (SO_4), fluoride (F), bromide (Br), and orthophosphate	P/125 mL	Filtered 0.45 μm, cool to 4 °C	Cl, SO_4, F, Br—28 days Orthophosphate—48 hours
Nitrate (NO_3), Nitrite (NO_2)	P/125 mL	Filtered 0.45 μm, cool to 4 °C	48 hours
Nitrate (NO_3 and NO_2 as N)	P/125 mL	Filtered 0.45 μm, H_2SO_4 pH <2	28 days
Ammonia, NO_3, NO_2	P/125 mL	Filtered 0.45 μm, H_2SO_4 pH <2	28 days
Ammonium	P/125 mL	Filter, cool, H_2SO_4 pH <2	28 days
Inorganic Cations			
Dissolved metals	PA/500 mL	Filtered 0.45 μm, HNO_3 pH <2	6 months (except mercury is 28 days)
Total metals	PA/500 mL	HNO_3 pH <2	6 months
Radioisotopes			
Uranium-234/uranium-238	P/1 L	Filtered 0.45 μm, HNO_3 pH <2	6 months
Thorium-230	P/1 L	Filtered 0.45 μm, HNO_3 pH <2	6 months
Polonium-210	P/1 L	Filtered 0.45 μm, HNO_3 pH <2	6 months
Lead-210	P/1 L	Filtered 0.45 μm, HNO_3 pH <2	6 months
Radium-226	P/1 L	Filtered 0.45 μm, HNO_3 pH <2	6 months
Radium-228	P/1 L, 3 each	Filtered 0.45 μm, HNO_3 pH <2	6 months
Gross alpha/beta	P/1 L	Filtered 0.45 μm, HNO_3 pH <2	6 months
Radon	G/40 mL with Teflon-lined septa, 3 each	Cool to 4 °C	Not established; analyze ASAP
Organics			
Volatile organics	GA/40 mL with Teflon-lined septa, 3 each	Cool to 4 °C, HCL pH <2	14 days
Semivolatile organics	GA/2.5 L with Teflon-lined cap	Cool to 4 °C	7 days extraction, 40 days analysis
Polychlorinated biphenyls and pesticides	GA/1 L with Teflon-lined cap	Cool to 4 °C	7 days extraction, 40 days analysis
Chlorinated herbicides	GA/1 L with Teflon-lined cap	Cool to 4 °C	7 days extraction, 40 days analysis
Total organic halides (TOX)	GA/1 L	Cool to 4 °C	28 days
Total organic carbon (TOC)	GA/125 mL	H_2SO_4 pH <2, cool to 4 °C	28 days
Phenols	GA/1 L	H_2SO_4 pH <2, cool to 4 °C	28 days
Oil and grease	GA/1 L	H_2SO_4 pH <2, cool to 4 °C	28 days
Other			
Biochemical oxygen demand (BOD)	GA/1 L	Cool to 4 °C	48 hours
Chemical oxygen demand (COD)	GA/1 L	Cool to 4 °C, H_2SO_4 pH <2	28 days
Total dissolved solids	P/125 mL	Cool to 4 °C	7 days
Cyanide	P/1 L	NaOH pH >12, cool to 4 °C	14 days
Sulfide	P/1 L	2 mL zinc acetate, NaOH pH >9, cool to 4 °C	7 days

[a]P = polyethylene; G = glass; A = amber; mL = milliliter; L = liter.
Note: Amber container is not required for metals unless photosensitive metals (e.g., silver) are being analyzed.

6. Apparatus

6.1 Sample bottles

6.2 Sample labels

6.3 Sample ticket books, example shown below.

NDX 651

Project _____

Site _____ Location _____

Date _____ Time _____ Matrix _____

Interval _____ Sampler _____

Comments _____

Analyte(s)	Container Type	Number Collected	Filtered	Preservative

GJ 1854
4/2005

White copy to Project Manager; canary to laboratory; pink remains in ticket book

Figure 1. Example of a Sample Ticket

6.4 Water Sampling Field Data Sheet (Form 1805), Figures 2a and 2b

6.5 Preservative solutions as required by the planning documents.

6.6 Dispensers for preservative solutions.

6.7 Coolers and ice for cooling collected samples.

6.8 In-line filter holders and filter sheets of 0.45 micrometer (µm) pore-size or in-line disposable 0.45-µm pore-size filters.

6.9 Pump and tubing

6.10 Distilled water and lint-free tissue

6.11 Project logbook

7. General Sample Collection Procedures

7.1 Collect all samples as close to the source as possible.

7.2 Choose the appropriate bottles for the analytes needed (see Table 1). Visually inspect the bottles for cleanliness, breaks, and missing parts prior to sampling. Sample bottles should be pre-cleaned to guidelines established by the U.S. Environmental Protection Agency (EPA) in reference 3.2.

7.3 Complete the sample ticket (Figure 1) and label the bottles as required by the planning documents or Standard Practice for Sample Labeling [GT-2(P)], reference 3.1.

7.4 Preservatives may be added at this time, or they may be added after sample collection. (Samples collected without headspace must be pre-preserved.)

7.5 Collect the samples by allowing the liquid to flow gently down the side of the bottle with minimal turbulence. Collect unfiltered samples prior to filtered samples.

7.6 Collect unfiltered samples in the following order:

7.6.1 Volatile organics and total organic halides

7.6.2 Dissolved gases and total organic carbon

7.6.3 Large-volume samples for organic compounds

7.6.4 Sensitive inorganics, such as nitrogen dioxide, ammonium, and ferrous oxide

7.6.5 Total metals

Water Sampling Field Data

Date 3-18-99 Project Location LaKeview Well / Location No. 504

Sequence Number 18 Sample Numb NDG 597

Well Purging Information

Depth to water 6.97 Casing Diameter 2"

Depth of well 79.92 Casing Volume 1X 12 3X 36 10X (gal.) 2"=.163, 4"=.653g/ft.

Depth of water 72.95 Borehole Volume NA Low Flow Purge Volume NA

Sampling Equipment Grundfos 12V Submersible Peristaltic Other:

Measurement Equipment YSI 3500, Hach 2100P Turbidimeter, Hach alkalinity, Other:

Calibration Information

Conductivity

Time of calibration check 0940

Temperature of calibration standard 6.7

Conductivity reading 661

Conductivity reading at 25° C 1042

pH

Time of two-buffer calibration 0940

Temperature of buffer solutions 6.7

Buffers used for calibration 7, 10

Turbidity

Time of operational check 0945

Gelex Standards

Assigned Value	Actual Reading
5.30	5.30
61.6	61.8
574	575

Dissolved Oxygen

Time of last check with $NaSO_3$ solution

Atmospheric pressure mmHg. Altitude

Temperature of calibration chamber

DO saturation

Correction Factor

Calibration Value

JC 3-18-99

Eh

Temperature of Zobell solution 0940

Eh of Zobell solution 255 mV

Final Sample Data

Measurement conditions: In situ ( ) Open container ( ) Air exclusion (X)

Time	Temp	Conductivity	Conductivity ATC	pH	Eh	Turbidity	D.O.
1023	11.0	958	1331	7.42	-14	0.11	NA

Alkalinity

Time 1027 Unfiltered Total alkalinity 108 ppm as $CaCO_3$

Time 1030 Filtered Total alkalinity 110 ppm as $CaCO_3$

Hach kit method: Titration cartridge 1.6 N H_2SO_4

Phenolphthalein alkalinity (for pH 8.3 or greater) Unfiltered: NA Filtered: NA

Filters

Number of 0.45 μ disposable filters used 1

Figure 2a. Example of a Water Sampling Field Data Sheet, Front (Form 1805)

Grand Junction Office
2597 B 3/4 Road
P.O. Box 14000
Grand Junction CO 81502

Sample Nu NDG 597 Well / Location No. 504

Date 3-18-99

Purge Data

Time Start at: 0950	Total Volume Purged (gal)	Temp. (° C)	Conductivity (µmhos/cm)	Conductivity ATC (µmhos/cm)	pH	Eh (mV)	Turbidity (NTU)	DO (mg/L or %)
0956	6	10.7	913	1283	7.40	112	0.76	NA
1001	12	10.9	952	1328	7.41	75	0.45	
1006	18	10.9	954	1329	7.42	45	0.28	
1011	24	11.0	956	1331	7.42	13	0.27	
1018	30	11.0	957	1331	7.42	4	0.06	
1023	36	11.0	958	1331	7.42	-14	0.11	

JC 3-15-99

Note: if low flow purging was performed, water level after optimizing pump rate NA and a final water level must be noted after purging is complete. WL NA Time NA

Well Inspection

Well Label	Guardposts	Concrete Pad	Protective casing	Riser Cap	Lock
OK	NA	NA	OK	OK	OK No lock New lock installed

Sample Preservation: Is ice in cooler (YES) (NO) Weather: Cloudy, cool

Comments:

Signature of Sampler Jan Copfell Date Signed 3-18-99

Checked by Charles E. Poland Date checked 3/18/99

Figure 2b. Example of a Water Sampling Field Data Sheet, Back (Form 1805)

7.7 Collect filtered samples in the following order:

7.7.1 Alkalines

7.7.2 Trace metals

7.7.3 Major cations/anions

7.7.4 Radionuclides

7.8 Add preservative as required, if not pre-preserved.

7.9 Cap the bottle securely.

7.10 Store as required. Some samples may require storing at 4 °C immediately after collection. Use a cooler with ice for storing these samples.

7.11 Complete the Water Sampling Field Data Sheet (Figures 2a and 2b) as shown.

8. Nonvolatile Organics Sampling Procedure

8.1 Follow Steps 7.1 through 7.3.

8.2 Add preservatives to the bottle, if required.

8.3 Collect samples for nonvolatile organics by slowly filling the bottle, allowing the liquid to flow gently down the side of the bottle with minimal turbulence. Do not filter samples to be analyzed for organics.

8.4 Cap the bottle securely.

8.5 Store as required. Most organic samples require storage at 4 °C.

9. Volatile Organics Sampling Procedure

9.1 Take special care when collecting a volatile organic sample to reduce the possibility of losing the volatile constituents. Volatile organics are collected in a 40-milliliter (mL) glass vial that has a Teflon-lined, silicone-septum cap.

9.2 Label the vial.

9.3 Add preservative (if required).

9.4 Slowly fill the vial to overflowing.

9.5 Hold the vial level or carefully set it on a level surface.

9.6 Place the cap with septum, Teflon-side down on the convex water meniscus and seal by screwing the cap to the bottle.

9.7 Check for air bubbles by inverting the vial and lightly tapping. There can be no air bubbles entrapped in the sample. If bubbles are present, uncap the vial, empty the contents, and repeat Steps 9.3 through 9.7.

10. Sample Filtration Procedure

10.1 Collect samples requiring filtration after unfiltered samples. If a pump is used, connect an in-line membrane filter directly to the pump outlet to filter the sample. If a bailer is used, connect the filter to the portable pump and pump the sample from the bailer or a clean sample bottle.

10.2 Start the pump and discard the first 100 mL of sample to flush the filter.

10.3 Place the sample bottle directly under the filter outlet and fill to the desired volume.

10.4 Preserve the sample (if not pre-preserved), as required.

10.5 Stop the pump, and disconnect the filter.

10.6 Discard the used filter after each sample. If a filter holder is used, clean all surfaces of the filter holder with distilled water and wipe dry with a lint-free tissue.

10.7 If a filter holder is used, place a new filter in the holder and reassemble.

11. Sample Preservation Guidelines

11.1 Samples are preserved by a variety of means to stabilize specific parameters so that the samples can be shipped to a laboratory for

analysis. Preservatives are intended to (1) retard biological effects, (2) retard hydrolysis, (3) reduce sorption effects, and (4) reduce volatility of constituents.

11.2 Preservation methods are generally limited to pH control, chemical addition, refrigeration, and protection from light. The following guidelines shall be considered during sample preservation.

11.2.1 Preservation of samples uses a variety of strong acids and bases. Care shall be taken in their storage and use; see Section 2.

11.2.2 Preserve samples prior to or as soon after collection as possible.

11.2.3 Take care not to cross-contaminate samples with preservatives.

11.2.4 Place samples requiring cooling to 4 °C in an ice chest with ice immediately after collection.

11.2.5 Consult Table 1 or the planning documents for recommended sample preservation techniques for each parameter. Generally, the laboratory performing the analysis will determine the bottle type, volume, and preservative to be used for a particular sampling event.

12. Quality Assurance

12.1 In the sample ticket book (Figure 1) or Water Sampling Field Data Sheet (Figures 2a and 2b), record the following information about the sample collection, filtration, and preservation for quality-assurance documentation.

12.1.1 The number and type of filter used for filtration.

12.1.2 The bottle size, bottle type, and number of samples collected.

12.1.3 The type of sample filtration, if any.

12.1.4 The preservative used.

12.1.5 The name of the person performing the sampling.

13. Keywords

13.1 Bottles, collection, filtration, liquid samples, organics, and preservation

End of current text

Standard Practice for the Inspection and Maintenance of Ground Water Monitoring Wells

Introduction

Ground water monitoring wells are commonly used for obtaining ground water samples, ground water elevation measurements, and aquifer hydraulic parameters. Because of natural processes and human activities, the condition of ground water monitoring wells may deteriorate with time. If the deterioration of a particular monitoring well is not documented and corrected, decisions based upon data collected from that well may be adversely affected. This procedure provides a standard practice for maintaining a record of the condition of a well and remediating wells that have deteriorated.

1. Scope

1.1 This procedure describes the standard practice for conducting routine inspections of ground water monitoring wells. The procedure also provides criteria to use in determining if and when a monitoring well should receive corrective maintenance. Corrective maintenance activities are based on the results of the routine inspections. This procedure describes the standard practices for conducting well maintenance. Well maintenance includes correcting deficiencies in the surface components of the well and redeveloping the well.

1.2 This procedure shall be applied only to ground water monitoring wells. Ground water production wells, used for water supply, are beyond the scope of this procedure. Because of the limitations associated with the redevelopment methods described in this procedure, the redevelopment section is not applicable to wells exceeding 6 inches in diameter. This procedure shall not be applied to multi-port, single-string monitoring wells.

1.3 This procedure shall be executed by a designated well-maintenance technician on all monitoring wells under the control of Contractor personnel. At the discretion of the Project Manager and appropriate regulatory agencies, inactive monitoring wells may be excluded from redevelopment activities. At the discretion of the Project Manager, the procedure may be implemented in conjunction with routine ground water sampling and data collection activities. In such a case, the inspection portion of the procedure shall be conducted before ground water sampling and other data collection activities. All well-maintenance activities shall be conducted after ground water sampling activities to eliminate the potential for contaminating samples or altering the chemistry of ground water samples.

2. Hazard Analysis

2.1 This procedure may involve the use of isopropanol or methanol for decontaminating water-level measurement devices and well redevelopment equipment. Methanol is an Occupational Safety and Health Administration (OSHA)-listed toxic and hazardous substance. Avoid eye and skin contact by wearing indirectly vented chemical goggles and disposable nitrile gloves. Avoid breathing vapors. Use only in well-ventilated areas. Keep away from heat, sparks, and flames.

2.2 Monitoring wells that penetrate contaminated subsurface environments may contain toxic or hazardous vapors at pressures exceeding atmospheric pressure. These vapors can be expelled from the well bore when the riser cap is removed. If a well penetrates highly contaminated subsurface materials or ground water, the off-gassing of vapors could continue for an extended period of time. If previous air-monitoring data have shown that the concentration of organic vapors exceeds the action level specified in the project Health and Safety Plan, respirators shall be worn before the well is opened. The respirators shall continue to be worn throughout the rest of the procedure or until current air-monitoring data indicate organic

vapor concentrations have dropped below the action level. For all other wells, stand upwind of the well when removing the riser cap and performing inspection and maintenance activities. As appropriate, allow the well riser to ventilate after opening before initiating inspection and maintenance activities. If the degree of contamination at the well site is unknown, or if the well has never been monitored for vapors, the air in the well bore shall be checked for the presence of volatile organic vapors before continuing with the procedure. Use a calibrated organic vapor analyzer (OVA) or photoionization detector (PID) to measure the total concentration of organic vapors. If the concentration indicated on the OVA or PID exceeds the action level specified in the project Health and Safety Plan, allow off-gassing to continue until the OVA or PID indicates that the concentration has dropped below the action level. If the concentration continues to exceed the action level, respirators shall be worn during the inspection and maintenance procedure.

2.3 This procedure may involve the use of compressed nitrogen gas for redeveloping monitoring wells. Compressed nitrogen is supplied in steel tanks and injected into the well through a regulator, a flexible hose, and a series of threaded polyvinyl chloride (PVC) pipes. Improper use of equipment or failure of equipment could cause an explosive rupture of the redevelopment apparatus. Safety glasses, a hard hat, and steel-toed safety shoes shall be worn at all times when using a compressed nitrogen apparatus for the redevelopment of monitoring wells. Because the valve on a compressed nitrogen bottle is susceptible to breakage, the valve cover shall be screwed tightly in place during transport in vehicles, transport on hand trucks, or manual transport by well maintenance personnel. In addition, the line pressure set on the regulator shall not be set in excess of 50 percent of the minimum-rated bursting pressure of either the flexible hose or the PVC pipe.

3. Referenced Document

3.1 *Environmental Procedures Catalog* (STO 6):

> Standard Test Method for the Measurement of Water Levels in Ground Water Monitoring Wells [LQ-2(T)].

4. Significance and Use

4.1 *Significance*—Application of this practice will prevent most forms of degradation in monitoring wells. Application of this procedure will prevent the undetected contamination of monitoring wells by infiltrating surface water and ensure a long service life for monitoring well installations.

4.2 *Use*—This procedure shall be used (1) to maintain an ongoing permanent record that documents the condition of ground water monitoring wells, (2) to identify when monitoring wells require maintenance, and (3) to specify the procedures that shall be used to conduct monitoring-well maintenance. Each time the inspection portion of the procedure is executed, the Well Maintenance Checklist (Figure 1), the Water Level and Well Maintenance Data Sheet (Figure 2), or a project-specific well maintenance checklist form shall be completed and filed in the project records. The project manager shall be notified in writing of any well maintenance discrepancies. If the procedure is executed by a sampling team, the inspection portion of the procedure shall be performed before sampling a well. Any required maintenance activities shall be performed after sampling a well. This procedure shall not be applied to water-supply wells. Application of this procedure shall be limited to monitoring wells 6 inches in diameter or less.

5. Apparatus

5.1 Well location map.

5.2 Well Maintenance Checklist (Figure 1) or the Water Level and Well Maintenance Data Sheet (Figure 2).

Well Maintenance Checklist

Site Identification _____ Well Number _____

Date _____ Field Technician _____

Surface Components Inspection	(circle one)		Action Required/Taken
Lock Working	Yes	No	_____
Cap on Surface Casing Present	Yes	No	_____
Surface Casing Intact	Yes	No	_____
Riser Cap Present	Yes	No	_____
Guard Posts Adequately Painted for High Visibility	Yes	No	_____
Concrete Surface Pad Present	Yes	No	Intact Yes No _____
Well Clearly and Correctly Numbered	Yes	No	_____
Organic Vapor Monitoring Conducted	Yes	No	_____

Subsurface Inspection

	Upper or Single Completion	Middle Completion	Lower Completion
Reported Depth of Well (below top of casing)	_____	_____	_____
Reported Bottom of Screened Interval (below top of casing)	_____	_____	_____
Static Depth to LNAPL (below top of casing)	_____	_____	_____
Static Depth to Water (below top of casing)	_____	_____	_____
Static Depth to DNAPL (below top of casing)	_____	_____	_____

Redevelop if measured well depth is less than or equal to depth of bottom of screened interval.

Redevelopment Conducted Yes No Method Used _____

Comments/Recommendations _____

_____

_____

Completed by _____ Verified by _____

Figure 1. Well Maintenance Checklist

WATER LEVELS and WELL MAINTENANCE DATA SHEET

Site:_____ Measuring Device_____ Date_____

	Subsurface Inspection			Surface Components Inspection							
Well ID	Time	Depth to Water (ft.)	Total Depth (ft.)	Well Label	Guard-posts	Lock	Conc. Pad	Protective Casing	Riser Cap	Technician Initials	Comments

Surface Components Inspection: S– Satisfactory D– Deficient (comment to describe problem)

Figure 2. Water Levels and Well Maintenance Data Sheet

5.3 Electric water-level sounder.

5.4 Interface probe (optional).

5.5 Measuring tape with engineering scale (required if graduations on water-level sounder or interface probe are greater than 0.01 foot).

5.6 Distilled or deionized water in a squeeze wash bottle or pump spray canister.

5.7 Alconox or equivalent.

5.8 Laboratory-grade isopropanol or methanol in a squeeze wash bottle or pump spray canister.

5.9 Kimwipe or equivalent lint-free tissue.

5.10 Compressed-nitrogen tank (required when using compressed nitrogen).

5.11 Compressed-gas regulator (required when using compressed nitrogen).

5.12 Nitrogen-jetting well-head apparatus (required when using compressed nitrogen).

5.13 Flexible compressed-gas transmission hose (required when using compressed nitrogen).

5.14 Threaded PVC pipe (required when using compressed nitrogen).

5.15 Jetting-T (required when using compressed nitrogen).

5.16 Submersible pump (optional).

5.17 Suction-lift pump (optional).

5.18 Surge block (optional).

5.19 PVC hose (optional).

5.20 Foot valve (optional).

5.21 High-visibility spray paint.

5.22 Steel stamp (for numbering wells).

5.23 Black permanent marking pen.

5.24 Black ink pen.

5.25 Personnel protective equipment/clothing (e.g., safety glasses, vented chemical glasses, steel-toed safety shoes, hard hats, respirators, gloves, monitoring equipment, etc.) may be required based on site conditions and as specified in the project Health and Safety Plan.

6. Procedures

6.1 This procedure is composed of three sections: Section 6.2, Inspection and Documentation; Section 6.3, Maintenance Criteria and Corrective Action; and Section 6.4, Redevelopment Procedures.

6.2 *Inspection and Documentation*

6.2.1 Each item on the Well Maintenance Checklist or the Water Levels and Well Maintenance Data Sheet shall be completed as the inspection is conducted. Corrective action to eliminate deficient aspects of a well installation is described in Section 6.3. For multi-completion monitoring wells (multiple-well casings in a single borehole), a single Well Maintenance Checklist or the Water Levels and Well Maintenance Data Sheet may be completed for a group of completions in a common borehole.

6.2.2 *Surface Components Inspection*—The first step of the inspection is to inspect the above-ground components of a monitoring-well installation. Some surface components identified in this section of the procedure are optional and will not be required at each well installation. An example is guard posts. The project manager and well-maintenance technician shall determine which components are required.

6.2.2.1 Check for presence of a lid on the steel security casing. If damaged, describe damage in "Comments/Recommendations" section of the Well Maintenance Checklist.

6.2.2.2 Check the lock on the steel security casing for proper operation.

6.2.2.3 Inspect the steel security casing for damage. If a drain or vent hole is present in the security casing, check to ensure that it is not plugged with debris. Clean the hole if necessary.

6.2.2.4 Check for presence of a casing-riser cap. If the well is a flush-mount well, note whether the casing-riser cap is a watertight cap, slip-on cap, or a threaded cap.

6.2.2.5 Inspect the casing riser for damage. No contamination should be able to enter the well through openings in the side of the casing riser. Note that some casing risers have a "weep" hole drilled just below the riser cap. This hole allows air pressure in the well to equilibrate with atmospheric pressure as water levels or the atmospheric pressure fluctuates. This weep hole should not be closed. If the well is a flush-mount installation and the riser has a weep hole, note this fact in the "Comments/Recommendations" section of the Well Maintenance Checklist. Weep holes are generally not recommended for flush-mount wells as they permit liquids to enter the well if the flush-mount vault becomes flooded. Weep holes in the risers of flush-mount wells are permissible if the vault of the flush-mount installation has been installed to permit drainage from the vault or the vault has a watertight cover.

6.2.2.6 Check for the presence of guard posts. If present, note whether guard posts are adequately painted for high visibility. If guard posts are not present, note this on the Well Maintenance Checklist.

6.2.2.7 Check for the presence of a concrete surface pad surrounding the security casing. If the concrete surface pad is absent or damaged, note this information on the Well Maintenance Checklist.

6.2.2.8 Check the well number or well identification to determine if it is clearly marked and in agreement with the well location map.

6.2.3 *Subsurface Inspection*—The second step of the inspection is to determine the subsurface condition of the well. This includes measuring the depth to water and the depth to the bottom of the well. These measurements should be recorded to the nearest 0.01 foot below the top

of the casing. The measured depth to the bottom of the well, when compared to the recorded well depth and screened interval depth, will indicate the amount of sediment in the well. If sediment has accumulated to a level above the bottom of the screened interval, the well should be redeveloped. If a well is located near storage tanks or transmission lines that contain fuels, solvents, or other immiscible organic liquids, liquid levels in wells should be measured with an interface probe that is capable of detecting light non-aqueous-phase liquids (LNAPLs or floaters), water, and dense non-aqueous-phase liquids (DNAPLs or sinkers). The procedure for measuring liquid levels in wells is described in Standard Test Method for the Measurement of Water Levels in Ground Water Monitoring Wells [LQ-2(T)]. Disposable gloves should be worn when conducting the subsurface inspection on wells with organic contaminants in the ground water.

6.2.3.1 If there are reasons to suspect severe organic chemical contamination in the subsurface near the well, the off-gases escaping from the well head should be monitored with an OVA or PID before making measurements. In such a case, the OVA or PID shall be calibrated each day before use. The casing-riser cap shall be removed and the well allowed to ventilate as appropriate. If the well is a flush-mount installation, all water standing in the vault shall be bailed before removing the riser cap. Place the intake nozzle of the OVA or PID just inside the well bore. Note the reading on the checklist. If the reading exceeds the action level specified in the project Health and Safety Plan, allow the wellhead to continue off-gassing for several minutes and then repeat the OVA or PID measurement. Record the reading on the checklist. Once the OVA or PID indicates the concentration is less than the action level, proceed with the inspection procedure. If the organic vapor concentration does not drop below the action level, respirators shall be worn for the remainder of work performed at the well. If the air contained in the well bore is known to contain no toxic vapors, no OVA or PID measurement is required.

6.2.3.2 Clean the water-level sounder or interface probe before inserting in the well, following the procedure presented in Standard Test Method for the Measurement of Water Levels in Ground Water Monitoring Wells [LQ-2(T)].

6.2.3.3 Measure the depth to water to the nearest 0.01 foot and record on the checklist. The depth shall be measured from the top of the casing riser; see Standard Test Method for the Measurement of Water Levels in Ground Water Monitoring Wells [LQ-2(T)]. If the well has contained NAPLs in the past, if it is located near NAPL storage or transmission equipment, or if the OVA or PID reading was unusually high, an interface probe should be used to measure an LNAPL-air interface depth, an LNAPL-water interface depth, and a water-DNAPL interface depth. On the Well Maintenance Checklist record the depth to the air-LNAPL interface after "Static Depth to LNAPL", record the depth to the LNAPL-water interface after "Static Depth to Water", and record the depth to the water-DNAPL interface after "Static Depth to DNAPL".

6.2.3.4 Measure the total depth of the well by gently lowering the probe to the bottom of the well. After the probe reaches the well bottom, slowly raise and lower it several times to accurately determine the depth to the top of any sediment column that may have accumulated in the well. Record the depth to the nearest 0.01 foot on the Well Maintenance Checklist.

6.2.3.5 Use lint-free tissue, isopropanol or methanol (if organic contaminants are known or suspected to be present in the ground water), and distilled or deionized water to clean the cable as it is removed from the well. The cable should first be cleaned with isopropanol or methanol (if necessary), followed by deionized or distilled water. When the probe is removed from the well, rinse it first with isopropanol or methanol (if necessary), then deionized or distilled water. Wipe the probe dry with a lint-free tissue. If non-aqueous-phase liquids are present in a well, the cable and probe should be cleaned with Alconox (or equivalent) before cleaning with isopropanol or methanol and deionized water. During decontamination, care should be taken to prevent decontamination fluids from dripping into the well.

6.3 *Maintenance Criteria and Corrective Action*

6.3.1 This section describes criteria used to evaluate the conformance or nonconformance aspects of each component of the well inspection. For each nonconformance criteria, a corrective action is described. Whenever possible, corrective action should be implemented during the same field trip during which a nonconformance aspect was identified. Any corrective action taken should be noted on the Well Maintenance Checklist.

6.3.2 If the lid on the security casing is missing or damaged to the point of permitting access to the well, arrange a temporary cover, if possible, and make arrangements to have a new lid fixed to the security casing (commonly by welding).

6.3.3 If the lock on the steel security casing is missing, it should be replaced. If all monitoring-well locks currently in use at a site are keyed identically, a similarly keyed lock should be used to replace a missing one. However, if a lock of the same key type as other security casing locks is not immediately available, any strong lock should be installed for temporary well protection. In such a case, note the need for a new lock on the checklist. If a lock has become difficult to operate because of exposure, a lubricant should be added to the tumbler assembly. **Do not** over lubricate, as these actions will give rise to contamination of the well or sampling equipment that will be used at the well in the future. Note all corrective action on the checklist.

6.3.4 If the entire steel security casing is missing, make arrangements to replace it. The bottom of the security casing should be set 3 feet below the ground surface in concrete. The concrete should extend to the surface and be sloped away from the well. Repairs should be made if the security casing is in place but is damaged and allows liquids to drain into the annular space around the well casing or is preventing proper access to the well. If repairs cannot be made, the need for these should be noted on the checklist.

6.3.5 If the casing-riser cap is missing, replace it. If the well is not a flush-mount well and the casing riser does not have a small hole drilled just below the cap, the riser cap should **not** be installed in an air-tight manner. If the well is a flush-mount well, the riser cap should be a water-tight cap. The water-tight cap should be installed securely in the well to prevent liquids that collect in the vault from entering the well casing. Flush-mount wells with vaults that permit drainage from the vault or those with water-tight vault lids do not need water-tight riser caps.

6.3.6 If the casing riser is damaged to the extent that standing liquids inside the security casing can enter the well, the damaged section should be cut off below the point of breakage and a new section of riser installed. The new riser should have a weep hole drilled in it just below the cap to allow air pressure equilibration within the well bore. Care should be taken to ensure that the new casing riser is fitted with a casing-riser cap. This corrective action should be noted on the checklist and the well should be scheduled for a new elevation survey.

6.3.7 If the well is not a flush-mount installation and is in a location subject to equipment or vehicle traffic, guard posts should be present. If guard posts are not present but are needed, make arrangements for installation as soon as possible. To be effective, three guard posts should be installed in the shape of an equilateral triangle centered at the well with each post 2 to 3 feet from the well. The guard posts should be painted with a highly visible paint, such as Day-Glo orange or safety yellow. Approval of the manager of the site should be obtained before installing and painting guard posts.

6.3.8 If the concrete surface pad is damaged or is missing, a new concrete surface pad should be installed or arrangements should be made for the installation of a concrete surface pad. The pad should extend 1 foot below the ground surface and 3 feet horizontally from the security casing. The pad should be sloped away from the well.

6.3.9 If the well is not numbered or marked with a well identification label, or if the number on the well does not match the well location map, a correct well identification number must be marked on the well. First, the correct well identification must be conclusively determined. This can be done by (1) consulting the well

location map, if it has been certified to be correct; (2) consulting original field logs and completion records relating to the well's installation; and (3) consulting logs from other previous field activities such as sampling, episodes, and water-level measurements. Project personnel may also be interviewed in an effort to establish well identification. Once the identity of the well has been conclusively established, the well should be labeled with this number using a permanent method. Stamping the well identifier into the steel security casing with a steel stamp is recommended. The identifier should be stamped in the lid on the security casing and on the security casing itself, just below the lock. The identifier should also be written on the bottom side of the security casing lid using a permanent ink pen. Multiple-completion wells should have the top of each riser cap marked with a letter designating the completion, such as "U" and "L" for "upper" and "lower", respectively. The casing risers in a multiple-completion well should then be marked in a similar manner. Take care to ensure that the label on the casing riser is below the position occupied by the cap or the weep hole, if present.

6.4 *Redevelopment Procedures*

6.4.1 Monitoring wells shall be redeveloped if the well-inspection procedure indicates that excessive sedimentation is occurring, if the capacity of the well appears to have significantly declined during the course of a sampling program, if there is evidence of screen encrustation or clogging by iron bacteria, or if the well is simply scheduled for regular redevelopment.

6.4.2 Possible redevelopment techniques include (1) compressed-nitrogen jetting and air-lift pumping, (2) surge blocking and pumping or bailing, (3) suction-lift pumping, (4) submersible pumping, and (5) foot-valve pumping.

6.4.3 Successful redevelopment requires that water be forced from the casing into the formation, and from the formation into the casing. This is best accomplished through the use of a surge block. Compressed-nitrogen jetting can also accomplish this flow reversal to some extent. Techniques 3, 4, and 5 (Section 6.4.2) are not effective in achieving flow reversal and are, therefore, best used in conjunction with nitrogen jetting or surge blocking.

6.4.4 Before placing any redevelopment equipment in a monitoring well, the equipment shall be cleaned by washing with soapy water (Alconox or equivalent), rinsing with isopropanol or methanol followed by deionized water, and wiping dry with a lint-free tissue. After removing redevelopment equipment from a well, the equipment shall be cleaned again.

6.4.5 *Nitrogen-Jetting Redevelopment Procedure*

6.4.5.1 If site conditions require that purge water from the well be contained, a discharge-control apparatus should be installed on the well riser. This apparatus typically consists of a compression-sleeve coupling with a discharge port that is connected to the well riser. A compression-type seal for the jetting pipe is rigged at the top of the discharge-control apparatus. Even if site regulations do not require discharge water to be collected and stored, a discharge-control apparatus should be used at sites that may have contaminated ground water. Use of the discharge-control apparatus will prevent the splashing of discharge water on well-maintenance technicians.

6.4.5.2 A jetting-T is connected to a series of PVC pipes (the jetting pipe) and lowered to the top of the screened interval. The top of the jetting pipe is then connected to a compressed nitrogen source via a flexible compressed gas transmission hose. The flexible hose is connected to a two-stage regulator on the nitrogen source. The first stage of the regulator displays the pressure in the nitrogen tank. The second stage displays the pressure at the flexible hose when the regulator is opened. To prevent injury caused by the nitrogen tank falling over, the tank must be either secured in an upright position with a chain or placed on its side and secured by wheel chocks.

6.4.5.3 Set the line pressure on the regulator at a maximum of 60 pounds per square inch (psi). Jet the well screen by quickly opening the line valve, allowing the water to rise in the well, and then closing the line valve. As air (or nitrogen)

escapes from the water column, the water in the well will fall back to near static levels and give rise to a flow reversal from the well into the formation. This pulsed jetting should be repeated for the entire length of screened interval by lowering the jetting pipe in small increments. The pulsed jetting will loosen sediment from the screen, the filter pack, and the well bottom.

6.4.5.4 As material is loosened during the pulsed jetting, the well should be air-lift pumped to remove the dislodged sediment. Air-lift pumping is accomplished by slowly but steadily opening the line valve. This action will discharge nitrogen into the water column within the well. The water will rise in the well as the nitrogen is introduced and expands. If the water level reaches the top of the well before the injected nitrogen reaches the top of the water column, "successful" air-lift pumping will occur. Air-lift pumping can continue as long as water is entering the well at a fast enough rate to maintain an aerated water column that extends to the top of the well.

6.4.5.5 Repeat the combination of pulsed jetting over the length of the well screen and air-lift pumping at least once. If the capacity of the well is not returned to near-original levels, or if the clarity of the well water fails to improve after the second cycle, the nitrogen-jetting redevelopment process shall be continued until the capacity of the well and the clarity of the water cease to improve.

6.4.6 *Surge-Blocking Redevelopment Procedure*

6.4.6.1 Lower the surge block into the well to a position below the water level in the well but above the top of the screened interval, if possible. Surging action should be initiated gently to loosen obstructing sediment. As the circulation improves during the redevelopment, more vigorous surging should be undertaken.

6.4.6.2 After operating the surge block in a given depth increment for several minutes, lower it to the next interval and repeat the surging action. This process should be repeated until surge blocking has been conducted in the entire screened interval.

6.4.6.3 After surge-blocking the entire screened interval, the surge block should be removed. Install a suction-lift pump intake and a submersible pump or a foot-valve pump, and pump water from the well to remove the dislodged sediment. An effort should be made to pump accumulated sediment from the bottom of the well. Pumping should continue until the discharged water is clear and several bore volumes have been removed.

6.4.6.4 The process of surge blocking and then pumping should be repeated at least once. If the capacity of the well is not restored to near-original levels, or if the clarity of the well water fails to improve after only two surge-and-pump cycles, the complete process should be continued until the capacity of the well and the clarity of the water cease to improve.

6.4.7 *Suction-Lift Pumping*

6.4.7.1 Suction-lift pumping is most suitable to use in combination with either surge-blocking or nitrogen jetting. When used with either of these techniques, suction-lift pumping is an effective means of removing suspended sediment particles and accumulated sediment that have collected at the bottom of a well. When used alone, suction-lift pumping is capable of providing only limited improvement in the capacity of a well.

6.4.7.2 When using suction-lift pumping in combination with surging or jetting, the suction-lift pump should be used to remove any accumulated sediment from the bottom of the well. This should be done before surging or jetting. Subsequently, the suction-lift pump should be used after each surging or jetting cycle to remove loosened sediment particles. Suction-lift pumping is conducted by simply installing the intake line in the well, connecting it to the pump intake port, and turning on the pump. Suction-lift pumping should then continue until the discharge water is clear. Suction-lift pumping can only be used if the depth to water is less than approximately 25 to 30 feet.

6.4.7.3 When using suction-lift pumping as the sole means of development, "over-pumping" is used to remove entrapped sediment from the well screen, filter pack, and formation. For this approach, the intake line is installed at the

bottom of the well, and the well is pumped at its maximum rate for extended periods (in excess of 10 minutes) and then allowed to recover. The process is repeated until maximum improvements in capacity and/or well-water clarity have been achieved.

6.4.8 *Submersible Pumping*

6.4.8.1 Submersible pumps may also be used in conjunction with surging or jetting for well development. Submersible pumps are not as effective as suction-lift pumps for pumping water with large amounts of suspended sediment (particularly sand-size sediment). In addition, submersible pumps cannot be used to pump accumulated sediment from the bottom of a well. For this reason, submersible pumping should not be used as the sole means of developing a well, as can be done when using a suction-lift pump. The sequence of surging or jetting and submersible pumping should continue until the capacity of the well and the clarity of the water cease to increase.

6.4.8.2 When using a submersible pump in conjunction with surging or jetting, the pump should be installed after completion of each surging or jetting episode. To provide for maximum removal of suspended sediment, the submersible pump should be lowered to the bottom of the well on a suspension cable. For small pumps and shallow wells, the cable can be lowered by hand. For large pumps or deep wells, the weight of the pump and the discharge hose requires that a cable reel mounted on a tripod or vehicle be used for lowering and retrieving the pump.

6.4.8.3 After the pump is lowered into position, the electrical cord should be connected to a power supply. **Do not** connect the electrical cord to the power supply until the pump is installed in the well. Some submersible pumps are not grounded and could electrocute an individual if the pump is touched while turned on. After turning on the pump, continue pumping until the discharge water is clear.

6.4.8.4 After the discharge water becomes clear (or ceases to improve) and the pump is disconnected from the power supply, remove the pump by lifting or cranking up the suspension cable. The pump should never be removed by lifting or pulling on the electrical cord or the discharge hose.

6.4.9 *Foot-Valve Pumping*

6.4.9.1 A foot-valve pump is simply a length of semirigid hose or pipe with a foot valve attached to one end. A foot-valve pump uses the momentum of water contained in the "discharge line" to lift water from the well as the discharge line is rapidly moved up and down. The foot valve on the bottom opens during the downstroke, allowing water to enter the discharge line. During the upstroke, a spring in the valve, combined with the weight of the water, forces the valve closed. A foot-valve pump can be used in conjunction with surging or jetting to remove entrapped sediment particles from a well. Foot-valve pumping is effective for removing sand-size particles. The method is also effective in removing accumulated sediment from the bottom of a well before initiating surging or jetting activity.

6.4.9.2 When using a foot-valve pump in conjunction with surging or jetting, the sediment in the bottom of the well should be removed before initiating surging or jetting activities. Install the foot-valve pump so that the lower end of the unit (the valve end) is at the bottom of the well. Commence pumping by rapidly raising and lowering the discharge line. As the line fills with water, its weight will increase. For shallow wells, this operation of the pump can be accomplished manually. For deep wells, the weight of the discharge line will require a mechanical means of raising and lowering the unit. Such mechanical devices typically consist of a specially made jack handle or a commercially made apparatus.

6.4.9.3 Once the initial pumping effort begins to produce water, pumping should continue until the discharge water is clear.

6.4.9.4 Surging or jetting should then be conducted, followed by another episode of foot-valve pumping. This sequence of steps shall be repeated until the capacity of the well and the clarity of the water cease to increase.

7. Precision and Bias

7.1 This standard practice presents guidelines for maintaining high-quality monitoring-well installations. Therefore, statements regarding precision and bias are not applicable, except in the context of such statements that might be included in Standard Test Method for the Measurement of Water Levels in Ground Water Monitoring Wells [LQ-2(T)].

8. Quality Assurance

8.1 To maintain quality control standards, the Well Maintenance Checklist or the Water Levels and Well Maintenance Data Sheet must be completed for each well that undergoes inspection and maintenance. The checklist and data sheet must be signed by the person completing the forms. Any discrepancies should be corrected by the well-maintenance technician. The checklist and data sheet should then be filed in the project files.

9. Keywords

9.1 Air-lift pumping, foot-valve pumping, monitoring well, nitrogen jetting, submersible pumping, surge blocking, well inspection, well-maintenance, and well redevelopment.

End of current text

Technical Comments on ASTM D 1889-00

Standard Test Method for Turbidity of Water

Summary of ASTM D 1889-00

This test method describes the measurement of turbidity in water and wastewater discharges using two types of instrumentation.

Additions Applicable to the Operating Contractor and Its Subcontractors

This addendum addresses specific procedures, equipment, and documentation requirements when using the HACH model 2100P portable turbidimeter to measure turbidity of ground water.

The following sections shall be interpreted in conjunction with the current published version of this ASTM procedure. These sections shall be interpreted in numerical order, using the published version as the base document for reference.

1. Scope

1.2.1 Turbidities up to 1,000 NTU can be accurately measured using the HACH model 2100P portable turbidimeter.

1.3.1 Turbidities greater than 1,000 NTU may be measured using the HACH model 2100P portable turbidimeter by serial dilution to below 1,000 NTUs.

2. Referenced Documents

2.3 HACH Company Manual, *Model 2100P Portable Turbidimeter Instruction Manual*, Loveland, CO, 1992.

3. Terminology

3.2.2 *Turbidimeter*—An instrument used to measure the turbidity of an aqueous sample.

5. Significance and Use

5.3 Turbidity measurements are used as indicators of the effectiveness of well-development activities. Turbidity measurements also are used to determine when purging of a monitoring well is complete and ground water sampling can commence.

6. Interferences

6.3.1 Periodically apply a thin layer of silicone oil to the sample cell to mask minor imperfections and scratches in the glass.

7. Apparatus

7.5 *Portable turbidimeter:*

7.5.1 HACH model 2100P portable turbidimeter.

7.5.2 Glass sample cells.

7.5.3 Silicone oil.

7.5.4 AEPA–I styrene/divynlbenzene polymer primary standard or Formazin primary calibration solution.

7.5.5 Gelex secondary turbidity standards.

7.5.6 Battery eliminator.

7.5.7 Logbook.

7.5.8 Kimwipes or equivalent lint-free tissue.

8. Reagents

8.3 Routine primary calibration of the HACH 2100P portable turbidimeter requires 0, 20, 100, and 800 NTU solutions.

11. Calibration

11.1 A primary calibration of the turbidimeter must be conducted before each sampling event.

11.2.1 Press the input/output (I/O) switch to turn the power on.

11.2.2 Fill a clean sample cell with the same dilution water used to prepare the standards, or the 0 NTU standard.

11.2.4 Close the lid and press the CAL key followed by the READ key. The turbidimeter will read the value of the dilution water or the 0 NTU standard and use this value to calculate a correction factor for the 20 NTU standard.

11.2.5.1 The display will automatically advance to the next standard and show "20 NTU." Remove the dilution water or 0 NTU solution sample from the cell compartment and replace it with a sample cell containing the 20 NTU standard (orientation marks should always be aligned). Press the READ key.

11.2.6.1 The display will automatically advance to the next standard and show "100 NTU." Remove the 20 NTU standard from the cell compartment and replace it with a sample cell containing the 100 NTU standard. Press the READ key.

11.2.6.2 The display again will advance to the next standard and show "800 NTU." Remove the 100 NTU standard from the cell compartment and replace it with a sample cell containing the 800 NTU standard. Press the READ key.

11.2.7.1 After the display reads "SO," press the CAL key to complete the calibration and store the calibration information within the electronics of the turbidimeter.

12. Procedure

12.1 *Operational check with Gelex secondary standards.* When using a HACH model 2100P portable turbidimeter, the following steps replace Section 12.1 found in the ASTM procedure.

12.1.1 After every primary calibration, values must be assigned to the Gelex standards for use in operational checks.

12.1.2 Clean the outside of the Gelex cells and apply a thin coating of silicone oil.

12.1.3 Place each of the Gelex standards in the cell compartment with the orientation marks aligned and press the READ key. Record the displayed value in the project logbook and mark the value on the cell above the band.

12.1.4 Before taking measurements, the turbidimeter must be operationally checked by placing the Gelex standards in the cell compartment and pressing the READ key. The displayed value must be within 10 percent of the assigned Gelex value obtained during primary calibration. If the value falls outside the 10 percent criteria, a new primary calibration must be performed.

12.2.2 Turbidities up to 1,000 NTUs can be measured without dilution of the sample using the HACH model 2100P portable turbidimeter.

12.2.3.2 Apply a thin film of silicone oil to the sample cell and wipe with a Kimwipe.

12.2.3.3 Place the sample cell in the instrument cell compartment with the orientation marks aligned.

12.2.3.4 Select manual or automatic range by pressing the RANGE key.

12.2.3.5 If the sample causes the display to change constantly, press the SIGNAL AVERAGE key.

12.2.3.6 Press the READ key. The display will show the turbidity in NTU. Record the value as specified in the project planning documents.

14. Precision and Bias

14.7 Accuracy of ± 2 percent and a repeatability of ± 1 percent, or ± 0.01 NTU (whichever is greater) can be expected using the HACH model 2100P portable turbidimeter.

16. Quality Assurance

16.1 Documentation for quality-assurance purposes when making turbidity measurements includes the following information:

16.1.1 Date and time of the primary calibration.

16.1.2 Manufacturer, expiration date, and NTUs of the primary calibration standards.

16.1.3 Values assigned to the Gelex secondary standards after the primary calibration.

16.1.4 Measurements of the Gelex standards prior to making the turbidity measurement.

16.1.5 Date and time of the turbidity measurement.

16.1.6 Measured sample turbidity.

16.1.7 Instrument manufacturer, model, and serial number of the turbidimeter.

16.1.8 Name of person performing the measurement.

17. Hazard Analysis

17.1 This test method may use Formazin for the preparation of calibration standards. Avoid contact with skin and eyes; use adequate eye protection and disposable gloves.

17.2 Site-specific controls are available in the planning documents for a particular project.

End of current text

Appendix B

Data Validation Guidance

1.0 Introduction

This document provides guidance to data validation (DataVal) leads when validating data obtained from routine water sampling conducted for the U.S. Department of Energy's (DOE) Office of Legacy Management. In addition, this document provides a framework that will allow uniform application of DataVal procedures, provide a consistent format for DataVal packages, and designate personnel responsibilities, which will result in a consistent, high-quality deliverable to DOE.

2.0 Data Validation Package Format and Content

The following items are required in each DataVal package submitted to DOE. Each DataVal package will be assembled in an electronic format to facilitate storage and transmittal. An example of the DataVal contents is shown in Figure 1.

2.1 Sampling Event Summary

This section summarizes the results of the sampling event. The summary will include a short introduction with the number and types of samples collected and any problems encountered during the event. The following elements will be addressed, if applicable, in the summary.

- Results from domestic wells that exceeded a U.S. Environmental Protection Agency (EPA) primary drinking water standard or health advisory. The appropriate DOE project manager must be notified immediately when a standard is exceeded in a sample from a domestic well.
- A comparison to standards table—All wells with results that exceeded EPA ground water standards (40 CFR 192.02, Table 1 to Subpart A) will be listed in the table. The comparison to standards table is generated by a DataVal application (DataVal) used to query the Site Environmental Evaluation for Projects (SEEPro) database. Standards exceeded at point of compliance wells should be highlighted and the implications discussed.
- A comparison to other ground water benchmarks that may be listed in compliance documents such as ground water compliance action plans, long-term surveillance plans, or long-term management plans. These benchmarks may include alternate concentration limits, benchmarks based on background concentrations, or risk-based benchmarks.
- Discussion of contaminant plume (or plumes) movement—This will include discussion of any unexpected contaminant plume movement, such as evidence of contamination in crossgradient portions of an aquifer or in deeper aquifers that were previously unaffected. In addition, historically unaffected downgradient wells that show evidence of arrival of the contaminant plume will be addressed. If there is no evidence of contaminant plume movement and current results are consistent with historical results, then this will be discussed. A discussion of the progress of the natural flushing compliance strategy (if applicable) will be included if results indicate an upward or downward trend. All interpretations of contaminant plume movement may be illustrated with time versus concentrations graphs or plume maps (as appropriate).

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Sampling Event Summary

Sample Location Map

Data Assessment Summary

Water Sampling Field Activities Verification Checklist
Laboratory Performance Assessment
Sampling Quality Control Assessment
Certification

ATTACHMENTS

Attachment 1—Assessment of Anomalous Data

Minimums and Maximums Report
Anomalous Data Review Checksheet

Attachment 2—Data Presentation

Ground Water Quality Data
Surface Water Quality Data
Equipment Blank Data
Static Water Level Data
Time Versus Concentration Graphs

Attachment 3—Sampling and Analysis Work Order

Attachment 4—Trip Report

EXAMPLE

Figure 1. Example of Data Validation Package Contents

- Discussion of impacts to surface water—In rivers and streams, results from locations adjacent to the site and downstream of the site will be compared to respective benchmark values derived from data collected at an upstream location. Other types of surface water features (e.g., seeps and ponds) also will have results compared to the benchmark values. The following criteria will be used to derive the benchmark value.
  - If more than 50 percent of the upgradient concentrations are below detection, the benchmark is the maximum observed concentration.
  - If more than 50 percent of the concentrations are above detection, then the benchmark is determined by assuming a lognormal distribution and using a statistical application routine through DataVal.

– If there are less than 10 historical upgradient data points, then the benchmark is the maximum observed concentration.

Concentrations of site related contaminants that exceed the benchmark must be listed and discussed. The discussion will include the type of surface water feature (i.e., river, seep, pond) and the implication of exceeding the benchmark.

Evaluations in the summary may be customized to address unique circumstances or monitoring objectives for a site. The Site Lead is responsible for content of the summary, including additional details specific to a site. The Site Lead (or designee) must sign the summary page when completed.

2.2 Sample Location Map

This section contains a site map displaying locations sampled during the event.

2.3 Data Assessment Summary

This section contains the following items:

- Water Sampling Field Activities Verification Checklist
- Laboratory Performance Assessment
- Sampling Quality Control Assessment
- Certification

Each of these items is detailed in the following subsections.

2.3.1 Water Sampling Field Activities Verification Checklist

Because consistent sample collection is the first step in obtaining valid and defensible data, an assessment of sample collection activities is an important step in the DataVal process. The Water Sampling Field Activities Checklist was developed primarily from criteria listed in the *Sampling and Analysis Plan for GJO Projects* (DOE 2002) (SAP). The SAP is the primary document that specifies sampling procedures and quality assurance measures to ensure that water samples are collected in a consistent and technically sound manner. The Water Sampling Field Activities Verifications Checklist compares required protocol with actual sample collection activities. Discrepancies noted on the checklist may require additional action. For example, data may be qualified at the discretion of the Site Lead and/or the DataVal Lead. Discrepancies determined to be significant will be documented in the Sampling Event Summary section.

2.3.2 Laboratory Performance Assessment

Assessment of laboratory performance will be conducted using procedures specified in the *Environmental Procedures Catalog* (GJO 6), “Standard Practice for Validation of Laboratory Data,” GT-9(P). This procedure incorporates EPA protocol for verification and validation of laboratory data, and provides criteria for qualification of data that does not meet recommended quality control acceptance criteria.

Laboratory performance will be assessed by reviewing and evaluating quality indicators that include the following: sample shipping and receiving practices; holding times; instrument calibrations; laboratory blanks; interference check samples; matrix spike and matrix spike duplicates; laboratory replicates; laboratory control samples; serial dilutions; sample dilutions; detection limits; peak integrations; radiochemical results uncertainty; and the electronic data deliverable (EDD). The results of the laboratory performance assessment are summarized in a Data Review and Validation Report .
.

Data qualifiers resulting from the laboratory assessment will be entered into the SEEPro database by the DataVal Lead using a DataVal application (DataVal) to update the database.

2.3.3 Sampling Quality Control Assessment

This subsection includes assigning data qualifiers based on sampling protocol and field measurements, and assessing field duplicate sample and field blank sample results.

Qualifiers based on sampling protocol include “F” and “Q” flags. Results obtained from a well that was sampled using a low-flow sampling method will be qualified with an “F” flag. This includes Category I, II, and III wells as specified in the SAP. Results obtained from a Category IV well (domestic well or flowing well) are not sampled using a low-flow method and, therefore, do not require an “F” flag. Results obtained from Category II and III wells will be qualified with a “Q” flag indicating the data is qualitative because of the sampling protocol used.

Results obtained from wells with a pH greater than 9 will be qualified with a “G” flag indicating potential grout contamination.

Organic and inorganic field duplicate sample results will be assessed using the following criteria. A control limit of ± 20 percent relative percent difference (RPD) will be used for sample concentrations greater than 5 times the reporting limit. RPD can be calculated using the following formula:

$$RPD = \frac{|S - D|}{(S + D)/2} \times 100$$

Where

S = sample concentration
D = duplicate concentration

For sample concentrations less than 5 times the reporting limit, a control limit of ± the reporting limit will be used.

Radiological field duplicate results will be addressed using the following criteria. Radiological duplicate results will be considered acceptable if the relative error ratio is less than 3. The relative ratio error is defined using the following formula:

$$RER = \frac{|S - D|}{\sqrt{\sigma^2 + \sigma^2}}$$

Where

RER = relative error ratio
S = sample concentration
D = duplicate concentration
σ = Uncertainty* ÷ 1.96

*Assumes uncertainty is reported as 2σ as specified in the laboratory statement of work.

Duplicate sample results that do not meet criteria will be noted in this section along with a discussion of potential implications on overall data quality. Data may be qualified if duplicate sample results do not meet criteria based on the professional judgment of the DataVal Lead.

Equipment blank results will be evaluated using the following criteria. Inorganic and organic equipment blank constituents (excluding major anions and cations) detected in concentrations less than 10 times the required detection limit are considered acceptable. If concentrations are less than 10 times the required detection limit, the decontamination process is considered adequate and concentrations are sufficiently low to not pose a significant cross contamination impact. Radiological equipment blank constituents are considered acceptable if they are less than the minimum detectable concentration plus the uncertainty. Major cations, anions, and total dissolved solids detected in equipment blanks are often a reflection of decontamination water chemistry, and, therefore, the criteria listed above does not apply. Major anions and cations (chloride, sulfate, calcium, sodium, magnesium, and potassium) detected in the equipment blank do not require additional discussion unless concentrations are determined to be significant by the DataVal Lead.

Trip blank results will be evaluated using the following criteria. Trip blanks are assumed to be contaminant free when collected; therefore, trip blank results should be below the required detection limit. All results below the required detection limit are acceptable. Analytes detected in the trip blank, with the exception of common laboratory contaminants, will be noted in this section along with a discussion of potential implications on overall data quality based on the professional judgment of the DataVal Lead. Because methylene chloride, acetone, 2-butanone, and cyclohexane are considered common laboratory contaminants (EPA 1999), these analytes do not require additional discussion if detected in the trip blank unless concentrations are determined to be significant by the DataVal Lead.

2.3.4 Certification

This section certifies the data as validated by the primary personnel responsible for completing the DataVal package. This section must be signed by the Laboratory Coordinator and the DataVal Lead or their respective designee. In addition, this subsection specifies data that are

available for use and may be used as final results, and/or lists any data that are conditional and not available for use.

2.4 Assessment of Anomalous Data

New data are assessed for potential anomalies by comparison to the historical data set. Data are initially screened using the Minimums and Maximums Report. Data listed in the Minimums and Maximums Report are further evaluated by the DataVal Lead, and follow-up action is implemented (if required). After follow-up action is completed, a decision of the final disposition of the potentially anomalous data is made and documented. Details of the assessment process and the associated documentation are presented in the following subsections.

2.4.1 Minimums and Maximums Report

The Minimums and Maximums Report is generated using the DataVal application. A routine in DataVal compares new data with the historical data set and lists all new data that fall outside the historical data range. Results listed in the report are further screened using the following criteria. Results are considered valid if (1) identified low concentrations are the result of low detection limits; (2) the concentration detected is within 50 percent of historical minimum or maximum values; (3) there were fewer than five historical data points for comparison. If results do not meet these criteria, then further screening is required.

2.4.2 Anomalous Data Review Checksheet

Data listed on the Minimums and Maximums Report that do not meet the criteria above are considered potentially anomalous and warrant further investigation. These data are listed on the Anomalous Data Review Checksheet along with the appropriate follow-up action. Follow-up action may include one or more of the following: consultation with the laboratory to check for errors; reanalysis of samples; comparison to results from the next sampling event; and qualification of data with a “J” (estimated) or “R” (unuseable) flag.

2.5 Data Presentation

This section of the DataVal package includes all of the data being validated. SEEPro database reports for ground water data, surface water data, field blank data, and static water level data are included (if applicable). Time versus concentration plots that support the interpretations and conclusions in the Sampling Event Summary will be included in this section. The DataVal lead will determine the locations and constituents for time versus concentration graphs, which can be produced from the SEEPro database. The time versus concentration graphs will be exported to Excel to facilitate the compilation of the DataVal package into one electronic file.

2.6 Sampling and Analysis Work Order

The sampling and analysis work order letter (or other planning document, if applicable) details the sample locations and the analyte list that were planned for a particular event. The work order is included in this section of the DataVal package.

2.7 Trip Report

The trip report details field activities of the sampling event. It is prepared by the Sampling Lead and is included in this section of the DataVal package.

3.0 Logistics

The goal for completion of DataVal packages and transmittal to DOE is 90 days after the completion of a sampling event or sampling period (e.g., calendar quarter). Actual due dates vary from year to year depending upon goals established in the task order. When the DataVal Lead responsible for a particular event or site is identified, his or her name will be entered on the Requisition Tracking spreadsheet by the Water Sampling Coordinator. This form is used to track the DataVal process from the start of fieldwork to the final submittal to DOE. The Water Sampling Coordinator will update the Requisition Tracking spreadsheet as each component of the spreadsheet is completed. An example of the spreadsheet is shown Figure 2, and the current spreadsheet is found on the share drive at \\459\sys\apps\seepro\Requisition_Tracking. A flowchart detailing the DataVal process is shown in Figure 3.

4.0 Reporting

The completed draft DataVal package is forwarded to DOE for review. When comments from DOE are addressed, the final DataVal package is delivered to DOE for distribution. Copies of each package are delivered (electronically if possible) to the stakeholders (see Table 1 for example). A copy of the completed DataVal will be posted on the web for a particular site, if available.

If samples have been collected from domestic-supply wells a letter and table for each sampling event are sent to the owners of the property where the wells are located. A sample letter and table are presented in Figure 4.

5.0 References

STO 6. *Environmental Procedures Catalog*, continuously updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy, Office of Legacy Management, Grand Junction, Colorado.

U.S. Department of Energy (DOE), 2002. *Sampling and Analysis Plan for GJO Projects*, GJO-2003-402-TAC, Rev. 6, U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

U.S. Environmental Protection Agency, 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA-540/R-00-008, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, DC.

Site	Work Order Letter Sent	Start of Field Work	Submit Samples to Lab	Lab Code	Req./RI No.	Report Due to TAC	Date Report Received	Elect. File Received from Lab	Field Data Entered	Database Updated	Outstanding Date Due to DOE	Standard Date Due to DOE	DV Package Submitted to DOE	Data Validation Lead	Comments

EXAMPLE

Figure 2. Example of the Requisition Tracking Spreadsheet

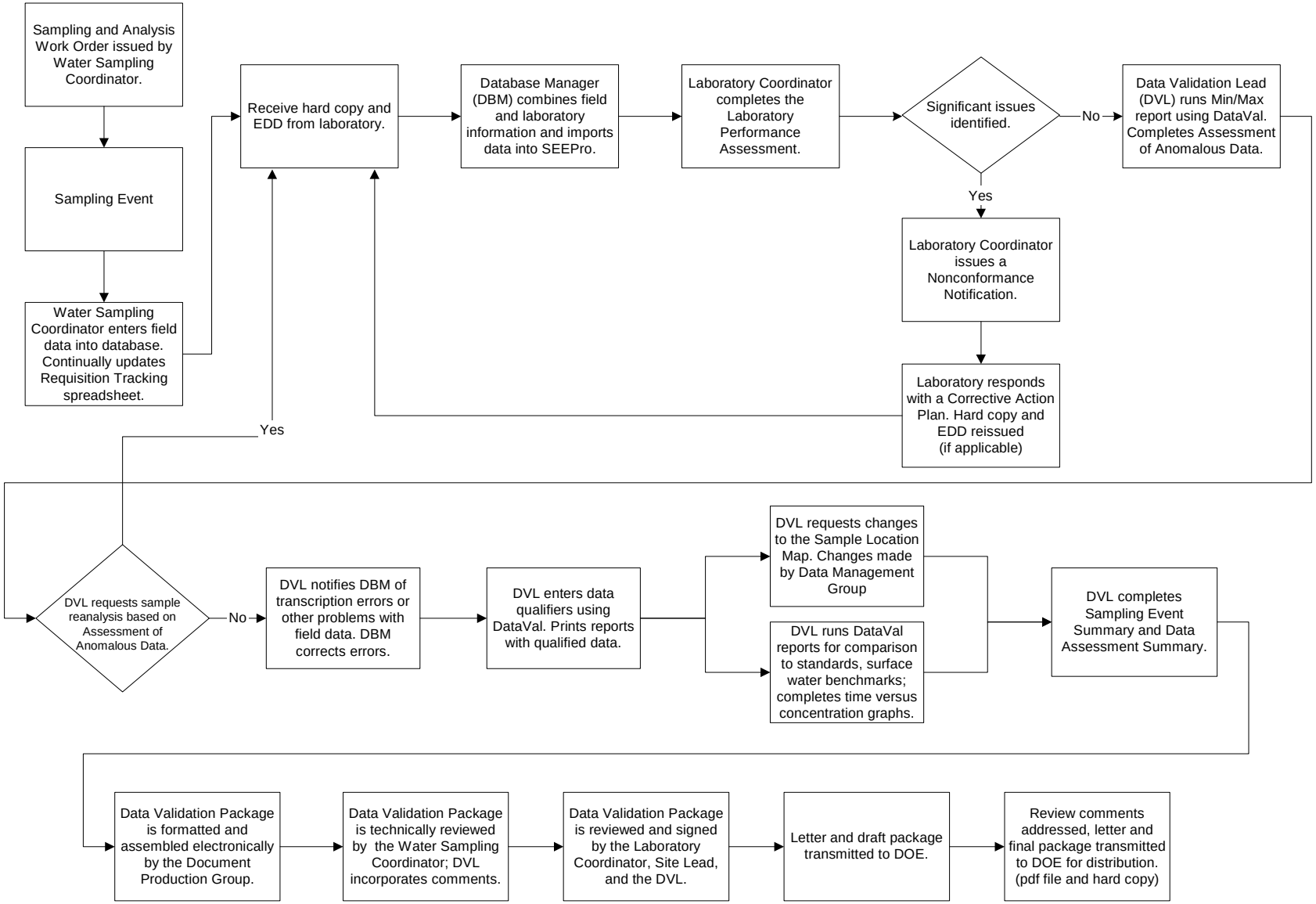

Figure 3. Data Validation Flowchart

Table 1. Example of a Data Validation Report Distribution List

Site	Project	Stakeholder	Total Number of Copies/Disks
Ambrosia Lake	LTSM	Scott McKitrick, New Mexico Environment Department (e-copy) cc w/enclosure: Kenneth Hooks, NRC/Rockville, MD	3/1
Canonsburg	LTSM	James Yusko, Pennsylvania Dept. of Environmental Protection cc w/enclosure: S. Harper, Pennsylvania Dept. of Environmental Protection cc w/enclosure: Mike Layton, NRC	4/0
Durango	UGW/LTSM	Wendy Naugle, CDPHE cc w/enclosure: W. Urbonas, San Juan Basin Health Dept. cc w/enclosure: Durango Public Library	4/0
Falls City	LTSM	Bruce Calder, Texas Dept. of Health, Bureau of Radiation Control (e-copy) cc w/enclosure: Falls City Public Library cc w/o enclosure: Gary Smith, Texas Dept. of Health, Bureau of Radiation Control	3/1
Grand Junction	UGW/LTSM	Wendy Naugle, CDPHE/Denver cc w/enclosure: Mesa County Public Library	3/0
Green River	UGW/LTSM	Rob Herbert, Utah Department of Environmental Quality (e-copy) cc w/enclosure: Green River Public Library cc w/o enclosure: Loren Morten, UDEQ	3/1
Gunnison	UGW/LTSM	Wendy Naugle, CDPHE/Denver Gunnison Public Library	3/0
Hallam	LTSM	Todd A. Chinn, Nebraska Public Power District cc w/enclosure: Jim DeFrain, Nebraska Health and Human Services	3/0
Lakeview	UGW	David Stewart-Smith, State of Oregon, Office of Radiation Control (e-copy) cc w/enclosure: Lake County Library	3/1
Lowman	LTSM	No DVPs being sent on this site (per M. Plessinger, OK'd by D. Metzler)	
Maybell	LTSM	Wendy Naugle, CDPHE/Denver	2/0
Mexican Hat	UGW/LTSM	Madeline Roanhorse, Navajo UMTRA Program (always gets 3 DVPs + e-copy) cc w/enclosure: Steve Osterberg, Knight Piesold cc w/enclosure: Eric Rich, Navajo EPA cc w/enclosure: Monument Valley High School Library cc w/o enclosure: Levon Benally, Navajo UMTRA	7/1
Moab	UGW	Loren Morton, UDEQ (e-copy) cc w/VDP: F. Gardner, Kayenta Consulting Group, Inc. B. Hedden, Grand Canyon Trust R. Irwin, National Park Service D. Kimball, National Park Service P. Mushovic, EPA, Region 8 P. Penoyer, National Park Service B. Waddell, U.S. Fish & Wildlife Service cc w/o enclosure: T. Wright, Stoller	10/1

EXAMPLE

Mr. George Smith
c/o Smith Construction, Co.
2720 Jones Avenue
Washington, Colorado 83838

SUBJECT: Water Quality Tests

Dear Mr. Smith:

In June 2004, S. M. Stoller Corporation, a subcontractor for the U.S. Department of Energy, collected a water sample from your property at well location 442, in Washington, Colorado, as part of the on-going assessment of ground water conditions near the UMTRA disposal site. Enclosed with this letter is a data table that shows the results for the June 2000 sampling. The samples were not filtered during the sampling process, thus representing what would be used for domestic purposes.

Drinking Water Standards

For most common chemicals, the U.S. Environmental Protection Agency (EPA) established standards for drinking water under the Safe Drinking Water Act that are called "Maximum Contaminant Levels" (MCLs). These values are based on available health effect data for each chemical and are designed to protect municipal drinking water supplies. Although MCLs are not used to regulate privately owned wells, the available MCLs are commonly used to evaluate the quality of water in private wells. Therefore, if the concentration in your well is below the MCL, there is no cause for concern.

For some chemicals, the EPA has set "Secondary Maximum Contaminant Levels" (SMCLs) for drinking water. An SMCL is simply a suggested level, based on aesthetic qualities of the water such as taste and odor. However, please note that an SMCL is not based on health effects and a recommended health-based limit would be at a higher value. For example, a recommended health-based limit for manganese would be 2.00 mg/L, compared to the SMCL of 0.05 mg/L.

UMTRA Ground Water Standard

EPA has promulgated standards for the cleanup of ground water at former uranium mill sites. These standards were finalized in January 1995 and are included in Column 4 of the attached table.

EXAMPLE

Figure 4. Example of Domestic Well Reporting

Results of the Sampling Program

A summary table of the June 2000 sampling is enclosed with this letter. On the data table, Column 1 lists the chemical name. Column 2 lists the amount detected in the well. Column 3 shows the units of measurement. The common units of measurement are: milligrams per liter (mg/L), one mg/L is approximately equivalent to one part per million; or picoCuries per liter (pCi/L), a picoCurie is a measure of the amount of radiation resulting from a chemical. Column 4 shows the MCL, SMCL, or UMTRA standard for the chemical. Column 5 indicates if the well exceeds the MCL, SMCL, or UMTRA standard associated with that chemical. If nothing appears in Column 5, the amount in the water does not exceed the MCL, SMCL, or UMTRA standards.

If you have any questions regarding this information, please feel free to contact me at (970) 248-7612.

Sincerely,

Donald R. Metzler
Project Manager

Enclosure

cc w/enclosure:
W. Naugle, CDPHE

cc w/o enclosure:
R. Plieness, DOE-GJO
GWRFL 3.2.4 (record thru P. Taylor)

EXAMPLE

Figure 4 (continued). Example of Domestic Well Reporting

Table 1.

Water Quality Analytical Results Unfiltered Well Water

Well Number: 442 Sample Date: 6/6/00

(1) Chemical	(2) Result	(3) Units	(4) EPA MCL	SMCL	UMTRA	(5) Exceeds?
Alkalinity as $CaCO_3$	377	mg/L				
Ammonia as NH_4	0.306	mg/L				
Arsenic	Nd	mg/L	0.05		0.05	
Fluoride	0.19B	mg/L	4.0	2.0		
Manganese	0.113	mg/L		0.05		SMCL
Molybdenum	0.0044B	mg/L			0.1	
Nitrate	71.8	mg/L	44		44	MCL/UMTRA
Oxidation Reduction	125	MV				
Selenium	0.00054B	mg/L	0.05		0.01	
Specific Conductance	5150	µmhos/cm				
Temperature	21.6	C				
Total Dissolved Solids	4720	mg/L		500		SMCL
Turbidity	3.47	NTU				
Uranium	0.0585	mg/L	0.030		0.044	MCL/UMTRA
Vanadium	Nd	mg/L				
pH	7.11	s.u.		6.5 – 8.5		

EXAMPLE

NOTE: nd = not detected; mg/L = milligrams per liter; NTU = nephelometric turbidity units; s.u. = standard units; mV = millivolts; µmhos/cm = micromhos per centimeter; C = degrees Centigrade; MCL = Maximum Contaminant Level; SMCL = Secondary Maximum Contaminant Level

Figure 4 (continued). Example of Domestic Well Reporting

End of current text

Appendix C

Job Safety Analysis

Job Safety Analysis

Scope:

Sampling activities will be conducted routinely at most LM sites. Routine tasks include collection, preservation, and shipping of water samples, field measurements including ground water levels and water quality measurements, and minor well maintenance. Driving to sites and sample locations is required along with occasional use of an ATV.

General Considerations:

Because of the nature of field work at numerous unique and sometimes remote sites, some unanticipated hazards may develop in the field that are not identified in this JSA. It is the responsibility of the field sampler to apply proper hazard controls and/or use appropriate protective equipment to mitigate the hazard based on their extensive safety training, which includes Site Safety Supervisor, Defensive Driving, Radiation Worker, 40 hour HAZWOPPER, ATV training, compressed gas handling, and hazard communication. The field sampler has the authority to stop work if possible hazard controls are inadequate to mitigate the hazard along with the responsibility to contact the Health and Safety organization and the appropriate manager to brief them on the hazard. The field sampler is empowered to make decisions regarding safety by employing their extensive training and common sense for all potential hazards not specifically listed in this JSA. Unanticipated hazards or new work scope identified in the field will be documented in the **Field Management Changes** section of this JSA

Define the Scope of Work by Tasks (CF#1)	Analyze the Hazards (CF#2)	Develop and Implement Controls (CF#3)	Performing Organization(s)	Perform Work Within Controls (CF#4) Date
General field work	Inclement weather (wind, lightning, tornados)	Seek shelter when weather conditions present a threat to safe working conditions.	Technical Services	Ongoing
	Heat/cold exposure	Wear adequate clothing for weather conditions. Take breaks as necessary. Maintain proper hydration.	Technical Services	Ongoing
	Slips, trips, and falls	Be aware of uneven terrain, keep work area clean and remove slip and trip hazards, if possible.	Technical Services	Ongoing
	Ladder use	Inspect ladders prior to use and remove those found unserviceable, do not exceed weight rating of ladder, use correct ladder for the job, personnel using ladders must have been trained in their safe and proper use.	Technical Services	Ongoing
	Hunting activities	Wear orange vests when conducting field work in remote areas during hunting season if hunting activities are expected in the area. Notify or alert hunters that you are working in the area.	Technical Services	Ongoing

Job Safety Analysis (continued)

Define the Scope of Work by Tasks (CF#1)	Analyze the Hazards (CF#2)	Develop and Implement Controls (CF#3)	Performing Organization(s)	Perform Work Within Controls (CF#4) Date
General field work	Back injury	Use correct lifting form, get help with heavy or awkward items, and use hand truck when able. Use proper lifting form – load close to the body, bend at the knees, keep back straight, do not rotate-when lifting, never carry a load that blocks your vision.	Technical Services	Ongoing
Driving to the site.	Vehicle accidents.	Use defensive driving techniques. Inspect vehicle prior to use.	Technical Services	Ongoing
	Towing a trailer	Insure all items in truck and trailer are securely fastened. Check trailer lights and connections. Use a spotter when backing truck and trailers.	Technical Services	Ongoing
	Jump starting a vehicle	Always wear safety glasses when handling batteries. Wear appropriate skin protection to prevent contact with battery acid. Inspect jumper cables and batteries for deficiencies, if found, correct them prior to jump-starting. Pull vehicle with good battery as close as possible to the one with the dead battery. Do not allow vehicles to touch each other. Ensure engines are off to both vehicles. Connect positive cable to positive post on dead battery first then to positive post on good battery. Connect negative cable to negative post on dead battery then to the vehicle frame away from the battery on good vehicle to prevent sparking near the battery. Ensure a good connection at each location. Start the vehicle with the good battery and run at fast idle for a couple minutes. Start vehicle with bad battery. As soon as the engine starts, remove both jumper cables. Do not allow connectors to touch each other.	Technical Services	Ongoing
Driving off road	Uneven terrain	Go slow. Use an appropriate vehicle such as a 4-wheel drive vehicle or ATV. If conditions do not allow safe vehicle travel, then walk to the sample location.	Technical Services	Ongoing
	Grass fires	Use discretion when traveling off road in grassy areas. If grass determined to be dry, tall enough to contact the bottom of the vehicle, and dense enough to sustain a fire, then use an ATV or walk to the sample location.	Technical Services	Ongoing

Job Safety Analysis (continued)

Define the Scope of Work by Tasks (CF#1)	Analyze the Hazards (CF#2)	Develop and Implement Controls (CF#3)	Performing Organization(s)	Perform Work Within Controls (CF#4) Date
Driving off road	Operating ATVs	Inspect ATV prior to operating. Operators must complete ATV Safe Operations Training. Motorcycle helmet is required.	Technical Services	Ongoing
Opening and accessing wells and well vaults	Pinch points, Crush Hazards, Cuts to Hands	Keep hands and fingers out of pinch points and crush areas. Wear leather work gloves to protect hands from cuts, abrasions, blisters, etc.	Technical Services	Ongoing
	Insect bites	Wear appropriate clothing covering as much exposed skin as possible, wear insect repellant. Beware of insects when opening a well.	Technical Services	Ongoing
	Snakes	Do not attempt to capture or handle snakes. Maintain a safe distance. Be aware of hands and feet in areas with thick vegetation and in well vaults.	Technical Services	Ongoing
	Confined Space	**Permit Required Confined Space Entry -** Posted as "Permit-Required Confined Space" CSEP required for entry, entrants and attendants must be current in confined space entry training, follow permit required confined space entry protocol. Emergency rescue team must be available. Contact H&S for guidance.	Technical Services	Ongoing
		Non-Permit Required Confined Space Entry - Posted as "Non-Permit Required Confined Space" This task is for inspection, maintenance and sampling only. If other work is to be performed contact Health & Safety. Due to the construction of the confined space, it may become permit-required due to the introduction of items as simple as PVC glue or exhaust from a generator or vehicle. Secure all well vault lids when in the open position to prevent inadvertent closure, especially during windy conditions. Use caution during ingress and egress.	Technical Services	Ongoing
	Radiological	If galvanized pipe is to be disconnected a Radiological Control Technician (RCT) shall be present. Fixed contamination will likely be encountered. Contaminated components shall be stored and disposed of per RCT direction. Whenever possible, galvanized components shall be replace with PVC or stainless steel to alleviate future contamination hazards.	Technical Services	Ongoing

Job Safety Analysis (continued)

Define the Scope of Work by Tasks (CF#1)	Analyze the Hazards (CF#2)	Develop and Implement Controls (CF#3)	Performing Organization(s)	Perform Work Within Controls (CF#4) Date
Opening and accessing wells and well vaults	Hantavirus	If rodent droppings or nests are encountered in well vaults, follow procedure STO 2.2, which includes respiratory protection and a disinfectant. Contact Health & Safety for guidance.	Technical Services	Ongoing
Sample collection and preservation; field measurements	Radiological	Use nitrile gloves when collecting samples or conducting field measurements. Contact H&S and follow Radiological Work Permit when accessing wells that penetrate directly into a disposal cell or when posted as a Radiological Contamination Area.	Technical Services	Ongoing
	Chemical Exposure	Review and follow MSDS's for all chemicals being used on site. Use nitrile gloves and safety glasses with side shields when dispensing sample preservatives (acids and bases), using calibrations solutions, or field test reagents.	Technical Services	Ongoing
	Drowning	Life jackets must be worn and a ring buoy with a minimum of 90 feet of line for emergency rescue must be provided while working within 5 feet of water where a drowning hazard exists.	Technical Services	Ongoing
Use of sampling equipment	Back injury	Use correct lifting form, get help with heavy or awkward items, and use hand truck when able. Use proper lifting form – load close to the body, bend at the knees, keep back straight, do not rotate-when lifting, never carry a load that blocks your vision.	Technical Services	Ongoing
	Noise exposure	Wear hearing protection in those areas that require the use of hearing protection, or when operating tools or equipment that exceed noise control levels.	Technical Services	Ongoing
	Electric shock	Inspect equipment prior to use and remove unserviceable cords and tools, use only double insulated tools, use GFCI for protection of personnel using outdoor outlets.	Technical Services	Ongoing

Job Safety Analysis (continued)

Define the Scope of Work by Tasks (CF#1)	Analyze the Hazards (CF#2)	Develop and Implement Controls (CF#3)	Performing Organization(s)	Perform Work Within Controls (CF#4) Date
Use of sampling equipment	Equipment Refueling	Vehicles and equipment shall not be fueled with the engine running. Cigarettes, open flames, or other ignition sources are not allowed within 50 feet of the fueling location. Flammable and combustible liquids shall be handled and used in approved safety cans that have flame arresters (screens), spring-closing (self-closing) lids, and spout covers. When transferring fuel between containers, a bonding wire shall be attached between containers (tanks, drums, etc.) to draw off static charge. The bonding wire or one of the containers must be grounded.	Technical Services	Ongoing
	Compressed gas cylinders	Only individuals trained in the safe use of compressed gas cylinders may use them on site. Use caution during transport, they shall remain upright with the regulator removed and protective cap in place. Use properly rated regulator for the control of gas flow. Maintain all fittings and connections free from dirt, grease and oil. Check for leaks after regulator and fittings are in place.	Technical Services	Ongoing
	Battery charging	Always wear safety glasses when handling batteries. Wear appropriate skin protection to prevent contact with battery acid. Inspect charger and battery for deficiencies, if found, correct them prior to charging. Connect charger cables to battery before plugging in charger to AC supply. Charge battery with caps in place. Connect positive cable to positive terminal first, negative cable to negative terminal last. Always plug charger into GFCI protected outlet. Set charger to appropriate voltage for battery being charged. Turn charger on. Do not overcharge battery. Ensure that there are no spark or flame generating sources near. Ensure good ventilation to area. After charging, disconnect in reverse sequence.	Technical Services	Ongoing

Job Safety Analysis (continued)

Define the Scope of Work by Tasks (CF#1)	Analyze the Hazards (CF#2)	Develop and Implement Controls (CF#3)	Performing Organization(s)	Perform Work Within Controls (CF#4) Date
Well maintenance	Hand tools	Inspect all hand tools prior to use and remove those from service that are unserviceable, wear safety glasses with side shields when exposed to flying particles, wear hearing protection for those that exceed noise level limits, wear leather work gloves to protect from cuts, scrapes, etc., keep hands and fingers out of pinch points associated with power tools. Make sure all manufacturer supplied guards are in place, or that the tool is properly guarded.	Technical Services	Ongoing
	Chemical exposure (painting well casing)	Review and follow MSDS's for all chemicals being used on site. Use nitrile gloves and safety glasses with side shields. Only paint in open areas with good ventilation.	Technical Services	Ongoing
	Eye injury from flying particles	Wear safety glasses with side shields when exposed to flying particles.	Technical Services	Ongoing
	Overhead hazards	Wear hard hat when working in areas where overhead work is being performed, or head bump hazards exist.	Technical Services	Ongoing
	Uncontrolled hazardous energy	Workers who may be exposed to uncontrolled hazardous energy must follow Lock Out/Tag Out (LO/TO) protocol.(STO 2 H&S Manual, Proc. 10.2)	Technical Services	Ongoing
	Pinch points, crush hazards, cuts to hands	Keep hands and fingers out of pinch points and crush areas. Wear leather work gloves to protect hands from cuts, abrasions, blisters, etc.	Technical Services	Ongoing

Job Safety Analysis (continued)

Field Management Changes:

Define New or Changed Scope of Work by Tasks (CF#1)	Analyze the New or Changed Hazards (CF#2)	Develop and Implement New Controls (CF#3)	Performing Organization(s) Print Name and Initial	Perform Work Within Controls (CF#4) Date

Job Safety Analysis (continued)

I have reviewed, thoroughly understand, and will comply with this ISMS Core Functions Work Planning and Control Document

Print Name	Signature	Company	Date
Sam Campbell	Sam Campbell	Stoller	10-8-07
DAVID Miller	[illegible]	Stoller	10/8/07

Provide Feedback and Improvement Suggestions: (CF#5):

Mark F. Reed	[illegible]	10-8-07
S.M. Stoller (Print Name)	Signature	Date
Subcontractor (Print Name)	Signature	Date

Appendix D

Site Specific Information and Program Directives

Current Index of Site Specific Program Directives as of November 2007

Directive No.	Effective Date	Expiration Date	Initiated By	Subject
FER-2008-01	9/30/07	10/01/08	Sam Campbell	Low-flow (micropurge) purging and sampling
FER-2008-02	9/30/07	10/01/08	Sam Campbell	Standard (high-flow) purging and sampling
FER-2008-03	9/30/07	10/01/08	Sam Campbell	Miscellaneous water sampling activities
FER-2008-04	9/30/07	10/1/08	Sam Campbell	Air monitoring activities
FER-2008-05	9/30/07	10/1/08	Sam Campbell	Parshall Flume Sampling, CAWWT Laboratory Operation
MND-2008-01	9/30/07	10/01/08	Sam Campbell	Ground Water Sampling
RFS-2008-01	9/30/07	10/1/08	Sam Campbell	Miscellaneous sampling activities (VOCs, holding times, alkalinity and turbidity measurements.
RFS-2008-02	9/30/07	10/1/08	Sam Campbell	Purging and sampling of low producing wells
RFS-2008-03	9/30/07	10/1/08	Sam Campbell	Disposition of excess water **Note:** guideline attached (7 pgs)
RFS-2008-04	9/30/07	10/1/08	Sam Campbell	Processing of composite surface water samples **Note:** guideline attached (1 pg)
RUL-2007-01	08/13/07	09/30/08	Sam Campbell	Natural Gas Sampling

Ambrosia Lake, New Mexico

Sampling Frequencies for Locations at Ambrosia Lake, New Mexico

Location ID	Quarterly	Semiannually	Annually	Triennially	Not Sampled	Notes
Monitor Wells						
675				X		Sampled every 3 years through 2032. Next in 11/2007
678				X		Sampled every 3 years through 2032. Next in 11/2007

Sampling conducted in November

Constituent Sampling Breakdown

Site	Ambrosia Lake	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	2	0
Field Measurements		
Alkalinity	X	
Dissolved Oxygen		
Redox Potential	X	
pH	X	
Specific Conductance	X	
Turbidity	X	
Temperature	X	
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Beryllium		
Bromide		
Cadmium		
Calcium		
Chloride		
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron		
Lead		
Lead-210		
Magnesium		
Manganese		
Molybdenum	X	
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	X	
PCBs		
Phosphate		
Polonium-210		
Potassium		
Radium-226		
Radium-228		
Selenium	X	
Silica		
Sodium		
Strontium		
Sulfate	X	
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids		
Total Organic Carbon		
Uranium	X	
Vanadium		
Zinc		
Total No. of Analytes	5	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Bluewater, New Mexico

Sampling Frequencies for Locations at Bluewater, New Mexico

Location ID	Quarterly	Semiannually	Annually	Triennially	Not Sampled	Notes
Monitor Wells						
E(M)			X			Sample for PCBs annually; all analytes every 3 yrs (next in 2007)
Y2(M)			X			Sample for PCBs annually; all analytes every 3 yrs (next in 2007)
F(M)			X			Sample for PCBs annually; all analytes every 3 yrs (next in 2007)
T(M)			X			Sample for PCBs annually; all analytes every 3 yrs (next in 2007)
X(M)					X	Sampled if standards exceeded at POC well. See LTSP.
L(SG)				X		Next sampling 11/2007
S(SG)				X		Next sampling 11/2007
OBS-3				X		Next sampling 11/2007
I(SG)					X	Sampled if standards exceeded at POC well. See LTSP.

Sampling conducted in November.

Constituent Sampling Breakdown

Site	Bluewater	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	7	0
Field Measurements		
Alkalinity	X	
Dissolved Oxygen		
Redox Potential	X	
pH	X	
Specific Conductance	X	
Turbidity	X	
Temperature	X	
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Beryllium		
Bromide		
Cadmium		
Calcium		
Chloride		
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron		
Lead		
Lead-210		
Magnesium		
Manganese		
Molybdenum	E(M), T(M), and F(M) only (next in 2007)	
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N		
PCBs	E(M), Y2(M), T(M), and F(M) only	
Phosphate		
Polonium-210		
Potassium		
Selenium	All except Y2(M), X(M), and I(SG) (next in 2007)	
Silica		
Sodium		
Strontium		
Sulfate		
Sulfide		
Total Dissolved Solids		
Total Organic Carbon		
Uranium	All except Y2(M), X(M), and I(SG) (next in 2007)	
Vanadium		
Zinc		
Total No. of Analytes	4	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Burrell, Pennsylvania

Sampling Frequencies for Locations at Burrell, Pennsylvania

Location ID	Quarterly	Semiannually	Annually	Biennially	Every 5 Years	Notes
Monitor Wells						
420					X	Next in October 2009
422					X	Next in October 2009
423					X	Next in October 2009
424					X	Next in October 2009
520					X	Next in October 2009
522					X	Next in October 2009
523					X	Next in October 2009
524					X	Next in October 2009
Surface Locations						
611					X	SEEP on cell; next in 10/09
612					X	SEEP on cell; next in 10/09

Sampling conducted in October

Constituent Sampling Breakdown

Site	Burrell	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	8	2
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen		
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Beryllium		
Bromide		
Cadmium		
Calcium	X	X
Chloride	X	X
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron	X	X
Lead	X	X
Lead-210		
Magnesium	X	X
Manganese	X	X
Molybdenum	X	X
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	X	X
PCBs		
Phosphate		
Polonium-210		
Potassium	X	X
Radium-226		
Radium-228		
Selenium	X	X
Silica		
Sodium	X	X
Strontium		
Sulfate	X	X
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids	X	X
Total Organic Carbon		
Uranium	X	X
Vanadium		
Zinc		
Total No. of Analytes	14	14

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Canonsburg, Pennsylvania

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
406A			X			
410			X			
412			X			
413			X			
414B			X			
424			X			
Surface Locations						
601			X			
602			X			
603			X			

Sampling conducted in October

Constituent Sampling Breakdown

Site	Canonsburg	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	6	3
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen		
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Beryllium		
Bromide		
Cadmium		
Calcium	X	X
Chloride	X	X
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha	X	
Gross Beta	X	
Iron		
Lead		
Lead-210		
Magnesium	X	X
Manganese	X	X
Molybdenum	X	X
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N		
PCBs		
Phosphate		
Polonium-210		
Potassium	X	X
Radium-226		
Radium-228		
Selenium		
Silica		
Sodium	X	X
Strontium		
Sulfate	X	X
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids		
Total Organic Carbon		
Uranium	X	X
Vanadium		
Zinc		
Total No. of Analytes	11	9

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Central Nevada Test Area, Nevada

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
MV-1			X			
MV-2			X			
MV-3			X			
HTH-1			X			
HTH-2			X			
UC-1-P-1S					X	
MV-4			X			To be Installed Spring 2008 - Download transducers/Start Sampling Fall 2008
MV-5			X			To be Installed Spring 2008 - Download transducers/Start Sampling Fall 2008
Six Mile Well			X			
Twin Springs Ranch			X			
Tybo Well			X			
Hot Creek Ranch			X			
Domestic Wells						
Blue Jay Maint Statn			X			
Site C - Base Camp			X			
Piezometers						
MV-1LPZ					X	Download transducers
MV-1UPZ					X	Download transducers
MV-2LPZ					X	Download transducers
MV-2UPZ					X	Download transducers
MV-3LPZ					X	Download transducers
MV-3UPZ					X	Download transducers
MV-4PZ					X	To be Installed Spring 2008 - Download transducers/Start Sampling Fall 2008
MV-5PZ					X	To be Installed Spring 2008 - Download transducers/Start Sampling Fall 2008
Surface Locations						
Blue Jay Springs			X			

Sampling conducted in March

Constituent Sampling Breakdown

Site	Central Nevada Test Area	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	13	1
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen	X	X
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Beryllium		
Bromide	MV-1, MV-2, MV-3, MV-4, MV-5	
Cadmium		
Calcium		
Carbon-14	MV-1, MV-2, MV-3, MV-4, MV-5, HTH-1, HTH-2 ONLY	
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec	X	
Gross Alpha		
Gross Beta		
Iodine-129	MV-1, MV-2, MV-3, MV-4, MV-5, HTH-1, HTH-2 ONLY	
Lead		
Lead-210		
Magnesium		
Manganese		
Molybdenum		
Nickel		
Nickel-63		
PCBs		
Phosphate		
Polonium-210		
Potassium		
Radium-226		
Radium-228		
Selenium		
Silica		
Sodium		
Strontium		
Sulfate		
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids		
Tritium	X	X
Uranium		
Vanadium		
Zinc		
Total No. of Analytes	3	1

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Durango, Colorado

Sampling Frequencies for Locations at Durango, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
DUR01 Mill Tailings						
612			X			
617			X			
630			X			
631			X			Download datalogger
633			X			Download datalogger
634			X			
635			X			
859					X	Download datalogger
863			X			Download datalogger
DUR02 Raffinate Pond						
594			X			Se and U ONLY
596					X	Download datalogger
598			X			Se and U ONLY
607			X			Se and U ONLY
879			X			Se and U ONLY
884			X			Se and U ONLY
888					X	Download datalogger
889					X	Download datalogger
890					X	Download datalogger
DUR03 Bodo Canyon						
605			X			
607			X			POC WELL
608			X			"
612			X			"
618			X			"; supplements 608
621			X			"
623			X			BACKGROUND
MW-1					X	Download datalogger
NVP					X	Download datalogger
P7					X	Download datalogger
Surface Locations						
DUR01 Mill Tailings						
584			X			
586			X			
652			X			RIVER
691			X			RIVER
DUR02 Raffinate Pond						
588			X			
654			X			RIVER
656			X			

Sampling conducted in June

Constituent Sampling Breakdown

Site	Durango	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	20	7
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen		
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Beryllium		
Bromide		
Cadmium	612 & 863 only	X
Calcium	DUR03 only	
Chloride	DUR03 only	
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron	DUR03 only	
Lead		
Magnesium	DUR03 only	
Manganese	All Mill Tailings Area and Bodo Canyon locations	
Molybdenum	All Mill Tailings Area and Bodo Canyon locations	X
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N		
Polonium-210		
Potassium	DUR03 only	
Radium-226		
Radium-228		
Selenium	X	X
Silica		
Sodium	DUR03 only	
Strontium		
Sulfate	All Mill Tailings Area and Bodo Canyon locations	
Sulfide		
Total Dissolved Solids	X	
Total Organic Carbon		
Uranium	X	X
Vanadium		
Zinc		
Total No. of Analytes	13	4

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Falls City, Texas

Sampling Frequencies for Locations at Falls City, Texas

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
709		X				
858		X				
862			X			
880		X				
886			X			
891			X			Download data logger
906		X				Download data logger
908		X				
916		X				
921		X				
924			X			Download data logger
963			X			Download data logger

Annual sampling conducted in April
Semiannual sampling conducted in October and April

Constituent Sampling Breakdown

Site	Falls City	
Analyte	Ground Water	Surface Water
Approx No. Samples\yr	19	0
Field Measurements		
Alkalinity	X	
Dissolved Oxygen		
Redox Potential	X	
pH	X	
Specific Conductance	X	
Turbidity	X	
Temperature	X	
Laboratory Measurements		
Aluminum	X	
Ammonia as N (NH3-N)	X	
Antimony	X	
Arsenic	X	
Beryllium	X	
Bromide	X	
Cadmium	X	
Calcium	X	
Chloride	X	
Chromium	X	
Cobalt	X	
Copper	X	
Fluoride		
Gamma Spec		
Gross Alpha	X	
Gross Beta		
Iron	X	
Lead	X	
Lead-210		
Magnesium	X	
Manganese	X	
Molybdenum	X	
Nickel	X	
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	X	
Polonium-210		
Potassium	X	
Radium-226	X	
Radium-228	X	
Selenium	X	
Silica		
Sodium	X	
Strontium		
Sulfate	X	
Sulfide	X	
Thallium	X	
Thorium-230		
Tin	X	
Total Dissolved Solids	X	
Total Organic Carbon		
Uranium	X	
Uranium-234, -238		
Vanadium	X	
VOCs		
Zinc	X	
Total No. of Analytes	33	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Program Directive
Fernald Site

Activities: Ground Water Monitoring **Directive No.:** FER-2008-01

Initiated By: Sam Campbell

Directive Subject: Low-flow (micropurge) purging and sampling.

Directive and Associated Task Changes:

Purging will be accomplished by pumping three pump/tubing volumes from the dedicated pump. Stability of field parameters, including water level, pH, specific conductance, and turbidity, are not required. Sampling can commence after three pump/tubing volumes are removed and field parameters are measured.

Organization(s) Affected: Environmental Monitoring/Field Services, Geosciences, Hydrology.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (DOE-LM/GJ1197-2006); *Sitewide CERCLA Quality (SCQ) Assurance Project Plan* (FD-1000); *Integrated Environmental Monitoring Plan, Rev 4B*; *Groundwater/Leak Detection and Leachate Monitoring Plan, On-Site Disposal Facility, Rev 2.*

Justification for Directive:

Because the Great Miami Aquifer is very productive, flow through the screened interval of conventional monitor wells completed in this aquifer is considered adequate to allow sampling with a minimal purge and without demonstrating field parameter stability. Demonstration of field parameter stability is the conventional practice to determine when water purged from a well is representative of the ground water conditions with minimal impacts from the well (stagnant water) or the sampling process. Collecting samples from conventional monitor wells completed in the Great Miami Aquifer without demonstrating stability of field parameters is justified because water within the screened interval of this highly conductive aquifer is continuously flowing and considered representative of ground water conditions. The low-flow rate (500 mL/min) and minimal purge volume allows collection of the water from the screened interval. This micropurge protocol has been approved by the regulatory agencies (U. S. EPA and Ohio EPA) and is the current protocol specified in the Site CERCLA Quality Assurance Plan.

Review and Concurrence:

10/17/07
Frank Johnston, Site Office Manager

10/17/07
Karen Voisard, East Sites Lead

10/17/07
Mike Hoge, QA Project Lead

Task Order Manager Approval to Issue:

Sam Campbell, Environmental Monitoring/Field Services Manager — Date: 10-17-07

Effective Date: 10/1/2007 **Expiration Date:** 9/30/2008

Distribution: Document Production – Master Copy
Record File through Dianna Roberts (ADM 130.10)
Distribution List for the Sampling and Analysis Plan for U. S. DOE LM Sites

Program Directive
Fernald Site

Activities: Ground Water Monitoring **Directive No.:** FER-2008-02

Initiated By: Sam Campbell

Directive Subject: Standard (High-Flow) Purging and Sampling

Directive and Associated Task Changes:

At wells where micropurging and sampling is not practicable, standard high-flow purging and sampling protocol may be used. The pump will be placed near the top of the water column to facilitate removal of stagnant water from the casing. For the standard purge, sampling can commence after 3 casing volumes have been purged from the well and consistent measurements of pH, temperature, dissolved oxygen, turbidity, and specific conductance have been obtained. A well may be purged dry and sampled if recovery occurs within 24 hours of purging.

Organization(s) Affected: Environmental Monitoring/Field Services, Geosciences, Hydrology.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (DOE-LM/GJ1197-2006); *Sitewide CERCLA Quality (SCQ)Assurance Project Plan* (FD-1000); *Integrated Environmental Monitoring Plan, Rev 4B*; *Groundwater/Leak Detection and Leachate Monitoring Plan, On-Site Disposal Facility, Rev 2.*

Justification for Directive:

Standard purging protocol is required at wells that are not equipped with a dedicated pump or at wells that do not yield sufficient water to maintain the water level during micropurging. Standard purging and sampling protocol has been approved by the regulatory agencies (U. S. EPA and Ohio EPA) and is consistent with the current protocol specified in the Site CERCLA Quality Assurance Plan.

Review and Concurrence:

10/12/07
Frank Johnston, Site Office Manager

10/17/07
Karen Voisard, East Sites Lead

10/17/07
Mike Hoge, QA Project Lead

Task Order Manager Approval to Issue:

Sam Campbell
Sam Campbell, Environmental Monitoring/Field Services Manager

10-17-07
Date

Effective Date: 10/1/2007 **Expiration Date:** 9/30/2008

Distribution: Document Production – Master Copy
Record File through Dianna Roberts (ADM 130.10)
Distribution List for the Sampling and Analysis Plan for U. S. DOE LM Sites

Program Directive
Fernald Site

Activities: Water Sampling

Directive No: FER-2008-03

Initiated By: Sam Campbell

Directive Subject: Miscellaneous Water Sampling Activities

Directive and Associated Task Changes:

(1). Water quality meter (Horiba brand) calibration will be conducted on a monthly basis, and an autocalibration will be conducted at each sampling location.
(2). Samples that require temperature regulation between 0° and 4° C can be stored using blue ice.
(3). If a dedicated pump is installed in a well, 8 hours must elapse prior to purging and sampling.
(4). An annual (at a minimum) performance check will be conducted on dedicated pressure transducers with acceptance criterion of ± 0.1ft. If the pressure transducer does not meet the acceptance criterion, it will be recalibrated or removed from service.
(5). Private or extraction wells will be flushed to remove stagnant water in the lines, with a minimum of one minute of flushing at full capacity prior to sample collection.
(6). Surface water sampling for low level mercury will be conducted according to protocol specified in EPA method 1631, Revision E.
(7). An annual check will be conducted on all water level indicators by comparing depth markings to a dedicated reference tape. If the difference is more than +/- 0.1 foot, then the water level indicator will be removed from service.

Organization(s) Affected: Environmental Monitoring/Field Services, Geosciences, Hydrology.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (DOE-LM/GJ1197-2006); *Sitewide CERCLA Quality (SCQ)Assurance Project Plan* (FD-1000); *Integrated Environmental Monitoring Plan, Rev 4B*; *Groundwater/Leak Detection and Leachate Monitoring Plan, On-Site Disposal Facility, Rev 2.*

Justification for Directive:

The calibration frequency of water-quality meters is appropriate for the brand of meter currently used at the site. All the practices listed in this directive have been approved by the regulatory agencies (U. S. EPA and Ohio EPA) and are consistent with current protocol specified in the Site CERCLA Quality Assurance Plan.

Review and Concurrence:

10/12/07
Frank Johnston, Site Office Manager

10/17/07
Karen Voisard, East Sites Lead

Michael B Hoge 10/17/07
Mike Hoge, QA Project Lead

Task Order Manager Approval to Issue:

Sam Campbell
Sam Campbell, Environmental Monitoring/Field Services Manager

10-17-07
Date

Effective Date: 10/1/2007 **Expiration Date:** 9/30/2008

Distribution: Document Production – Master Copy
Record File through Dianna Roberts (ADM 130.10)
Distribution List for the Sampling and Analysis Plan for U. S. DOE LM Sites

Program Directive
Fernald Site

Activities: Air Monitoring

Directive No: FER-2008-04

Initiated By: Sam Campbell

Directive Subject: Air Monitoring Activities

Directive and Associated Task Changes:

Air monitoring activities will be conducted using the technical instructions of the following Fluor Fernald procedures: *Calibration of the Graseby GMW High Volume Air Sampler; Air Monitoring Data Review and Analysis; High Volume Air Monitoring; Evaluating Continuous Radon Monitoring Data; Pylon AB-5, Continuous Environmental Radon Monitoring; Environmental Direct Radiation Monitoring;* and *Estimating Radiological Pathway Dose.* Administrative portions of these procedures, including references to personnel, company organizations, organizational interfaces, training, and records disposition, are not applicable.

Organization(s) Affected: Environmental Monitoring/Field Services, Geosciences, Hydrology.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (DOE-LM/GJ1197-2006); *Sitewide CERCLA Quality (SCQ) Assurance Project Plan* (FD-1000), *Integrated Environmental Monitoring Plan, Rev 4B.*

Justification for Directive:

LM does not have general air monitoring procedures because air-monitoring programs are typically site-specific and procedures for operation of air sampling equipment are typically equipment-specific. Site-specific procedures have been developed for the air-monitoring program at the Fernald site. Continuation of these procedures after transition to LM is necessary to provide a consistency of calibration, documentation, and sampling processes to ensure the resulting data meets the established data quality objectives. Administrative portions of these procedures do not apply because they reference Fluor Fernald systems and practices under the EM structure, which has been replaced by the LM structure.

Review and Concurrence:

10/17/07
Frank Johnston, Site Office Manager

10/17/07
Karen Voisard, East Sites Lead

Michael B Hoge 10/17/07
Mike Hoge, QA Project Lead

Task Order Manager Approval to Issue:

Sam Campbell
Sam Campbell, Environmental Monitoring/Field Services Manager

10-17-07
Date

Effective Date: 10/1/2007 **Expiration Date:** 1/1/2008

Distribution: Document Production – Master Copy
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Distribution List for the Sampling and Analysis Plan for U. S. DOE LM Sites

Program Directive

Fernald Site

Activity or Task: Parshall Flume Sampling, CAWWT Laboratory Operation **Directive No.:** FER-2008-05

Initiated By: Sam Campbell

Directive Subject: NPDES Sampling and Analysis Activities

Directive and Associated Task Changes:

The following procedures will be followed when conducting activities in support of the NPDES sampling program. Parshall flume sampling will be conducted according to the following Fluor procedures: *IEMP Surface Water Sampling; NPDES Sampling; and Daily Operations at the Parshall Flume.* Field instrumentation will be used and calibrated in accordance with manufacturer's instructions, which includes HACH Sigma 900 automatic sampler, HACH HQ40D pH and DO meters. Analysis of samples at the Fernald Analytical Laboratory will be conducted using the following Fluor analyte-specific procedures: *Uranium, Total Dissolved Solids*; *Dissolved Oxygen*; *Free and Total Chlorine*; *Fecal Coliform*; *Total Hardness*; *Total Suspended Solids*; *Biological Oxygen Demand and Carbonaceous Biological Oxygen Demand*; *Fluoride*; *pH*; and *Wastewater*. Operation of the laboratory will be conducted using the following Fluor procedures: *ALS Control Chart Maintenance*; *Logkeeping*; *Calibration Verification of Analytical Balances*; *Preventative Maintenance for Analytical Balances*; *Analytical Services Laboratory Quality Assurance Plan; Management and Reporting of Analytical Laboratory Results*; *Monitoring Refrigerators for Environmental Samples*; *Data Package Assembly and Review*; *Preparation of Reagents and Standards*; *Cleaning Laboratory Glassware*; and *Calibration Verification of Thermometers*. Administrative portions of these procedures, including references to personnel, company organizations, organizational interfaces, training, and records disposition, are not applicable.

Organization(s) Affected: Environmental Monitoring/Field Services, Geosciences, Hydrology.

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (DOE-LM/GJ1197-2006); *Sitewide CERCLA Quality (SCQ) Assurance Project Plan* (FD-1000), *Integrated Environmental Monitoring Plan, Rev 4B.*

Justification for the Directive:

LM does not have procedures specific to Parshall flume sampling and laboratory operation at the Fernald site. Site-specific procedures have been developed and are in place for these activities at the Fernald site. Continuation of these procedures is necessary to provide a consistency of calibration, documentation, sampling, and analytical processes to ensure the resulting data meets the established data quality objectives. Administrative portions of the Fluor procedures do not apply because they reference Fluor Fernald systems and practices under the EM structure, which has been replaced by the LM structure.

Review and Concurrence:

10/17/07
Frank Johnston, Site Office Manager

10/17/07
Karen Voisard, East Sites Lead

10/17/07
Mike Hoge, QA Project Lead

Issuing Manager Approval:

Sam Campbell, Environmental Monitoring/Field Services Manager

10-17-07
Date

Effective Date: 10/1/2007 **Expiration Date:** 9/30/2008

Distribution: Document Production – Master Copy
Record File through Dianna Roberts (ADM 130.10)
Distribution List for the Sampling and Analysis Plan for U. S. DOE LM Sites

Sampling Frequencies for Locations at Gasbuggy, New Mexico

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
Jicarilla Well 1			X			Windmill
Lower Burro Canyon			X			Windmill
Well 30.3.32.343 (N)			X			Windmill
Well 28.3.33.233 (S)			X			Windmill
Windmill #2			X			Windmill
Domestic Wells						
Arnold Ranch Well			X			
Surface Locations						
Arnold Ranch Spring			X			
Bubbling Springs			X			
Cave Springs			X			
Cedar Springs			X			
La Jara Creek			X			
Pnd N WL 30.3.32.343			X			

Annual sampling conducted in June

Constituent Sampling Breakdown

Site	Gasbuggy	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	6	6
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen	X	X
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Beryllium		
Bromide		
Cadmium		
Calcium		
Carbon-14		
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec	X	
Gross Alpha		
Gross Beta		
Iodine-129		
Lead		
Lead-210		
Magnesium		
Manganese		
Molybdenum		
Nickel		
Nickel-63		
PCBs		
Phosphate		
Polonium-210		
Potassium		
Radium-226		
Radium-228		
Selenium		
Silica		
Sodium		
Strontium		
Sulfate		
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids		
Tritium	X	X
Uranium		
Vanadium		
Zinc		
Total No. of Analytes	1	1

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Gnome-Coach, New Mexico

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
Well DD-1			X			Depth specific bailer
LRL-7			X			Depth specific bailer
J. Mobley Ranch			X			
Loving City Well #7			X			
Carlsbad City WL #7			X			
PHS Well 6			X			
PHS Well 8			X			Windmill
PHS Well 9			X			Windmill
PHS Well 10			X			Pump jack
USGS-1			X			Windmill
USGS-4			X			Depth specific bailer
USGS-8			X			Depth specific bailer

Annual sampling conducted in June

Constituent Sampling Breakdown

Site	Gnome	
Analyte	**Ground Water**	**Surface Water**
Approx. No. Samples/yr	12	0
Field Measurements		
Alkalinity	X	
Dissolved Oxygen	X	
Redox Potential	X	
pH	X	
Specific Conductance	X	
Turbidity	X	
Temperature	X	
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Beryllium		
Bromide		
Cadmium		
Calcium		
Carbon-14		
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec	X	
Gross Alpha		
Gross Beta		
Iodine-129		
Lead		
Lead-210		
Magnesium		
Manganese		
Molybdenum		
Nickel		
Nickel-63		
PCBs		
Phosphate		
Polonium-210		
Potassium		
Radium-226		
Radium-228		
Selenium		
Silica		
Sodium		
Strontium		
Sulfate		
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids		
Tritium	X	
Uranium		
Vanadium		
Zinc		
Total No. of Analytes	1	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Grand Junction
Disposal Site

Sampling Frequencies for Locations at Grand Junction Disposal Site

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
731			X			Download data logger
732			X			Download data logger
733			X			Download data logger

Sampling conducted in August

Constituent Sampling Breakdown

Site	GRJ-Disposal Site	
Analyte	Ground Water	Surface Water
Approx No. Samples\yr	3	0
Field Measurements		
Alkalinity	X	
Dissolved Oxygen		
Redox Potential	X	
pH	X	
Specific Conductance	X	
Turbidity	X	
Temperature	X	
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Beryllium		
Bromide		
Cadmium		
Calcium		
Chloride		
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron		
Lead		
Lead-210		
Magnesium		
Manganese		
Molybdenum	X	
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	X	
PCBs	X	
Potassium		
Radium-226		
Radium-228		
Selenium	X	
Silica		
Sodium		
Strontium		
Sulfate	X	
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids	X	
Total Organic Carbon		
Uranium	X	
Uranium-234, -238		
Vanadium	X	
VOCs		
Zinc		
Total No. of Analytes	8	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Grand Junction
Office Facility

Sampling Frequencies for Locations at Grand Junction Office Facility

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
8-4S			X			
11-1S			X			
6-2N			X			
14-13NA			X			
GJ84-04			X			
GJ01-01			X			
10-19N			X			
Surface Locations						
Upper Gunnison			X			
Upper Middle Gunnison			X			
Lower Gunnison			X			
South Pond			X			
North Pond			X			
Wetland Area			X			

Sampling conducted in February

Constituent Sampling Breakdown

Site	GJO-Office Facility	
Analyte	Ground Water	Surface Water
Approx No. Samples\yr	7	6
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen		
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	X
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Beryllium		
Bromide		
Cadmium		
Calcium		
Chloride		
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron		
Lead		
Lead-210		
Magnesium		
Manganese	X	
Molybdenum	X	X
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N		
Polonium-210		
Potassium		
Radium-226		
Radium-228		
Selenium	X	X
Silica		
Sodium		
Strontium		
Sulfate	X	X
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids		
Total Organic Carbon		
Uranium	X	X
Uranium-234, -238		
Vanadium		
VOCs		
Zinc		
Total No. of Analytes	5	4

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Grand Junction
Processing Site

Sampling Frequencies for Locations at Grand Junction Processing Site

Location ID	Quarterly	Semiannually	Annually	Every 5 Years	Not Sampled	Notes
Monitor Wells						
590				X		Download data logger; next sampling in 1/2011
745				X		Next sampling in 1/2011
1001				X		Download data logger; next sampling in 1/2011
1014				X		Next sampling in 1/2011
Surface Locations						
423				X		Next sampling in 1/2011
427				X		Next sampling in 1/2011

Sampling conducted in January

Check for data loggers in the following wells:
744, 746, 1002, 1013, 1017, 1022, 1033

Constituent Sampling Breakdown

Site	GJT-Processing Site	
Analyte	Ground Water	Surface Water
Approx No. Samples\yr	4	2
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen		
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)	X	X
Antimony		
Arsenic		
Beryllium		
Bromide		
Cadmium		
Calcium		
Chloride		
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron		
Lead		
Lead-210		
Magnesium		
Manganese		
Molybdenum	X	X
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N		
Polonium-210		
Potassium		
Radium-226		
Radium-228		
Selenium		
Silica		
Sodium		
Strontium		
Sulfate		
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids	X	X
Total Organic Carbon		
Uranium	X	X
Uranium-234, -238		
Vanadium		
VOCs		
Zinc		
Total No. of Analytes	4	4

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Green River, Utah

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
171			X			Telemetry
173			X			Telemetry
176			X			Telemetry
179			X			Telemetry
180					X	Telemetry; WL only
181			X			
182					X	Telemetry; WL only
183					X	Telemetry; WL only
184					X	Telemetry; WL only
185					X	Telemetry; WL only
188			X			
189			X			
192			X			
194			X			
582					X	Telemetry; WL only
588					X	Telemetry; WL only
813			X			Telemetry
817					X	Telemetry; WL only
Surface Locations						
846			X			
847			X			

Annual sampling conducted in June

Constituent Sampling Breakdown

Site	Green River	
Analyte	Ground Water	Surface Water
Approx No. Samples\yr	10	2
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen		
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)	X	X
Antimony		
Arsenic	X	X
Beryllium		
Bromide		
Cadmium		
Calcium		
Chloride		
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron		
Lead		
Lead-210		
Magnesium		
Manganese		
Molybdenum		
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	X	X
Polonium-210		
Potassium		
Radium-226		
Radium-228		
Selenium	X	X
Silica		
Sodium		
Strontium		
Sulfate		
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids		
Total Organic Carbon		
Uranium	X	X
Uranium-234, -238		
Vanadium		
VOCs		
Zinc		
Total No. of Analytes	5	5

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Gunnison, Colorado

Location ID	Quarterly	Semiannually	Annually	Every 5 years	Not Sampled	Notes
Monitor Wells						
GUN01						
002			X			
005			X			
006			X			
012			X			
013			X			
062			X			
063			X			
064			X			
065			X			
066			X			
067			X			
102			X			
105			X			
106			X			
112			X			
113			X			
125			X			
126			X			
127			X			
135			X			
136			X			
160			X			
161			X			
181			X			
183			X			
186			X			
187			X			
188			X			
189			X			
GUN08						
609				X after 5/15		BKGD; next in 2011
630					X	WLs ONLY; next in 2011
634					X	WLs ONLY; next in 2011
663					X	WLs ONLY; next in 2011
709					X	WLs ONLY; next in 2011
710					X	WLs ONLY; next in 2011
712					X	WLs ONLY; next in 2011
714					X	WLs ONLY; next in 2011
715					X	WLs ONLY; next in 2011
716				X after 5/15		BKGD; next in 2011
720				X after 5/15		POC; next in 2011
721				X after 5/15		POC; next in 2011
722				X after 5/15		POC; next in 2011
723				X after 5/15		POC; next in 2011
724				X after 5/15		POC; next in 2011
725				X after 5/15		POC; next in 2011

Sampling Frequencies for Locations at Gunnison, Colorado

Location ID	Quarterly	Semiannually	Annually	Every 5 years	Not Sampled	Notes
Surface Locations						
GUN01						
248			X			
777			X			
780			X			
792			X			
795			X			
Domestic Wells						
GUN01						
080			X			
081			X			
082			X			
468			X			
469			X			
476			X			
477			X			
478			X			
667			X			
683			X			

GUN01 Sampling conducted in April

GUN08 sampling at the disposal cell must not be conducted before May 15th due to CDOW requirements regarding access to this site during Sage Grouse mating.

Constituent Sampling Breakdown

Site	Gunnison		
Analyte	Ground Water		Surface Water
Approx. No. Samples/yr.	29		5
Field Measurements			
Alkalinity	X		X
Dissolved Oxygen			
Redox Potential	X		X
pH	X		X
Specific Conductance	X		X
Turbidity	X		X
Temperature	X		X
Laboratory Measurements	*GUN01*	*GUN08*	
Aluminum			
Ammonia as N (NH3-N)			
Antimony			
Arsenic			
Boron			
Beryllium			
Bromide			
Cadmium			
Calcium		X	
Chloride		X	
Chromium			
Cobalt			
Copper			
Fluoride			
Gamma Spec			
Gross Alpha			
Gross Beta			
Iron		X	
Lead			
Lead-210			
Magnesium		X	
Manganese	X	X	X
Molybdenum			
Nickel			
Nickel-63			
Nitrate + Nitrite as N (NO3+NO2)-N			
Polonium-210			
Potassium		X	
Radium-226			
Radium-228			
Selenium			
Silica			
Sodium		X	
Strontium			
Sulfate		X	
Sulfide			
Thallium			
Thorium-230			
Tin			
Total Dissolved Solids		X	
Tritium			
Uranium	X	X	X
Uranium-234, -238			
Vanadium			
Zinc			
Total Analytes	2	10	2

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Hallam, Nebraska

Sampling Frequencies for Locations at Hallam, Nebraska

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
OBS1A			X			
OBS1B			X			
OBS2A			X			
OBS2B			X			
OBS2B2			X			
OBS2C2			X			
OBS3A			X			
OBS3B			X			
OBS4A			X			
OBS4B			X			
OBS4C			X			
OBS5A			X			
OBS5B			X			
OBS6A					X	Water level; micropurge if possible
OBS6B					X	Water level; micropurge if possible
OBS7B			X			
OBS7C			X			
OBS8B			X			
OBS8C			X			

Sampling conducted in June

Constituent Sampling Breakdown

Site	Hallam	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr.	17	0
Field Measurements		
Alkalinity	X	
Dissolved Oxygen		
Redox Potential	X	
pH	X	
Specific Conductance	X	
Turbidity	X	
Temperature	X	
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Boron		
Beryllium		
Bromide		
Cadmium		
Calcium		
Chloride		
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec	X	
Gross Alpha	X	
Gross Beta	X	
Iron		
Lead		
Lead-210		
Magnesium		
Manganese		
Molybdenum		
Nickel		
Nickel-63	X	
Nitrate + Nitrite as N (NO3+NO2)-N		
Potassium		
Radium-226		
Radium-228		
Selenium		
Silica		
Sodium		
Strontium		
Sulfate		
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids		
Total Organic Carbon		
Tritium	X	
Uranium		
Uranium-234, -238		
Vanadium		
Zinc		
Total Analytes	5	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

L-Bar, New Mexico

Sampling Frequencies for Locations at L-BAR, New Mexico

Location ID	Quarterly	Semiannually	Annually	Triennially	Not Sampled	Notes
Monitor Wells						
1A			X			Annually first 3 years (2005-2007); then triennially (2010)
17B			X			Annually first 3 years (2005-2007); then triennially (2010)
29A			X			Annually first 3 years (2005-2007); then triennially (2010)
61			X			Annually first 3 years (2005-2007); then triennially (2010)
62			X			Annually first 3 years (2005-2007); then triennially (2010)
63			X			Annually first 3 years (2005-2007); then triennially (2010)
69			X			Annually first 3 years (2005-2007); then triennially (2010)
72			X			Annually first 3 years (2005-2007); then triennially (2010)
81			X			Annually first 3 years (2005-2007); then triennially (2010)
100			X			Annually first 3 years (2005-2007); then triennially (2010)
Moquino - Old			X			Annually first 3 years (2005-2007); then triennially (2010); Water users backup well.
Moquino - New			X			Annually first 3 years (2005-2007); then triennially (2010); Water users supply well.

Sampling conducted in November

Constituent Sampling Breakdown

Site	L-Bar	
Analyte	**Ground Water**	**Surface Water**
Approx. No. Samples/yr.	12	0
Field Measurements		
Alkalinity	X	
Dissolved Oxygen		
Redox Potential	X	
pH	X	
Specific Conductance	X	
Turbidity	X	
Temperature	X	
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Boron		
Beryllium		
Bromide		
Cadmium		
Calcium		
Chloride	X	
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron		
Lead		
Lead-210		
Magnesium		
Manganese		
Molybdenum		
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	X	
Potassium		
Radium-226		
Radium-228		
Selenium	X	
Silica		
Sodium		
Strontium		
Sulfate	X	
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids	X	
Total Organic Carbon		
Tritium		
Uranium	X	
Uranium-234, -238		
Vanadium		
Zinc		
Total Analytes	6	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Lakeview, Oregon

Sampling Frequencies for Locations at Lakeview, Oregon

Location ID	Quarterly	Semiannually	Annually	Biennially	Every 5 years	Notes
Monitor Wells						
LKV01 - Processing Site						
503				X		Next sampling in 5/2008
505				X		Next sampling in 5/2008
509				X		Next sampling in 5/2008
540				X		Next sampling in 5/2008
LKV02 - Disposal Site						
515					X	Every 5 years; next in 5/09
602					X	Every 5 years; next in 5/09
603					X	Every 5 years; next in 5/09
604					X	Every 5 years; next in 5/09
605					X	Every 5 years; next in 5/09
606					X	Every 5 years; next in 5/09
607					X	Every 5 years; next in 5/09
608					X	Every 5 years; next in 5/09
609					X	Every 5 years; next in 5/09
Private Wells						
LKV01 - Processing Site						
543				X		Next sampling in 5/2008

Sampling conducted in May

Constituent Sampling Breakdown

Site	Lakeview	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr.	5	0
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen		
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic	Disposal site only	
Cadmium	Disposal site only	
Calcium	Disposal site only	
Chloride	Disposal site only	
Chromium		
Cobalt		
Copper		
Fluoride		
Gross Alpha		
Gross Beta		
Iron	Disposal site only	
Lead		
Lead-210		
Magnesium	Disposal site only	
Manganese	X	
Molybdenum		
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N		
Potassium	Disposal site only	
Radium-226		
Radium-228		
Selenium		
Silica	Disposal site only	
Sodium	Disposal site only	
Strontium		
Sulfate	X	
Sulfide		
Tin		
Total Dissolved Solids	Disposal site only	
Uranium	Disposal site; 0509 & 0540 on millsite	
Uranium-234, -238		
Vanadium		
Zinc		
Total Analytes	13	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Monticello, Utah

Sampling Frequencies for Locations at Monticello, Utah

Location ID	Quarterly	Semi-annually	Annually	Every 5 Years	Not Sampled	Notes
North Off-Site Wells						
31NE93-205				X[a]		Water Level (WL) Semi-annually
95-07				X[a]		WL Semi-annually
Former Millsite Wells						
93-01			X			WL Semi-annually
MW00-01		X				WL Semi-annually
MW00-02					X	WL Semi-annually
MW00-03					X	WL Semi-annually
T00-01			X			WL Semi-annually
T00-04			X			WL Semi-annually
T01-01		X				
T01-02		X				
T01-04		X				
T01-05		X				
T01-06					X	WL Semi-annually
T01-07		X				
T01-08					X	WL Semi-annually
T01-09					X	WL Semi-annually
T01-10					X	WL Semi-annually
T01-12		X				
T01-13			X			WL Semi-annually
T01-18			X			WL Semi-annually
T01-19		X				
T01-20			X			WL Semi-annually
T01-23			X			WL Semi-annually
T01-24					X	WL Semi-annually
T01-25			X			WL Semi-annually
T01-26					X	WL Semi-annually
T01-27					X	WL Semi-annually
T01-28					X	WL Semi-annually
T01-35		X				
Downgradient Wells						
82-08		X				
83-70			X			WL Semi-annually
88-85		X				Datalogger
92-07		X				
92-08		X				
92-09		X				
92-10			X			WL Semi-annually
92-11		X				
92-12					X	WL Semi-annually
95-01			X			WL Semi-annually
95-02					X	WL Semi-annually
95-03			X			WL Semi-annually
95-04					X	WL Semi-annually
95-06				X[a]		WL Semi-annually
95-08					X	WL Semi-annually
0200		X				

Sampling Frequencies for Locations at Monticello, Utah

Location ID	Quarterly	Semi-annually	Annually	Every 5 Years	Not Sampled	Notes
Downgradient Wells (continued)						
202		X				
MW00-06		X				
MW00-07			X			WL Semi-annually
P92-02					X	WL Semi-annually
P92-06		X				
PW-10					X	WL Semi-annually
PW-14					X	WL Semi-annually
PW-16					X	WL Semi-annually
PW99-16					X	WL Semi-annually
PW-17		X				
PW-18					X	WL Semi-annually
PW-20					X	WL Semi-annually
PW-22					X	WL Semi-annually
PW-23					X	WL Semi-annually
PW-28		X				
Downgradient PeRT Wells						
R1-M1					X	WL Semi-annually
R1-M3		X				
R1-M4		X				
R1-M6					X	WL Semi-annually
R2-M4					X	WL Semi-annually
R2-M7					X	WL Semi-annually
R3-M2		X				
R3-M3		X				
R4-M3		X				
R4-M6		X				
R6-M1					X	WL Semi-annually
R6-M2					X	WL Semi-annually
R6-M3		X				
T6-D					X	WL Semi-annually
R6-M4		X				
R6-M5					X	WL Semi-annually
R6-M6					X	WL Semi-annually
R7-M1					X	WL Semi-annually
R8-M1					X	WL Semi-annually
R9-M1					X	WL Semi-annually
R10-M1		X				
R11-M1					X	WL Semi-annually
Former Millsite Seeps and Wetland (W3) Locations						
Seep 1		X				
Seep 2		X				
Seep 3		X				
Seep 5		X				
Seep 6		X				
W3-03		X				
W3-04		X				

Sampling Frequencies for Locations at Monticello, Utah

Location ID	Quarterly	Semi-annually	Annually	Every 5 Years	Not Sampled	Notes
Surface Water Locations (stream flow is measured semi-annually at each SW location)						
SW00–01		X				
SW00–02		X				
SW01–02		X				
SW01–03		X				
SW01–01		X				
Sorenson		X				
SW00–04		X				
SW92–08		X				

Semi-annual sampling occurs the first week of April and October
Annual sampling occurs the first week of October

[a] 5-year sample frequency begins in October 2006.

The wells listed below are inactive and are not included in the monitoring program (water level measurements or sampling). These wells are inspected for surface component integrity during the Annual LTSM Site Inspection, which typically occurs in September.

Former Millsite Wells

T00-02 T00-03 T00-05 T00-06 T00-07

Downgradient PeRT Wells

R1-M2	R2-M9	R4-M7	R5-M7	T2-S	T7-D	TW-08
R1-M5	R2-M10	R4-M8	R5-M8	T3-D	TW-01	TW-09
R2-M1	R3-M1	R5-M1	R5-M9	T3-S	TW-02	TW-10
R2-M2	R3-M4	R5-M2	R5-M10	T4-S	TW-03	TW-11
R2-M3	R4-M1	R5-M3	R7-M2	T4-D	TW-04	TW-12
R2-M5	R4-M2	R5-M4	T1-D	T5-D	TW-05	TW-13
R2-M6	R4-M4	R5-M5	T1-S	T5-S	TW-06	TW-14
R2-M8	R4-M5	R5-M6	T2-D	T6-S	TW-07	

Constituent Sampling Breakdown

Site	MONTICELLO			
Analyte	**Ground Water**	**PeRT Wells**	**Surface Water**	**Seeps**
Approx No. Samples\yr	55	18	20	10
Field Measurements				
Alkalinity	X	X	X	X
Dissolved Oxygen	88-85, 92-07 and 92-11 only	X		
Redox Potential	88-85, 92-07 and 92-11 only	X		
pH	X	X	X	X
Specific Conductance	X	X	X	X
Turbidity	X	X		
Temperature	X	X	X	X
Laboratory Measurements				
Aluminum				
Ammonia as N (NH3-N)				
Antimony				
Arsenic	X	X	X	X
Bromide				
Cadmium				
Calcium	X	X	X	X
Chloride	X	X	X	X
Chromium				
Cobalt				
Copper				
Fluoride	X	X	X	X
Gamma Spec				
Gross Alpha				
Gross Beta				
Iron	X	X	X	X
Lead				
Lead-210				
Lithium				
Magnesium	X	X	X	X
Manganese	X	X	X	X
Mercury				
Molybdenum	X	X	X	X
Nickel				
Nickel-63				
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	X	X
Phosphate				
Polonium-210				
Potassium	X	X	X	X
Radium-226				
Radium-228				
Selenium	X	X	X	X
Silica				
Sodium	X	X	X	X
Strontium				
Sulfate	X	X	X	X
Sulfide				
Tin				
Total Dissolved Solids	T01-01, T01-12, 88-85, 82-08 and MW00-06 only		SW01-02, SW00-02, SW01-01, and Sorenson only	Seep 2 only
Total Organic Carbon				
Uranium	X	X	X	X
Uranium-234, -238				
Vanadium	X	X	X	X
VOCs				
Zinc				
Total No. of Analytes	16	15	16	16

Note: All analyte samples are considered filtered unless stated otherwise. The total number of analytes does not include the field parameters. The collection of samples for TDS analyses at specified Monticello GW & SW locations will be established by Program Directives specific to the sampling event.

Sampling Frequencies for Locations at Monument Valley, Arizona

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
400					X	
402					X	
403					X	
602					X	
604		X				
606		X				
619		X				Gross alpha, radium-226/228, U-234/238
655		X				
656		X				
657		X				Gross alpha, radium-226/228, U-234/238
662		X				Gross alpha, radium-226/228, U-234/238
669		X				
760		X				
761		X				
762		X				
764		X				
765		X				
767		X				
768		X				
770		X				
771		X				
772		X				
774		X				Gross alpha, radium-226/228, U-234/238
775					X	
776					X	
777					X	
Private Wells						
200					X	
201					X	IHS water supply well
625					X	
640					X	

Sampling conducted in December and June

Constituent Sampling Breakdown
For Individual Sites

Site	Monument Valley	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	19	0
Field Measurements		
Alkalinity	X	
Dissolved Oxygen		
Redox Potential	X	
Residual Chlorine		
pH	X	
Specific Conductance	X	
Turbidity	X	
Temperature	X	
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)	X	
Antimony		
Arsenic		
Barium		
Bromide		
Cadmium		
Calcium		
Chloride	X	
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha	0619, 0657, 0662, and 0774 only	
Gross Beta		
Iron		
Lead		
Magnesium		
Manganese		
Molybdenum		
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	X	
Nitrite		
Potassium		
Radium-226	0619, 0657, 0662, and 0774 only	
Radium-228	0619, 0657, 0662, and 0774 only	
Selenium		
Sodium		
Strontium		
Sulfate	X	
Sulfide		
Thallium		
Tin		
Total Dissolved Solids		
Uranium	X	
Uranium-234, -238	0619, 0657, 0662, and 0774 only	
Vanadium	X	
Zinc		
Total Analytes	10	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Mound, Ohio

Program Directive

Mound Site

Activity or Task: Ground Water Monitoring **Directive No.:** MND-2008-01 .

Initiated By: Sam Campbell

Directive Subject: Ground Water Monitoring Program

Directive and Associated Task Changes:

Locations, frequency of sampling, analytes, and ground-water-level measurements for the ground water monitoring program at the Mound Site will be conducted according to the following plans: *Phase I Remedy (Monitored Natural Attenuation) Ground Water Monitoring Plan* (CH2MHILL 2004) and the *OU-I Pump and Treatment Operation and Maintenance Plan* (DOE 2000). Ground water sampling will be conducted according to the procedures specified in the *Sampling and Analysis Plan for the U.S. Department of Energy Office of Legacy Management Sites* (DOE 2007), with one exception. Low-producing monitor wells that will not sustain a flow rate of 100 mL/min without drawdown (Category II and III wells) will be sampled by purging the well dry and collecting samples when sufficient recovery has occurred.

Organization(s) Affected: Geosciences, Quality Assurance, Environmental Monitoring/Field Services

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (DOE-LM/GJ1197-200), *Phase I Remedy (Monitored Natural Attenuation) Ground Water Monitoring Plan* (CH2MHILL 2004), *OU-I Pump and Treatment Operation and Maintenance Plan* (DOE 2000)..

Justification for the Directive:

The ground water monitoring program at the Mound Site is specified in the regulator approved OU-I Operation and Maintenance Plan and the Phase I MNA Plan; however, sampling procedures in the OU I Operation and Maintenance Plan reference high-flow purging procedures, which are no longer used at the site, and sampling procedures in the Phase I MNA Plan reference procedures in the Mound Compendium, which are no longer applicable to LM. The sampling procedures in the LM SAP, therefore, will be used to implement low-flow sampling protocol (current practice at the site). Use of the LM SAP will allow integration of LM protocol, practices, and infrastructure into the ground water monitoring program at the Mound site. Deviation from the SAP on low-producing monitor wells will provide consistency of practice and avoid potential shifts in data.

Glenn G. Griffiths 2007.10.15 08:27:26 -04'00'

Glenn Griffiths, Task Order Manager

10-15-07

Rebecca Cato, Project Technical Lead

Michael O Hoge 2007.10.15 08:18:01 -04'00'

Mike Hoge, QA Specialist

Issuing Manager Approval:

Sam Campbell 2007.10.15 09:16:13 -06'00'

Sam Campbell, Environmental Monitoring/Field Services Manager

Date

Effective Date: 11/1/2007 **Expiration Date:** 9/30/2008

Distribution: w Attachments
Document Production – Master Copy
Record File ADM 130.10 through Dianna Roberts
Distribution List for the *Sampling and Analysis Plan for US DOE LM Sites*

Mound Site, Miamisburg, Ohio
Sampling Summary

NOTE: Total number of samples taken per month "in-house" is approximately 255 this includes air/bubblers/NPDES/pH/rain.

1. NPDES Sampling Summary (Sampling Activities Performed "in-house")

OUTFALL NP-001 – Sanitary Sewage Plant		
Parameter	**Type**	**Volume**
DAILY		
pH	Grab	
TWO PER WEEK		
CBOD-5	Composite	1000 ml
Total Suspended Solids	Composite	500 ml
WEEKLY		
Fecal Coliform (summer)	Grab	
BIWEEKLY		
Ammonia (summer only)	Composite	500 ml
MONTHLY		
Total Dissolved Solids	Composite	500 ml
Nitrite + Nitrate	Composite	500 ml
Phosphorus	Composite	500 ml
Metals (Cu, Pb, Zn)	Composite	500 ml
QUARTERLY		
VOCs	Grab	(3) 40 ml
Oil and Grease	Grab	1000 ml
Additional Information		
Summer only – May 1 through October 31 Quarterly – Samples to be collected in March, June, August, and December TDS and TSS can be combined in 1000 ml HDPE – will be noted on COC Phosphorus and Nitrite + Nitrate can be combined in 1000 ml HPDE – will be noted on COC		

OUTFALL NP-002 – Storm Water		
Parameter	**Type**	**Volume**
BIWEEKLY		
pH	Grab	
COD	Composite	500 ml
Total Suspended Solids	Composite	500 ml
Total Dissolved Solids	Composite	500 ml
MONTHLY		
Oil and Grease	Grab	1000 ml
Metals (Cu, Mo, Sr, Zn)	Composite	500 ml
Additional Information		
Summer only – May 1 through October 31 Quarterly – Samples to be collected in January, April, July, and October TDS and TSS can be combined in 1000 ml HDPE – will be noted on COC		

Mound Site, Miamisburg, Ohio
Sampling Summary

OUTFALL NP-003 – OU-1 Pump and Treat System		
Parameter	**Type**	**Volume**
WEEKLY		
pH	Grab	
MONTHLY		
Dissolved Oxygen	Grab	
VOCs	Grab	(3) 40 ml
Mercury (low level)	Grab	
CBOD-5	Composite	1000 ml
Total Dissolved Solids	Composite	500 ml
Metals (Cu)	Composite	500 ml
SEMIANNUAL		
Toxicity – Bioassay	Composite	4000 ml
Additional Information		
Summer only – May 1 through October 31 Semiannual – Samples to be collected in April and October		

NPDES sampling is ongoing until turned over to the City which should be upon completion of OU1.Quarterly oil/grease/VOCs will increase this total number by two samples every quarter. Pump and Treat System ongoing for 30 years.

2. Air Sampling Summary (Sampling Activities Performed "in-house")

Air Sampling	
Sample ID	**Analysis**
Quarterly	
CNL	Th-228, Th-230,& Th-232
101	Th-228, Th-230,& Th-232
112	Th-228, Th-230,& Th-232
119	Th-228, Th-230,& Th-232
124	Th-228, Th-230,& Th-232
212	Th-228, Th-230,& Th-232
214	Th-228, Th-230,& Th-232
215	Th-228, Th-230,& Th-232
216	Th-228, Th-230,& Th-232
217R	Th-228, Th-230,& Th-232
Monthly	
CNL	PU-238/239/240, HT
101	PU-238/239/240, HT
112	PU-238/239/240, HT
119	PU-238/239/240, HT
124	PU-238/239/240, HT
212	PU-238/239/240, HT
214	PU-238/239/240, HT
215	PU-238/239/240, HT
216	PU-238/239/240, HT
217R	PU-239/239/240, HT
Additional Information	
Samples are collected weekly (i.e. 4 samples each station per month). Monthly samples need to be prepped and shipped at the end of each month. Quarterly samples are shipped at the end of each quarter. Each sample is cut in half, one half is put aside for the monthly and the other half is put aside for the quarterly.	

Air samples will be taken for a period of one year after completion of OU1.

3. Summary of Groundwater Sampling Programs at Mound (Contractor Performed)

Programs required by CERCLA O&M

OU-1 Monitoring Program
Phase I MNA Monitoring Program
Implements ROD requirements ongoing for 20 years.

Programs pending CERCLA ROD

Parcel 6, 7, and 8 MNA Monitoring Program
Ongoing until regulator approved standard is met.

Programs to support EM

OU-1 Additional Excavation Monitoring Program

OU-1 Monitoring Program

Groundwater samples are collected from the wells in Table 1 on a quarterly basis.

Table 1 Groundwater and Hydraulic Monitoring for OU-1

Location	VOC Analysis	Groundwater Hydraulic Measurement
0305	X	X
0410	X	X
0416	X	
0417	X	X
0418	X	
0419	X	
0422		X
0423		X
P003		X
P015	X	
P027	X	
P031	X	

Mound Site, Miamisburg, Ohio
Sampling Summary

OU-1 Additional Excavation Monitoring Program

Groundwater samples will be sampled according to the schedule in Table 2 during the OU-1 excavation activities.

Table 2 Groundwater Monitoring Program in Support of Additional Excavation in the OU-1 Area

Well ID	Sampling Frequency	Primary Analytes
0305	Monthly	Tetrachloroethylene (PCE) Trichloroethylene (TCE) cis-1,2-Dichloroethylene (DCE) trans-1,2-Dichloroethylene (DCE) Vinyl Chloride (VC)
0410		
0416		
0417		
0418		
0419		
P015	Bimonthly	
P027		
P031	Quarterly	

Phase I MNA Monitoring Program

Groundwater samples are collected from the wells in Tables 3 and 4 on a quarterly basis.

Table 3. Remedy (MNA) Monitoring for Phase I

Monitoring Location	Area	Parameters
Well 0411	Well 0411 Area	Trichloroethylene (TCE) Dichloroethylene (DCE) Vinyl Chloride (VC)
Well 0443		
Well 0353	Downgradient Bedrock Monitoring	
Well 0444		
Well 0445		
Seep 0617		
Well 0400	Downgradient Buried Valley Aquifer Monitoring	
Well 0402		
Well P033		

Table 4 Confirmatory Monitoring for Phase I

Monitoring Location	Parameters
0319	Chromium, Nickel, Sodium, Chloride
0400	Barium, Ra-226, Ra-228, Chromium, Nickel, Sodium, Chloride
0402	Barium, Ra-226, Ra-228, Sodium, Chloride
0442	Chromium, Nickel, Sodium, Chloride
0443	Chromium, Nickel, Sodium, Chloride
0445	Barium, Ra-226, Ra-228, Sodium, Chloride
P033	Barium, Ra-226, Ra-228, Sodium, Chloride

Parcels 6, 7, and 8 MNA Monitoring Program

Groundwater samples are collected from the wells in Table 5 on a quarterly basis.

Table 5 Groundwater Monitoring for Parcels 6, 7 and 8 and Off-site

Monitoring Location	Area	Parameters
Well 0315	Well 0315 / 0347 Area	Trichloroethylene (TCE) Dichloroethylene (DCE) Vinyl Chloride (VC)
Well 0347		
Well 0124	Downgradient BVA Monitoring	
Well 0126		
Well 0386		
Well 0387		
Well 0389		
Well 0392		
Seep 0601	Main Hill Seeps	Trichloroethylene (TCE) Dichloroethylene (DCE) Vinyl Chloride (VC) Ra-226 and Ra-228 Tritium Sr-90
Seep 0602		Trichloroethylene (TCE) Dichloroethylene (DCE) Vinyl Chloride (VC) Tritium
Seep 0605		
Seep 0606		
Seep 0607		
Well 0118	Downgradient Monitoring for Seeps	Trichloroethylene (TCE) Dichloroethylene (DCE) Vinyl Chloride (VC) Tritium
Well 0138		
Well 0301		
Well 0311		
Well 0333		
Well 0334		
Well 0346		
Well 0347		
Well 0379		

Naturita, Colorado

Sampling Frequencies for Locations at Naturita, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
NAT01						
NAT01-1			X			
NAT02			X			
NAT08			X			
NAT26			X			
MAU07			X			
MAU08			X			
DM1			X			
NAT14						
BR95-1				Even year		
BR95-2				Even year		
BR95-3				Even year		
CM93-1				Even year		
CM93-2				Even year		
Surface Locations						
531			X			
533			X			
538			X			
SM2			X			
SM4			X			

Annual sampling conducted in July
Biennial sampling conducted in July

Constituent Sampling Breakdown

Site	Naturita	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	12	5
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen		
Redox Potential	X	X
Residual Chlorine		
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic	BR & CM wells only	
Barium		
Bromide		
Cadmium		
Calcium		
Chloride		
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron		
Lead		
Lead-210		
Magnesium		
Manganese		
Molybdenum	BR & CM wells only	
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N		
Nitrite		
PCBs		
Polonium-210		
Potassium		
Radium-226		
Radium-228		
Selenium		
Sodium		
Strontium		
Sulfate		
Sulfide		
Thallium		
Thorium-230		
Tin		
Total Dissolved Solids	X	X
Uranium	X	X
Uranium-234, -238		
Vanadium	X	X
Zinc		
Total Analytes	5	3

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Parkersburg, West Virginia

Sampling Frequencies for Locations at Parkersburg, West Virginia

Location ID	Quarterly	Semiannually	Annually	Every 5 years	Not Sampled	Notes
Monitor Wells						
MW-1					X	
MW-2					X	
MW-3					X	
MW-4					X	
MW-5				X		Next sampling 10/08
MW-6				X		Next sampling 10/08

Sampling conducted in October

Constituent Sampling Breakdown

Site	Parkersburg	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	2	0
Field Measurements		
Alkalinity	X	
Dissolved Oxygen		
Redox Potential	X	
pH	X	
Specific Conductance	X	
Turbidity	X	
Temperature	X	
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony	X	
Arsenic		
Barium	X	
Beryllium	X	
Bromide		
Cadmium	X	
Calcium	X	
Chloride	X	
Chromium	X	
Cobalt		
Copper		
Fluoride		
Gross Alpha	X	
Gross Beta	X	
Hafnium	X	
Iron		
Lead	X	
Lead-210		
Magnesium	X	
Manganese		
Mercury	X	
Molybdenum		
Nickel	X	
Nitrate + Nitrite as N (NO3+NO2)-N	X	
Nitrite	X	
Phosphate		
Polonium-210		
Potassium	X	
Radium-226	X	
Radium-228	X	
Selenium	X	
Silica		
Sodium	X	
Strontium		
Sulfate	X	
Sulfide		
Thallium	X	
Thiocyanate	X	
Thorium-230		
Tin		
Total Dissolved Solids		
Total Organic Carbon		
Uranium	X	
Vanadium		
Zinc		
Zirconium	X	
Total Analytes	26	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Rifle, Colorado

Sampling Frequencies for Locations at Rifle, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
New Rifle						
169			X			
170			X			
172			X			
173			X			
195			X			
201			X			Data logger
210			X			
215			X			
216			X			
217			X			
590			X			Data logger
620			X			
635			X			
658			X			
659			X			
664			X			
669			X			
670			X			
855			X			
Old Rifle						
292					X	GCAP; location to move in 08
304		X				GCAP
305		X				GCAP
309		X				GCAP
310		X				GCAP; data logger
597		X				Background well
655		X				GCAP; data logger
656		X				GCAP
658		X				Background well
Private Wells						
New Rifle						
442			X			Johnson - sample at wellhead
446			X			Johnson - after the RO unit
447			X			Gilstrap - before RO unit
448			X			Gilstrap - after RO unit
Surface Locations						
New Rifle						
320			X			Wetland Pond
322			X			Colorado River
323			X			Gravel pit pond
324			X			Colorado River downgradient
452			X			Wetland Pond
453			X			Wetland Pond
575			X			Gravel pit pond
Old Rifle						
294		X				Added by D. Dayvault 7/17/07
396		X				GCAP
398		X				GCAP
538					X	GCAP; location to move in 08
741		X				

Sampling Frequencies for Locations at Rifle, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Disposal Cell						
RFL08-Disposal Cell Effluent						
MW02			X			July
MW03			X			July

Semi-annual sampling conducted in November; annual sampling conducted in April

Constituent Sampling Breakdown
For Individual Sites

Site	Rifle (2)				
Analyte	**Ground Water**		**Surface Water**		
Approx. No. Samples/yr	41		15		
Field Measurements					
Alkalinity	X		X		
Dissolved Oxygen					
Redox Potential	X		X		
Residual Chlorine					
pH	X		X		
Specific Conductance	X		X		
Turbidity	X				
Temperature	X		X		
Laboratory Measurements	**RFO*	**RFN*	*RFO*	*RFN*	*RFL*
Aluminum					
Ammonia as N (NH3-N)		X		X	X
Antimony					
Arsenic					X
Barium					
Bromide					
Cadmium					
Calcium					
Chloride					
Chromium					
Cobalt					
Copper					
Fluoride					
Gamma Spec					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Lead-210					
Magnesium					
Manganese					
Molybdenum		X		X	X
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N		X		X	X
Nitrite					
Polonium-210					
Potassium					
Radium-226					
Radium-228					
Selenium	X		X		X
Sodium					
Strontium					
Sulfate					X
Sulfide					
Thallium					
Thorium-230					
Tin					
Total Dissolved Solids	X		X		X
Uranium	X	X	X	X	X
Uranium-234, -238					
Vanadium	X	0215, 0216, 0217, 0590, 0658, 0659, 0664, 0669, 0670, 0855 only	X	X	X
Zinc					
Total Analytes	4	5	4	5	9

*RFN = New Rifle; RFO = Old Rifle

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Constituent Sampling Breakdown

RIO BLANCO

On-site Location (SEEPro Location_Code)	Depth (ft)	Sample Analytes		Comment
		Tritium*	Gamma Spec	
Wells				
RB-D-01	1651	X	X	
RB-D-03		X	X	
RB-S-03	820	X	X	
RB-W-01		X	X	shallow
Surface				
Fawn Creek 500ft Dwn		X	X	
Fawn Creek 500ft Ups		X	X	

Also collect field measurements for specific conductivity, pH, & T.

25% of tritium samples are analyzed by the enriched tritium method.

Off-site Location (SEEPro Location_Code)	Sample Analytes		Comment
	Tritium*	Gamma Spec	
Wells			
Johnson Artesian WL	X	X	
Brennan Windmill	X	X	
Surface			
B-1 Equity Camp	X	X	
CER #1 Black Sulphur	X	X	
CER #4 Black Sulphur	X	X	
Fawn Creek #1	X	X	
Fawn Creek #3	X	X	
Fawn Creek 6800ft Up	X	X	
Fawn Creek 8400ft Dw	X	X	

Also collect field measurements for specific conductivity, pH, & T.

* 25% of tritium samples are analyzed by the enriched tritium method.

Riverton, Wyoming

Sampling Frequencies for Locations at Riverton, Wyoming

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
101					X	WL only
110					X	WL only
111					X	WL only
700					X	WL only
702					X	Data logger
705		X				
707		X				Data logger
709					X	Data logger
710		X				
711					X	WL only
712					X	WL only
713					X	WL only
714					X	WL only
715					X	WL only
716		X				
717		X				
718		X				
719		X				
720		X				
721		X				
722R		X				
723		X				
724					X	WL only
725					X	WL only
726					X	WL only
727					X	WL only
728					X	WL only
729		X				
730		X				
732					X	WL only
733					X	WL only
734					X	WL only
735		X				Data logger
736					X	WL only
784		X				Added by S. Campbell 6/26/06
788		X				
789		X				Data logger
809		X				Data logger
824		X				
825		X				
826					X	Not drilled yet

Sampling Frequencies for Locations at Riverton, Wyoming

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Surface Locations						
747		X				
749		X				
794		X				
796		X				
810		X				Gravel pit
811		X				Little Wind River
812		X				Little Wind River
822		X				
823		X				
827(Stilling well)					X	Data logger only
Domestic Wells						
405		X				921 Rendezvous Road
422					X	10 Whitetail Drive
430		X				204 Goes in Lodge Road
436		X				33 St Stephens Road
440					X	898 Rendezvous Road; on hold
441					X	898 Rendezvous Road; pending owner's permission
454		X				10369 Highway 789
460		X				140 Goes in Lodge Road
828		X				33 St Stephens Road
951					X	865 Rendezvous Road
Water Supply System						
813			X			November
814			X			November
815			X			November
816			X			November
818			X			November
819			X			November
820			X			November
821			X			November
829			X			November
830			X			November
834			X			November

Sampling conducted in November and June

Water Supply System sampling in November; end of program.

Constituent Sampling Breakdown

Site	Riverton		
Analyte	Ground Water	Surface Water	Water System
Approx. No. Samples/yr	52	18	11
Field Measurements			
Alkalinity	X	X	X
Dissolved Oxygen			X
Redox Potential	X	X	X
Residual Chlorine			X
pH	X	X	X
Specific Conductance	X	X	X
Turbidity	X	X	X
Temperature	X	X	X
Laboratory Measurements			
Aluminum			
Ammonia as N (NH3-N)			
Antimony			
Arsenic			
Barium			
Bromide			
Cadmium			
Calcium			
Chloride			
Chromium			
Cobalt			
Copper			
Fluoride			
Gamma Spec			
Gross Alpha			X
Gross Beta			X
Iron			
Lead			
Lead-210			
Magnesium			
Manganese	X	X	
Molybdenum	X	X	
Nickel			
Nickel-63			
Nitrate + Nitrite as N (NO3+NO2)-N			
Nitrite			
PCBs			
Polonium-210			
Potassium			
Radium-226		0822 only	X
Radium-228		0822 only	X
Selenium			
Sodium			
Strontium			
Sulfate	X	X	
Sulfide			
Thallium			
Thorium-230			
Tin			
Total Dissolved Solids			
Uranium	X	X	X
Uranium-234, -238			
Vanadium			
Zinc			
Total Analytes	4	6	5

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Rocky Flats, Colorado

Program Directive
Rocky Flats Site

Activities Ground Water and Surface Water Monitoring **Directive No.** RFS-2008–01

Initiated By: Sam Campbell

Directive Subject: Miscellaneous Sampling Activities

Directive and Associated Task Changes:

1. Collection of volatile organic compounds (VOC) may be collected through a peristaltic pump.
2. Holding time for unpreserved VOCs will be 14 days.
3. Alkalinity may be measured in unfiltered water following Thermo Electron Corporation Procedure 517, "Total Alkalinity measurement in natural waters."

Organization(s) Affected: Environmental Monitoring/Field Services, Hydrology, Programs and Projects.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (DOE-LM/GJ1197-2006), *Rocky Flats Legacy Management Agreement*, Attachment 2 (2007), *Rocky Flats Site Operations Guide*, (DOE-LM/1429-2007).

Justification for Directive:

1. Because of geologic and hydrologic conditions at the Rocky Flats Site, numerous low-producing wells with highly variable water levels exist, which limits the options to withdraw water from a well. Collection of samples, including VOC samples, through a peristaltic pump is the best alternative for many wells, even though there is a potential for lower VOC concentrations through increased volatilization caused by the suction lift pump.
2. Unpreserved volatile organic compound samples typically have a 7-day holding time; however, an agreement with the State of Colorado allows an increase in the holding time to 14 days. This increase in holding time will ease constraints on sample shipping and batching.
3. Utilization of specific field instrumentation historically used at the site will continue, which will provide continuity in making field measurements and consistency in the resulting data.

Review and Concurrence:

Linda Kaiser, Task Order Manager

George Squibb, Surface Water Lead

John Boylan, Ground Water Lead

Mike Hoge, QA Coordinator 2007.10.30 14:05:38 -04'00'

Issuing Manager Approval:

Sam Campbell, Environmental Monitoring/Field Services Manager 2007.10.30 13:36:33 -06'00'

Date

Effective Date: 10/1/2007 **Expiration Date:** 9/30/2008

Distribution: Document Production – Master Copy
Record File through Dianna Roberts (ADM 130.10)
Distribution List for the Sampling and Analysis Plan for U. S. DOE LM Sites

Program Directive
Rocky Flats Site

Activities Ground Water Monitoring **Directive No.** RFS-2008-02 .

Initiated By: Sam Campbell

Directive Subject: Purging and Sampling of Low-Producing Wells.

Directive and Associated Task Changes:

Low-producing wells will be purged prior to sample collection until the well is dewatered. A low-producing well is defined as a well where water level stability can not be obtained at a purge rate of 100 mL/min. Sample collection can commence, with the exception of VOC sample collection, when sufficient recovery has occurred. If a VOC sample is to be collected, the sample shall be collected no later than 48 hours after purging is complete. If the well has not recovered sufficiently within 48 hours, then a VOC sample shall not be collected. The well may be repurged and a VOC sample collected within 48 hours of the repurge, or VOC sampling from that well shall be cancelled until the next sampling event.

Organization(s) Affected: Environmental Monitoring/Field Services, Hydrology, Programs and Projects.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (DOE-LM/GJ1197-2006), *Rocky Flats Legacy Management Agreement*, Attachment 2 (2007), *Rocky Flats Site Operations Guide*, (DOE-LM/1429-2007).

Justification for Directive:

Numerous low-producing wells exist at the Rocky Flats site because of the low and variable permeability of the shallow aquifer. Obtaining a representative sample from a low-producing well is problematic, and there is not adequate guidance for sampling wells completed in low permeability formations. Therefore, this site-specific directive will be used to purge and sample low producing wells at the Rocky Flats Site, which will be consistent with historical practices and will avoid any potential data shifts caused by change in procedure.

Review and Concurrence:

Linda L. Kaiser

Linda Kaiser, Task Order Manager

John Boylan, Ground Water Lead

Michael O Hoge 2007.10.30 14:07:27 -04'00'

Mike Hoge, QA Coordinator

Task Order Manager Approval to Issue:

Sam Campbell 2007.10.30 13:43:33 -06'00'

Sam Campbell, Environmental Monitoring/Field Services Manager

Date

Effective Date: 10/1/2007 **Expiration Date:** 9/30/2008

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Program Directive
Rocky Flats Site

Activities Ground Water and Surface Water Monitoring **Directive No.** RFS-2008-03

Initiated By: Sam Campbell

Directive Subject: Disposition of Excess Water

Directive and Associated Task Changes:

Disposition of excess water generated during sampling activities will conducted according to instructions specified in the attached *Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water.*

Organization(s) Affected: Environmental Monitoring/Field Services, Hydrology, Programs and Projects.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (DOE-LM/GJ1197-2006), *Rocky Flats Legacy Management Agreement*, Attachment 2 (2007), *Rocky Flats Site Operations Guide*, (DOE-LM/1429-2007).

Justification for Directive:

Prior to closure of site, all excess water generated during sampling activities was managed through an onsite water treatment facility. This facility was removed during remediation of the site; therefore, new guidelines are necessary to manage and dispose of excess water.

Review and Concurrence:

Linda Kaiser, Task Order Manager

George Squibb, Surface Water Lead

John Boylan, Ground Water Lead

Mike Hoge, QA Coordinator 2007.10.30 14:08:37 -04'00'

Issuing Manager Approval:

Sam Campbell, Environmental Monitoring/Field Services Manager 2007.10.30 13:45:43 -06'00'

Date

Effective Date: 10/1/2007 **Expiration Date:** 9/30/2008

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Distribution List for the Sampling and Analysis Plan for U. S. DOE LM Sites

Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water

1. The Rocky Flats Site water monitoring program will disposition purge, decon, and excess sample water from ground water wells and surface water sampling locations according to guidance in EPA's "Guide to Management of Investigation-Derived Wastes" (January 1992) and Appendix 2 of CDPHE's "Corrective Action Guidance Document" (May 2002).

2. The Site will follow the steps listed below to determine which disposition option is appropriate:

   a. Compare contaminant levels measured in purge, decon, and excess sample water to state surface water standards per Table 1 of RFCA Attachment 5.
   b. If historic contaminant levels from a particular well or sample location are below surface water standards, water from that location may be poured onto the ground in a manner that minimizes erosion and avoids direct discharge to surface water.
   c. Water that contains historic contaminant levels that exceed surface water standards may not be poured on the ground. That water will be containerized and then either shipped offsite for treatment and/or disposal, or dispositioned in an appropriate onsite treatment system. An appropriate onsite treatment system is one whose capacity and maximum allowable concentration limit is not exceeded by the contaminant levels in the water being treated. Water with contaminant concentrations greater than surface water standards may be dispositioned in on-site treatment systems. Water collected from specific areas where a treatment system exists will be taken to that specific treatment system; i.e., water collected from a location used to monitor the east trenches plume will be taken to the East Trenches Plume Treatment System. For areas where a specific treatment system does not exist and for all surface water locations, this water will be dispositioned in the Solar Ponds Plume Treatment System.
   d. If data from four consecutive sampling events (or the most recent year's worth of data for locations sampled less than quarterly) indicates the water to be below surface water standards for all contaminants, that water may be poured on the ground. Water from subsequent sampling at that location will also be considered to be below surface water standards, until new data indicates otherwise. New data for that particular location will be evaluated in accordance with procedures specified in the FY2005 IMP, Rev. 1 (DOE 2005), before the water will be considered to be consistently greater than surface water standards.
   e. When data from four consecutive sampling events (or the most recent year's worth of data) indicate water from a particular location is greater than surface water standards, the water will be placed into an appropriate on-site treatment system, until new data indicates otherwise. New data for that particular location will be evaluated in accordance with the procedures specified in the FY2005 IMP, Rev. 1 (DOE 2005), before the water will be considered to be consistently less than surface water standards.

3. If water collected from any well location appears to be contaminated, e.g., through visual observation of phase separation in a sample container, the non-aqueous phase portion will be separated and it will be containerized and shipped off-site for appropriate treatment and/or disposal.

Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water

4. The ultimate disposition option selected for each sample location will be based on best professional judgment, will require the concurrence of the RFCA Parties, and will consider the following factors:

    a. Protectiveness of human health and the environment;
    b. Compliance with ARARs;
    c. Site access controls;
    d. Worker safety;
    e. Institutional controls on water usage;
    f. Sampling and analysis history;
    g. IDW minimization; and
    h. Natural background levels.

5. See Attached Table 1 for proposed disposition path including supporting Tables 2 (ground water well locations) and 3 (surface water monitoring locations).

Table 1: Disposition of water from ground water and surface water sampling activities.

Location	Water Type	Proposed Disposition	Basis
Ground water			
All wells	Decon Water	Pour on the Ground	Contaminant concentrations in decon water would be less than surface water standards.
All wells	Purge Water	Place into appropriate on-site treatment system (see Table 2).	Contaminants may be present in concentrations greater than surface water standards. Using an on-site treatment system eliminates the need to characterize individual wells.[1]
Surface water			
All surface water locations	Excess Sample[2]	Place into Solar Ponds Treatment System (see Table 3).	Contaminants may be present in concentrations greater than surface water standards. Using an on-site treatment system eliminates the need to characterize individual surface water monitoring locations.
All surface water locations	Decon Water	Pour onto the ground	Contaminant concentrations in decon water would be less than surface water standards.

[1] At some point in time, it may be appropriate to determine which wells are consistently below surface water standards, allowing that purge water to be poured on the ground in lieu of using an on-site treatment system. See disposition guidelines for details.
[2] An excess sample may only exist at continuous flow-paced sampling locations and not at locations where grab samples are collected.

Table 2: Ground water well locations and classifications.

Location	Frequency	Class	Plume or Area	Treatment System	Purpose
00191	Every other year	Evaluation	903 Pad	ETPTS	Monitor eastward flow of 903 Pad Plume
00193	Semiannual	AOC	Woman Creek Drainage	ETPTS	Monitor ground water in Woman Creek drainage downgradient of ground water plumes
00203	Every other year	Evaluation	Solar Ponds	SPPTS	Monitor southeast flow from 700 Area and SEPs
00491	Every other year	Evaluation	903 Pad/Ryan's Pit	ETPTS	Monitor Ryan's Pit/903 Pad Plume
00797	Semiannual	Sentinel	881 Hillside	ETPTS	Monitor flowpath from B881 to Woman Creek
00897	Every other year	Evaluation	Mound	MSPTS	Monitor Mound Plume source area
00997	Semiannual	AOC	South Walnut Creek Drainage	ETPTS	Monitor South Walnut Creek drainage at Pond B-5
03991	Every other year	Evaluation	East Trenches	ETPTS	Monitor east component of East Trenches Plume toward South Walnut Creek
04091	Semiannual	Sentinel	East Trenches	ETPTS	Monitor east component of East Trenches Plume toward South Walnut Creek
05691	Every other year	Evaluation	East Trenches	ETPTS	Monitor East Trenches Plume source area
07391	Every other year	Evaluation	903 Pad/Ryan's Pit	ETPTS	Monitor Ryan's Pit source area
0487	Quarterly	Decision Document	OU1	ETPTS	Monitor downgradient OU1 Plume in accordance with OU1 CAD/ROD
1786	Semiannual	Decision Document	Solar Ponds Plume	SPPTS	Monitor downgradient of SPPTS in accordance with associated Decision Document
3586	Semiannual	Decision Document	South Walnut Creek	MSPTS	Monitor downgradient of MSPTS in accordance with associated Decision Document
3687	Every other year	Evaluation	East Trenches	ETPTS	Monitor East Trenches Plume source area
4087	Semiannual	Sentinel	Present Landfill	PLS	Monitor downgradient Present Landfill/East Landfill Pond ground water quality
4787	Semiannual	Decision Document	OU1	ETPTS	Monitor downgradient OU1 Plume in accordance with OU1 CAD/ROD
4887	Semiannual	Decision Document	OU1	ETPTS	Monitor downgradient OU1 Plume in accordance with OU1 CAD/ROD
10304	Semiannual	AOC	Woman Creek Drainage	ETPTS	Monitor flowpath of Ryan's Pit/903 Pad Plume toward Woman Creek
10394	Annual	Boundary	Woman Creek at Indiana Street	ETPTS	Monitor ground water in Woman Creek drainage at Indiana Street
10594	Semiannual	AOC	North Walnut Creek Drainage	SPPTS	Monitor North Walnut Creek drainage below Pond A-1
10992	Semiannual	Decision Document	OU1	ETPTS	Monitor downgradient OU1 Plume in accordance with OU1 CAD/ROD
11092	Semiannual	Decision Document	OU1	ETPTS	Monitor downgradient OU1 Plume in accordance with OU1 CAD/ROD
11104	Semiannual	AOC	Woman Creek Drainage	SPPTS	Monitor Woman Creek drainage downgradient of South IA Plume and Original Landfill
11502	Semiannual	Sentinel	South IA	SPPTS	Monitor South IA Plume and B444 flow toward Woman Creek
15699	Semiannual	Sentinel	Mound	MSPTS	Monitor downgradient MSPTS ground water quality
18199	Every other year	Evaluation	IHSS 118.1/B771	MSPTS	Monitor IHSS 118.1 source area removal
20205	Semiannual	Sentinel	B771/774	SPPTS	Monitor downgradient of 700 Area, IHSS 118.1
20505	Semiannual	Sentinel	B771/774	SPPTS	Monitor downgradient of 700 Area, IHSS 118.1
20705	Semiannual	Sentinel	700 Area	SPPTS	Monitor downgradient of 700 Area and IHSS 118.1
20902	Every other year	Evaluation	700 Area	SPPTS	Monitor downgradient of IHSS 118.1 and 700 Area

Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water

Location	Frequency	Class	Plume or Area	Treatment System	Purpose
21505	Every other year	Evaluation	North IA	SPPTS	Monitor downgradient of 700 Area
22205	Every other year	Evaluation	North IA	SPPTS	Monitor downgradient (north) tip of SEP VOC plume toward North Walnut Creek
22996	Every other year	Evaluation	B886	SPPTS	Monitor ground water flowing east from 800 Area
23296	Semiannual	Sentinel	South Walnut Creek	ETPTS	Monitor ground water downgradient of ETPTS
30002	Semiannual	Sentinel	North Walnut Creek	SPPTS	Monitor ground water in North Walnut Creek drainage below PU&D Yard Plume
30900	Every other year	Evaluation	PU&D	ETPTS	Monitor PU&D Yard Plume source area
33502	Every other year	Evaluation	Oil Burn Pit #1	MSPTS	Monitor VOC Plume source area in buried drainage south of B371
33604	Every other year	Evaluation	Oil Burn Pit #1	MSPTS	Monitor VOC Plume source area in buried drainage south of B371
33703	Semiannual	Sentinel	Oil Burn Pit #1	MSPTS	Monitor VOC Plume front in buried drainage south of B371
33905	Every other year	Evaluation	North IA	MSPTS	Monitor North IA Plume by drainage between B371 and B559
37405	Semiannual	Sentinel	B371/374	SPPTS	Monitor downgradient of B371/374
37505	Semiannual	Sentinel	B371/374	SPPTS	Monitor downgradient of B371/374
37705	Semiannual	Sentinel	B371/374	SPPTS	Monitor downgradient of B371/374
40005	Every other year	Evaluation	B444	SPPTS	Monitor South IA Plume at VOC source area near B444
40205	Every other year	Evaluation	B444	SPPTS	Monitor South IA Plume downgradient of VOC source area near B444
40305	Semiannual	Sentinel	B444	SPPTS	Monitor South IA Plume downgradient of VOC source area near B444
41691	Annual	Boundary	Walnut Creek at Indiana Street	ETPTS	Monitor ground water in Walnut Creek drainage at Indiana Street
42505	Semiannual	AOC	700 Area at North Walnut Creek	SPPTS	Monitor downgradient of 700 area, IHSS 118.1, and FC-2 at confluence with North Walnut Creek
45605	Semiannual	Sentinel	Southwest of B991	MSPTS	Monitor adjacent to interrupted perforated line feeding SW056
50299	Every other year	Evaluation	903 Pad/Lip Area	ETPTS	Monitor Ryan's Pit/903 Pad Plume
51605	Semiannual	Sentinel	North Walnut Creek	SPPTS	Monitor downgradient of Solar Ponds Plume at Pond A-1; also supports Decision Document for associated ground water treatment system
52505	Semiannual	Sentinel	North Walnut Tributary Drainage	SPPTS	Monitor FC-2 drainage between B371/B771
55905	Every other year	Evaluation	B559	SPPTS	Monitor downgradient of B559, 700 Area, North IA Plume
56305	Every other year	Evaluation	B559	SPPTS	Monitor downgradient of B559, 700 Area, and North IA Plume near drainage between B371 and B559
70099	Semiannual	Decision Document	SPPTS	SPPTS	Monitor ground water near western end of SPPTS in accordance with associated Decision Document
70193	Quarterly	RCRA	Present Landfill	ETPTS	Monitor upgradient Present Landfill ground water quality
70299	Semiannual	Sentinel	SPPTS	SPPTS	Monitor ground water near western end of SPPTS
70393	Quarterly	RCRA	Present Landfill/PU&D	ETPTS	Monitor upgradient Present Landfill ground water quality
70693	Quarterly	RCRA	* Present Landfill/PU&D	ETPTS	Monitor upgradient Present Landfill/downgradient PU&D Yard ground water quality
70705	Every other year	Evaluation	700 Area	SPPTS	Monitor 700 Area, North IA Plume
73005	Quarterly	RCRA	Present Landfill	PLS	Monitor downgradient Present Landfill ground water quality
73105	Quarterly	RCRA	Present Landfill	PLS	Monitor downgradient Present Landfill ground water quality
73205	Quarterly	RCRA	Present Landfill	PLS	Monitor downgradient Present Landfill ground water quality
79102	Every other year	Evaluation	Solar Ponds	SPPTS	Monitor SEP VOC and U/N plumes source area

Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water

Location	Frequency	Class	Plume or Area	Treatment System	Purpose
79202	Every other year	Evaluation	Solar Ponds	SPPTS	Monitor SEP VOC and U/N plumes source area
79302	Every other year	Evaluation	Solar Ponds	SPPTS	Monitor SEP U/N plume source area
79402	Every other year	Evaluation	Solar Ponds	SPPTS	Monitor SEP U/N plume source area
79502	Every other year	Evaluation	Solar Ponds	SPPTS	Monitor SEP U/N plume source area
79605	Every other year	Evaluation	Solar Ponds	SPPTS	Monitor SEP U/N plume source area
80005	Quarterly	RCRA	Original Landfill	SPPTS	Monitor downgradient Original Landfill ground water quality
80105	Quarterly	RCRA	Original Landfill	SPPTS	Monitor downgradient Original Landfill ground water quality
80205	Quarterly	RCRA	Original Landfill	SPPTS	Monitor downgradient Original Landfill ground water quality
88104	Semiannual	Sentinel	B881	SPPTS	Monitor flow from B881, 800 Area toward Woman Creek
88205	Every other year	Evaluation	B881	SPPTS	Monitor flow from B881, 800 Area toward Woman Creek
89104	Semiannual	AOC	OU1/Woman Creek	ETPTS	Monitor OU1 Plume front downgradient of French drain-SID diversion
891WEL	Quarterly	Decision Document	OU1	ETPTS	Monitor OU1 Plume source area in accordance with OU1 CAD/ROD
90299	Semiannual	Sentinel	903 Pad/Ryan's Pit	ETPTS	Monitor downgradient Ryan's Pit/903 Pad Plume
90399	Semiannual	Sentinel	903 Pad/Ryan's Pit	ETPTS	Monitor downgradient Ryan's Pit/903 Pad Plume
90402	Every other year	Evaluation	903 Pad	ETPTS	Monitor southeastward flow of 903 Pad Plume
90804	Every other year	Evaluation	Ryan's Pit/903 Pad	ETPTS	Monitor Ryan's Pit/903 Pad Plume
91105	Every other year	Evaluation	Oil Burn Pit #2	MSPTS	Monitor Oil Burn Pit #2 source area
91203	Semiannual	Sentinel	Oil Burn Pit #2	MSPTS	Monitor downgradient Oil Burn Pit #2
91305	Semiannual	Sentinel	South Walnut Creek	MSPTS	Monitor South Walnut Creek immediately east of B991 and northwest of Oil Burn Pit #2
95099	Semiannual	Sentinel	East Trenches	ETPTS	Monitor downgradient of ETPTS
95199	Semiannual	Sentinel	East Trenches	ETPTS	Monitor downgradient of ETPTS
95299	Semiannual	Sentinel	East Trenches	ETPTS	Monitor downgradient of ETPTS
99305	Semiannual	Sentinel	B991/Solar Ponds	SPPTS	Monitor downgradient of B991, SEPs
99405	Semiannual	Sentinel	B991/Solar Ponds	SPPTS	Monitor downgradient of B991, SEPs
B206989	Semiannual	Sentinel	Present Landfill	PLS	Monitor downgradient Present Landfill/East Landfill Pond ground water quality
B210489	Every other year	Evaluation	North Walnut Creek	SPPTS	Monitor Solar Pond Plume at North Walnut Creek
P114689	Every other year	Evaluation	IA	SPPTS	Monitor IA Plume near B559
P115589	Every other year	Evaluation	IA	SPPTS	Monitor IA Plume near B551
P208989	Every other year	Evaluation	Solar Ponds	SPPTS	Monitor SEP VOC and U/N plumes source area
P210089	Semiannual	Sentinel	North Walnut Creek	SPPTS	Monitor Solar Pond Plume between SEPs and SPPTS
P210189	Every other year	Evaluation	Solar Ponds	SPPTS	Monitor SEP VOC and U/N plumes source area
P416589	Quarterly	RCRA	Original Landfill	SPPTS	Monitor upgradient of Original Landfill
P416889	Every other year	Evaluation	IA	SPPTS	Monitor downgradient of B444 and South IA Plume
P419689	Every other year	Evaluation	B444	SPPTS	Monitor South IA Plume downgradient of VOC source area near B444
TH046992	Semiannual	Sentinel	South Walnut Creek	ETPTS	Monitor downgradient of ETPTS at South Walnut Creek

ETPTS = East Trenches Plume Treatment System; MSPTS = Mound Site Plume Treatment System; PLS = Present Landfill Seep Treatment System; and SPPTS = Solar Ponds Plume Treatment System

Table 3: Surface water locations and classifications.

Location	Frequency	Class	Location	Treatment System	Purpose
GS01	CFP	POC; non-POC	Walnut @Indiana	SPPTS	SW Leaving Site
GS03	CFP	POC; non-POC	Woman @Indiana	SPPTS	SW Leaving Site
GS05	CFP; qtrly grabs	RCRA; Investigative	Woman @W. fenceline	SPPTS	SW upgradient of OLF and GS01
GS08	CFP	POC	Pond B-5 Outlet	SPPTS	SW Discharges from B-5
GS10	CFP; semi-annual grabs	POE; Performance	S. Walnut above B-Ponds	SPPTS	SW Entering B-Ponds; MSPTS
GS11	CFP	POC	Pond A-4 Outlet	SPPTS	SW Discharges from A-4
GS13	CFP; semi-annual grabs	Performance; Investigative	N. Walnut above A-Ponds	SPPTS	SW Entering A-Ponds; SPPTS
GS31	CFP	POC	Pond C-2 Outlet	SPPTS	SW Discharges from C-2
GS51	CFP	Investigative	903 Pad/Lip Hillside	SPPTS	SW runoff to SID
GS59	CFP; qtrly grabs	Performance; Investigative	Woman south of former B850	SPPTS	SW upgradient of OLF and GS01
GWISINFNORTH	qtrly grabs	Performance	Present Landfill: N GWIS Influent	NA	GWIS quality; App VIII
GWISINFSOUTH	qtrly grabs	Performance	Present Landfill: S GWIS Influent	NA	GWIS quality; App VIII
PLFPONDEFF	as needed	Performance	East end of Landfill Pond	NA	Landfill Pond quality
PLFPONDINF	as needed	Performance	West end of Landfill Pond	NA	Landfill Pond quality
PLFSEEPINF	qtrly grabs	Performance	Present Landfill: Treatment Sys Seep Influent	NA	Present Landfill treat Sys
PLFSYSEFF	qtrly grabs	Performance	Present Landfill: Treatment Sys Effluent	NA	Present Landfill treat Sys
POM2	semi-annual grabs	Performance	S. Walnut @B-4 Outlet	NA	ETPTS
POM3	semi-annual grabs	Performance	S. Shoreline B-2	NA	ETPTS
SPP DIS GALLERY	semi-annual grabs	Performance	Discharge from SPPTS	NA	SPPTS
SW018	CFP; semi-annual grabs	Performance; Investigative	W. of former B771 on N. Walnut tributary	NA	IHSS 118.1 and SW to SW093
SW027	CFP	POE	SID above Pond C-2	SPPTS	SW Entering C-2
SW093	CFP	POE	N. Walnut above SPPTS	SPPTS	SW Entering A-Ponds
Pond A-4	as needed	Predischarge	Pond A-4	NA	batch discharges
Pond B-5	as needed	Predischarge	Pond B-5	NA	batch discharges
Pond C-2	as needed	Predischarge	Pond C-2	NA	batch discharges

CFP = continuous flow-paced; POC = Point of Compliance; POE = Point of Evaluation

MSPTS = Mound Site Plume Treatment System; ETPTS = East Trenches Plume Treatment System; SPPTS = Solar Ponds Plume Treatment System; PLS = Present Landfill Seep Treatment System.

NA = An excess sample may only exist at continuous flow-paced sampling locations and not at locations where grab samples are collected.

Program Directive
Rocky Flats Site

Activities Surface Water Monitoring **Directive No.** RFS-2008–04

Initiated By: Sam Campbell

Directive Subject: Processing of Composite Surface Water Samples

Directive and Associated Task Changes:

Composite surface water samples will be processed using the attached procedure.

Organization(s) Affected: Environmental Monitoring/Field Services, Hydrology, Programs and Projects.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (DOE-LM/GJ1197-2006), *Rocky Flats Legacy Management Agreement*, Attachment 2 (2007), *Rocky Flats Site Operations Guide*, (DOE-LM/1429-2007).

Justification for Directive:

Because composite surface water samples have the potential to remain in the composite sampler carboy for extended periods of time, special processing procedures are required for homogenization, preservation, and splitting of sample fractions.

Review and Concurrence:

Linda L. Kaiser

Linda Kaiser, Task Order Manager

George Squibb

George Squibb, Surface Water Lead

Michael O Hoge 2007.10.30 14:09:49 -04'00'

Mike Hoge, QA Coordinator

Issuing Manager Approval:

Sam Campbell 2007.10.30 13:35:06 -06'00'

Sam Campbell, Environmental Monitoring/Field Services Manager

Date

Effective Date: 10/1/2007 **Expiration Date:** 9/30/2008

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Record File through Dianna Roberts (ADM 130.10)
Distribution List for the Sampling and Analysis Plan for U. S. DOE LM Sites

Guidelines for the Processing of Automated Surface-Water Composite Samples at the Rocky Flats Site

The purpose of this procedure is to describe the techniques and methods used for the processing of Rocky Flats automated surface-water composite samples. These composite samples are flow-proportional composites collected continuously using automated samplers. This procedure contains personnel responsibilities, QA/QC and documentation requirements that will be used for collection activities in order to attain acceptable standards of accuracy, comparability, precision, and completeness.

Automated samplers are stationed in drainage basins throughout the Site and collect composite samples in dedicated 15- or 22-liter carboys. The number of carboys and volume collected will vary by location and be determined by streamflow rates. All automated composite sample carboys will be collected, delivered, processed, and shipped in accordance with the applicable controlling documents.

Qualified personnel will retrieve the carboys from the field under the direction of the Surface Water Lead, and transport them to the Sample Management Station in accordance with DOT regulations.

Each carboy will then be mixed (homogenized) for a minimum of two minutes on a magnetic stir plate. During mixing, all samples except for radionuclide analysis, will be extracted via a peristaltic pump from the carboy into the appropriate sample container. Silicon tubing used in this process is dedicated and will be disposed of after use.

The remaining carboy water will be preserved with $HN0_3$ to a pH just above two (2.0). The carboy will set idle for a minimum of 16 hours to remove any potential plating on the carboy walls. Custody of the carboy must be maintained in accordance with the LM SAP. The carboy water will then be re-mixed (homogenized) and the preserved samples will be pumped into the appropriate sample containers.

All sample containers will be labeled, custody sealed, preserved, packaged and shipped according to the LM SAP.

Any remaining carboy water will be neutralized with baking soda and disposed in accordance the *Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water* program directive. Carboys will then be de-contaminated with dedicated cleaning equipment in accordance with the LM SAP for subsequent re-use in the field.

Heavy containers such as filled carboys will be handled safely, in accordance with the LM Project Safety Plan, and proper lifting techniques to avoid back injuries.

Rulison, Colorado

Constituent Sampling Breakdown

On-site Location (SEEPro Location_Code)	Sample Analytes		
	Tritium*	Gamma Spec	Comment
Surface			
Spr 300 Yrd N Of GZ	X	X	Lot 11, Welsey Kent
Sprg 500ft E of GZ	X	X	Lot 11, Cary Weldon

Also collect field measurements for specific conductivity, pH, & T.
25% of tritium samples are analyzed by the enriched tritium method.

RULISON

Off-site Location (SEEPro Location_Code)	Sample Analytes		
	Tritium*	Gamma Spec	Comment
Wells			
CER Test Well	X	X	TD = 54 ft.
Daniel Gardener	X	X	
Kevin Whelan	X	X	
Morrissania Ranch	X	X	
Patrick McCarty	X	X	
Tim Jacobs Ranch New	X	X	
Municipal Water Supply			
City Springs	X	X	Collection point for feeder springs
Surface			
Battlement Creek			
Potter Ranch	X	X	

Also collect field measurements for specific conductivity, pH, & T.
* 25% of tritium samples are analyzed by the enriched tritium method.

Program Directive

Rulison Site

Activity or Task Natural Gas Sampling **Directive No.** Rul-2007-01 .

Initiated By: Sam Campbell – Manager Environmental Monitoring/Field Services

Directive Subject: Natural Gas Sampling at a Natural Gas Production Well

Directive and Associated Task Changes:

Collection of a natural gas sample at the wellhead of a producing natural gas well will be conducted as described in the attached procedures.

Organization(s) Affected: Nevada Offsites, Environmental Monitoring/Field Services

Affected Documents: Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites (DOE-LM/GJ1197-2006); and SEEPro Database.

Justification for the Directive:

Procedures for sampling natural gas are not addressed in the Sampling and Analysis Plan. This procedure will be used to guide sample collection.

Review and Concurrence:

10/08/07
Rick Hutton, Task Order Manager

8-14-2007
Steve Donivan, Laboratory Services Coordinator

Rick Findlay, Project Technical Lead

10/8/07
Mike Finton, QA Specialist

Issuing Manager Approval:

Sam Campbell, Manager Environmental Monitoring/Field Services

8-14-07
Date

Effective Date: 8/13/2007 **Expiration Date:** 9/30/2008

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Record File RUL.000 through (Dianna Roberts)
Distribution List for *Sampling and Analysis Plan for US DOE LM Sites*

Nevada Offsites
Rulison Drilling Projects
Water and Gas Sampling Job Safety Analysis
June 2007

Scope:

The Nevada Test Site was the primary continental location for conducting nuclear tests; however, nuclear explosive tests were performed at several other locations for purposes, including stimulating natural gas production and cataloging seismic detonation signatures. The DOE Nevada Site Office of Environmental Management is responsible for characterization and remediation activities and has monitored environmental conditions at these sites under the Nevada Offsites Project. Long-term monitoring activities will consist primarily of ensuring that use restrictions remain in force and maintaining site integrity to protect public health and the environment. Drilling operations are being conducted near the Rulison site, all drilling has been conducted outside of the exclusion zone. The drilling being performed is closing in on the exclusion zone therefore water and gas sampling is being conducted to insure that no contamination is encountered.

Tasks (CF#1)	Analyze for Hazards (CF#2)	Develop Mitigators (CF#3)	Performing Organization(s)	Date
Task 1: Mobilization and demobilization of equipment. • The sampling crew will bring a support vehicle, all materials necessary to perform the sampling operations, and appropriately trained personnel.	Vehicle collisions while driving and parking/backing	Use defensive driving techniques, walk around vehicle prior to operation, use spotter while backing. Secure all equipment prior to travel. Heavy equipment and rough terrain will be encountered during travel to remote drill pad locations, extra caution shall be taken.	Sampling crew	

Task 2: General hazards present throughout the job site.	Eye Injury from Flying Particles	Wear safety glasses when performing field activities.	Sampling crew	
	Slips, trips, and falls	Keep work area clean and remove tripping hazards. Drill rigs, platforms and associated equipment have many tripping hazards present be cautious and pay attention to your surroundings. Use caution on stairways and platforms, muddy conditions exist.		
	Back injury	Use correct lifting form, get help with heavy or awkward items, use hand truck when able.		
	Fire	Do not refuel equipment while operating, no smoking within 50 ft of ignition source, gasoline shall be stored in approved safety cans. Containers shall be properly grounded and bonded.		
	Biological	Beware of snakes, insects, spiders, and poisonous plants. Use repellant when necessary based on manufacturer's recommendations.		
	Heat Stress	Utilize the buddy system to check for signs and symptoms		

General hazards-continued		of heat stress, take breaks as necessary, and maintain proper hydration.	Sampling crew	
	Pinch points, crush hazards, cuts to hands	Keep hands and fingers out of pinch points and crush areas. Wear leather work gloves to protect hands from cuts, abrasions, blisters etc.		
	Electrical Shock	Inspect equipment prior to use and remove unserviceable cords and tools, use only double insulated tools, use GFCI for protection of personnel using outdoor outlets.		
	Overhead hazards	Hard hats shall be required when working at drill pads where overhead work is being performed, or head bump hazards exist.		
	Rotating equipment	Inspect all equipment prior to use, insure all manufactured guards are in place and functional. Keep all body parts away and pay attention to your surroundings when using such equipment.		

General hazards- continued	Noise exposure	. Wear hearing protection in those areas that require the use of hearing protection, or when operating tools or equipment that exceed noise control levels. Hearing protection required during drilling operations.	Sampling crew	
	Hand Tools	Inspect all hand tools prior to use and remove those from service that are unserviceable, Make sure all manufacturer supplied guards are in place, or that the tool is properly guarded.		
	Fall hazards	Personal fall protection is required when working within 6 feet of an unprotected edge. Sampling location is on top of frack tanks above 6'; insure proper guardrails are in place prior to access.		
	Uncontrolled hazardous energy	Workers exposed to uncontrolled sources of hazardous energy must use LO/TO protocol. Contact H&S for guidance.		
	Inclement weather	Awareness of lightning, flooding, strong winds, sunburn, visibility, etc. If		

	Site control	lighting is observed within one mile all work shall stop and workers shall take cover. Sampling crew shall check in with the drilling supervisor prior to performing any sampling activities.	Sampling crew	
Task 3: Collection of drilling mud samples Personnel will collect samples for laboratory analyses.	Same hazards as above Eye injury Sampling drilling fluids (mud) Slips, trips, falls	See above Safety goggles are required during sampling. High volumes of drilling mud are piped into the sampling bin, which creates a splash hazard. Wear nitrile gloves when sampling drilling fluids. Extra caution at sampling bin due to spilled drilling mud on the deck.	Sampling crew	
Task 4: Collection of gas and liquid samples from production well for laboratory analyses.	Same hazards as above Eye injury Flame and Spark	See above Wear safety glasses with side shields for all work and sampling activities around wells, separators, and all other associated gas well equipment. Wear Nomex Shirt prior to	Sampling crew	

	Producing Activities	beginning set-up and sampling activities. No smoking at any time (this includes during set-up, sampling, or demobilization activities. Vehicles shall be turned off prior to set-up activities begin.		
	Sampling High Pressure Natural Gas Lines	Prior to sampling, ensure sampling hose, fittings and pressure reducing regulators are rated to handle gas delivery pressures at sampling ports. Wear nitrile gloves when sampling gas and water. Don Nomex Shirt prior to set-up and sampling activities. No Smoking, flame or spark produce activities during set-up, sampling and de-moblization. Vehicles shall be turned off prior to set-up activities begin.		
	Transportation of pressurized sampling containers	Ensure sampling container is secure prior to transport from sampling site. Ensure proper shipping documents are completed prior to transport from sampling site.		

FIELD MANAGEMENT CHANGES:

Define New or Changed Scope of Work by Tasks (CF#1)	Analyze the New or Changed Hazards (CF#2)	Develop and Implement New Controls (CF#3)	Performing Organization(s) Print Name & Initial	Perform Work Within Controls (CF#4) Date

I have reviewed, thoroughly understand, and will comply with this ISMS Core Functions/ Job Safety Analysis

Print Name	Signature	Company	Date
Sam Campbell	Sam Campbell	Stoller	8-14-07
JACK DURAY	J Duray	Stoller	8-15-07
Mark Kautsky	Mark Kautsky	S. M. Stoller	8-15-07
JEFF WALTERS	Jeff Walt	STOLLER	10-15-07

PROVIDE FEEDBACK & IMPROVEMENT: (CF#5)

Richard C. Findlay	Richard C. Findlay	8-14-07
SM Stoller Print Name	**Signature**	**Date**
Mark E. Reed		8-14-07
Health & Safety Print Name	**Signature**	**Date**

High Pressure Natural Gas Sampling Using a Propane Tank

Introduction and Purpose

The following procedure will be used to collect samples from natural gas production wells in the vicinity of the Rulison, Colorado, Site. Isotech Laboratories Inc. will be conducting the analyses of the gas samples and will provide a prepared "propane" tank to collect the natural gas sample. This procedure is a compilation of three Isotech Laboratories Inc. procedures related to gas sampling. The objective of this sampling is to obtain carbon-14 and tritium data from natural gas production wells in the vicinity of the Rulison site to verify radionuclides are not migrating beyond the ground zero detonation site.

Health and Safety

All tasks associated with this procedure will be conducted according to the requirements of the attached Job Safety Analysis (JSA).

Equipment

Equipment used for this procedure includes flexible natural gas tubing (350 pounds per square inch [psi] working pressure), brass connectors, Teflon tape, a pressure regulator (rated to 3,000 psi), a standard 20-pound propane tank, and a high-pressure gauge (5,000 psi). The flexible tubing/pressure regulator assembly and the propane tank are shown in Figure 1. The propane tank is provided by Isotech Laboratories and is purged and evacuated prior to delivery. Personal protective equipment required per the attached JSA includes a fire retardant shirt, hardhat, safety glasses, hearing protection, and nitrile gloves.

Procedure

1. Meet with a representative from the company that is responsible for operation of the production well. Have the representative locate a sampling port with control valve on a line coming from the well. Sampling locations for other media (e.g. condensate water) may be located at this time.
2. Verify line pressure from an inline gauge next to the sample port or install a high-pressure gauge (5,000 psi) gauge at the sampling port. Use Teflon tape at all threaded connections.
3. If the pressure is greater than 2,500 psi, then do not attempt to sample from that location.
4. If the pressure is between 350 psi and 2,500 psi, install the inlet side of the pressure regulator directly to the sample port via a quick connect fitting.
5. If the line pressure is less than 350 psi, then install the inlet side of the flexible tubing/pressure regulator assembly to the sample port.
6. Connect the outlet side of the flexible tubing/pressure regulator assembly to the propane tank. Note: the threads on the propane tank are left-handed thread, so turn counter-clockwise to tighten. Do not overtighten.
7. Open the control valve at the sampling port.
8. Adjust the outlet pressure on the pressure regulator to 20 psi.
9. Open the bypass valve on the propane tank and purge the line for approximately 10 seconds to purge the air space in the pressure regulator and flexible tubing, and then close the bypass valve.

10. Open (for approximately 2 seconds) and close the bypass valve approximately 15 times to purge the air space between the bypass valve and the propane tank.
11. With the bypass valve closed, open the valve on the propane tank and allow the tank to fill until gas flow into the propane tank is no longer audible (approximately 30 seconds).
12. Close the valve on the propane tank. Do not overtighten.
13. Close the control valve at the sample port.
14. Open the bypass valve on the propane tank to release the pressure and then close the bypass valve.
15. Disconnect the flexible tubing/pressure regulator assembly.
16. Label the propane tank and complete chain-of-custody form.

Shipping

The natural gas sample contained within the propane tank is regulated by the U. S. Department of Transportation (DOT), and, therefore, must be shipped as a hazardous material per DOT regulations. The attached sheet from Isotech Laboratories has the necessary shipping information. Contact a Certified Shipper to complete and sign the required documentation and oversee the shipment.

References

Isotech Laboratories, Inc., 2007. Sampling procedures *Sample Collection Procedures Using a 12 Volt Pump and Propane Tanks*; *Collection of Gas Samples with Single-Ended Cylinders*; *Sampling from High-Pressure Wells*; and *Shipping Instructions for Gas Samples in LP Tanks*. Located at http://www.isotechlabs.com/customersupport/samplingprocedures/. Last accessed on 10/5/2007.

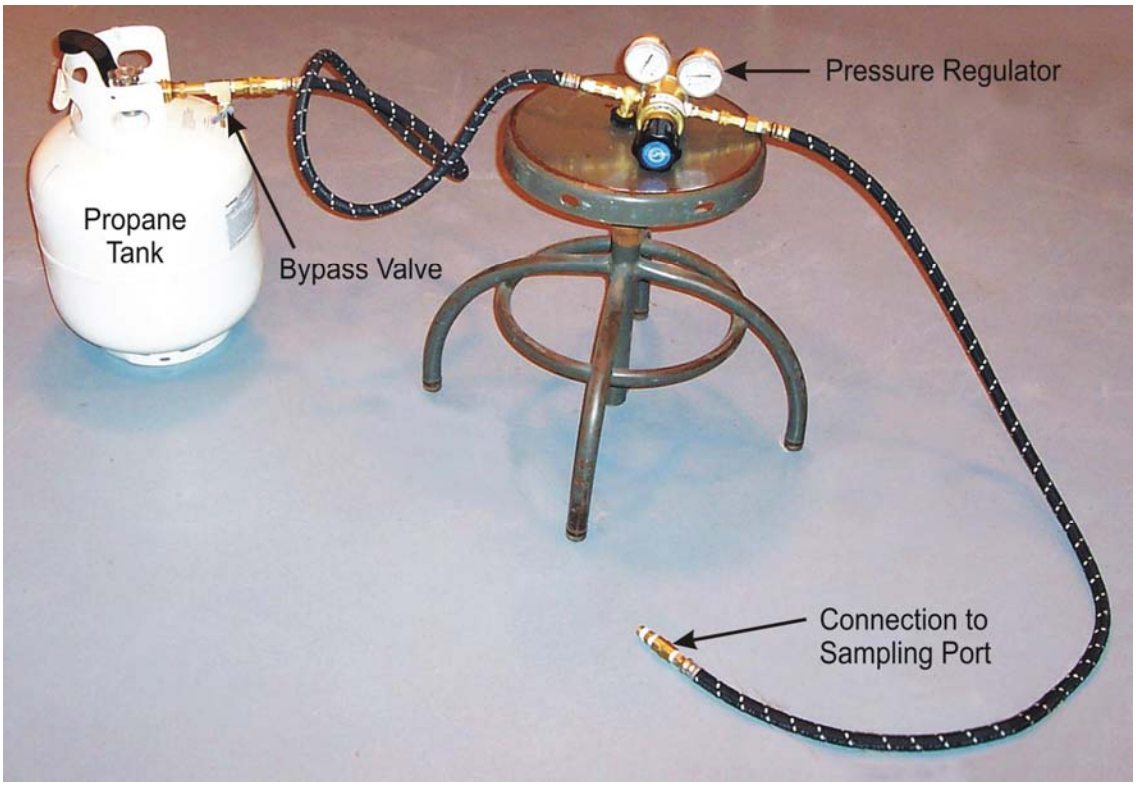


Figure 1. Flexible Tubing/Pressure Regulator Assembly and Propane Tank

ISOTECH®
ISOTECH LABORATORIES INC
1308 Parkland Court Champaign, IL 61821 • (877) 362-4190 • www.isotechlabs.com

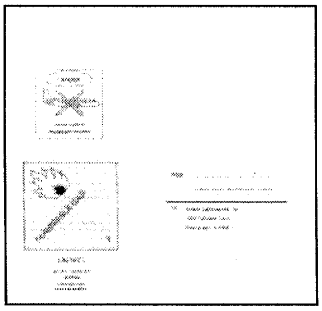
Shipping Instructions for Gas Samples in LP Tanks

(domestic shipment)

NOTE: You must be certified to ship hazardous goods in order to legally ship flammable gas samples.

1. Check to insure that the tank valve is tightly closed, return the tank to the cardboard shipping carton, and seal it with packaging tape.

2. Attach the provided address and warning labels to each carton as shown. One set of hazard labels should be on the top of the box, next to the address label and another set may be placed on the front side of the box.



3. Deliver to the nearest commercial shipping office that will accept hazardous materials or dispatch through your shipping pickup service. Air shipment of flamm ble gases must be in "cargo only" aircraft Airborne Express and Federal Express will both accept compressed gases. UPS will only accept hazarous materials from certified hazmat shippers who have a signed contract with them, and then only for ground shipment. If your company does not meet this requirement, we suggest using Airborne Express.

4. Complete the shipping documents required (these vary from company to company). To assist you in filling out these documents, the various pieces of information that you may need are provided on the back of these shipping instructions.

5. Please notify us when samples have been shipped, either by telephone (217) 398-3490 or by FAX (217) 398-3493.

Ship to: Isotech Laboratories, Inc.
1308 Parkland Court
Champaign, Illinois 61821
Telephone number 217/398-3490
FAX number 217/398-3493

Airport of Destination:	CMI (Willard Airport, Champaign, IL)
Proper Shipping Identification:	*Shipping Name:* Methane, Compressed (Landfill gas, >50% methane) *Class or Division:* 2.1, Flammable Gas *UN or ID No.:* UN1971
Type of packaging:	USA Department of Transportation (D.O.T.) approved gas cylinder(s) with fiberboard box as outer package.
Total Net Quantity:	<1 KG
Maximum Allowed Quantity Per Package:	150 KG
Packing Instructions:	200
Transport Details:	Cargo Aircraft Only
Shipment type:	Non-radioactive
Description of Contents:	Gas cylinder(s) containing methane gas samples.

As required by the Department of Transportation (49 CFR - Part 172, Subpart G, §172.604) a person who offers a hazardous material for transportation must provide an emergency response telephone number, including the area code or international access code, for use in the event of an emergency involving the hazardous material. You MUST use your company's emergency response telephone number. If one is not available to you please contact us and we can advise you on how to obtain one.

These instructions have been prepared to simplify the task of shipping samples and are based on the "IATA Dangerous goods Regulations 44th Edition, 2003,". However, <u>it is you, the shipper, who is ultimately responsible for the safe and legal shipment of these samples</u> in compliance with the most recent applicable local, state, and international shipping regulations. Isotech assumes no liability resulting from the improper packaging and shipment of samples and makes no guarantees regarding the validity of the information presented here.

Warning: Samples containing high concentrations of hydrogen sulfide (>1%) cannot be shipped by air. Samples containing hydrogen sulfide are Class 2.3, toxic gas, and have additional shipping restrictions.

Salmon, Mississippi

Constituent Sampling Breakdown

SALMON

On-site Location (SEEPro Location_Code)	Sample Analytes				Water Level
	VOC	Metals[a]	Tritium	Gamma Spec[c]	
Source Area 1					
SA1-1-H	X*	X	X*		WL
SA1-2-H	X*	X	X*		WL
SA1-3-H	X*	X	X*		WL
SA1-4-H	X*	X	X*		WL
SA1-5-H	X*	X	X*		WL
SA 1-6-H	X*	X	X*		WL
SA1-7-H	X*	X	X*		WL
SA1-12-H[b]	X*	X	X*		WL
HMH-5R	X*	X	X*	X	WL
HMH-16R	X*	X	X*	X	WL
HM-S	X*	X	X*	X	WL
SA1-8-L[b]		X	X*	X	WL
HM-L		X	X*	X	WL
HM-1			X*	X	WL
HM-2A			X*	X	WL
HM-2B			X*	X	WL
HM-3		X*	X*	X*	WL
SA1-11-3[b]			X*	X*	WL
Source Area 2					
SA2-1-L		X	X*	X	WL
SA2-2-L		X	X*		WL
SA2-4-L		X	X*	X	WL
Source Area 3					
SA3-4-H	X*	X	X*		WL
E-7	X*		X*	X*	WL
SA3-11-3			X*	X*	WL
Source Area 4					
HM-L2		X	X*	X	WL
SA4-5-L		X	X*	X	WL
Source Area 5					
SA5-4-4			X*	X*	WL
SA5-5-4			X*	X*	WL
Surface					
HALFMOON CREEK		X	X	X	
HALFMOONCRKOVERFLOW		X	X	X	
Pond west of GZ		X	X	X	
REECo Pit (A)		X	X		
REECo Pit (B)		X	X		
REECo Pit (C)		X	X		

Off-site Location (SEEPro Location_Code)	Sample Analytes		Comment
	Tritium	Gamma Spec	
Municipal Water Supply Wells			
Bx.Cty WL #370007-04	X	X	Baxterville
Cty WL 46-003--5-6-7	X	X	Columbia
Greenville Community	X	X	Greenville Community Center
Lumberton Cty WL #2	X	X	
Purvis Cty Supply WL	X	X	
Thompson's Blue Stor	X	X	Thompson's Blue Store aka Hub Water Association
Surface			
B.R. Anderson Pond	X	X	
James Lowe Pond	X	X	
Lower Little Crk #1	X	X	
Lower Little Crk #2	X	X	
Nobles Pond	X	X	
Smith, Howard - Pond	X	X	

Also collect field measurements for specific conductivity, pH, & T.
*Sample is required by SCR/LTS; 25% of tritium samples are analyzed by the enriched tritium method.

Also collect field measurements for specific conductivity, pH, & T.
All wells, except the two in SA5, have bladder pumps. Drop tubes in 5 wells require rework before sampling.
Pumps in the two wells in SA5 are electric. See the 11--21 2007 Trip Report.
*Sample is required by SCR/LTS; 25% of tritium samples are analyzed by the enriched tritium method.
[a]RCRA metals plus antimony, beryllium, nickel, and zinc.
[b]Well within Source Area 1.
[c]Gamma spectroscopy is done on half of the samples analyzed for tritium

Sampling Frequencies for Locations at Sherwood, WA

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
MW-2B			X			
MW-4			X			
MW-10			X			
P1					X	Water level only
P2					X	Water level only
P3					X	Water level only
P4					X	Water level only

Sampling conducted in July

Constituent Sampling Breakdown

Site	Sherwood	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	3	0
Field Measurements		
Alkalinity	X	
Dissolved Oxygen		
Redox Potential	X	
pH	X	
Specific Conductance	X	
Turbidity	X	
Temperature	X	
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Barium		
Beryllium		
Bromide		
BTEX		
Cadmium		
Calcium		
Chloride	X	
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron		
Lead		
Lead-210		
Magnesium		
Manganese		
Mercury		
Molybdenum		
Nickel		
Nitrate + Nitrite as N (NO3+NO2)-N		
Organics		
Potassium		
Selenium		
Silica		
Sodium		
Strontium		
Sulfate	X	
Sulfide		
Thallium		
Thorium-230		
Thorium-232		
Tin		
Total Dissolved Solids	X	
Uranium		
Uranium-234, -238		
Vanadium		
VOCs		
Zinc		
Total Analytes	3	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Shiprock, New Mexico

Sampling Frequencies for Locations at Shiprock, New Mexico

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
SHP01						
608		X				Low flow
614		X				Low flow
615		X				Low flow
617					X	Data logger only
618		X				Low flow
619		X				Low flow
734		X				Low flow
735		X				Low flow
736		X				Low flow; data logger
797		X				Low flow
850		X				Low flow
854					X	Data logger only
857					X	Data logger only
862					X	WLs only in Feb.
863					X	WLs only in Feb.
1000					X	WLs only in Feb.
1001					X	WLs only in Feb.
1008					X	Data logger only
1062					X	WLs only in Feb.
1089		X				U, SO4, NO3 only at vault
1104		X				U, SO4, NO3 only at vault
1105		X				
1109		X				Trench 2; U, SO4, NO3 only at vault
1110		X				Trench 1; U, SO4, NO3 only at vault
1111		X				Well point; U, SO4, NO3 only. Purge 1 casing vol then sample
1112		X				Well point; U, SO4, NO3 only. Purge 1 casing vol then sample
1113		X				Well point; U, SO4, NO3 only. Purge 1 casing vol then sample
1114		X				Well point; U, SO4, NO3 only. Purge 1 casing vol then sample
1115		X				Well point; U, SO4, NO3 only. Purge 1 casing vol then sample
1116		X				Well point; U, SO4, NO3 only. Purge 1 casing vol then sample
1117		X				Well point; U, SO4, NO3 only. Purge 1 casing vol then sample
SHP02						
600					X	WL semi-annually only
602					X	WL; Data logger
603					X	WL semi-annually only
604					X	WL semi-annually only; data logger
648				Odd year		Measure flow rate semiannually; sample biennially; next in 2/07
725					X	Data logger only
726					X	WLs semi-annually
728					X	WLs semi-annually; data logger

Sampling Frequencies for Locations at Shiprock, New Mexico

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
730		X				Data logger
731					X	WL; Data logger
800					X	Water levels only; in March
SHP02						
801					X	Water levels only; in March
802					X	Water levels only; in March
803					X	Water levels only; in March
812					X	WLs semi-annually
813					X	WLs semi-annually; data logger
814					X	WL semi-annually only
815					X	WL semi-annually only
816					X	WL semi-annually only
817		X				Low flow; WL semi-annually
818		X				Ext. well; U, SO4, NO3 only at vault
819					X	WL semi-annually only; data logger
820					X	WL semi-annually only
821					X	WL semi-annually only
822					X	WL semi-annually only
823					X	WL semi-annually only
824					X	WL semi-annually only
825					X	WL semi-annually only
826					X	Data logger; WL semi-annually
827					X	WL; Data logger
828					X	WL semi-annually only; data logger
829					X	WL semi-annually only
830		X				Data logger
832		X				Low flow
833					X	WL semi-annually only
835		X				Low flow; data logger
836		X				Low flow; data logger
837					X	Data logger only
838		X				Low flow
839		X				Low flow
841		X				Low flow; data logger; WL semi-annually
843					X	Data logger only
844					X	WL semi-annually only
846		X				Low flow; data logger
848					X	WL; Data logger
1002					X	WL semi-annually only
1003					X	WL semi-annually only
1004					X	WL semi-annually only
1007					X	WL semi-annually only
1048					X	WL semi-annually only
1049					X	WL semi-annually only
1057		X				WL semi-annually only
1059					X	WL semi-annually only
1060		X				Low flow; data logger
1067					X	WL only; Bob Lee Wash
1068					X	WL only; Bob Lee Wash
1069					X	WL only; Bob Lee Wash; data logger
1070		X				Ext. well; U, SO4, NO3 only at vault

Sampling Frequencies for Locations at Shiprock, New Mexico

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
1071		X				Ext. well; U, SO4, NO3 only at vault
1073					X	WL semi-annually only; data logger
1078		X				Ext. well; U, SO4, NO3 only at vault
1079		X				Low flow
1087		X				SUMP-Bob Lee Wash
1088		X				SUMP-Many Devils Wash
SHP02						
1091		X				Ext. well; U, SO4, NO3 only at vault
1092		X				Ext. well; U, SO4, NO3 only at vault
1093		X				Ext. well; U, SO4, NO3 only at vault
1095		X				Ext. well; U, SO4, NO3 only at vault
1096		X				Ext. well; U, SO4, NO3 only at vault
MW1					X	WL semi-annually only
DM7					X	WL semi-annually only
Surface Locations						
SHP01						
501		X				East of disposal cell
655		X				Drainage channel
887		X				Distributary channel
897		X				Just below mouth of Many Devils Wash
898		X				San Juan River upgradient
937		X				
938		X				
939		X				
940		X				Just NE of 1004, San Juan River
956		X				San Juan River at intake
959		X				Distributary channel just below 1st wash
965		X				San Juan River about 1500' below dist. Channel
1118		X				Seep sump (423/426) U, SO4, NO3 only at vault
1203		X				East of disposal cell
1205		X				San Juan River E of well 853
Surface Locations						
SHP02						
662		X				Lower Bob Lee Wash
786		X				Seep below US Hwy 666 bridge; FLOW RATE
884		X				Irrigation return flow
885		X				Upper Bob Lee Wash; water level
889		X				Many Devils Wash
933		X				1st wash W of Highway 666
934		X				2nd wash W of Highway 666
936		X				Seep between 1st & 2nd washes
942		X				Pond NW of 847
958				Odd year		Helium lateral canal where water comes into canal at pump station; next in 3/09

Sampling conducted in March and September

Constituent Sampling Breakdown

Site	Shiprock	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	92	24
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen	X	
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)	X	X
Antimony		
Arsenic		
Cadmium		
Calcium	X	X
Chloride	X	X
Chromium		
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron		
Lead		
Lead-210		
Magnesium	X	X
Manganese	X	X
Mercury		
Molybdenum		
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	X	X
Organics		
Potassium	X	X
Radium-226		
Radium-228		
Radon-222		
Selenium	X	X
Silica		
Sodium	X	X
Strontium	X	X
Sulfate	X	X
Sulfide		
Thallium		
Thorium-230		
Thorium-232		
Tin		
Total Dissolved Solids	X	
Uranium	X	X
Uranium-234, -238		
Vanadium		
VOCs		
Zinc		
Total Analytes	13	12

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Shirley Basin
South, Wyoming

Sampling Frequencies for Locations at Shirley Basin South, Wyoming

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
40-SC			X			
5-SC			X			
51-SC			X			
54-SC			X			
10-DC			X			
5-DC			X			
19-DC			X			
K.G.S.#3			X			

Sampling conducted in August

Constituent Sampling Breakdown

Site	Shirley Basin South	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	8	0
Field Measurements		
Alkalinity	X	
Dissolved Oxygen		
Redox Potential	X	
pH	X	
Specific Conductance	X	
Turbidity	X	
Temperature	X	
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Barium		
Beryllium		
Bromide		
BTEX		
Cadmium	X	
Calcium		
Chloride	X	
Chromium	X	
Cobalt		
Copper		
Fluoride		
Gamma Spec		
Gross Alpha		
Gross Beta		
Iron		
Lead	X	
Lead-210		
Magnesium		
Manganese		
Mercury		
Molybdenum		
Nickel	X	
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	X	
Organics		
PCBs		
Potassium		
Radium-226	X	
Radium-228	X	
Selenium	X	
Silica		
Sodium		
Strontium		
Sulfate	X	
Sulfide		
Thorium-230	X	
Thorium-232		
Tin		
Total Dissolved Solids	X	
Uranium	X	
Uranium-234, -238		
Vanadium		
VOCs		
Zinc		
Total Analytes	13	0

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Shoal, Nevada

Sampling Frequencies for Locations at Shoal, Nevada

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
H-2			X			
H-3			X			
HC-1			X			Download transducers
HC-2			X			Download transducers
HC-3			X			Download transducers
HC-4			X			
HC-5			X			Download transducers
HC-6			X			Download transducers
HC-7			X			Download transducers
HC-8			X			Download transducers
HS-1			X			
MV-1			X			Download transducers
MV-2			X			Download transducers
MV-3			X			Download transducers
Spring Windmill			X			
Hunt's Station			X			
Piezometers						
MV-1PZ					X	Download transducers
MV-2PZ					X	
MV-3PZ					X	Download transducers
Surface Locations						
Flowing Spring			X			

Sampling conducted in March

Constituent Sampling Breakdown

Site	Shoal	
Analyte	**Ground Water**	**Surface Water**
Approx. No. Samples/yr	16	1
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen	X	X
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Bromide	MV-1, MV-2, and MV-3	
Cadmium		
Calcium		
Carbon-14	HC-1, HC-4, MV-1, MV-2, and MV-3 ONLY	
Chromium		
Cobalt		
Gamma Spec	X	
Gross Alpha	HC-1, HC-4, MV-1, MV-2, and MV-3 ONLY	
Gross Beta		
Iodine-129	HC-1, HC-4, MV-1, MV-2, and MV-3 ONLY	
Lead		
Manganese		
Molybdenum		
Nickel		
Nickel-63		
PCBs		
Phosphate		
Polonium-210		
Potassium		
Radium-226		
Radium-228		
Selenium		
Silica		
Sodium		
Strontium		
Sulfate		
Sulfide		
Thallium		
Thorium-230		
Tritium	X	X
Uranium	HC-1, HC-4, MV-1, MV-2, and MV-3 ONLY	
Uranium Isotopic	HC-1, HC-4, MV-1, MV-2, and MV-3 ONLY	
Vanadium		
Zinc		
Total No. of Analytes	6	1

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Slick Rock, Colorado

Sampling Frequencies for Locations at Slick Rock, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
Union Carbide						
317			X			
318			X			
319			X			
320			X			
324					X	Per Sam C. 2/4/04
508			X			
510			X			
684			X			
North Continent						
303			X			
305			X			
307			X			
309			X			
310			X			
311			X			
312			X			
Surface Locations						
Union Carbide						
347			X			
349			X			
693			X			
694			X			
North Continent						
692			X			
696			X			
700			X			

Sampling conducted in September

Constituent Sampling Breakdown

Site	Slick Rock	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	14	7
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen		
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	X
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		
Beryllium		
Bromide		
BTEX	319	
Cadmium		
Calcium		
Chloride		
Chromium		
Cobalt		
Copper		
Gross Alpha		
Gross Beta		
Iron		
Lead		
Lead-210		
Magnesium		
Manganese	318, 320, 508, 510,684	347, 349, 693, 694
Mercury		
Molybdenum	317, 318, 320, 508, 510, 684	347, 349, 693, 694
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	318, 320, 508, 510, 684	347, 349, 693, 694
Organics		
Potassium		
Radium-226	319	
Radium-228	319	
Radon-222		
Selenium	305, 307, 318, 320, 508, 510, 684	347, 349, 693, 694
Silica		
Sodium		
Strontium		
Sulfate		
Thorium-230		
Thorium-232		
Tin		
Uranium	303, 305, 307, 309, 310, 311, 312, 318, 320, 508, 510, 684	X all samples
Uranium-234, -238		
Vanadium		
VOCs		
Zinc		
Total Analytes	9	5

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Tuba City, Arizona

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
251		X				
252		X				
258		X				
261			X			August
262		X				
263		X				
264		X				
265		X				
266		X				
267		X				
268		X				
271			X			August
272		X				
273		X				
274		X				
275		X				
276		X				
277			X			August
278			X			August
279			X			August
280			X			August
281		X				
282		X				
283		X				
284					X	Water level only
285					X	Water level only
683			X			August
684			X			August
685			X			August
686			X			DATA LOGGER; August
687			X			DATA LOGGER; August
688			X			DATA LOGGER; August
689			X			August
690			X			August
691		X				
692			X			August
695			X			August
901			X			August
902					X	Water level only
903			X			August
904			X			August
906		X				DATA LOGGER
908		X				DATA LOGGER
909		X				DATA LOGGER
910			X			August
911			X			August
912			X			August
913			X			August

Sampling Frequencies for Locations at Tuba City, Arizona

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
914			X			August
915			X			August
916			X			August
917					X	Water level only
918					X	Water level only
919					X	Water level only
920			X			August
921			X			August
929		X				
930		X				
932		X				
934		X				DATA LOGGER
935		X				Converted to extraction well 7/05
936		X				DATA LOGGER
938		X				Converted to extraction well 7/05
940		X				DATA LOGGER
941		X				DATA LOGGER
942		X				DATA LOGGER
943			X			DATA LOGGER; August
945			X			August
946			X			DATA LOGGER; August
947			X			August
948					X	Water level only
1003			X			August
1004			X			August
1005					X	Water level only
1006			X			August
1007			X			August
1008					X	Water level only
1101			X			August
1102			X			August
1103			X			August
1104			X			August
1105			X			August
1106			X			August
1107			X			August
1108			X			August
1109			X			August
1110			X			August
1111			X			August
1112			X			August
1113			X			August
1114			X			August
1115			X			August
1116			X			August
1117			X			August
1118			X			August
1119			X			August

Sampling Frequencies for Locations at Tuba City, Arizona

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitor Wells						
1120			X			August
1121			X			August
1122			X			August
1123			X			August
1124			X			August
1125			X			August
1126			X			August
1127			X			August
1128			X			August
1129			X			August
1130			X			August
1131			X			August
1132			X			August
1133			X			August
Surface Locations						
759			X			August; Moenkopi wash-downgradient
778			X			August; Moenkopi wash-at Jimmy Spring
965			X			August; Moenkopi wash-far upgradient
1569		X				Evap pond - North
1570		X				Evap pond - South
1571			X			Jimmy Spr West - August
1572					X	Jimmy Spr East
1573			X			West pipe Shonto Well - August
1574					X	East pipe Shonto Well

Semi-annual sampling conducted in February and August; Annual sampling conducted in August.

Constituent Sampling Breakdown

Site	Tuba City	
Analyte	Ground Water	Surface Water
Approx. No. Samples/yr	133	9
Field Measurements		
Alkalinity	X	X
Dissolved Oxygen		
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)	X	
Antimony		
Arsenic	X	X
Barium		
Beryllium		
Bromide		
BTEX		
Cadmium		
Calcium	X	X
Chloride	X	X
Chromium		
Cobalt		
Copper		
Fluoride		
Gross Alpha		
Gross Beta		
Iron	X	X
Lead		
Lead-210		
Magnesium	X	X
Manganese	X	X
Mercury		
Molybdenum	X	X
Nickel		
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	X	X
Organics		
PCBs		
Phosphate		
Polonium-210		
Potassium	X	X
Radium-226		
Radium-228		
Selenium	X	X
Silica	X	
Sodium	X	X
Strontium		
Sulfate	X	X
Sulfide		
Thallium		
Thorium-230		
Thorium-232		
Tin		
Total Dissolved Solids	X	X
Uranium	X	X
Vanadium		
Zinc		
Total Analytes	16	14

Note: All analyte samples are considered filtered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Weldon Spring, Missouri

Location ID	Monthly	Quarterly	Semiannually	Annually	Not Sampled	Notes
Quarry Monitor Wells						
MW-1002		X				
MW-1004		X				
MW-1005		X				
MW-1006		X				
MW-1007		X				
MW-1008		X				
MW-1009		X				
MW-1012		X				
MW-1013		X				
MW-1014		X				
MW-1015		X				
MW-1016		X				
MW-1017			X			
MW-1018		X				
MW-1019			X			
MW-1021			X			
MW-1024					X	Water level only
MW-1027		X				
MW-1028			X			
MW-1029					X	Water level only
MW-1030		X				
MW-1031		X				
MW-1032		X				
MW-1044			X			
MW-1045		X				
MW-1046		X				
MW-1047		X				
MW-1048		X				
MW-1049		X				
MW-1050			X			
MW-1051		X				
MW-1052		X				
RMW1		X		X		
RMW2				X		
RMW3				X		
RMW4				X		
OW-1					X	Water level only
OW-2					X	Water level only
OW-4					X	Water level only
OW-5					X	Water level only
Chemical Plant Monitor Wells						
MW-2001			X			
MW-2002			X			
MW-2003			X			
MW-2005			X			

Sampling Frequencies for Locations at Weldon Spring, Missouri

Location ID	Monthly	Quarterly	Semiannually	Annually	Not Sampled	Notes
MW-2006		X				
Chemical Plant Monitor Wells						
MW-2012		X				
MW-2013		X				
MW-2014		X				
MW-2017			X			
MW-2021				X		
MW-2022					X	Water level only
MW-2023					X	Water level only
MW-2024					X	Water level only
MW-2032			X			Disposal Cell Monitoring Well
MW-2033		X				
MW-2034			X			
MW-2035				X		
MW-2036				X		
MW-2037			X			
MW-2038			X			
MW-2039			X			
MW-2040			X			
MW-2045		X				
MW-2046			X			Disposal Cell Monitoring Well
MW-2047			X			Disposal Cell Monitoring Well
MW-2049		X				
MW-2050		X				
MW-2051			X			Disposal Cell Monitoring Well
MW-2052		X				
MW-2053		X				
MW-2054		X				
MW-2055			X			Disposal Cell Monitoring Well
MW-3003		X				
MW-3006			X			
MW-3023		X				
MW-3024		X				
MW-3025			X			
MW-3026			X			
MW-3027			X			
MW-3028		X				
MW-3029		X				
MW-3030		X				
MW-3031			X			
MW-3032			X			
MW-3034		X				
MW-3035		X				
MW-3036		X				
MW-3037			X			
MW-3038		X				

Sampling Frequencies for Locations at Weldon Spring, Missouri

Location ID	Monthly	Quarterly	Semiannually	Annually	Not Sampled	Notes
MW-3039		X				
MW-4001			X			
Chemical Plant Monitor Wells						
MW-4002				X		
MW-4006			X			
MW-4007			X			
MW-4011			X			
MW-4013			X			
MW-4014			X			
MW-4015		X				
MW-4020			X			
MW-4022				X		
MW-4023			X			
MW-4024			X			
MW-4026				X		
MW-4027			X			
MW-4028		X				
MW-4029		X				
MW-4030		X				
MW-4031			X			
MW-4032		X				
MW-4033			X			
MW-4034				X		
MW-4035					X	Water level only
MW-4036		X				
MW-4037			X			
MW-4038			X			
MW-4039		X				
MWS-4			X			
MWS-21		X				
MW-ICO1					X	Water level only
MW-ICO2					X	Water level only
MW-ICO3					X	Water level only
MW-ICO4					X	Water level only
MW-ICO5					X	Water level only
MW-ICO6					X	Water level only
MW-LIW1					X	Water level only
MW-HIW1					X	Water level only
Springs						
SP-5303		X				low flow/Qtrly; high flow/semi
SP-5304		X				low flow/Qtrly; high flow/semi
SP-6301		X				low flow/Qtrly; high flow/semi
SP-6303		X				low flow/Qtrly; high flow/semi
SP-6306		X				low flow/Qtrly; high flow/semi

Sampling Frequencies for Locations at Weldon Spring, Missouri

Location ID	Monthly	Quarterly	Semiannually	Annually	Not Sampled	Notes
Surface Water						
SW-1003			X			
SW-1004			X			
SW-1005			X			
SW-1010			X			
SW-2004			X			
SW-2005			X			
SW-2012			X			
SW-2016			X			
SW-2024			X			
Disposal Cell Leachate						
LW-DC10	X					Sampling dependant on leachate volume

Constituent Sampling Breakdown

Site	WELDON	
Analyte	Ground Water	Surface Water
Approx No. Samples\yr	277	60
Field Measurements		
Alkalinity		
Dissolved Oxygen	X	X
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic		12
Barium	14	12
Beryllium		
Cadmium		
Calcium		
Chloride	12	2
Chromium	14	12
Cobalt	12	2
Copper		12
Fluoride	12	2
Gamma Spec		
Gross Alpha	14	12
Gross Beta		
Iron	127	12
Lead	12	12
Lead-210		
Lithium		
Magnesium		
Manganese	12	2
Mercury		12
Molybdenum		
Nickel	12	12
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	97	42
PAHs		
PCBs	12	2
Potassium		
Radium-226	14	12
Radium-228	14	12
Selenium	12	12
Silica		
Silver		12
Sodium		
Strontium		
Sulfate	124	2
Sulfide		
Thallium	12	2
Thorium-230	14	12
Tin		
Total Dissolved Solids	12	2
Total Suspended Solids		12
Total Organic Carbon	12	2
Uranium	224	60
Vanadium		
VOCs	87	42
Zinc	14	12
Total No. of Analytes	23	28

Note: All analyte samples are considered **UNFILTERED** unless stated otherwise. The total number of analytes does not include the field parameters.

Sampling Frequencies for Locations at Weldon Spring, Missouri

Location ID	Monthly	Quarterly	Semiannually	Annually	Not Sampled	Notes
Quarry Monitor Wells						
MW-1002		X				
MW-1004		X				
MW-1005		X				
MW-1006		X				
MW-1007		X				
MW-1008		X				
MW-1009		X				
MW-1012		X				
MW-1013		X				
MW-1014		X				
MW-1015		X				
MW-1016		X				
MW-1017			X			
MW-1018			X			
MW-1019			X			
MW-1021			X			
MW-1024					X	Water level only
MW-1027		X				
MW-1028			X			
MW-1029					X	Water level only
MW-1030		X				
MW-1031		X				
MW-1032		X				
MW-1044			X			
MW-1045		X				
MW-1046		X				
MW-1047		X				
MW-1048		X				
MW-1049		X				
MW-1050			X			
MW-1051		X				
MW-1052		X				
RMW1				X		
RMW2				X		
RMW3				X		
RMW4				X		
Chemical Plant Monitor Wells						
MW-2001					X	Water level only
MW-2002					X	Water level only
MW-2003					X	Water level only
MW-2005					X	Water level only
MW-2006					X	Water level only
MW-2012			X			
MW-2013					X	Water level only
MW-2014			X			
MW-2017				X		
MW-2021				X		
MW-2022				X		
MW-2023				X		

Sampling Frequencies for Locations at Weldon Spring, Missouri

Location ID	Monthly	Quarterly	Semiannually	Annually	Not Sampled	Notes
Chemical Plant Monitor Wells						
MW-2024					X	Water level only
MW-2032			X			Disposal Cell Monitoring Well
MW-2035				X		
MW-2038			X			
MW-2040			X			
MW-2046			X			Disposal Cell Monitoring Well
MW-2047			X			Disposal Cell Monitoring Well
MW-2050			X			
MW-2051			X			Disposal Cell Monitoring Well
MW-2052			X			
MW-2053			X			
MW-2054			X			
MW-2055			X			Disposal Cell Monitoring Well
MW-3003			X			
MW-3006				X		
MW-3023					X	Water level only
MW-3024			X			
MW-3025					X	Water level only
MW-3026					X	Water level only
MW-3027					X	Water level only
MW-3028					X	Water level only
MW-3029					X	Water level only
MW-3030			X			
MW-3031				X		
MW-3032					X	Water level only
MW-3034			X			
MW-3035					X	Water level only
MW-3036					X	Water level only
MW-3037				X		
MW-3038					X	Water level only
MW-3039			X			
MW-3040		X				
MW-4001					X	Water level only
MW-4002					X	Water level only
MW-4006					X	Water level only
MW-4007				X		
MW-4011					X	Water level only
MW-4013			X			
MW-4014				X		
MW-4015				X		
MW-4020					X	Water level only
MW-4022				X		Water level only
MW-4023				X		
MW-4024					X	Water level only
MW-4026				X		
MW-4027					X	Water level only
MW-4028					X	Water level only
MW-4029			X			
MW-4030					X	Water level only

Sampling Frequencies for Locations at Weldon Spring, Missouri

Location ID	Monthly	Quarterly	Semiannually	Annually	Not Sampled	Notes
Chemical Plant Monitor Wells						
MW-4031			X			
MW-4032					X	Water level only
MW-4033					X	Water level only
MW-4034					X	Water level only
MW-4035					X	Water level only
MW-4036			X			
MW-4037					X	Water level only
MW-4038					X	Water level only
MW-4039				X		
MW-4040		X				
MW-4041				X		
MW-4042		X				
MWD-2				X		
MWS-1				X		
MWS-4				X		
MW-ICO1					X	Water level only
MW-ICO2					X	Water level only
MW-ICO3					X	Water level only
MW-ICO4					X	Water level only
MW-ICO5					X	Water level only
MW-ICO6					X	Water level only
MW-LIW1					X	Water level only
MW-HIW1					X	Water level only
Springs						
SP-5303			X			
SP-5304			X			
SP-6301		X				
SP-6303				X		
SP-6306				X		
Surface Water						
SW-1003			X			
SW-1004			X			
SW-1005			X			
SW-1010			X			
SW-2004				X		
SW-2005				X		
SW-2007				X		
SW-2012				X		
SW-2016				X		
SW-2024				X		
Disposal Cell Leachate						
LW-DC10/ LW-DC12	X		X			Sampling dependant on leachate volume/hauling

Constituent Sampling Breakdown

Site	WELDON	
Analyte	Ground Water	Surface Water
Approx No. Samples\yr	190	30
Field Measurements		
Alkalinity		
Dissolved Oxygen	X	X
Redox Potential	X	X
pH	X	X
Specific Conductance	X	X
Turbidity	X	
Temperature	X	X
Ferrous iron	114	
Laboratory Measurements		
Aluminum		
Ammonia as N (NH3-N)		
Antimony		
Arsenic	10	8
Barium	10	8
Beryllium		
Boron		
Bromide		
Cadmium		
Calcium		
Chloride	10	4
Chromium	10	8
Cobalt	10	4
Chemical Oxygen Demand	10	4
Copper		4
Fluoride	10	4
Gamma Spec		
Gross Alpha		4
Gross Beta		
Iron	124	8
Lead	10	8
Lead-210		
Lithium		
Magnesium		
Manganese	10	8
Mercury		4
Molybdenum		
Nickel	10	8
Nickel-63		
Nitrate + Nitrite as N (NO3+NO2)-N	97	9
Nitoraromatics	71	10
PAHs	10	4
PCBs	10	4
Phosphate		
Polonium-210		
Potassium		
Radium-226	10	8
Radium-228	10	8
Selenium	10	8
Silica		
Silver		4
Sodium		
Strontium		
Sulfate	124	4
Sulfide		
Thallium	10	4
Thorium-230	10	4
Tin		
Total Dissolved Solids	10	4
Total Suspended Solids		4
Total Organic Carbon	10	4
Uranium	184	30
Uranium-234, -238		
Vanadium		
VOCs	33	7
Zinc		4
Total No. of Analytes	25	31

Note: All analyte samples are considered **UNFILTERED** unless stated otherwise. The total number of analytes does not include the field parameters.