Stoller Newport News Nuclear

LMS/PRO/S04351-14.11

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

Work performed under DOE contract number DE-LM0000415
for the U.S. Department of Energy Office of Legacy Management.

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Sampling and Analysis Plan
for
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Abbreviations

BOA	Basic Ordering Agreement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EDD	Electronic Data Deliverable
EPA	U.S. Environmental Protection Agency
FDCS	Field Data Collection System
ft	foot (or feet)
GPS	global positioning system
HDPE	high-density polyethylene
ICPT	Integrated Contractor Purchasing Team
JSA	job safety analysis
L	liter
LM	Office of Legacy Management
µm	micrometer(s)
mg/L	milligram(s) per liter
mL	milliliter(s)
mL/min	milliliter(s) per minute
NIST	National Institute of Standards and Technology
NTU	nephelometric turbidity unit
PCB	polychlorinated biphenyl
PDA	personal digital assistant
PDF	Portable Document Format
QC	quality control
QSAS	Quality Systems for Analytical Services
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
VOC	volatile organic compound

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 LM. This document provides detailed procedures for the field sampling teams so that samples are collected in a consistent and technically defensible manner. Site-specific plans (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, which identify sample locations, sample frequencies, types of samples, field measurements, and associated analytes for each site. Additionally, within each tabbed section, program directives will be included, when developed, to establish additional site-specific requirements to modify or clarify requirements in this plan as they apply to the corresponding site. A flowchart detailing project tasks required to accomplish routine sampling is displayed in Figure 1.

LM environmental procedures are contained in the *Environmental Procedures Catalog* (LMS/POL/S04325), which incorporates American Society for Testing and Materials (ASTM), DOE, and U.S. Environmental Protection Agency (EPA) guidance. Specific procedures used for groundwater and surface water monitoring are included in Appendix A. If other environmental media are monitored, SOPs used for air, soil/sediment, and biota monitoring can be found in the site-specific tabbed sections in Appendix D or in site-specific documents. The procedures in the *Environmental Procedures Catalog* are intended as general guidance and require additional detail from planning documents in order to be complete; the following sections fulfill that function and specify additional procedural requirements to form SOPs.

Routine revision of this Sampling and Analysis Plan will be conducted annually at the beginning of each fiscal year when attachments in Appendix D, including program directives and sampling location/analytical tables, will be reviewed by project personnel and updated. The sampling location/analytical tables in Appendix D, however, may have interim updates according to project direction that are not reflected in this plan. Deviations from location/analytical tables in Appendix D prior to sampling will be documented in project correspondence (e.g., startup letters). If significant changes to other aspects of this plan are required before the annual update, then the plan will be revised as needed.

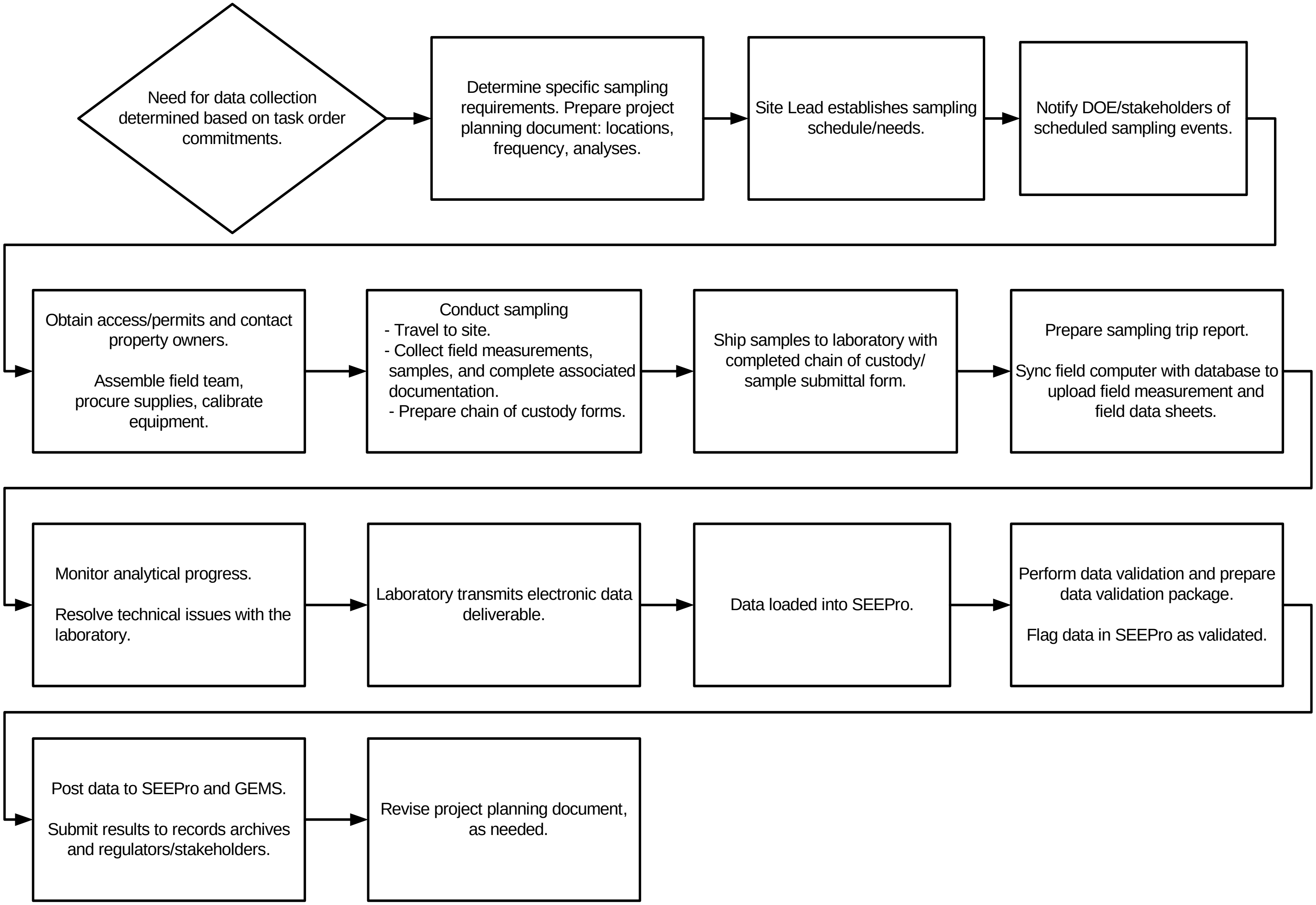

Figure 1. Sampling Flowchart

2.0 Pre-Trip Planning

Sampling personnel will meet with the site lead or appropriate manager before each sampling event. The purpose of the meeting is to:

- Discuss any new site issues involving safety, access to locations, or landowner concerns.
- Identify tasks that the sampling team can complete while at the site. These may include conducting well maintenance, collecting global positioning system (GPS) data, downloading data loggers, repairing or replacing pumps, replacing signs, repairing fences, and providing telemetry support.
- Capture changes to sampling locations and, if necessary, required analyses.
- Sign off on the Plan-of-the-Week to authorize the planned sampling, the planned maintenance work, or both.

The site lead is responsible for ensuring that valid access agreements are in place and that landowner notifications are made before 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 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.

Other pre-trip planning activities may include:

- Taking an inventory of sampling equipment and supplies, and loading them.
- Syncing field computers.
- Obtaining sampling documentation, including sampling lists, pre-printed labels, chain of custody forms, signed job safety analyses (JSA), and material safety datasheets sheets.
- Calibrating field instrumentation.
- Taking an inventory of the equipment in the sampling vehicle, including a winch kit, first aid kit, and fire extinguisher.
- Trip logistics.

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3.0 Sampling Protocol

3.1 Water

3.1.1 Groundwater

3.1.1.1 Groundwater Quality

Well Classification

Groundwater 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 mL/min.[a]
Category II	Wells that produce less than 100 mL/min and have either an initial water level above the top of the screened interval or have a dedicated pump/tubing installed.
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.

[a] mL/min = milliliters per minute.

Category I Protocol

Category I wells will be purged and sampled using a low-flow method, as described in ASTM D 4448-01 (Reapproved 2007), "Standard Guide for Sampling Ground-Water Monitoring Wells," which is provided in the *Environmental Procedures Catalog* and Appendix A. Category I protocol combines the monitoring of water levels and indicator parameters, purging at a low-flow rate, and a sampling device within the screened interval, as described in the guidance. In theory, the slow pumping rate will allow water to flow directly from the formation to the pump intake. The slow pumping rate will cause 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 must be placed within the screened interval of a well for low-flow sampling. The depth of the intake should be set the same level for each sampling event to enhance sampling consistency. Intake depths may be specified by project personnel on a site-specific or well-specific basis to meet monitoring objectives. Intake depths will be noted during pump/tubing installation and documented in the trip report.
- If a portable pump is used, a minimum of 4 hours after installation is required before purging and sampling can commence.

As described in the *Environmental Procedures Catalog* procedure (which is included in Appendix A, “ASTM D 4750-87 [Reapproved 2001]—Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well [Observation Well]”), depth to water will be measured with an electric sounder immediately before purging. The average flow rate during the purging process must be less than 500 milliliters per minute (mL/min); therefore, the initial pumping should be adjusted accordingly. 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 pumping rate should be decreased until the drawdown stops or a pumping 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) 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 Category II or Category III.

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 measurements will be considered stable when the three most recent consecutive readings are within 10 percent and 0.2 pH units, respectively; turbidity measurements will be considered stable when the most recent reading is less than 10 nephelometric turbidity units (NTUs). All field measurements will be recorded in the Field Data Collection System (FDCS), which will alert the sampler when stability criteria have be attained. Criteria for purging a Category I well are summarized in Table 1.

Table 1. Summary of Groundwater Sampling Protocol

Well Classification	Parameter	Purge Criteria	Qualification
Category I	Purge volume	One pump/tubing volume	Qualify[b] field and laboratory results with “F.” If water level criterion is not met, the well may have been misclassified.
	Average flow rate	<500 mL/min	
	Water level	<0.05 ft drop[a,c]	
	pH	± 0.2 pH units[a]	
	Specific conductance	± 10 percent[a]	
	Turbidity	<10 NTUs	
Category II	Purge volume	One pump/tubing volume	Qualify field and laboratory results with “F” and “Q.”
	Average flow rate	<500 mL/min	
	Water level	None	
	pH	None	
	Specific conductance	None	
	Turbidity	None	
Category III	All parameters	No purge required	Qualify field and laboratory results with “F” and “Q.”
Category IV	All parameters	No purge required	No qualification of results required.

[a] Criterion is for the three most recent consecutive readings; the range between the highest and the lowest values for the last three measurements cannot exceed the stated limits.
[b] See Section 5.2 and Appendix A for descriptions of the qualifiers.
[c] When the water level is rising, there is no criteria limit.

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. Criteria for purging a Category II well are summarized in Table 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. Typically, only the first bailer of water will be used because subsequent bailers introduced into the water column increase turbidity and reduce sample quality. If directed by the site lead, additional trips down the well with the bailer may be required to get sufficient sample volume. Because the volume of water may be limited using a bailer, prioritization of analytes may be required. Prioritization will require an estimation of sample volume before 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 the water column has sufficient volume to use a portable pump or 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.

Note *If a dedicated pump or tubing is used, then the well must be classified, purged, and sampled as a Category II well. (One pump/tubing volume must be purged before sampling.)*

Because obtaining a representative sample from a low-producing well (Category II and Category III) is problematic (Korte 2001), and because guidance for sampling wells completed in low-permeability formations is inadequate (EPA 1995), site-specific documents may require an alternative method for sampling low-producing wells. Such a method may include purging a well dry and sampling when recovery is sufficient, purging without dewatering the screen, or passive diffusive sampling.

Category IV Protocol

With domestic and flowing wells, it is assumed that formation water flows continuously from the well, eliminating stagnant water and the need to purge. These wells will be sampled by filling bottles at the discharge point and, if required, filtering. When sampling from a tap, allow a sufficient volume of water to flow before sample collection until the purged water is not visibly changing (e.g., rust, particulates have cleared).

Sample Collection

Groundwater samples can be collected with a peristaltic pump, bladder pump, submersible pump, or bailer. Selection of specific pump type/bailer used for withdrawing water from the well, including the type of material it is made of, will be determined in the field based on site-specific conditions, the well category, and the guidance in ASTM D 4448-01 (Reapproved 2007), “Standard Guide for Sampling Ground-Water Monitoring Wells,” which is provided in the *Environmental Procedures Catalog* and Appendix A. Sample collection will be conducted with 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 is used.

Samples will be filtered as specified in Table 2 if sample turbidity is greater than or equal to 10 NTUs; no sample filtration is required if turbidity is less than 10 NTUs. An alternative sample filtration protocol will be specified in a program directive. Samples requiring filtration will be pumped through a 0.45 micrometer (µm) filter, and samples requiring cooling will be stored in a cooler with ice immediately after they have been collected. For samples preserved with acid or sodium hydroxide, the pH of selected samples will be checked (using pH paper) to establish the volume of preservative required and to verify that 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 2.

3.1.1.2 Groundwater Levels

Groundwater levels will be measured according to “ASTM D 4750-87 (Reapproved 2001) —Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well),” which is provided in the *Environmental Procedures Catalog* and Appendix A. If water level measurements are required on wells that are not sampled, the information should be collected using the Water Level Recorder program installed on a personal digital assistant (PDA) or other electronic device. The Water Level Recorder is a computer-based system designed to (1) interface with LM databases and software to download needed information into a PDA before collecting water levels, (2) provide for the collection of water level data or document well inspection and maintenance activities in an electronic format, (3) interface with LM databases to automatically upload water level data or well-inspection and maintenance information after collection, (4) produce an electronic summary report of water level data or well-inspection information and automatically move the report to an LM share drive for storage, (5) provide a well-specific quality control (QC) check of the water level, and (6) provide a paper-free method of data collection.

Operation and use of the Water Level Recorder is detailed in “Water Level Recorder Desk Instructions” (Appendix B). In some cases (e.g., a computer malfunctions, a PDA is unavailable), use of the Water Level Recorder may not be practical, so paper forms will be used instead.

Data loggers may be installed in some wells to provide a continuous record of water levels. Operation, maintenance, calibration, and downloading of data loggers will be conducted according to “Standard Practice for Data Logger System Field Measurements,” which is provided in the *Environmental Procedures Catalog* and Appendix A.

Table 2. Water Sample Collection Requirements

Analytical Parameter	**Container Type[b]/Size**	**Filtration[c]**	**Preservation**	**Holding Time**
Alkalinity	HDPE/500 mL[d]	Filtered	Cool 0 °C to 6 °C	14 days
Am-241	HDPE/500 mL[d]	Filtered	HNO_3 pH < 2	6 months
Ammonia	HDPE/125 mL	Filtered	H_2SO_4 pH < 2, cool 0 °C to 6 °C	28 days
Anions (Br, Cl, F, SO_4, SiO_2)	HDPE/125 mL	Filtered	Cool 0 °C to 6 °C (Cooling required for SO_4 only)	28 days
Chemical oxygen demand	HDPE/125 mL	**Do not filter**	H_2SO_4 pH < 2, cool 0 °C to 6° C	28 days
Cyanide	HDPE/1 L	Filtered	NaOH pH > 12, 0.6 g ascorbic acid if Cl_2 present, cool 0 °C to 6 °C	14 days
Gamma spectrometry	HDPE/1 L[d]	Filtered	HNO_3 pH < 2	6 months
Gross α, gross β	HDPE/1 L[d]	Filtered	HNO_3 pH < 2	6 months
Hardness	HDPE/125 mL	Filtered	HNO_3 pH < 2	6 months
Herbicides	Amber glass/1 L[e]	**Do not filter**	Cool 0 °C to 6 °C	7 days
Metals	HDPE/500 mL	Filtered	HNO_3 pH < 2	6 months
Ni-63	HDPE/1 L[d]	Filtered	HNO_3 pH < 2	6 months
Nitrate plus nitrite as N, as N	HDPE/125 mL	Filtered	H_2SO_4 pH < 2, cool 0 °C to 6 °C	28 days
Nitroaromatics	Amber glass/1 L[e]	**Do not filter**	Cool 0 °C to 6 °C	7 days
Np-237	HDPE/1 L[d]	Filtered	HNO_3 pH < 2	6 months
PAH, polynuclear aromatic hydrocarbons	Amber glass/1 L[e]	**Do not filter**	Cool 0 °C to 6 °C	14 days
Pb-210	HDPE/1 L[d]	Filtered	HNO_3 pH < 2	6 months
PCBs	Amber glass/1 L[e]	**Do not filter**	Cool 0 °C to 6 °C	1 year
Pesticides	Amber glass/1 L[e]	**Do not filter**	Cool 0 °C to 6 °C	7 days
Phosphate	HDPE/125 mL	Filtered	H_2SO_4 pH < 2, cool 0 °C to 6 °C	28 days
Po-210	HDPE/1 L[d]	Filtered	HNO_3 pH < 2	6 months
Pu-238, Pu-239, Pu-240	HDPE/1 L[d]	Filtered	HNO_3 pH < 2	6 months
Ra-226	HDPE/2 @ 1 L[d]	Filtered	HNO_3 pH < 2	6 months
Ra-228	HDPE/2 @ 1 L[d]	Filtered	HNO_3 pH < 2	6 months
Rn-222	Glass/3 @ 40 mL	**Do not filter**	Cool 0° C to 6 °C, no headspace	Not established
Sulfide	HDPE/1 L[d]	Filtered	NaOH pH > 9, 2 mL of 2 N zinc acetate, cool 0 °C to 6 °C, no headspace	7 days
Tc-99	HDPE/1 L	Filtered	HNO_3 pH < 2	6 months
Th-230	HDPE/1 L	Filtered	HNO_3 pH < 2	6 months
Total dissolved solids	HDPE/125 mL	Filtered	Cool 0 °C to 6 °C	7 days
Total organic carbon	HDPE/125 mL	**Do not filter**	H_2SO_4 pH < 2, cool 0 °C to 6 °C	28 days
Total suspended solids	HDPE/1 L	**Do not filter**	Cool 0 °C to 6 °C	7 days
TPH	Amber glass/1 L[e]	**Do not filter**	Cool 0 °C to 6 °C	14 days
Tritium	HDPE/1 L[d]	**Do not filter**	No preservative	6 months
Semivolatiles	Amber glass/1 L[e]	**Do not filter**	Cool 0 °C to 6 °C	7 days
U-234, U-238	HDPE/1 L	Filtered	HNO_3 pH < 2	6 months
Volatiles	Amber glass/3 @ 40 mL with Teflon-lined septa	**Do not filter**	Cool 0 °C to 6 °Cs, HCl pH < 2, no headspace	14 days

[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.

[c] Filtration through a 0.45 µm pore-size filter is required only if sample turbidity is greater than or equal to 10 NTUs.

[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.

L = Liter
mL = milliliter
µm = micrometer

3.1.2 Surface Water

For the purposes of this plan, surface water may include contained water within any natural or manmade 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, in a 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 by using a stainless-steel weight attached to the intake tubing of the peristaltic pump, by directly immersing the sample container, or by using a dip-type sampler. If the surface water is flowing, approach the sampling location from downstream and point the sample container or dip sampler upstream.
- 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 samples 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 GPS device or the sample location map.
- Sample location data should be collected using a GPS device and downloaded into the SEEPro database. Any departure from collecting a sample at the normal location must be documented in the FDCS or other field notes.

Samples will be filtered as specified in Table 2 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 will be specified in a program directive. Samples requiring filtration will use a 0.45 μm 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 of selected samples will be checked (using pH paper) to establish the volume of preservative required and to verify that 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 2.

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. Field measurements will be made according to *Environmental Procedures Catalog* procedure “Standard Practice for Conducting Field Measurements During Water Sampling Activities,” which is included in Appendix A.

Field instruments must be calibrated before a sampling event begins. For occupied sites that sample continuously and do not sample in distinct events, field instrumentation will be calibrated at least monthly. Calibration and operational check requirements for field instruments are shown in Table 3. If the acceptance criteria are not met during the operational check, then a primary calibration of the affected probes and instruments must be conducted.

Table 3. Calibration and Operational Check Requirements for Field Instruments

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	Daily and at end of sampling event	± 0.2 pH unit
Specific conductance	1-point calibration	Prior to start of sampling event	NA
	1-point operational check	Daily and at end of sampling event	± 10 percent of standard
Oxidation-reduction potential	1-point calibration	Prior to start of sampling event	NA
	1-point operational check	Daily and at end of sampling event	± 10 percent of standard
Dissolved oxygen	Calibration in water saturated air	Prior to start of sampling event	NA
	1-point operational check in water saturated air	Daily and at end of sampling event	± 0.3 mg/L of theoretical DO in water-saturated air
Turbidity	4-point calibration	Every 3 months	NA
	3-point operational check	Daily and at end of sampling event	± 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.

Occasionally, calibration and operational checks are acceptable but probe or instrument functionality is suspect. Indications of a reduction in probe or instrument performance may include the following:

- A response time is slower than normal.
- A probe diagnostic parameter is within the acceptance range but close to a limit of the range.
- The age of a probe is nearing the manufacturer’s recommended lifetime.
- There is visible contamination on a sensing surface (hard water deposits, oil or grease, organic matter, etc.).

If a reduction in instrument or probe performance is suspected, one or more of these additional measures may be necessary to improve performance:

- Probe cleaning
- Probe replacement
- Sonde cleaning
- Sonde resistance checks

If a reduction in instrument or probe performance is suspected, additional operational checks in solutions with different values may be required to verify probe performance. These may include:

- A zero-oxygen solution for dissolved oxygen.
- Additional calibration solutions for pH (4, 7, or 10 buffers) and specific conductance (100 or 10,000 µmhos/cm).
- Tap water to verify that the probes are giving meaningful readings in environmental water.

Calibration, operation, cleaning, and troubleshooting of field instruments will be conducted according to manufacturers' instructions.

3.1.4 Field Data Collection System

Sampling activities will be captured using the FDCS. The FDCS is a computer-based system designed to (1) interface with LM databases and software to download needed information into a field computer before a sampling event, (2) provide for collection of field information and data in an electronic format during water sampling activities, (3) interface with LM databases to automatically upload field data after collection, (4) produce an electronic report of sampling data and information from each sampling location and automatically move the report to an LM share drive for storage, (5) provide QC checks through the sampling process, and (6) provide a paper-free method of data collection.

Operation and use of the FDCS is detailed in "Field Data Collection Desk Instructions" (Appendix B–1). In some cases (e.g., nonroutine sampling activities, computer malfunction), use of the FDCS may not be practical; paper forms will be used instead.

3.1.5 Sample Identification and Handling Procedures

Each sample will be assigned a unique sample number and a location number corresponding to each well or surface sample location. QC samples will be assigned a fictitious location 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 in the FDCS.

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 then documented in the FDCS at each location 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). Sample bottles will be labeled before or immediately after sample collection according to *Environmental Procedures Catalog* procedure “Standard Practice for Field Documentation” (Appendix A).

To ensure the integrity of the sample, the sampling lead or a designee is responsible for the care, packaging, and custody of the samples until they are dispatched to the laboratory. The “Standard Practice for Field Documentation” will be implemented to provide security and document sample custody, and the “Standard Practice for Sample Submittal to Contract Analytical Laboratories” will be implemented to transfer samples to the designated laboratory.

Custody seals, evidence tape, or both 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 the container is temporarily stored in a motel room) to keep the samples secure from the 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 that are used for temporary sample storage and that are not custody-sealed must be in direct control of a sampling team member.

If samples are transported by subcontract employees or a commercial carrier, the shipping container will have custody seals, evidence tape, or both placed over the opening, before shipment, to ensure that the integrity of the samples is not compromised during transport. 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 and analysis before the expiration of sample holding times.

If a commercial carrier sends the packages, receipts and any other shipping-related documents will be 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. Documentation of a change in custody is not required if samples are transferred among members of the sampling team or to other contractor personnel to ship or transport the samples.

3.1.6 Sampling Equipment

3.1.6.1 Operation and Maintenance

A variety of equipment and instrumentation is used when conducting sampling activities. Examples of equipment and instrumentation used during a water sampling event include a water quality meter, water level indicator, colorimeter, turbidity meter, pumps, generator, compressor, compressed air cylinder, control box, all-terrain vehicle, winch, motor vehicle, data loggers, field computer, and hand tool. Operation, inspection, maintenance, calibration (if required), and safety precautions associated with using this equipment will be conducted according to manufacturer’s instructions, which can be found in the Equipment Manuals and Procedures folder found at \\crow\Projects\SamplingProg\Equipment Manuals and Procedures.

3.1.6.2 Equipment Decontamination

Nondedicated sampling equipment will be decontaminated by rinsing all equipment surfaces with diluted detergent followed by deionized water as described in “Technical Comments on ASTM D 5088-02 (Reapproved 2008) Standard Practice for Decontamination of Field Equipment Used at Waste Sites” (*Environmental Procedures Catalog* and Appendix A). If nondedicated 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. Nondedicated sampling equipment will be decontaminated immediately after use at a sampling location. Between samplings or until further use, decontaminated equipment will be stored in protective containers or plastic bags.

3.1.7 Investigation-Derived Waste

Purge water generated during groundwater sampling activities, including decontamination water and excess sample water, will be managed as specified in Table 4. Excess calibration standards, excess test-kit solutions, and excess sample from field tests will be containerized in the field and brought back to the home-office facility for proper disposal as specified in the facility’s chemical hygiene plan. Examples of excess sample from field tests include (but are not limited to) total alkalinity, iron, chlorine, and acidity tests. Solid waste generated during sampling activities (e.g., gloves, filters, wipes, containers) will be managed by bagging the waste and placing the bag in a trash receptacle for disposal at a municipal landfill.

3.2 Air

Air monitoring may include sampling air particulates, radon, or tritium; measuring gamma radiation; or conducting meteorological monitoring. Air monitoring procedures, if required, will be included in program directives located in the appropriate site-specific tabbed section in Appendix D or in a site-specific document.

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*. 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 in the appropriate site-specific tabbed section in Appendix D or in a site-specific document.

3.4 Ecological

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

Table 4. Purge Water Disposition at LM Sites

Category	Site	Applicable Documents	Disposition	Comments
UMTRCA Title I	Ambrosia Lake	*Management Plan for Field-Generated Investigation Derived Waste* (DOE 2000)	Disperse on ground	Keep purge[a] water from entering surface water
	Burrell			
	Canonsburg			
	Durango			
	Falls City			
	Grand Junction			
	Green River			
	Gunnison			
	Lakeview			
	Lowman			
	Monument Valley			
	Naturita			
	Rifle			
	Riverton			
	Sherwood			
	Shiprock			
	Slick Rock			
	Tuba City			
UMTRCA Title II	Bluewater	Analysis of expected concentrations in purge water from Title II sites is pending, and the *Management Plan for Field-Generated Investigation Derived Waste* will be updated to include Title II sites	To be determined	Purge water disposition will be specified in a Notice to File or SAP[b] program directive until the *Management Plan for Field-Generated Investigation Derived Waste* is updated
	Gas Hills East			
	Gas Hills North			
	L-Bar			
	Sherwood			
	Shirley Basin South			
	Split Rock			
D&D Sites	Grand Junction	Notice to file	Disperse on ground	
	Hallam			

Table 4 (continued). Purge Water Disposition at LM Sites

Category	Site	Applicable Documents	Disposition	Comments
Offsites Project	CNTA	*Fluid Management Plan Central Nevada Test Area Corrective Action Unit 443*, LMS/CNT/S03736	Discharge to infiltration basin/ground	
	Gasbuggy	NA	NA	No purge water generated
	Gnome-Coach	Notice to file	Contain purge water from wells USGS-4, USGS-8, and LRL-7 and transport back to Grand Junction for temporary storage. Disperse purge water from other wells on ground	
	Rio Blanco	NA		No purge water generated
	Rulison	NA		No purge water generated
	Salmon	Notice to file	Purge water from wells HMH-5R, HM-3, SA1-3-H, and SA4-5-L may require special handling—previous year's data from these wells will be evaluated and a notice to file will be issued by Environmental Compliance prior to each sampling event with detailed instructions on purge water management. All other wells: disperse on ground	
	Shoal	Notice to file pending	Disperse on ground	
CERCLA	Monticello	*Monticello Mill Tailings Site Operable Unit III Post-Record of Decision Monitoring Plan* (DOE 2004)	Disperse on ground at all wells except permeable reactive barrier wells. Return purge water at the permeable reactive barrier to the well from which it was purged	
	Mound		Contain water at wells with contaminant concentrations that exceed EPA's maximum contaminant level; disperse on ground at all other wells	
	Rocky Flats	SAP Program Directive – *Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water*	Dispose of in applicable onsite treatment system	
	Pinellas	SAP	Dispose in on-site treatment system—Air Stripper # 1	
	Weldon Spring	SAP Program Directive	Type I wells—disperse on ground. Type II wells—dispose of at LCRS	
Other	Parkersburg	*Long-Term Surveillance Plan for the Parkersburg, West Virginia, Disposal Site*, September 1995	Disperse on ground	Groundwater meets state and federal groundwater and drinking water standards, respectively

[a] Purge water includes purge water, decontamination water, and excess sample water.
[b] SAP = Sampling and Analysis Plan

4.0 Analytical Program

Analytical services are procured under the DOE Integrated Contractor Purchasing Team (ICPT) Basic Ordering Agreement (BOA) as specified in Attachment 1 of *Basic Ordering Agreement, Statement of Work, Laboratory Analytical Services* (DOE 2006) and modified by the LM BOA Implementation Requirements document (DOE 2007). The ICPT BOA provides a standardized system for procuring analytical services from commercial laboratories and includes 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, is provided in Attachment 1 of the LM BOA Implementation Requirements document (DOE 2007). Site-specific analytical requirements, including required analytical methods and required detection limits, are listed in Appendix D. The analytical methods used for groundwater and surface water analyses as specified in Attachment 1 are typically from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA 1996) or *Methods for Chemical Analysis of Water and Wastes* (EPA 1983).

Commercial laboratories provide these analytical services in accordance with the *DOE Quality Systems for Analytical Services* (QSAS) (updated annually) to ensure that data are of known, documented quality. The QSAS provides specific technical requirements, clarifies DOE requirements, and conforms to DOE Order 414.1C, *Quality Assurance*. The QSAS is based in total on EPA's *National Environmental Laboratory Accreditation Conference*, Chapter 5, "Quality Systems" (EPA 2003), which was implemented in July 2005 and was based on *General Requirements for the Competence of Testing and Calibration Laboratories* (ISO 1999). The QSAS provides a framework for performing, controlling, documenting, and reporting laboratory analyses. Analytical data will be validated according to "Standard Practice for Validation of Environmental Data" (*Environmental Procedures Catalog*).

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5.0 Quality Assurance

The *Quality Assurance Manual* (LMS/POL/S04320) specifies quality assurance requirements used to implement all environmental sampling and monitoring programs. This manual addresses the requirements necessary for planning, implementing, documenting, and reviewing the activities, equipment, and records resulting from using this Sampling and Analysis Plan. Additional quality assurance requirements and guidance for LM Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites (i.e., Monticello, Fernald, Mound, and Rocky Flats) are provided in the *Legacy Management CERCLA Sites Quality Assurance Project Plan* (LMS/PLN/S04353).

5.1 Field Quality Assurance

Field quality assurance procedures include following the SOPs discussed in this document, collecting and analyzing QC samples, and inspecting and maintaining monitoring wells. 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. If fewer than 20 water samples are collected during a sampling event, one field duplicate will be required. Duplicate water samples will be collected by filling the original sample (all aliquots) followed by the duplicate sample. The frequency of duplicate samples for other matrices is specified in the site-specific procedure located in 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 nondedicated equipment. If fewer than 20 samples—and at least one sample—are collected with nondedicated 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 nondedicated sampling equipment. The collection and frequency of equipment blanks for other matrices or filter blanks (air) are specified in the site-specific procedure 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 before 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.

5.1.4 Monitoring Well Inspection and Maintenance

Because of natural processes and human activities, the condition of groundwater monitoring wells deteriorate with time, and a routine monitoring well inspection and maintenance program is necessary to mitigate deterioration. As a quality assurance component of a comprehensive groundwater monitoring program, a routine inspection and maintenance program should be in place that includes periodic monitoring well redevelopment in order to promote collection of representative samples, especially when using low-flow purging and sampling techniques (Korte 2001). Inspection and maintenance activities will be conducted according to the "Standard Practice for the Inspection and Maintenance of Groundwater Monitoring Wells," which is provided in the *Environmental Procedures Catalog* and Appendix A. Monitoring well inspection and maintenance information should be collected using the Water Level Recorder program installed on a PDA or other electronic device. Instructions for using the Water Level Recorder program are provided in Appendix B-2. The frequency of monitoring well inspection and maintenance will be determined on a site-specific basis.

5.2 Data Qualification and Validation

Data obtained from groundwater 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. Results associated with a Category I well where a purging stability criterion was not met may be qualified with a "J" flag (estimated). Data obtained from samples collected at Category I and Category IV wells are considered to be of 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 may be documented in summary reports. Data validation procedures including preparation of data validation packages are addressed in the "Standard Practice for Validation of Environmental Data" (*Environmental Procedures Catalog* and Appendix A).

5.3 Training

Personnel participating in sampling activities and using SOPs addressed in this plan will be proficient in the procedures and equipment/instrumentation used for the work they perform. Specifically, personnel will complete "Water Sampling Training" (WS300), which was developed according to the requirements of the *Training Manual* (LMS/POL/S04323). This course involves the following on-the-job training:

- Required reading of this plan.
- Calibration and operation of instrumentation and test kits used to collect field data.
- Operation of various sampling pumps and associated equipment (e.g., controllers, compressors, generators).
- Well purging and groundwater sampling protocol.
- Surface water sample collection.
- Operation of the FDCS.

- Sample labeling, preservation, and chain of custody.
- Decontamination of sampling equipment.
- Collection of QC samples.
- Operation of the Water Level Recorder program.
- Review and sign-off of the JSA for water sampling.

Training will be conducted by an experienced sampler with a minimum of 10 years of experience. An example of a form used to document water sampling training is shown in Figure 2. Training for sampling other media will be documented on a similar form. Completed forms will be transferred to the Training department and included in an individual's training file.

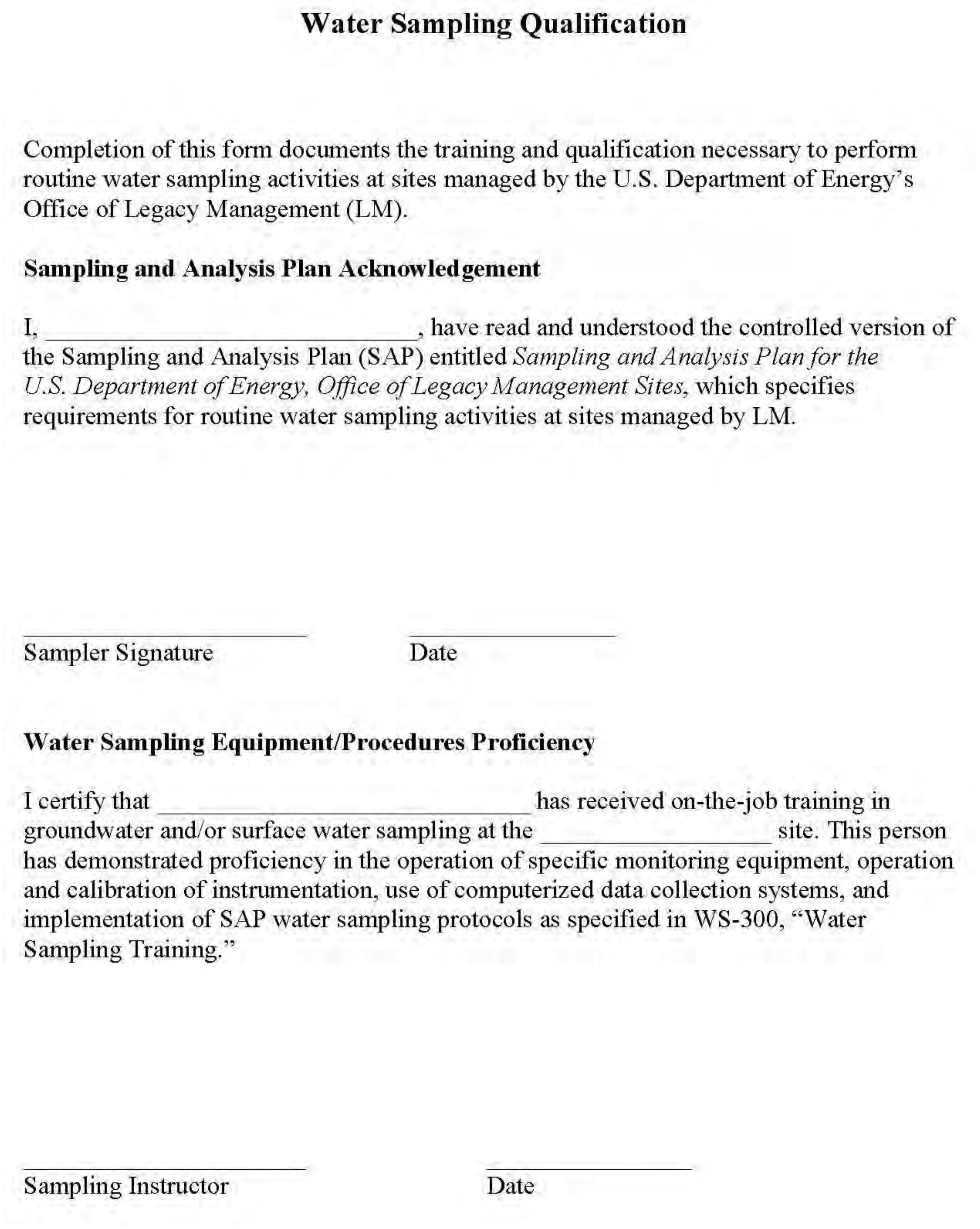
5.4 Data Quality

Data generated from routine water sampling activities using procedures specified in this plan will be of sufficient quality to make defensible decisions regarding compliance to applicable permits and standards, establishment of remediation strategies, assessment of the progress of remedial actions, regulatory issues, assessment of the effectiveness of treatment systems, and assessment of risk to human health and the environment.

Data of known, documented quality are produced through the following aspects of this plan:

- Defensible and comprehensive sampling procedures.
- Calibration of field instrumentation.
- Collection of field QC samples.
- Documentation of sampling activities.
- Training of sampling personnel.
- Records management.
- Use of accredited commercial laboratories that:
  - Conform to QSAS requirements.
  - Are audited according to the DOE Consolidated Audit Program annually.
  - Use approved analytical procedures.
- Data validation and qualification.

If a project does not require the level of documented data-quality generated by using the procedures specified in this plan, and a lower level of rigor is applied, then data objectives and project goals must be documented that detail the sampling and analysis protocols necessary to obtain the level of data quality required to make project decisions.



Water Sampling Qualification

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

Sampling and Analysis Plan Acknowledgement

I, ______________________________, have read and understood the controlled version of the Sampling and Analysis Plan (SAP) entitled *Sampling and Analysis Plan for the U.S. Department of Energy, Office of Legacy Management Sites*, which specifies requirements for routine water sampling activities at sites managed by LM.

________________________ ________________

Sampler Signature Date

Water Sampling Equipment/Procedures Proficiency

I certify that ______________________________ has received on-the-job training in groundwater and/or surface water sampling at the ___________________ site. This person has demonstrated proficiency in the operation of specific monitoring equipment, operation and calibration of instrumentation, use of computerized data collection systems, and implementation of SAP water sampling protocols as specified in WS-300, "Water Sampling Training."

________________________ ________________

Sampling Instructor Date

Figure 2. Example Water Sampling Qualification and Proficiency Documentation Form

5.5 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 Section 5.0, “Program Directives,” within the *Document Production Manual* (LMS/POL/S09818). 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 Operations manager, site management personnel, or site technical personnel and are approved by the Environmental Monitoring Operations manager. Site management and Quality and Performance Assurance personnel will review and concur with program directives prior to finalization. Program directives will be included with the appropriate site-specific information in this plan. Guidelines, tracking logs, directive templates, and PDF files of approved directives are managed by Document Production.

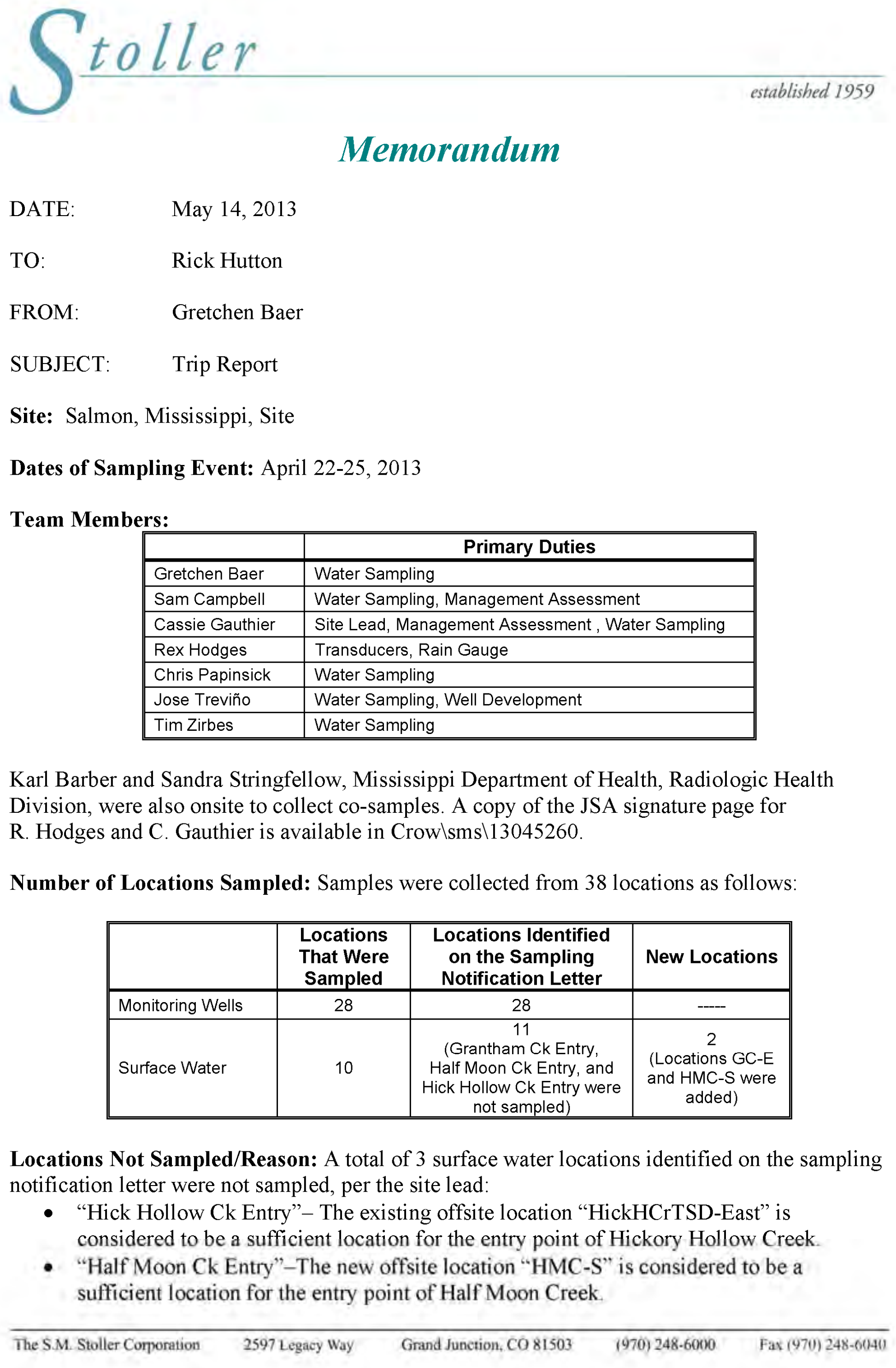
5.6 Documentation

5.6.1 Trip Reports

After the completion of a sampling event or period, the sampling lead or designee will prepare a Trip Report that will document the specifics of the sampling event or field activity (e.g., monitoring well redevelopment). The Trip Report is the record of communication from the sampling team to the Site lead or Site manager and is used to communicate and document field activities and site issues. Items that will be documented in the Trip Report may include:

- Dates of the sampling event.
- Team members.
- Number of locations sampled.
- Locations not sampled and reason.
- Number, types, and identification of QC samples.
- Analytical report identification numbers.
- Well inspection summary.
- References to the sampling procedure used and any applicable Program Directives.
- Additional instructions from Site Lead or Site Manager.
- Field variances (variance from sampling procedures).
- Equipment problems.
- Pump/tubing installation details.
- Air sampler volume.
- Air sampler flow rate.
- Weight of particulates.
- Dates of deployment (thermoluminescent dosimeters, passive radon monitors).
- Stakeholder/Regulatory issues.
- Site disturbances.
- Access issues.
- Corrective actions required/taken
- Incident Reports initiated.

An example of a Trip Report is shown in Figure 3.



Stoller

established 1959

Memorandum

DATE: May 14, 2013

TO: Rick Hutton

FROM: Gretchen Baer

SUBJECT: Trip Report

Site: Salmon, Mississippi, Site

Dates of Sampling Event: April 22-25, 2013

Team Members:

	Primary Duties
Gretchen Baer	Water Sampling
Sam Campbell	Water Sampling, Management Assessment
Cassie Gauthier	Site Lead, Management Assessment , Water Sampling
Rex Hodges	Transducers, Rain Gauge
Chris Papinsick	Water Sampling
Jose Treviño	Water Sampling, Well Development
Tim Zirbes	Water Sampling

Karl Barber and Sandra Stringfellow, Mississippi Department of Health, Radiologic Health Division, were also onsite to collect co-samples. A copy of the JSA signature page for R. Hodges and C. Gauthier is available in Crow\sms\13045260.

Number of Locations Sampled: Samples were collected from 38 locations as follows:

	Locations That Were Sampled	Locations Identified on the Sampling Notification Letter	New Locations
Monitoring Wells	28	28	-----
Surface Water	10	11 (Grantham Ck Entry, Half Moon Ck Entry, and Hick Hollow Ck Entry were not sampled)	2 (Locations GC-E and HMC-S were added)

Locations Not Sampled/Reason: A total of 3 surface water locations identified on the sampling notification letter were not sampled, per the site lead:

- "Hick Hollow Ck Entry"– The existing offsite location "HickHCrTSD-East" is considered to be a sufficient location for the entry point of Hickory Hollow Creek.
- "Half Moon Ck Entry"–The new offsite location "HMC-S" is considered to be a sufficient location for the entry point of Half Moon Creek.

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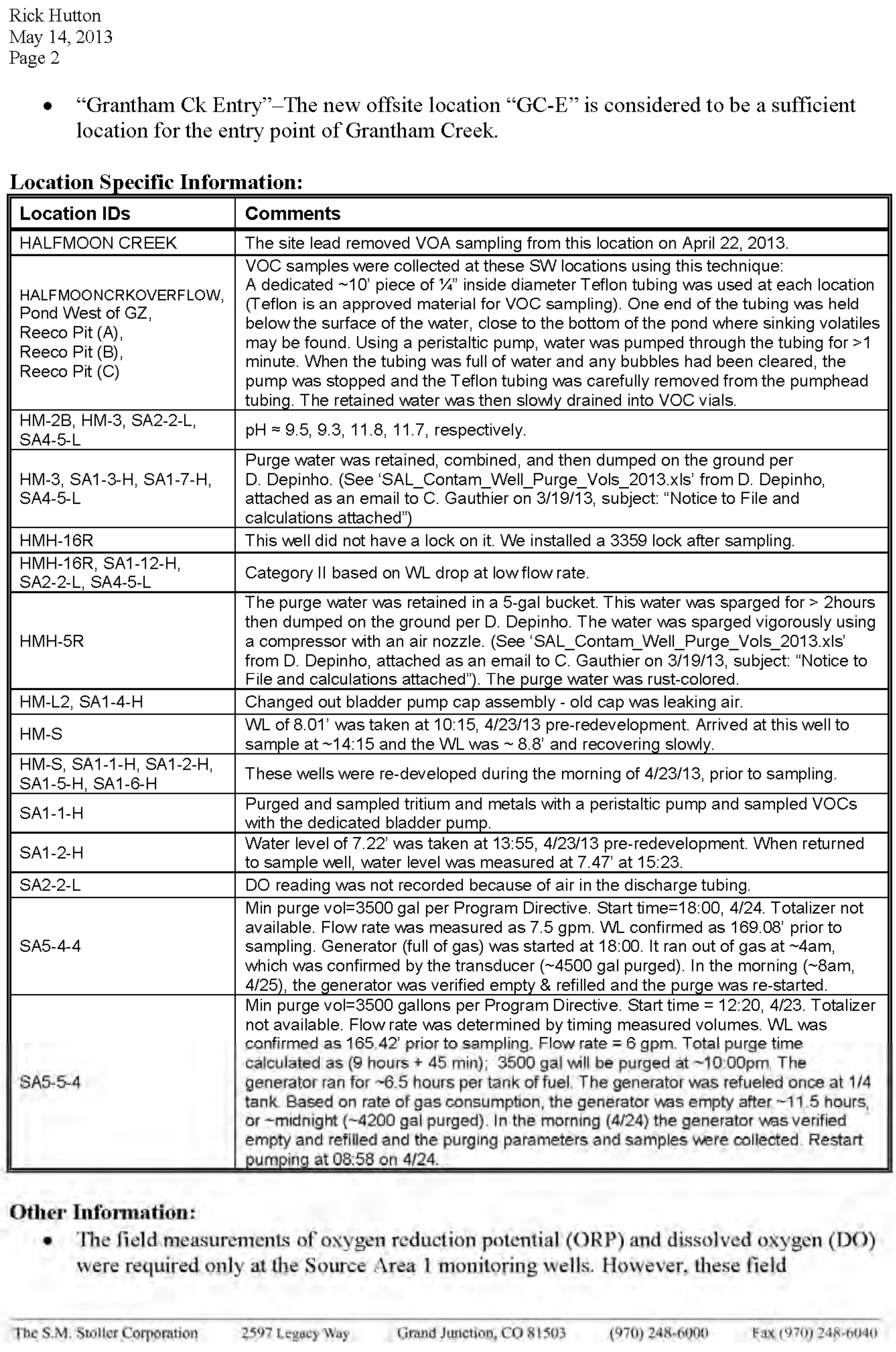
Figure 3. Trip Report Example



Rick Hutton
May 14, 2013
Page 2

- "Grantham Ck Entry"–The new offsite location "GC-E" is considered to be a sufficient location for the entry point of Grantham Creek.

Location Specific Information:

Location IDs	Comments
HALFMOON CREEK	The site lead removed VOA sampling from this location on April 22, 2013.
HALFMOONCRKOVERFLOW, Pond West of GZ, Reeco Pit (A), Reeco Pit (B), Reeco Pit (C)	VOC samples were collected at these SW locations using this technique: A dedicated ~10' piece of ¼" inside diameter Teflon tubing was used at each location (Teflon is an approved material for VOC sampling). One end of the tubing was held below the surface of the water, close to the bottom of the pond where sinking volatiles may be found. Using a peristaltic pump, water was pumped through the tubing for >1 minute. When the tubing was full of water and any bubbles had been cleared, the pump was stopped and the Teflon tubing was carefully removed from the pumphead tubing. The retained water was then slowly drained into VOC vials.
HM-2B, HM-3, SA2-2-L, SA4-5-L	pH ≈ 9.5, 9.3, 11.8, 11.7, respectively.
HM-3, SA1-3-H, SA1-7-H, SA4-5-L	Purge water was retained, combined, and then dumped on the ground per D. Depinho. (See 'SAL_Contam_Well_Purge_Vols_2013.xls' from D. Depinho, attached as an email to C. Gauthier on 3/19/13, subject: "Notice to File and calculations attached")
HMH-16R	This well did not have a lock on it. We installed a 3359 lock after sampling.
HMH-16R, SA1-12-H, SA2-2-L, SA4-5-L	Category II based on WL drop at low flow rate.
HMH-5R	The purge water was retained in a 5-gal bucket. This water was sparged for > 2hours then dumped on the ground per D. Depinho. The water was sparged vigorously using a compressor with an air nozzle. (See 'SAL_Contam_Well_Purge_Vols_2013.xls' from D. Depinho, attached as an email to C. Gauthier on 3/19/13, subject: "Notice to File and calculations attached"). The purge water was rust-colored.
HM-L2, SA1-4-H	Changed out bladder pump cap assembly - old cap was leaking air.
HM-S	WL of 8.01' was taken at 10:15, 4/23/13 pre-redevelopment. Arrived at this well to sample at ~14:15 and the WL was ~ 8.8' and recovering slowly.
HM-S, SA1-1-H, SA1-2-H, SA1-5-H, SA1-6-H	These wells were re-developed during the morning of 4/23/13, prior to sampling.
SA1-1-H	Purged and sampled tritium and metals with a peristaltic pump and sampled VOCs with the dedicated bladder pump.
SA1-2-H	Water level of 7.22' was taken at 13:55, 4/23/13 pre-redevelopment. When returned to sample well, water level was measured at 7.47' at 15:23.
SA2-2-L	DO reading was not recorded because of air in the discharge tubing.
SA5-4-4	Min purge vol=3500 gal per Program Directive. Start time=18:00, 4/24. Totalizer not available. Flow rate was measured as 7.5 gpm. WL confirmed as 169.08' prior to sampling. Generator (full of gas) was started at 18:00. It ran out of gas at ~4am, which was confirmed by the transducer (~4500 gal purged). In the morning (~8am, 4/25), the generator was verified empty & refilled and the purge was re-started.
SA5-5-4	Min purge vol=3500 gallons per Program Directive. Start time = 12:20, 4/23. Totalizer not available. Flow rate was determined by timing measured volumes. WL was confirmed as 165.42' prior to sampling. Flow rate = 6 gpm. Total purge time calculated as (9 hours + 45 min); 3500 gal will be purged at ~10:00pm. The generator ran for ~6.5 hours per tank of fuel. The generator was refueled once at 1/4 tank. Based on rate of gas consumption, the generator was empty after ~11.5 hours, or ~midnight (~4200 gal purged). In the morning (4/24) the generator was verified empty and refilled and the purging parameters and samples were collected. Restart pumping at 08:58 on 4/24.

Other Information:

- The field measurements of oxygen reduction potential (ORP) and dissolved oxygen (DO) were required only at the Source Area 1 monitoring wells. However, these field

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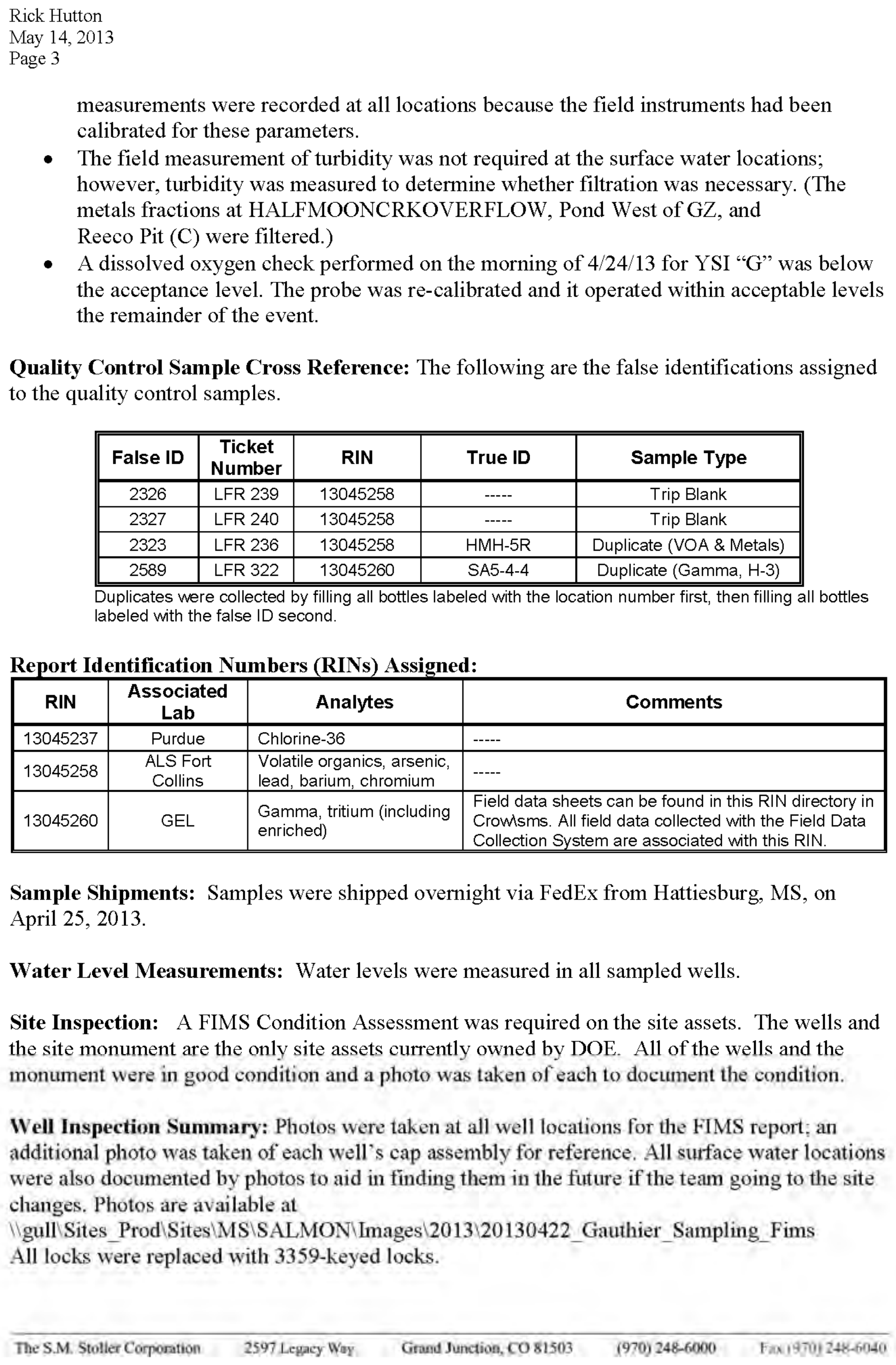
Figure 3 (continued). Trip Report Example



measurements were recorded at all locations because the field instruments had been calibrated for these parameters.

- The field measurement of turbidity was not required at the surface water locations; however, turbidity was measured to determine whether filtration was necessary. (The metals fractions at HALFMOONCRKOVERFLOW, Pond West of GZ, and Reeco Pit (C) were filtered.)
- A dissolved oxygen check performed on the morning of 4/24/13 for YSI "G" was below the acceptance level. The probe was re-calibrated and it operated within acceptable levels the remainder of the event.

Quality Control Sample Cross Reference: The following are the false identifications assigned to the quality control samples.

False ID	Ticket Number	RIN	True ID	Sample Type
2326	LFR 239	13045258	-----	Trip Blank
2327	LFR 240	13045258	-----	Trip Blank
2323	LFR 236	13045258	HMH-5R	Duplicate (VOA & Metals)
2589	LFR 322	13045260	SA5-4-4	Duplicate (Gamma, H-3)

Duplicates were collected by filling all bottles labeled with the location number first, then filling all bottles labeled with the false ID second.

Report Identification Numbers (RINs) Assigned:

RIN	Associated Lab	Analytes	Comments
13045237	Purdue	Chlorine-36	-----
13045258	ALS Fort Collins	Volatile organics, arsenic, lead, barium, chromium	-----
13045260	GEL	Gamma, tritium (including enriched)	Field data sheets can be found in this RIN directory in Crow\sms. All field data collected with the Field Data Collection System are associated with this RIN.

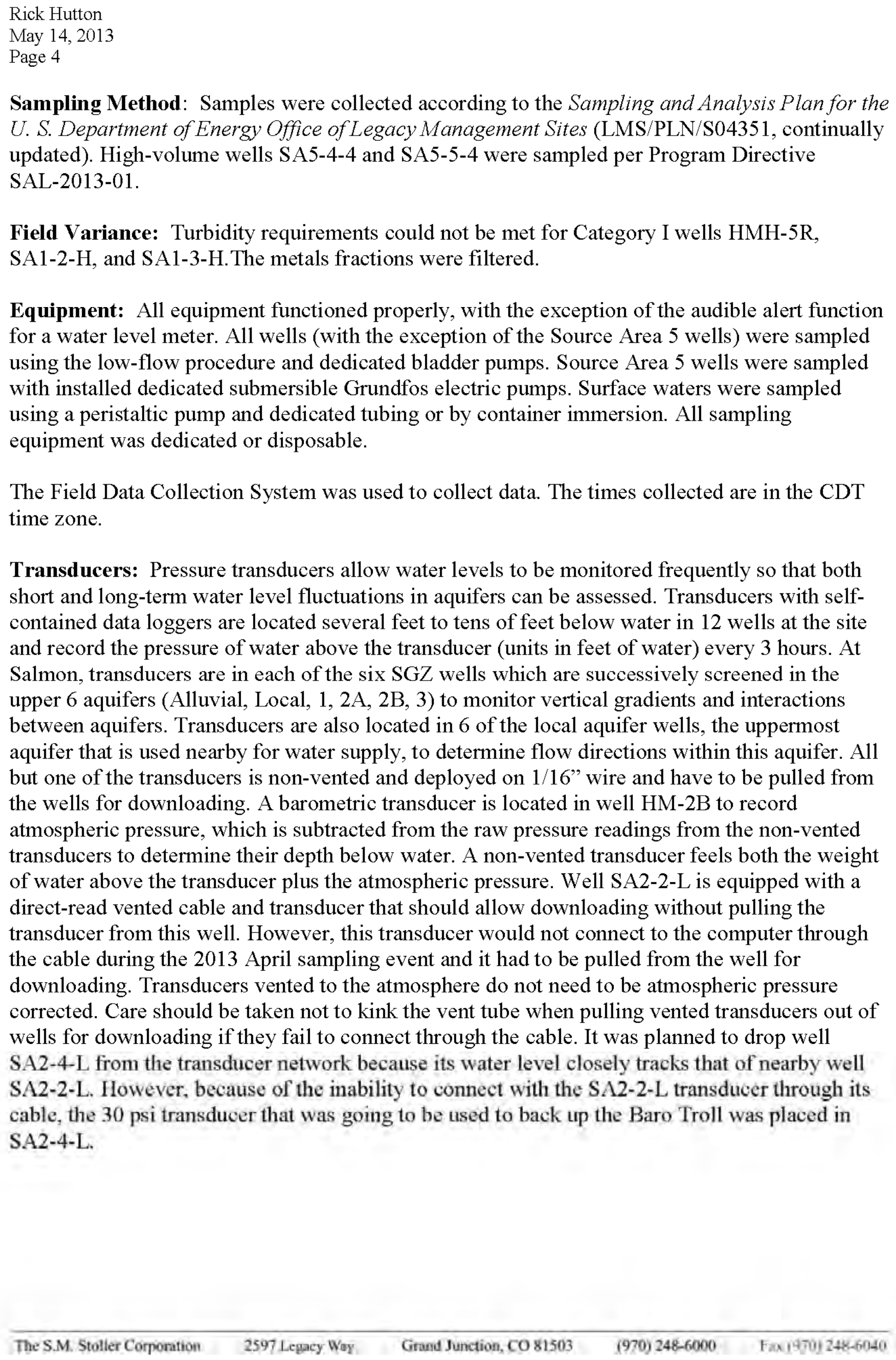
Sample Shipments: Samples were shipped overnight via FedEx from Hattiesburg, MS, on April 25, 2013.

Water Level Measurements: Water levels were measured in all sampled wells.

Site Inspection: A FIMS Condition Assessment was required on the site assets. The wells and the site monument are the only site assets currently owned by DOE. All of the wells and the monument were in good condition and a photo was taken of each to document the condition.

Well Inspection Summary: Photos were taken at all well locations for the FIMS report; an additional photo was taken of each well's cap assembly for reference. All surface water locations were also documented by photos to aid in finding them in the future if the team going to the site changes. Photos are available at
\\gull\Sites_Prod\Sites\MS\SALMON\Images\2013\20130422_Gauthier_Sampling_Fims
All locks were replaced with 3359-keyed locks.

Figure 3 (continued). Trip Report Example



Sampling Method: Samples were collected according to the *Sampling and Analysis Plan for the U. S. Department of Energy Office of Legacy Management Sites* (LMS/PLN/S04351, continually updated). High-volume wells SA5-4-4 and SA5-5-4 were sampled per Program Directive SAL-2013-01.

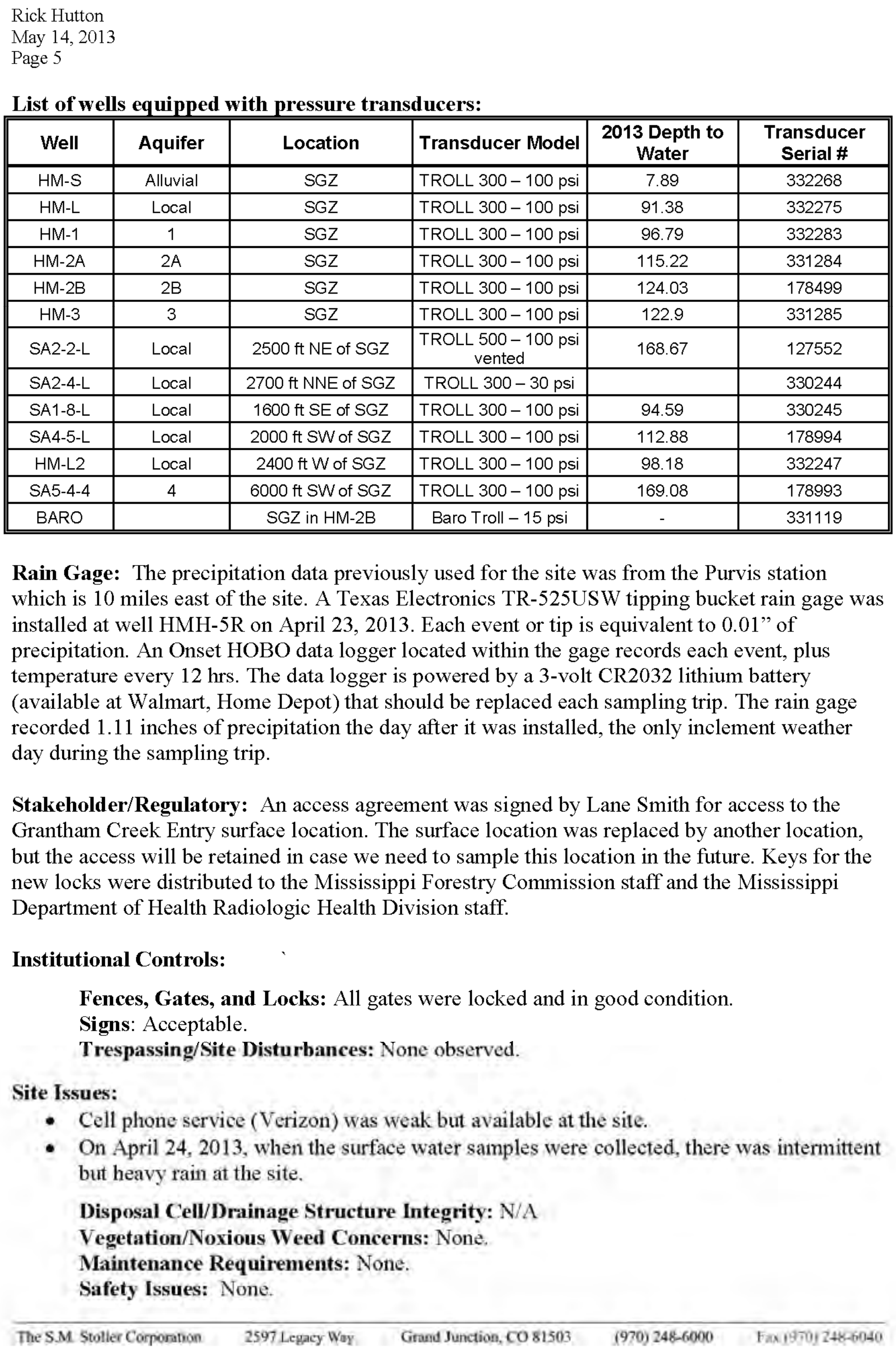
Field Variance: Turbidity requirements could not be met for Category I wells HMH-5R, SA1-2-H, and SA1-3-H.The metals fractions were filtered.

Equipment: All equipment functioned properly, with the exception of the audible alert function for a water level meter. All wells (with the exception of the Source Area 5 wells) were sampled using the low-flow procedure and dedicated bladder pumps. Source Area 5 wells were sampled with installed dedicated submersible Grundfos electric pumps. Surface waters were sampled using a peristaltic pump and dedicated tubing or by container immersion. All sampling equipment was dedicated or disposable.

The Field Data Collection System was used to collect data. The times collected are in the CDT time zone.

Transducers: Pressure transducers allow water levels to be monitored frequently so that both short and long-term water level fluctuations in aquifers can be assessed. Transducers with self-contained data loggers are located several feet to tens of feet below water in 12 wells at the site and record the pressure of water above the transducer (units in feet of water) every 3 hours. At Salmon, transducers are in each of the six SGZ wells which are successively screened in the upper 6 aquifers (Alluvial, Local, 1, 2A, 2B, 3) to monitor vertical gradients and interactions between aquifers. Transducers are also located in 6 of the local aquifer wells, the uppermost aquifer that is used nearby for water supply, to determine flow directions within this aquifer. All but one of the transducers is non-vented and deployed on 1/16" wire and have to be pulled from the wells for downloading. A barometric transducer is located in well HM-2B to record atmospheric pressure, which is subtracted from the raw pressure readings from the non-vented transducers to determine their depth below water. A non-vented transducer feels both the weight of water above the transducer plus the atmospheric pressure. Well SA2-2-L is equipped with a direct-read vented cable and transducer that should allow downloading without pulling the transducer from this well. However, this transducer would not connect to the computer through the cable during the 2013 April sampling event and it had to be pulled from the well for downloading. Transducers vented to the atmosphere do not need to be atmospheric pressure corrected. Care should be taken not to kink the vent tube when pulling vented transducers out of wells for downloading if they fail to connect through the cable. It was planned to drop well SA2-4-L from the transducer network because its water level closely tracks that of nearby well SA2-2-L. However, because of the inability to connect with the SA2-2-L transducer through its cable, the 30 psi transducer that was going to be used to back up the Baro Troll was placed in SA2-4-L.

Figure 3 (continued). Trip Report Example



List of wells equipped with pressure transducers:

Well	Aquifer	Location	Transducer Model	2013 Depth to Water	Transducer Serial #
HM-S	Alluvial	SGZ	TROLL 300 – 100 psi	7.89	332268
HM-L	Local	SGZ	TROLL 300 – 100 psi	91.38	332275
HM-1	1	SGZ	TROLL 300 – 100 psi	96.79	332283
HM-2A	2A	SGZ	TROLL 300 – 100 psi	115.22	331284
HM-2B	2B	SGZ	TROLL 300 – 100 psi	124.03	178499
HM-3	3	SGZ	TROLL 300 – 100 psi	122.9	331285
SA2-2-L	Local	2500 ft NE of SGZ	TROLL 500 – 100 psi vented	168.67	127552
SA2-4-L	Local	2700 ft NNE of SGZ	TROLL 300 – 30 psi		330244
SA1-8-L	Local	1600 ft SE of SGZ	TROLL 300 – 100 psi	94.59	330245
SA4-5-L	Local	2000 ft SW of SGZ	TROLL 300 – 100 psi	112.88	178994
HM-L2	Local	2400 ft W of SGZ	TROLL 300 – 100 psi	98.18	332247
SA5-4-4	4	6000 ft SW of SGZ	TROLL 300 – 100 psi	169.08	178993
BARO		SGZ in HM-2B	Baro Troll – 15 psi	-	331119

Rain Gage: The precipitation data previously used for the site was from the Purvis station which is 10 miles east of the site. A Texas Electronics TR-525USW tipping bucket rain gage was installed at well HMH-5R on April 23, 2013. Each event or tip is equivalent to 0.01" of precipitation. An Onset HOBO data logger located within the gage records each event, plus temperature every 12 hrs. The data logger is powered by a 3-volt CR2032 lithium battery (available at Walmart, Home Depot) that should be replaced each sampling trip. The rain gage recorded 1.11 inches of precipitation the day after it was installed, the only inclement weather day during the sampling trip.

Stakeholder/Regulatory: An access agreement was signed by Lane Smith for access to the Grantham Creek Entry surface location. The surface location was replaced by another location, but the access will be retained in case we need to sample this location in the future. Keys for the new locks were distributed to the Mississippi Forestry Commission staff and the Mississippi Department of Health Radiologic Health Division staff.

Institutional Controls: `

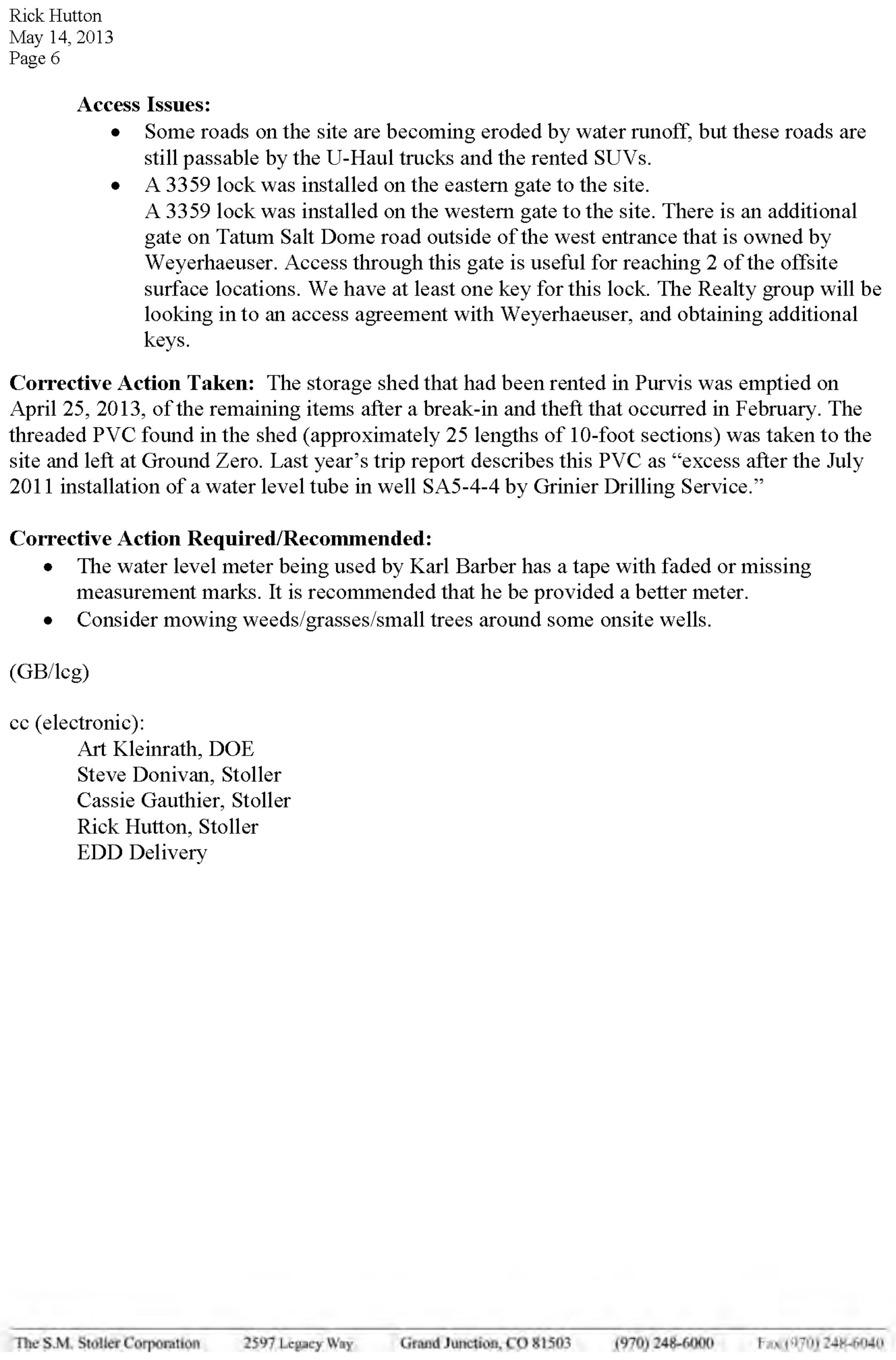
Fences, Gates, and Locks: All gates were locked and in good condition.
Signs: Acceptable.
Trespassing/Site Disturbances: None observed.

Site Issues:

- Cell phone service (Verizon) was weak but available at the site.
- On April 24, 2013, when the surface water samples were collected, there was intermittent but heavy rain at the site.

Disposal Cell/Drainage Structure Integrity: N/A
Vegetation/Noxious Weed Concerns: None.
Maintenance Requirements: None.
Safety Issues: None.

Figure 3 (continued). Trip Report Example



Access Issues:

- Some roads on the site are becoming eroded by water runoff, but these roads are still passable by the U-Haul trucks and the rented SUVs.
- A 3359 lock was installed on the eastern gate to the site.
  A 3359 lock was installed on the western gate to the site. There is an additional gate on Tatum Salt Dome road outside of the west entrance that is owned by Weyerhaeuser. Access through this gate is useful for reaching 2 of the offsite surface locations. We have at least one key for this lock. The Realty group will be looking in to an access agreement with Weyerhaeuser, and obtaining additional keys.

Corrective Action Taken: The storage shed that had been rented in Purvis was emptied on April 25, 2013, of the remaining items after a break-in and theft that occurred in February. The threaded PVC found in the shed (approximately 25 lengths of 10-foot sections) was taken to the site and left at Ground Zero. Last year's trip report describes this PVC as "excess after the July 2011 installation of a water level tube in well SA5-4-4 by Grinier Drilling Service."

Corrective Action Required/Recommended:

- The water level meter being used by Karl Barber has a tape with faded or missing measurement marks. It is recommended that he be provided a better meter.
- Consider mowing weeds/grasses/small trees around some onsite wells.

(GB/lcg)

cc (electronic):
Art Kleinrath, DOE
Steve Donivan, Stoller
Cassie Gauthier, Stoller
Rick Hutton, Stoller
EDD Delivery

Figure 3 (continued). Trip Report Example

5.6.2 Field Information and Data

The FDCS 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, instrument operational check time, and sampling personnel. The FDCS will also be used to document pre-trip calibrations, daily operational checks, and daily safety meetings. If the FDCS cannot be used, the Water Sampling Field Data form will be completed. Water sampling documentation will follow the protocol specified in “Standard Practice for Field Documentation” in the *Environmental Procedures Catalog* and included in Appendix A. Deviations from the procedures specified in this plan will be documented as a field variance comment in the FDCS and included in the sampling Trip Report. The Water Level Recorder program will be used to record water level data or well inspection and maintenance activities for wells that are not sampled.

5.7 Records

Records associated with or generated through sampling activities may include:

- The *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*.
- Program directives.
- Water Sampling Field Data form.
- PDF reports from the FDCS.
- Chain-of-Custody forms.
- Sampling trip reports.
- Laboratory analytical data reports.
- Field and laboratory data validation summary reports.
- Air monitoring logs.
- Calibration logs.
- Soil sample collection logs and field maps.
- JSAs.

Records will be transferred to the appropriate records coordinator when complete and will be filed under the applicable record file index or project file index. Records will be maintained in accordance with the *Records Management Manual* (LMS/POL/S04327).

6.0 Health and Safety

Sampling activities will be conducted according to the health and safety requirements specified in the *Health and Safety Manual* (LMS/POL/S04321). At some sites where site conditions are more complex (e.g., Tuba City), site access training will be specified in a formal site briefing. Task-specific health and safety requirements (including personal protective equipment) are addressed in JSAs. An example of a JSA for sampling activities is found in Appendix C. All signed copies of JSAs generated for sampling activities, including copies with field changes, will be transferred to the applicable records coordinator for archiving and management as a record. Daily safety meetings will be conducted and documented to highlight specific hazards and controls specified in the JSA that will be applicable to the planned work for the day. Nonroutine sampling activities not specified in the JSA for sampling will be addressed in additional health and safety documents, such as an additional JSA, Safe Work Permit, Radiological Work Permit, or Confined Space Evaluation.

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7.0 References

Document Production Manual, LMS/POL/S09818, continually updated, prepared by Stoller Newport News Nuclear, Inc., a wholly owned subsidiary of Huntington Ingalls Industries, Inc., for the U.S. Department of Energy Office of Legacy Management.

DOE Order 414.1C, *Quality Assurance*, June 17, 2005.

DOE (U.S. Department of Energy), 2000. *Management Plan for Field-Generated Investigation Derived Waste*, MAC-GWADM 21.1-1 Rev. 1.0, U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado.

DOE (U.S. Department of Energy), 2004. *Monticello Mill Tailings Site Operable Unit III Post-Record of Decision Monitoring Plan*, DOE–LM/GJ684–2004, Office of Legacy Management, Grand Junction, Colorado.

DOE (U.S. Department of Energy), 2006. *Basic Ordering Agreement Attachment 1, Statement of Work, Laboratory Analytical Services*, DOE Integrated Contractor Purchasing Team.

DOE (U.S. Department of Energy), 2007. *BOA Implementation Requirements, Attachment to Request for Proposal 1965PZ,* Office of Legacy Management, Grand Junction, Colorado.

Records Management Manual, LMS/POL/S04327, continually updated, prepared by Stoller Newport News Nuclear, Inc., a wholly owned subsidiary of Huntington Ingalls Industries, Inc., for the U.S. Department of Energy Office of Legacy Management.

DOE (U.S. Department of Energy), updated annually. *DOE Quality Systems for Analytical Services*, Rev. 2.3, Washington, DC.

Environmental Procedures Catalog, LMS/POL/S04325, continually updated, prepared by Stoller Newport News Nuclear, Inc., a wholly owned subsidiary of Huntington Ingalls Industries, Inc., for the U.S. Department of Energy Office of Legacy Management.

EPA (U.S. Environmental Protection Agency), 1983. *Methods for Chemical Analysis of Water and Wastes*, EPA 600/44-79-020, Office of Research and Development, Washington, DC.

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, DC.

EPA (U.S. Environmental Protection Agency), 1995. *Ground Water Sampling—A Workshop Summary*, EPA/600/R-94/205, November 30 to December 2, 1993, Dallas, Texas.

EPA (U.S. Environmental Protection Agency), 1996. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, SW-846, Office of Solid Waste and Emergency Response, Washington, DC.

EPA (U.S. Environmental Protection Agency), 2003. *National Environmental Laboratory Accreditation Conference*, Chapter 5, “Quality Systems.”

Health and Safety Manual, LMS/POL/S04321, continually updated, prepared by Stoller Newport News Nuclear, Inc., a wholly owned subsidiary of Huntington Ingalls Industries, Inc., for the U.S. Department of Energy Office of Legacy Management.

ISO (International Organization for Standardization), 1999. *General Requirements for the Competence of Testing and Calibration Laboratories*, ISO 17025.

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

Legacy Management CERCLA Sites Quality Assurance Project Plan, LMS/PLN/S04353, continually updated, prepared by Stoller Newport News Nuclear, Inc., a wholly owned subsidiary of Huntington Ingalls Industries, Inc., for the U.S. Department of Energy Office of Legacy Management.

Quality Assurance Manual, LMS/POL/S04320, continually updated, prepared by Stoller Newport News Nuclear, Inc., a wholly owned subsidiary of Huntington Ingalls Industries, Inc., for the U.S. Department of Energy Office of Legacy Management.

Training Manual, LMS/POL/S04323, continually updated, prepared by Stoller Newport News Nuclear, Inc., a wholly owned subsidiary of Huntington Ingalls Industries, Inc., for the U.S. Department of Energy Office of Legacy Management.

Appendix A

Procedures Used for Groundwater and Surface Water Sampling and Analysis

1.0 Preparing or Revising Procedures for the *Environmental Procedures Catalog*

1.1 Purpose and Scope

This practice describes the preparation, review, approval, and distribution of procedures in the *Environmental Procedures Catalog* (LMS/POL/S04325).

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* that will be used.

1.2 Terminology

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.

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

May: In procedures, a suggestion only.

Must: In procedures, a required action. Synonymous with “shall” and “will.”

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.

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

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

Qualified: An employee who has met the requirements for a specific position or task.

Shall: In procedures, a required action. Synonymous with “must” and “will.”

Should: In procedures, a recommendation.

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.

Will: In procedures, a required action. Synonymous with "must" and "shall."

1.3 Procedures

1.3.1 New Procedures

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, management will review the suggested procedure to determine if it is appropriate for inclusion.

The following sections should be included in new procedures:

- Title (mandatory)
- Purpose and Scope (mandatory)
- Terminology (mandatory)
- Materials and Equipment (optional)
- Procedure (mandatory)
- Checklist (optional)
- Documentation (mandatory)
- References (optional)

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.

Procedure Format: The format of procedures should follow the standard format. Procedures purchased from the American Society of Testing and Materials (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 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.).

1.3.2 Miscellaneous Points of Style

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.

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.

Text should be provided to Document Production by a word file attached to an e-mail. The file should include all figures and forms. Document Production will ensure that the procedure is in the proper format, coordinate reviews, and assist the author in comment resolution.

1.3.3 Changes to Procedures

When changes to a procedure are required, the originator shall submit an electronic copy of the proposed revision to the assigned lead (per Legacy Management Support Contractor Work Control Documents on the LM Intranet). For questions, contact the assigned lead.

If only editorial changes are needed, and the changes do not affect 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 assigned lead.

Procedures from this catalog that will be used on a specific project in planning documents should be identified in those documents.

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

1.4 Documentation (Procedure Review, Publication, Approval, and Distribution)

Each new, revised, or adopted procedure in this catalog will be sent electronically to qualified technical individuals and personnel from environmental, safety, and quality groups for review. Editorial changes, as described in Section 1.3.3, require review only by the catalog lead. Reviews will use a Record of Review form (LMS 1696e). Comments must be resolved by the author and/or assigned lead before submitting the procedure for publication.

New and revised procedures are posted on the Contractor Information page of the LM Intranet as a controlled document.

An electronic copy of the final procedure is submitted to the catalog lead for approval before the procedure is released and distributed. A record of the approval will be maintained by the catalog lead.

Procedures may be printed directly from the Contractor Information page of the LM Intranet, and will be automatically marked as “Uncontrolled if Printed.” They may be 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.

1.5 Records

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

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2.0 Standard Practice for Sample Submittal to Contract Analytical Laboratories

2.1 Purpose and Scope

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 (ICPT) Basic Ordering Agreement (BOA) as modified by the *Legacy Management BOA Implementation Requirements* document.

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

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

2.2 Terminology

Basic Ordering Agreement: The ICPT BOA provides a standardized system for procuring analytical services from commercial laboratories, including a statement of work for analytical services and provisions for laboratory audits.

Environmental samples: Samples of air, soil, water, or other media that are not expected to exhibit properties classified by the U.S. Department of Transportation (DOT) as hazardous.

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

Line item code: A cost code used to specify analytes or analyte groups. Line item codes are defined in the BOA based on sample matrices, analytes, analytical methods, and required detection limits.

Radioactive material: Any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in Title 49 *Code of Federal Regulations* Part 173.436 (49 CFR 173.436).

Requisition index number: A unique eight-digit number that identifies a group of samples that are submitted, analyzed, and reported together.

U.S. Department of Transportation–regulated samples: Samples of air, soil, water, or other media 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 hazardous wastes unless so stated.

2.3 Procedure

Note

Deviations from procedures are made in accordance with the Contractor Quality Assurance Manual *(LMS/POL/S04320).*

2.3.1 Sample Type Classification—Environmental or DOT Regulated

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 processes, and field screening results will assist in classifying 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.

2.3.2 Laboratory Coordinator

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:

- Number and types of samples
- Analytes requested
- Special requirements, regulatory methods, detection limits, etc.
- Turnaround time requirements
- Reporting requirements

The analytical requirements of routine sampling events are listed in Appendix E of the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (SAP) (LMS/PLN/S04351).

The laboratory coordinator assigns a unique requisition index number (RIN) to the sample event and selects the line item codes (LICs) to specify the analyses to be performed. RINs are generated using the Sample Management System (SMS) application. The Sample Tracking System application is also used to produce Chain of Custody (COC) forms and sample labels.

Laboratory Notification: The laboratory coordinator prepares an Analysis Confirmation form listing the number and types of samples, LICs, 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.

Project Manager Notification: The Analysis Confirmation form is also sent to the applicable project manager or site lead as notification of the services requested of the laboratory.

2.3.3 Sample Collection

Samples are collected, preserved, and packaged in accordance with the plan governing the sample event, such as a sampling and analysis plan.

Field activities and all comments regarding or deviations from procedures are documented in the Field Data Collection System (FDCS), on the Water Sampling Field Data form (Figure 2), or in the trip report in accordance with the “Standard Practice for Field Documentation” chapter.

Samples are sealed and labeled for shipment; refer to the “Standard Practice for Field Documentation” chapter.

Sample security must be maintained (samples must be locked and/or under constant supervision, and protected from tampering) and sample transfers documented on a COC form. Refer to the “Standard Practice for Field Documentation” chapter for guidance on protecting sample custody. See Figure 3 for an example of a COC form.

2.3.4 Sample Shipment and Receipt Requirements

The samples are shipped in compliance with DOT regulations. The shipment must include copies of signed COC form(s).

Upon sample receipt, the contracted analytical laboratory is required to:

- Sign and record the date and time on the COC form, indicating sample receipt.
- Assign unique laboratory identification numbers to the samples.
- Measure the pH and/or temperature of each aqueous sample or cooler, as appropriate, to verify that the sample has been preserved correctly. (In the case of a volatile analysis, measure the pH at the time of analysis to avoid contamination, and record in the lab notebook if the COC form has already been returned to the laboratory coordinator).
- Record the pH and/or temperature (if measured) on the COC form or sample receiving report.
- Contact the laboratory coordinator to resolve any discrepancies in documentation or samples received.
- Return a copy of the COC form and, if applicable, a copy of the sample receiving report to the laboratory coordinator.

- Notify the laboratory coordinator within 24 hours of discovering that samples have been lost, damaged, or destroyed.
- 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.

2.4 Documentation

The following documents may be generated by the use of this procedure:

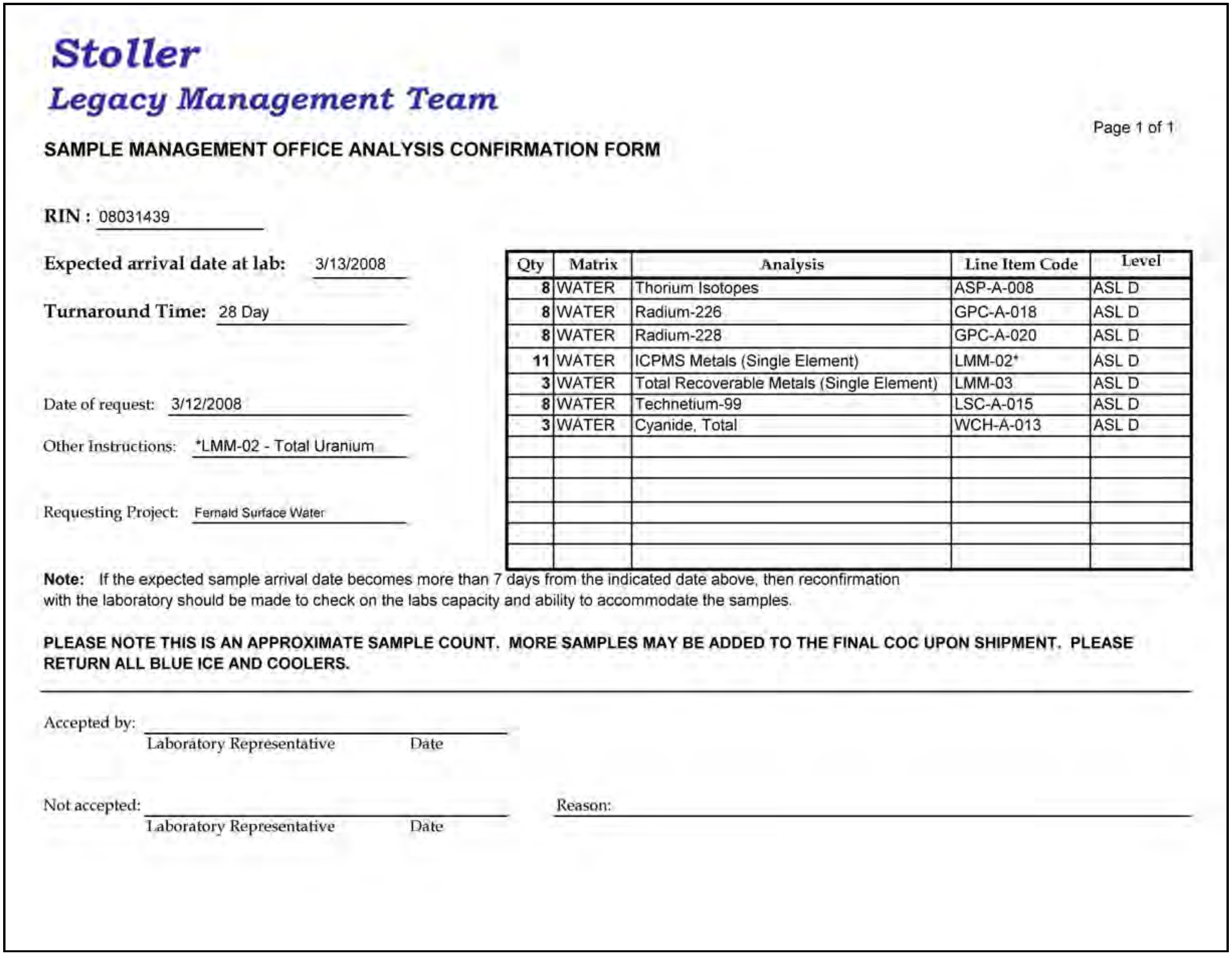
- Analysis Confirmation form
  - This form is generated by the laboratory coordinator. It is signed by a representative of the Analytical Laboratory prior to sample submittal. A copy is also sent to the project manager or site lead.
- Chain of Custody/Sample Submittal form
  - The form is generated by the laboratory coordinator using the SMS. It may also be generated in the field by the sampling team. The original of this form is returned by the Analytical Laboratory as part of the analytical report.
- 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. If an electronic data deliverable (EDD) is part of the analytical package, it is forwarded to the Data Management group for loading into the SEEPro database. Electronic deliverables are managed by the Data Management group.

2.5 References

Environmental Procedures Catalog, LMS/POL/SO4325, continually updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

4.0 Standard Practice for Field Documentation

Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites, LMS/PLN/S04351, continually updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.



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SAMPLE MANAGEMENT OFFICE ANALYSIS CONFIRMATION FORM

RIN : 08031439

Expected arrival date at lab: 3/13/2008

Turnaround Time: 28 Day

Date of request: 3/12/2008

Other Instructions: *LMM-02 - Total Uranium

Requesting Project: Fernald Surface Water

Qty	Matrix	Analysis	Line Item Code	Level
8	WATER	Thorium Isotopes	ASP-A-008	ASL D
8	WATER	Radium-226	GPC-A-018	ASL D
8	WATER	Radium-228	GPC-A-020	ASL D
11	WATER	ICPMS Metals (Single Element)	LMM-02*	ASL D
3	WATER	Total Recoverable Metals (Single Element)	LMM-03	ASL D
8	WATER	Technetium-99	LSC-A-015	ASL D
3	WATER	Cyanide, Total	WCH-A-013	ASL D

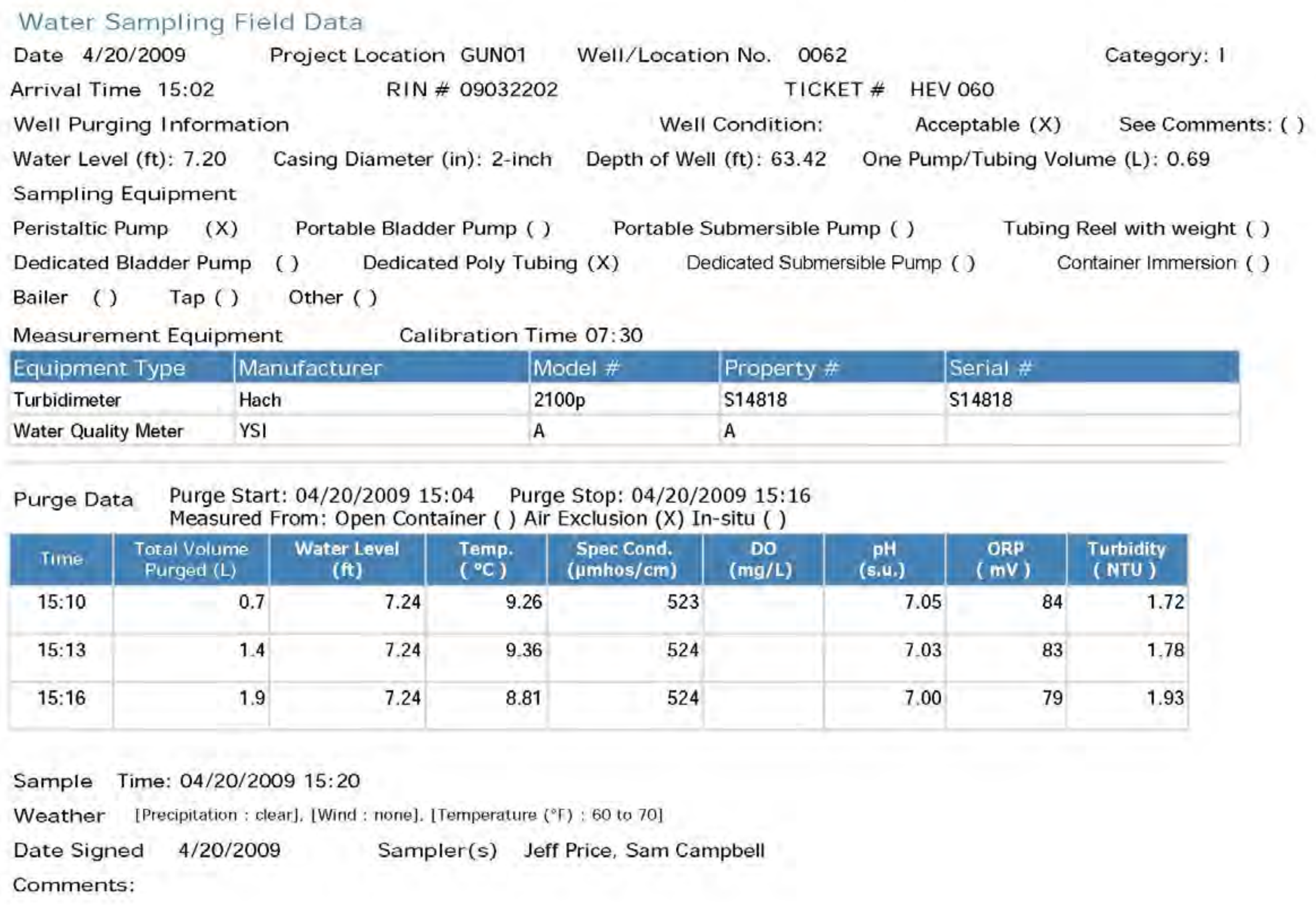
Note: If the expected sample arrival date becomes more than 7 days from the indicated date above, then reconfirmation with the laboratory should be made to check on the labs capacity and ability to accommodate the samples.

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



Water Sampling Field Data

Date 4/20/2009 Project Location GUN01 Well/Location No. 0062 Category: I

Arrival Time 15:02 RIN # 09032202 TICKET # HEV 060

Well Purging Information Well Condition: Acceptable (X) See Comments: ( )

Water Level (ft): 7.20 Casing Diameter (in): 2-inch Depth of Well (ft): 63.42 One Pump/Tubing Volume (L): 0.69

Sampling Equipment

Peristaltic Pump (X) Portable Bladder Pump ( ) Portable Submersible Pump ( ) Tubing Reel with weight ( )

Dedicated Bladder Pump ( ) Dedicated Poly Tubing (X) Dedicated Submersible Pump ( ) Container Immersion ( )

Bailer ( ) Tap ( ) Other ( )

Measurement Equipment Calibration Time 07:30

Equipment Type	Manufacturer	Model #	Property #	Serial #
Turbidimeter	Hach	2100p	S14818	S14818
Water Quality Meter	YSI	A	A	

Purge Data Purge Start: 04/20/2009 15:04 Purge Stop: 04/20/2009 15:16
Measured From: Open Container ( ) Air Exclusion (X) In-situ ( )

Time	Total Volume Purged (L)	Water Level (ft)	Temp. (°C)	Spec Cond. (µmhos/cm)	DO (mg/L)	pH (s.u.)	ORP (mV)	Turbidity (NTU)
15:10	0.7	7.24	9.26	523		7.05	84	1.72
15:13	1.4	7.24	9.36	524		7.03	83	1.78
15:16	1.9	7.24	8.81	524		7.00	79	1.93

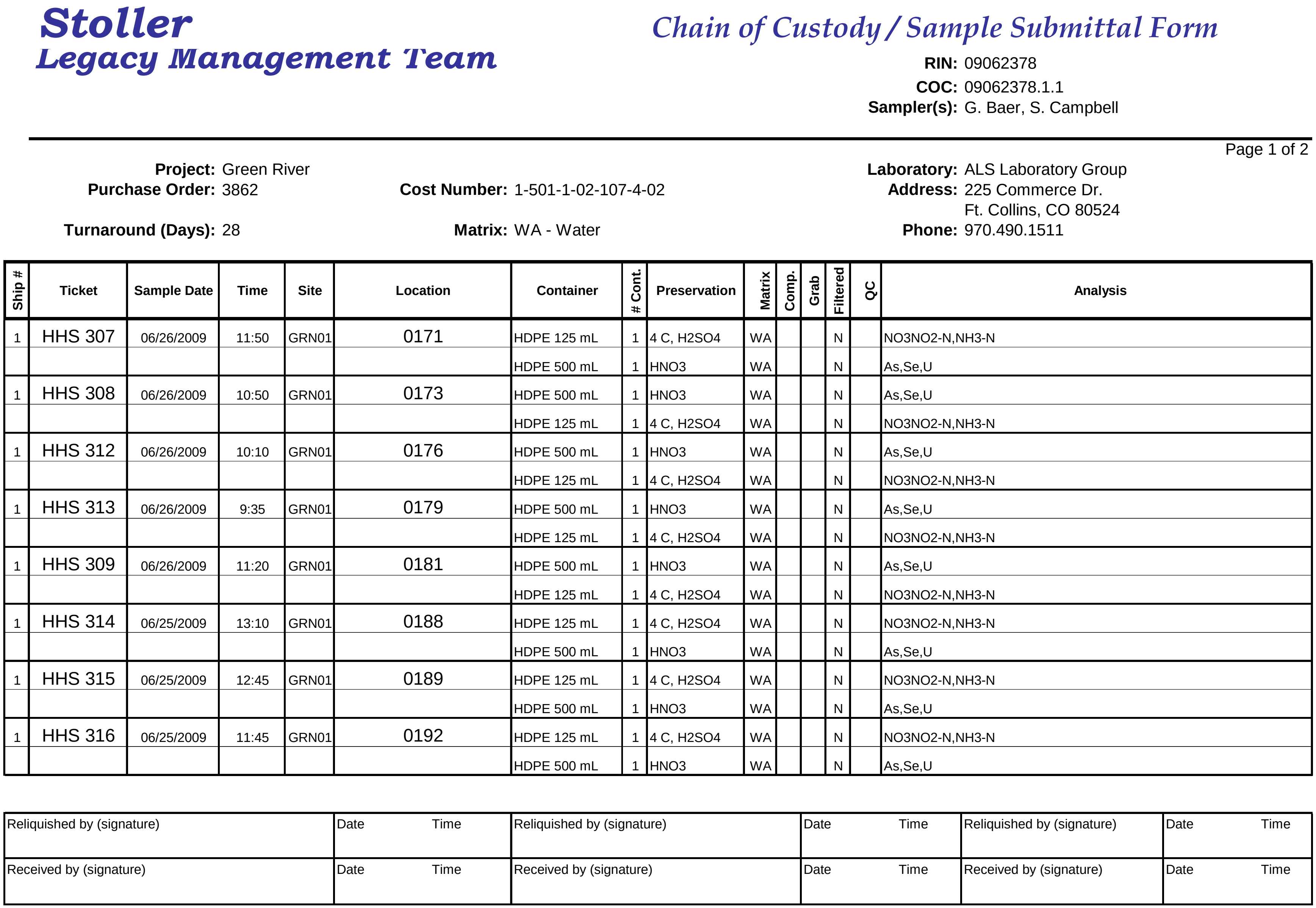
Sample Time: 04/20/2009 15:20

Weather [Precipitation : clear], [Wind : none], [Temperature (°F) : 60 to 70]

Date Signed 4/20/2009 Sampler(s) Jeff Price, Sam Campbell

Comments:

Figure 2. Water Sampling Field Data Form Example



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Chain of Custody / Sample Submittal Form

RIN: 09062378
COC: 09062378.1.1
Sampler(s): G. Baer, S. Campbell

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Project: Green River
Purchase Order: 3862
Cost Number: 1-501-1-02-107-4-02
Turnaround (Days): 28
Matrix: WA - Water

Laboratory: ALS Laboratory Group
Address: 225 Commerce Dr.
Ft. Collins, CO 80524
Phone: 970.490.1511

Ship #	Ticket	Sample Date	Time	Site	Location	Container	# Cont.	Preservation	Matrix	Comp.	Grab	Filtered	QC	Analysis
1	HHS 307	06/26/2009	11:50	GRN01	0171	HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
						HDPE 500 mL	1	HNO3	WA			N		As,Se,U
1	HHS 308	06/26/2009	10:50	GRN01	0173	HDPE 500 mL	1	HNO3	WA			N		As,Se,U
						HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
1	HHS 312	06/26/2009	10:10	GRN01	0176	HDPE 500 mL	1	HNO3	WA			N		As,Se,U
						HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
1	HHS 313	06/26/2009	9:35	GRN01	0179	HDPE 500 mL	1	HNO3	WA			N		As,Se,U
						HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
1	HHS 309	06/26/2009	11:20	GRN01	0181	HDPE 500 mL	1	HNO3	WA			N		As,Se,U
						HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
1	HHS 314	06/25/2009	13:10	GRN01	0188	HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
						HDPE 500 mL	1	HNO3	WA			N		As,Se,U
1	HHS 315	06/25/2009	12:45	GRN01	0189	HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
						HDPE 500 mL	1	HNO3	WA			N		As,Se,U
1	HHS 316	06/25/2009	11:45	GRN01	0192	HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
						HDPE 500 mL	1	HNO3	WA			N		As,Se,U

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

Figure 3. COC Form

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3.0 Standard Practice for Sample Management Office Operations

3.1 Purpose and Scope

This standard practice describes sample management including preparing statements of work (SOWs), placing subcontracts for analytical services, overseeing analytical work, tracking the status of sample analysis and reporting, and evaluating laboratory performance.

This practice applies to the management of submittals to laboratories that provide services as specified in the ICPT BOA or other SOWs.

This practice provides an organized, documented sample management process when submitting samples to contract laboratories and will be used for all sample submittals to commercial laboratories.

This practice complements procedures for the collection, preservation, and shipment of samples as documented elsewhere (see Section 3.5, “References”).

All samples shipments must comply with DOT regulations (49 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.

3.2 Terminology

Analytical Service Level: There are five analytical service levels that are assigned depending on the intended use of the data. The following are definitions of Analytical Service Levels A through E.

> **Analytical Service Level A (Field Analyses):** Field measurements of alkalinity, dissolved oxygen, oxidation-reduction potential, temperature, and other parameters may be required on a project-specific basis. Specific conductance, pH, and turbidity may also be required or may be used as stabilization parameters when purging a monitoring well. See the SAP for calibration and quality control requirements pertaining to field measurements. Field data are recorded in the FDCS or on the Water Sampling Field Data form.
>
> **Analytical Service Level B (Quantitative with Results Only Deliverable):** Laboratory data fully compliant with requirements specified in the *Quality Systems for Analytical Services* (QSAS), the SOW, or project-specific documents. The “results only” deliverable comprises the sample results, case narrative, and COC documentation. No calibration or quality assurance sample data are reported. Analytical Service Level B may be used when rapid turnaround results of undocumented quality are needed.
>
> **Analytical Service Level C (Quantitative with Standard Deliverable):** Laboratory data meeting the same requirements as for Analytical Service Level B with a standard deliverable. The standard deliverable includes those deliverables defined for the “results only” package plus all applicable EPA Contract Laboratory Program forms or their equivalent. No raw data, spectra, or laboratory logbook copies are required.

Analytical Service Level D (Quantitative with Standard Plus Raw Data Deliverable): Laboratory data meeting the same requirements as Analytical Service Level C with a standard plus raw data deliverable. The standard plus raw data deliverable includes those deliverables defined for the standard data package plus all raw data and spectra generated in the acquisition of the samples. This is to include, but not be limited to, laboratory-originating quality indicator samples, analyses performed but not used for reporting, data for all preparation, chemistry, counting, and instrument data generated during sample analysis.

Analytical Service Level E (Nonstandard Methods): Analyses using nonstandard methods for unusual analytes or when the method performance standards cannot be met. Nonstandard methods may be needed to meet project-specific requirements that cannot be met using existing analytical methods.

Basic Ordering Agreement: The ICPT BOA provides a standardized system for procuring analytical services from commercial laboratories including a statement of work for analytical services and provisions for laboratory audits.

Integrated Contractor Purchasing Team: The ICPT was established by DOE to provide a vehicle for the communication of procurement-related issues of the prime Contractor community. The ICPT negotiates BOAs for use by DOE and its eligible subcontractors.

Line Item Code: A cost code used to specify analytes, or analyte groups. Line item codes are defined in the BOA based on sample matrices, analytes, analytical methods, and required detection limits.

Mixed Analyte Performance Evaluation Program: A single-blind performance evaluation program administered by the DOE Analytical Services Division. Laboratories analyze performance evaluation samples containing organic, inorganic, and radiochemical analytes at concentrations known only to the program to assess laboratory performance.

Quality Systems for Analytical Services: The quality requirements document that supplements the ICPT BOA. The Quality Systems for Analytical Services is prepared and maintained by the DOE Consolidated Audit Program (CAP) team.

Radioactive material: Any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in 49 CFR 173.436.

Requisition index number: A unique 8-digit number that identifies a group of samples that are submitted, analyzed, and reported together.

Sample Management System: A database application used to define sample submittals (requisition index numbers), track sample analysis progress and analytical costs, and support data validation.

U.S. Department of Energy Consolidated Audit Program: The laboratory auditing program administered by the DOE Analytical Services Division. The CAP team performs annual audits of contract laboratories to assess performance and contract compliance.

3.3 Procedure

Note

Deviations from procedures are made in accordance with the Contractor Quality Assurance Manual.

3.3.1 Placement of Analytical Subcontracts

The subcontract technical representative (STR) determines the analytical requirements of a site or project by consulting with the project manager (or other project contact) and reviewing relevant project documents.

The STR determines if a project-specific SOW is needed to define requirements that have not been previously identified in the BOA SOW, the associated QSAS, or other requirements documents. SOWs with limited scope can be amended according to an existing laboratory agreement as needed.

The STR prepares the following documents, as needed:

- The SOW that clarifies the technical requirements.
- A document list comprising the documents that will be requested of the prospective laboratories for use during proposal evaluation.
- An evaluation plan that details how the proposals will be evaluated and ranked.
- A list of prospective laboratories, prepared from the laboratories that have current ICPT agreements.
- A requisition with an estimated cost, charge codes, and appropriate manager approval.

Laboratories must meet the requirements specified in the SOW to be approved for contract award. Fundamental requirements include that the laboratory:

- Has been audited by the DOE CAP or other accrediting authority as specified in the SOW within the last 18 months.
- Has a proper license to handle radioactive material, as needed, and has procedures for the control of radioactive material.
- Has procedures for sample receiving, login, storage, analysis, and disposal with appropriate COC.
- Has procedures for the implementation of the analytical methods to be performed.
- Has a facility with adequate building security.
- Has a document control system.
- Has a quality assurance program that meets the requirements in the QSAS or other Quality Systems as specified in the SOW.

- Has documented personnel and laboratory experience in the analysis category (inorganic, organic, radiochemical, geotechnical), including acceptable performance in performance evaluation programs.
- Has demonstrated the ability to comply with all applicable reporting requirements.
- Has demonstrated the ability to comply with all other contractual requirements as set forth in technical SOWs.
- Has administrative programs in place that comply with the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR 1910.1450 and 10 CFR 835, as applicable, and has a hazardous waste management program.
- Has demonstrated successful performance in at least two recognized inter-laboratory performance evaluation programs, such as the Mixed Analyte Performance Evaluation Program (MAPEP).
- Has the necessary equipment, in working order and capable of performing the analyses for which the laboratory will be contracted.

A review of the requirements may be included in the technical evaluation plan.

The STR submits the documents for technical review to a review committee composed of the project manager or a designee and other appropriate personnel. Quality assurance, data validation, and sample management personnel may be included in the review of the proposal as determined by the STR.

After reviews and modifications are complete, the STR submits the requisition package to Procurement for placement.

The review committee recommends placement of the contract after ranking the responses to the SOW in accordance with the evaluation plan.

3.3.2 Sample Collection and Submittal

Samples are collected in accordance with the SAP or project-specific sampling plans. Variances from the SAP are documented in a project-specific program directive.

Samples are submitted to the contract laboratory as specified in the “Standard Practice for Sample Submittal to Contract Analytical Laboratories” chapter. The laboratory coordinator or a designee selects the analytical service level (ASL) and turnaround time requirements when the submittal is defined in SMS.

All documentation associated with the submittal, including COC forms, Sample Submittal forms, Nonconformance Notifications (NCNs), communications with the laboratory, and the required deliverables are stored in the RIN subdirectory under the SMS directory on the network (//crow/SMS).

3.3.3 Monitoring Analytical Work Progress

The following events are recorded in SMS by the laboratory coordinator or a designee as they occur:

- Sample shipment
- Receipt of samples at the laboratory
- Receipt of deliverables from the laboratory
- Invoice receipt

The laboratory coordinator or a designee:

- Updates the RIN information in SMS upon receiving a copy of the COC form from the laboratory.
- Checks on the status of submitted samples, confirms expected data delivery dates, and resolves any technical issues concerning the handling or analysis of, or analytical data reporting for, the submitted samples, including issues regarding contract relief.
- Reviews and reconciles all analytical invoices received from contract laboratories.

3.3.4 Receipt of Deliverables from Contract Laboratories and Data Validation

The deliverables required from the contract laboratory generally include a hard-copy report that satisfies the requirements of the ASL specified, a PDF of the hard-copy report, and an EDD file. EDD files are e-mailed to an EDD delivery account and are accompanied by an EDD notification message. Upon receiving the deliverables, the laboratory coordinator or a designee:

- Notifies the site lead or project manager and the data management group, by e-mail, that the work has been completed.
- Verifies that the EDD meets specifications, using the EDD validation module in SMS.
- Verifies that the deliverables meet the specified ASL requirements.
- Validates the data in accordance with the “Standard Practice for Validation of Laboratory Samples” chapter, to a degree comparable with the ASL selected, and qualifies the data as necessary.
- Requests clarification or corrections from the laboratory if errors are detected.
- Issues NCNs when contract requirements are not satisfied.
- Prepares a data validation package, if required, or forwards the report to the designated person for data-validation-package preparation.

3.3.5 Request for Corrections

Questions concerning data entry errors, data calculation errors, lack of expected information, illegible documents, or other errors may require resolution with the laboratory. Errors may be detected:

- When sample information is being updated after sample receipt.
- When deliverables are received from the laboratory.
- During the EDD file-checking process.
- During data validation.

Requests for additional information, data entry corrections, EDD revision, etc., are communicated to the laboratory via e-mail. The nature of the request and the laboratory response is documented in the data validation package or can be saved in the RIN subdirectory under the SMS directory on the network. Errors that indicate noncompliance with contract requirements are documented in an NCN.

Nonconformance Reporting

The laboratory coordinator or a designee issues an NCN to document cases of noncompliance with contract requirements. The NCN states:

- The date it was issued.
- An explanation of the problem.
- A statement of the requirement.
- The source document that states the requirement.
- The corrective action required.
- The response-by date.
- The affected RINs and LICs.

NCNs and the associated laboratory responses are stored in the NCR subdirectory under the SMS directory.

3.3.6 Assessing Contract Laboratory Performance

Laboratory performance is assessed using the following elements:

- Annual DOE CAP audit reports and corrective action reports.
- MAPEP sample analysis results.
- NCN reports, corrective action reports, reoccurring NCNs.
- Data validation results.
- Percentage of on-time deliverables.

The following conditions may preclude continued use of a laboratory:

- Issuance of a Priority I finding during a DOE CAP audit.
- Issuance of a Priority II finding during a DOE CAP audit that may significantly impact data quality.
- Continued poor performance on MAPEP or other performance evaluation samples.
- Continued poor performance in meeting the analytical method performance criteria.
- Poor performance in meeting turnaround time requirements.

3.4 Documentation

3.4.1 Documents Prepared by the STR

The STR may prepare the following documents, as required:

- The SOW that clarifies the technical requirements.
- A list comprising the documents that will be requested of the prospective laboratories for use during proposal evaluation.
- An evaluation plan that details how the proposals will be evaluated and ranked.
- A list of prospective laboratories, prepared from the laboratories that have current ICPT agreements.
- A requisition with an estimated cost, charge codes, and appropriate manager approval.
- NCNs.
- Data validation packages. These documents are part of the project records and are forwarded to the Archive Information and Records Management group for inclusion in the project files.

Copies of these documents are kept in the SMS directory, and except as noted, the originals are retained as records by the Contracts Services group.

3.4.2 Other Documents

Other documents may include:

- Analytical invoices. These are kept as records by the Finance department.
- Hard-copy analytical reports. These are part of the project records and are forwarded to Archive Information and Records Management for inclusion in the project files.
- EDDs. These are not considered records. Copies are kept in the SMS RIN folders and in the Environmental Data Management folders on the LMS network.

3.5 References

49 CFR 171–179. U.S. Department of Transportation, *Code of Federal Regulations*, including HM230, 2006.

Attachment 1, *Basic Ordering Agreement, Statement of Work, Laboratory Analytical Services*, 2006, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

DOE (U.S. Department of Energy), 2007. *Quality Systems for Analytical Services*, Revision 2.3.

Environmental Procedures Catalog, LMS/POL/S04325, continually updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

    2.0 Standard Practice for Sample Submittal to Contract Analytical Laboratories

    4.0 Standard Practice for Field Documentation

    8.0 Standard Practice for Validation of Environmental Data

Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites, LMS/PLN/S04351, continually updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

4.0 Standard Practice for Field Documentation

4.1 Purpose and Scope

This procedure covers the general requirements for documenting activities related to field sampling and measurement. These records include sample logs, COC records, technical record books, and data collection forms. These records may be either in a hard copy or an electronic format. This practice covers photographs, videos, and other electronic media.

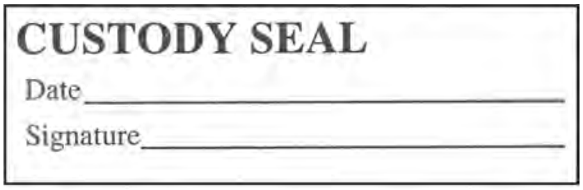
This practice also covers the general requirements for sample labeling and for creating a COC form.

4.2 Terminology

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, sample preservation, filtration status, and traceability.

Custody: To maintain a sample in sight, immediate possession, or locked under one's personal control. Custody may be individual, apply to all members of a sampling team, or apply to members of the same company.

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. An example is shown in Figure 1.



CUSTODY SEAL

Date____________________________

Signature____________________________

Figure 1. Custody Seal

Duplicate sample: More than one sample collected from the same source location but placed in separate containers.

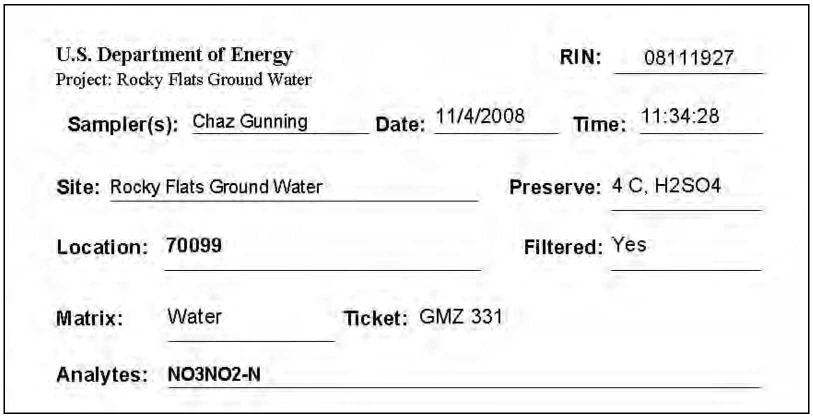
Field: Any place where the material for analyses or testing is collected.

Records (Quality Assurance): 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 include but are not limited to data sheets, logbooks, field notebooks, maps, drawings, photographs, and electronic data-recording media.

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

Sample (*vt.*): To select and collect a sample.

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 2.



U.S. Department of Energy
Project: Rocky Flats Ground Water

RIN: 08111927

Sampler(s): Chaz Gunning **Date:** 11/4/2008 **Time:** 11:34:28

Site: Rocky Flats Ground Water **Preserve:** 4 C, H2SO4

Location: 70099 **Filtered:** Yes

Matrix: Water **Ticket:** GMZ 331

Analytes: NO3NO2-N

Figure 2. Sample Label

Sample log: A document that lists all samples collected during a field visit or visits. A COC form or sample ticket book are examples of sample logs.

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 letters and three numerals.

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

Technical record books: For the purposes of this procedure, “technical record books” will refer to logbooks and field notebooks. These books are to be bound and the pages consecutively numbered.

Water Sampling Field Data: Form used to document routine groundwater and surface water sampling activities.

4.3 General Procedures for Records

All records, paper and electronic, shall be traceable to the program or site, the person generating the record, the date the record was generated, and the type of data or activity recorded. The term “record” in this procedure is used as a quality assurance term and does not imply management and storage requirements as a project record by Archive Information and Records Management.

4.3.1 Paper Records

Paper records must be clear, legible, and reproducible. For paper documentation, black or blue ink is preferred. Reproducible photocopies of penciled documents are acceptable as records.

Errors on paper records will be corrected by drawing a single line through the incorrect entry, making the correction, and initialing and dating the correction. The erroneous information must not be obliterated or erased.

4.3.2 Electronic Records

Electronic records must be in a format approved by the project manager. The required information on the project or site, the generator of the record, and the date may be conveyed through comments inserted into the media file or through the file titles and naming conventions of the directory where it is stored. For example, "\\crow\projects\LM\Work Dir\DoeJ\SAL(JRD)\SAL_2008_Images\SAL_Images_14-18Apr08\2008_04_14" would identify the site as Salmon, Mississippi, the owner of the image as John Doe, and the date the image was taken as April 14, 2008.

Errors in electronic media should be corrected when noticed during the field activities or data review and validation. If corrections are required while the data is being uploaded into SEEPro, or after the data have been uploaded, corrections shall be tracked using the SEEPro Issue Tracking database.

Errors in other electronic media (such as photographs) may be corrected at any time. If possible, a note should be inserted into the file, stating who made the correction, the data that was corrected, and the reason for the correction.

4.3.3 Sample Labeling

All samples collected by Contractor personnel shall have a sample label and a Contractor-generated sample number. Sample labels may be obtained by using the SMS or purchased from a vendor.

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

The sample label shall include the following information, at a minimum:

- Sample number.
- Date and time the sample was collected.
- Name or initials of the person who collected the sample.
- Analysis required for the portion of the sample in the container to which the label is attached.
- Location at which the sample was collected. Examples of sample locations include well numbers, grid locations, or surveyed coordinates.
- Whether the sample is filtered or unfiltered.

- Whether the sample was cooled.
- Any preservatives used.

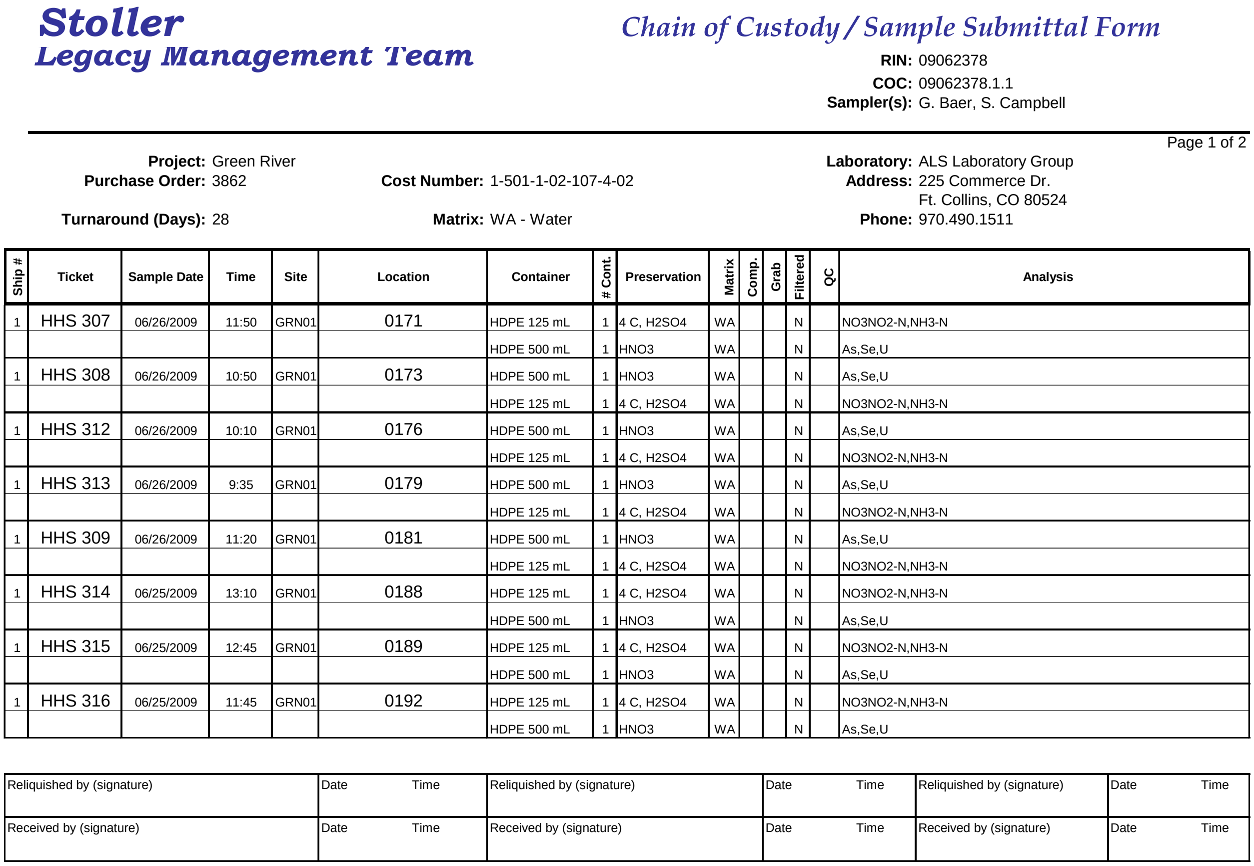
Additional information such as the project, sample matrix, or comments may also be included on the label.

The sampler shall maintain a record of sample numbers and other pertinent information on a sample log.

If multiple sample fractions are taken at the same location or if split samples are made in the field, the sample number shall be identical for each sample in the entire group of fractions or splits. The exception is quality control duplicates, which shall be given a fictitious sample number. The fictitious sample number will be tracked through the Contractor copy of the sample log.

4.3.4 Chain of Custody

An example of a COC form is shown in Figure 3. A COC form may be generated by the sample management office (SMO) or purchased from a vendor.



Stoller
Legacy Management Team

Chain of Custody / Sample Submittal Form

RIN: 09062378
COC: 09062378.1.1
Sampler(s): G. Baer, S. Campbell

Page 1 of 2

Project: Green River
Purchase Order: 3862
Cost Number: 1-501-1-02-107-4-02
Turnaround (Days): 28
Matrix: WA - Water

Laboratory: ALS Laboratory Group
Address: 225 Commerce Dr.
Ft. Collins, CO 80524
Phone: 970.490.1511

Ship #	Ticket	Sample Date	Time	Site	Location	Container	# Cont.	Preservation	Matrix	Comp.	Grab	Filtered	QC	Analysis
1	HHS 307	06/26/2009	11:50	GRN01	0171	HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
						HDPE 500 mL	1	HNO3	WA			N		As,Se,U
1	HHS 308	06/26/2009	10:50	GRN01	0173	HDPE 500 mL	1	HNO3	WA			N		As,Se,U
						HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
1	HHS 312	06/26/2009	10:10	GRN01	0176	HDPE 500 mL	1	HNO3	WA			N		As,Se,U
						HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
1	HHS 313	06/26/2009	9:35	GRN01	0179	HDPE 500 mL	1	HNO3	WA			N		As,Se,U
						HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
1	HHS 309	06/26/2009	11:20	GRN01	0181	HDPE 500 mL	1	HNO3	WA			N		As,Se,U
						HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
1	HHS 314	06/25/2009	13:10	GRN01	0188	HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
						HDPE 500 mL	1	HNO3	WA			N		As,Se,U
1	HHS 315	06/25/2009	12:45	GRN01	0189	HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
						HDPE 500 mL	1	HNO3	WA			N		As,Se,U
1	HHS 316	06/25/2009	11:45	GRN01	0192	HDPE 125 mL	1	4 C, H2SO4	WA			N		NO3NO2-N,NH3-N
						HDPE 500 mL	1	HNO3	WA			N		As,Se,U

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

Figure 3. COC Form

The purpose of the custody records is to demonstrate that custody of the samples was maintained. It provides documentation of the control and transfer of samples. Custody documentation is not required when samples are transferred between members of the sampling team or other Contractor employees such as personnel shipping the samples.

When the samples are physically transferred from Contractor personnel to a commercial carrier, the Contractor shall sign the “Relinquisher” blocks on the COC form, with the date and time of sample transfer. The relinquisher, by signing, verifies that sample custody has been maintained, and samples have been physically secure. The relinquisher retains a copy of the form. Noncontractor employees (e.g., employees of commercial carriers) are not required to sign the form; the subcontracted laboratory shall sign the “Received” block on the COC form with the data and time the samples were received.

The samplers shall attach custody tags or seals to the container openings when the container is not in sight or is not otherwise under their control—for example, when samples are stored in a hotel room or shipped by a commercial carrier.

The original COC form shall accompany the samples until they are received by the laboratory.

The COC form should contain the following information:

- Ticket number
- Data and time sample was collected
- Site
- Location where sample was collected
- Type and number of containers
- Preservative used on the sample
- Sample matrix
- Type of sample (composite or grab)
- Whether the sample was filtered or unfiltered
- Analyses requested
- Optional information (e.g., whether the sample is for laboratory quality control)

4.3.5 Water Sampling Field Data

The Water Sampling Field Data form is used to document routine water sampling activities. The form may be generated and completed electronically (Figure 4) using the FDCS.

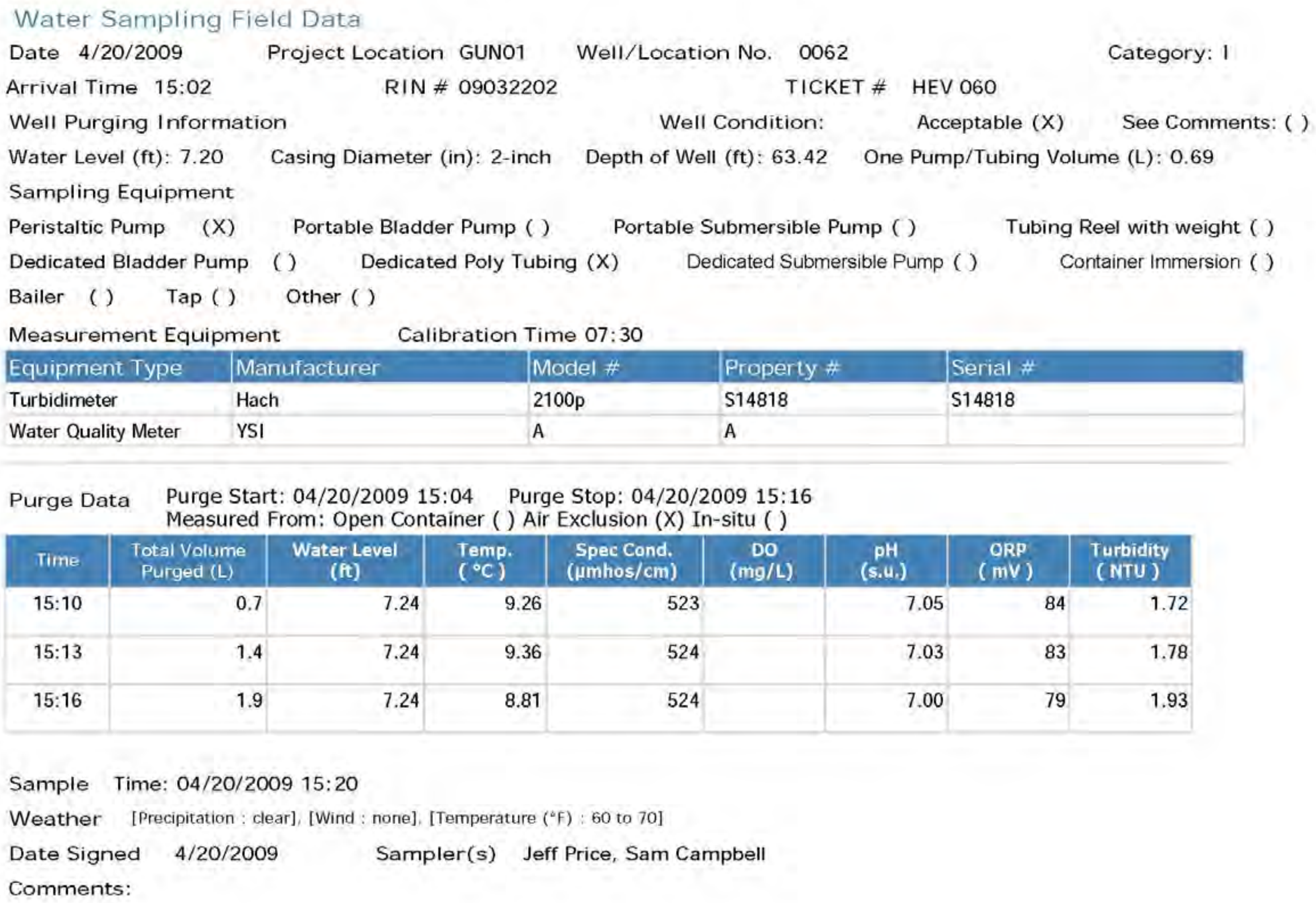
4.4 Documentation

Not all the documents produced using this procedure are considered project records. Some documents, such as sample labels, are no longer required once the sample analyses are completed. All documents must be protected against damage, deterioration, and loss until they are no longer required, or until they are properly transferred to Archive Information and Records Management as project records.

For short-term tasks, the work plan will define the project records for each task conducted and the management of the records. The following are suggested records of a short-term task:

- Operational check data
- Data sheets
- Technical record books
- Official correspondence
- Planning documents
- Electronically stored data

For established programs, a Working Records File Index defines what records will be generated, how long they will be retained, and how they will be disposed of.



Water Sampling Field Data

Date 4/20/2009 Project Location GUN01 Well/Location No. 0062 Category: I

Arrival Time 15:02 RIN # 09032202 TICKET # HEV 060

Well Purging Information Well Condition: Acceptable (X) See Comments: ( )

Water Level (ft): 7.20 Casing Diameter (in): 2-inch Depth of Well (ft): 63.42 One Pump/Tubing Volume (L): 0.69

Sampling Equipment

Peristaltic Pump (X) Portable Bladder Pump ( ) Portable Submersible Pump ( ) Tubing Reel with weight ( )

Dedicated Bladder Pump ( ) Dedicated Poly Tubing (X) Dedicated Submersible Pump ( ) Container Immersion ( )

Bailer ( ) Tap ( ) Other ( )

Measurement Equipment Calibration Time 07:30

Equipment Type	Manufacturer	Model #	Property #	Serial #
Turbidimeter	Hach	2100p	S14818	S14818
Water Quality Meter	YSI	A	A	

Purge Data Purge Start: 04/20/2009 15:04 Purge Stop: 04/20/2009 15:16
Measured From: Open Container ( ) Air Exclusion (X) In-situ ( )

Time	Total Volume Purged (L)	Water Level (ft)	Temp. (°C)	Spec Cond. (µmhos/cm)	DO (mg/L)	pH (s.u.)	ORP (mV)	Turbidity (NTU)
15:10	0.7	7.24	9.26	523		7.05	84	1.72
15:13	1.4	7.24	9.36	524		7.03	83	1.78
15:16	1.9	7.24	8.81	524		7.00	79	1.93

Sample Time: 04/20/2009 15:20

Weather [Precipitation : clear], [Wind : none], [Temperature (°F) : 60 to 70]

Date Signed 4/20/2009 Sampler(s) Jeff Price, Sam Campbell

Comments:

Figure 4. Water Sampling Field Data Form Example

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7.0 Technical Comments on ASTM D 5088-02 (Reapproved 2008)—Standard Practice for Decontamination of Field Equipment Used at 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 groundwater at 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 sample and analysis plans, safety plans, or project quality assurance plans.

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

4. Summary of Practice

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

4.2—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

7.2.3—When samples will undergo inorganic analyses, the use of an inorganic desorbing agent may not be required if the quality assurance/quality control program documents that the decontamination protocol is sufficient for the sampling methods being used.

8. Quality Assurance/Quality Control

8.1.3—The frequency for the minimum number of samples to demonstrate completeness of decontamination for quality assurance/quality control purposes may be either increased or decreased on a site-specific basis based on an evaluation of quality assurance/quality control samples and project-specific objectives.

9. Report

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

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8.0 Standard Practice for Validation of Environmental Data

8.1 Introduction

Validation of environmental data is performed to determine if data meet the specific technical and quality criteria established in the applicable quality system documents, and to establish the usability and extent of bias of any data not meeting those criteria. Validation can include evaluation of all activities that impact data quality. This procedure includes guidelines for evaluating sample collection and field measurement activities against the requirements found in the SAP, and for evaluating laboratory analyses against the requirements found in the reference analytical procedures, the Statement of Work and *Quality Systems for Analytical Services* (QSAS) when applicable. These guidelines provide consistency in data qualification; however, they are not intended to eliminate the need for professional judgment in evaluating the data quality. On the basis of experience and familiarity with the analytical techniques, historical data, or sample matrices, the data validator may be more or less stringent in evaluating the results. To make judgments at this level requires a complete understanding of the intended use of the data. When variations in the application of data qualifiers are warranted, the justification and rationale are explained in the validation report.

Data are validated at one of the three levels described in Section 8.3, and a graded approach is applied when determining the appropriate level. Factors influencing the selection of a validation level include the data quality objectives of the relevant project, the potential impact of the data on the decision making process, and the level of defensibility needed. Data from routine monitoring events that occur frequently where analyte concentrations and laboratory performance are well characterized can generally be validated at level 2.

The laboratory portions of this procedure are organized by the analytical techniques used, and follow the format of the EPA documents *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, *USEPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review*, and *USEPA Evaluation of Radiochemical Data Usability*. Any redundancy between sections is intentional for the sake of completeness and accuracy.

8.2 Scope

This procedure specifically covers the validation of sample collection, field measurements, and laboratory analyses, as applicable, related to environmental monitoring sampling events. Data associated with process control and research activities generally do not require validation. While this procedure is to be used as an aid in the formal data validation process, other sources of guidance and information, as well as professional judgment, should also be used to determine the ultimate usability of data, especially in those cases where all data do not meet specific technical criteria.

8.3 Data Validation Review Level

All environmental monitoring data are subject to validation, and may include an evaluation of sampling activities and field measurements. When applicable, the following elements associated with field activities are evaluated:

- Completeness, all data were collected as planned
- Calibration and operational checks of field instruments
- Compliance with sampling protocols
- Field quality control sample results

Laboratory data resulting from environmental monitoring sampling events are validated at one of the following levels:

- Level 1, Data Deliverables Examination
- Level 2, Data Deliverables Verification
- Level 3, Data Validation

8.3.1 Data Deliverables Examination, Level 1

Data deliverables examination is the minimum data validation level and is performed on all data packages received from contract laboratories. The purpose of the examination is to assess the completeness of the deliverables, identify any reporting errors, and assess the usability of the data based on the laboratory's evaluation of their data as described in the case narrative received with the data. The following are reviewed at this level:

- Chain of Custody (COC) form and receipt documentation
- Case narrative
- Completeness of the analytical data
- Compliance with holding times

This validation level is applied when limited documentation is received from the laboratory.

8.3.2 Data Deliverables Verification, Level 2

Data deliverables verification consists of an evaluation of the data package report forms to determine the extent to which the laboratory met the method and contract-specific quality control and reporting requirements. In addition to the elements listed for Level 1, the following are reviewed at this level:

- Surrogate recoveries (organics)
- Internal standards recoveries
- Chemical recoveries (radiochemistry)
- Laboratory blank data
- Matrix spike performance

- Laboratory control sample (LCS) performance
- Duplicate sample performance
- Assessment of potential outliers

This validation level is applied when the documentation received from the laboratory includes the appropriate quality control reporting forms.

8.3.3 Data Validation, Level 3

Data validation consists of determining the data quality and the extent to which the laboratory accurately and completely reported all sample and quality control results, and satisfied all contract requirements. Data validation will be completed in accordance with all of the steps identified in Section 8.4. In addition to the elements listed for Level 2, the following are reviewed at this level:

- Initial calibration
- Continuing calibration
- Target compound identification

This validation level is applied to data where complete documentation is received from the laboratory and complete validation is required.

8.4 Sample Management System

The Sample Management System (SMS) application is used to define sample events in terms of sample locations and analytes; track the dates of sample shipment, sample receipt, deliverables receipt, and validation; track the associated analytical costs; validate and report the resulting analytical data. The following SMS modules are used to support data validation. Reports from these modules are generally included in data validation reports to document the validation.

8.4.1 Field Data Module

The Field Data module is used to review field data that have been collected using the Field Data Collection System (FDCS). Sample collection details and field measurements can be reviewed. Groundwater monitoring well purge data are automatically compared to the applicable acceptance criteria. Field instrument calibration data can also be reviewed.

8.4.2 Check SEDD File

The Staged Electronic Data Deliverable (SEDD) files received from contract laboratories containing the sample and quality control results are reviewed using this module. The SEDD file can be checked for errors and compliance with the LM SEDD specification. The checks performed are:

a. Required fields missing data

b. Incorrect sample matrix

c. Incorrect Requisition Index Number (RIN)

d. Invalid dates
e. Incorrect lab code
f. Incorrect Line Item codes (LICs)
g. Duplicate ticket numbers
h. Incorrect site code, location code, ticket number
i. Incorrect sample filtration status
j. Incorrect sample composite status
k. Incorrect, missing, or extra analytes
l. Missing samples
m. Incorrect units
n. Invalid laboratory qualifiers

8.4.3 General Validation Worksheet

The general validation worksheet is used to document number of samples, analytes, sample matrix, chain of custody, and sample integrity during the data validation process. This module uses the SEDD file as input. Holding times and detection limits are automatically compared to requirements and exceptions are listed on the worksheet.

This worksheet is also used to identify and review data for field duplicates, equipment blanks, and trip blanks. When applicable, this review should be performed early in the validation process to identify data that merit additional review.

8.4.4 Metals, Wet Chemistry, Organics, and Radiochemistry Worksheets

These worksheets are used to record and store quality control parameters for metals, inorganic, organic, and radiochemical methods. These worksheets can be populated from the SEDD file.

8.4.5 Potential Outliers Report

An Outliers Report can be generated whenever there is sufficient historical data to do so. This report lists data that are outside the historical range and identifies data that may be statistical outliers (see Section 8.7.2.4 for details). Errors can be identified that otherwise would have gone undetected.

8.4.6 Anion/Cation Balance Worksheet

The anion/cation balance is used to determine if major ion concentrations have been quantified correctly. The total anions should balance with (be equal to) the total cations when expressed in milliequivalents per liter. A relative percent difference (RPD) of 10 percent or less is used as the acceptance criteria. The cation/anion worksheet is used to calculate and display the cation/anion balance for the samples in a RIN. The sample data from the environmental database are used to perform the calculation.

8.4.7 Database Load Validation

The Load Validation module can be used to review and validate the data after it has been loaded into the environmental database. This is a final check to verify that the data loaded are complete and correct.

8.5 Validation of Field Activities

The validation guidance in this section applies to the sampling activities and field data associated with the collection of groundwaters and surface waters.

8.5.1 Field Measurements

Field instruments must be calibrated monthly or prior to starting a sampling event for those sites sampled infrequently. Additionally, operational checks are required daily during the sampling event and at completion of the sampling event. Calibration and operational check requirements for field instruments are documented in the SAP. Field instrument calibration data are typically only reviewed when FDCS is used to capture the calibration data.

Evaluation	Action
If field instrument calibration or operational checks were not performed as specified in the SAP.	Qualify field measurement results collected after the most recent successful operational check as “J.”
If calibration or operational check data do not meet the acceptance criteria specified is the SAP.	Qualify the associated field measurement results as “J.”
If there is evidence of instrument failure from operational checks or field notes.	Use professional judgment, and, if appropriate, qualify the associated field measurements made after the last acceptable calibration or operational check as “R.”

8.5.2 Groundwater Sample Collection

Wells used for groundwater sampling are classified according to their hydraulic properties or intended use. Groundwater sampling requirements are based on that classification and site-specific requirements, and are included in the SAP as Program Directives. Typically, those requirements include well purging criteria that must be met prior to sample collection. When available, well purge data are reviewed to determine compliance with the applicable requirements.

Evaluation	Action
If the minimum volume was not purged before sample collection.	Use professional judgment, and, if appropriate, qualify the affected results as “J” or “R.”
If the sampled well is classified as Category I and all purge criteria are met.	Qualify all associated data as “F.”
If the sampled well is classified as Category I and *turbidity* criteria was not met, but the sample was filtered as required in the SAP, and all other purge criteria are met.	Qualify all associated data as “F.” Additional qualification is not required.
If the sampled well is classified as Category I and one of the purging monitoring parameters did not meet criteria.	Qualify the associated results as “F” or, if the impact on data quality is judged to be significant, “FJ.”
If the sampled well is classified as Category I and two or more of the purging monitoring parameters did not meet criteria.	Qualify the associated results as “FJ.”
If the sampled well is classified as Category II or Category III.	Qualify all associated data as “FQ.”
If the sampled well is classified as Category II and the minimum volume was not purged prior to sample collection.	Qualify the associated results as “FQ” or, if the impact on data quality is judged to be significant, “FQJ.”
If the sampled well is classified as Category II and a volume *much greater than* the minimum volume was purged prior to sample collection.	Qualify the associated results as “FQ” or, if the impact on data quality is judged to be significant, “FQJ.”
If the pH in the well is greater than 9.	If grout contamination is suspected, qualify all associated data as “G.”
If the turbidity was greater than 10 nephelometric turbidity units, but the sample was not filtered as required.	Use professional judgment, and, if appropriate, qualify the affected results as “J” or “R.”
If the sample volumes were filtered but the alkalinity was measured on an unfiltered aliquot.	Usually, additional qualification (as “J”) is not necessary; use professional judgment.

8.5.3 Surface Water Sample Collection

Surface water samples include samples collected from any natural or manmade 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 samples must be filtered when the turbidity exceeds 10 nephelometric turbidity units (NTUs) as specified in the SAP. If required, site-specific filtration criteria are specified in a Program Directive.

Evaluation	Action
If the turbidity was greater than 10 NTUs, but the sample was not filtered as required in the SAP.	Use professional judgment, and, if appropriate, qualify the affected laboratory results as “J” or “R.”

8.5.4 Sampling Quality Control

Quality control (QC) samples associated with sampling activities include field duplicates, equipment blanks, and trip blanks. QC samples are submitted to the laboratory under a fictitious identifier.

8.5.4.1 Field Duplicates

Duplicate water samples are generally collected on a frequency of one duplicate sample per 20 or fewer water samples. Field duplicate sample results for non-radiochemical analytes are assessed using the following criteria. A control limit of ± 20 percent RPD is used for sample results that are greater than 5 times the practical quantitation limit (PQL). For sample results less than 5 times the PQL, the control limit is ± the PQL.

The relative error ratio (RER) calculated using the 1-sigma total propagated uncertainty (TPU) is used to assess duplicate precision for radiochemical results. Radiochemical duplicate results are acceptable if the RER is less than 3.

Evaluation	Action
If an analyte result of the field duplicate sample does not meet the acceptance criteria.	Qualify the sample and duplicate results for that analyte as “J.”

8.5.4.2 Equipment Blanks

Equipment blanks provide a check for cross-contamination of samples from ineffective equipment decontamination. One equipment blank sample is generally prepared in the field for every 20 or fewer water samples that are collected with non-dedicated equipment. Sample results collected using the same non-dedicated equipment associated with an equipment blank may be qualified based on the equipment blank results.

Equipment blanks are assumed to be contaminant free; therefore, results should be below the method detection limit. When an analyte is detected in an equipment blank, associated sample results (except for major anions and cations) that are less than five times the blank concentration are qualified with a “J” flag as estimated values. Sample results for major anions and cations (chloride, sulfate, calcium, sodium, magnesium, and potassium) that are less than 10 times the blank concentration are qualified with a “J” flag as estimated values.

Evaluation	Action
If an analyte (except a major anion or cation) is detected in an equipment blank.	Qualify the associated sample results for the analyte that are less than 5 times the blank concentration as “J.”
If a major anion or cation is detected in an equipment blank.	Qualify the associated sample results for the analyte that are less than 10 times the blank concentration as “J.”

8.5.4.3 Trip Blanks

Trip blank samples are prepared prior to the sampling trip when collection of water samples for volatile organic compound (VOC) analyses is required.

Trip blanks are assumed to be contaminant free; therefore, trip blank analyte results should be below the relevant method detection limit. When an analyte is detected in a trip blank, associated sample results (except for common laboratory contaminants) that are less than five times the blank concentration are qualified with a “U” flag as not detected. Sample results for common laboratory contaminants (acetone, 2-butanone, methylene chloride, and toluene) that are less than ten times the blank concentration are qualified with a “U” flag as not detected.

Evaluation	Action
If an analyte (except a common laboratory contaminant) is detected in a trip blank.	Qualify the associated sample results for the analyte that are less than 5 times the blank concentration as “U.”
If a common laboratory contaminant is detected in a trip blank.	Qualify the associated sample results for the analyte that are less than 10 times the blank concentration as “U.”

8.6 Validation of Laboratory Data

8.6.1 General

8.6.1.1 .1.1 Data Package Narrative

Criteria: The laboratory shall include a data package narrative that specifically addresses the analyses performed and any technical difficulties encountered.

Evaluation	Action
Verify that the data package narrative includes the following, as applicable: • References to the procedures or methods used for sample preparation and analysis. • Descriptions of technical difficulties encountered during sample analysis. • Justification for sample dilution. • Explanations of quality control deficiencies, missed holding times, or inability to achieve the required detection limits. • Explanations for any re-analyses performed. • Explanations and descriptions of deviations from the cited procedures.	Review the data package narrative. Discuss discrepancies in the data validation report. Request clarification or additional information from the laboratory as necessary.

8.6.1.2 Chain of Custody

Criteria: The laboratory shall include a login form that specifically addresses the receipt of samples and any discrepancies or anomalies associated with a sample shipment. The following should be documented on the login form:

- Condition of the shipping container
- Presence or absence and condition of custody seals on the shipping container
- Air bill or air bill sticker numbers
- Presence or absence of COC forms
- Agreement or non-agreement of information on the COC form and on the sample containers
- Temperature in the shipping container
- pH of the samples, when appropriate
- Problems or discrepancies

8.6.1.3 Holding Times

Samples must be extracted and analyzed within method specific holding times for results to be acceptable without qualification. Analytical data generated outside of the specified holding time criteria must be qualified. Holding times must be evaluated to ascertain the validity of results.

Solid matrix samples submitted for the determination of non-organic analytes are generally exempt from qualification for exceeded holding times. The reviewer should evaluate the stability of the analyte in the sample matrix and half-life, if applicable, and qualify based on professional judgment.

Criteria: All samples will be extracted and analyzed within the holding times specified in the cited analytical methods.

8.6.1.4 Preservation (Chemical and Temperature)

Samples must be preserved as specified in the cited methods for results to be acceptable without qualification. Analytical data generated from incorrectly preserved samples must be qualified. The validation report shall include a discussion of any preservation discrepancies and resulting qualifications.

Criteria: All samples shall be preserved and shipped under conditions specified in the cited analytical methods.

Samples that were received without the required chemical preservation but were preserved by the laboratory after receipt do not require qualification if the samples were allowed to equilibrate at least 16 hours before sample analysis.

Evaluation	Action
For samples that are received outside the temperature criteria,	Use professional judgment, and, if appropriate, qualify detects as “J” and non-detects as “J” or “R” (see below).
Many organic compounds and most metals and radioisotopes are not affected by temperature variations up to ambient temperature and are generally not qualified. Volatile organics (VOCs) and mercury are subject to analyte loss at elevated temperatures. If temperature violations occur,	Use professional judgment, and, if appropriate, qualify detects and non-detects for VOCs and mercury as “J”; qualify non-detects for VOCs as “R” if extreme temperature violations occur.
If the samples were not allowed to equilibrate after laboratory preservation or if documentation does not show the samples were allowed to equilibrate,	Qualify all detects and non-detects as “J.”
For samples that were received without the required preservation and that were not preserved by the laboratory after receipt,	Qualify all detects as “J” and non-detects as “R.”

8.6.1.5 Precedence of Blanks

The general precedence for application of qualifiers due to blank contamination is:

(1) Instrument blank

(2) Preparation blank or method blank

As a general guideline, if the instrument blank is contaminated, then field samples and method blanks that are analyzed in the same analytical run would be qualified. If the preparation blank is contaminated, all samples prepared with that blank are qualified, even if the samples are analyzed in different runs. Professional judgment must be employed by the validator to determine the effect of multiple blank contaminations upon the quality of field sample data.

8.6.1.6 Completeness

Criteria: Results must be reported correctly for all analytes requested. Appropriate contract-required laboratory qualifiers must be used. Appropriate target analyte lists must be used, and the required detection limits specified must be met or, if not, an explanation provided in the laboratory case narrative.

Evaluation	Action
If a result is not reported for each analyte on the target analyte list, and if the analysis was completed,	Request an amended report from the laboratory.
If the analysis was not completed and can be completed within holding time,	Request analysis and an amended report from the laboratory.
If the analysis was not completed and the holding time has expired,	Contact the laboratory coordinator for further instructions.
If results are reported in incorrect units, or if appropriate laboratory qualifiers have not been applied,	Request an amended report from the laboratory.
If required method detection limits have not been met and an explanation is not included in the case narrative,	Contact the laboratory coordinator for further instructions.

Criteria: All radiochemistry results must include the TPU calculated at 2-sigma. Reporting at 2-sigma must be clearly defined.

Evaluation	Action
If criteria are not met,	Request an amended report from the laboratory.

Criteria: The laboratory shall report the method detection limit (MDL) or, for radiochemistry, the minimum detectable concentration (MDC) associated with each analyte. The PQL is five times the MDL.

Evaluation	Action
If the MDLs and MDCs are not reported,	Request additional information from the laboratory.
Organic sample results that are ≤PQL or below the calibration standard and >MDL,	Shall be qualified “J” by the laboratory.
Inorganic sample results that are ≤PQL and >MDL,	Shall be qualified “B” by the laboratory.
Sample results that are <MDL,	Shall be qualified “U” by the laboratory.
Sample results that are <MDC,	Shall be qualified “U” by the laboratory.
If the laboratory did not apply the proper qualifiers,	Request an amended report from the laboratory.

Criteria: Supporting documentation must include the following, as appropriate, for the ASL specified:

Required Data: Gas Chromatography (GC)/Mass Spectrometry (MS)

- Case narrative
- Instrument tuning data
- Initial calibration data
- Initial calibration blank data
- Continuing calibration check data
- Instrument and preparation blank data
- Surrogate data

- Internal standard performance data
- Matrix spike/matrix spike duplicate data
- LCS data
- Sample results and analytical data for the requested target analyte list, including results from dilutions, if analyzed
- Identification and data for any sample tentatively identified compounds
- Instrument run logs
- COC form and shipping documents
- Login worksheet
- Laboratory replicate sample data, if analyzed

Required Data: GC and High-Performance Liquid Chromatography (HPLC)

- Case narrative
- Initial calibration data, including secondary column, if appropriate
- Initial calibration blank data
- Continuing calibration verification data
- Instrument and method blank data
- Surrogate data
- Matrix spike/matrix spike duplicate data
- LCS data
- Sample results and analytical data for the analytes on the target analyte list, including data from dilutions, if analyzed
- Confirmation data and relative percent difference between the results
- Instrument run logs
- COC form and shipping documents
- Login worksheet
- Laboratory replicate sample data, if analyzed

Required Data: Liquid Chromatography (LC)/Mass Spectrometry (MS)/Mass Spectrometry (MS)

- Case narrative
- Initial calibration data
- Initial calibration blank data
- Continuing calibration check data
- Instrument and preparation blank data
- Surrogate data

- Internal standard performance data
- Matrix spike/matrix spike duplicate data
- LCS data
- Sample results and analytical data for the requested target analyte list, including results from dilutions, if analyzed
- Instrument run logs
- COC form and shipping documents
- Login worksheet
- Laboratory replicate sample data, if analyzed

Required Data: Inorganic

- Case narrative
- Initial calibration data
- Initial calibration blank data
- Continuing calibration verification data
- Continuing calibration blank data
- Instrument and method blank data
- Matrix spike data
- LCS data
- Laboratory replicate sample data
- Inductively coupled plasma (ICP) interference check sample data
- ICP serial dilution data
- PQL verification (CRI)
- Sample results and analytical data, including data from dilutions, if analyzed
- Instrument run logs
- COC form and shipping documents
- Login worksheet

Required Data: Radiochemistry

- Case narrative
- Instrument and preparation blank data
- Matrix spike data
- LCS data
- Laboratory replicate data
- Sample results

- Carrier or chemical tracer data
- Instrument run logs
- COC form and shipping documents
- Login worksheet

Action: If all required data are not present, contact the laboratory to request an amended report.

8.6.1.7 Special Laboratory Flags

“X” Flags

Criteria: The analyst may have reason to believe that the result for a specific analysis has a high probability of being a false positive due to interferences. In this case, the laboratory shall qualify the result as “X” and narrate the justification for the flag. Generally, the “X” flag can be used only in conjunction with additional data such as spectral matching or results from another analytical technique. The validator should review the raw data and narrative to determine if he or she agrees with the identification of a false positive.

Evaluation	Action
When evaluating the “X” qualifier, the validator should attempt to determine if the interference is the most significant source of the instrument response (i.e., is the result primarily a false positive, or is it a result with a very high bias?). If the interference masks the target response significantly, use of the data is not recommended.	Qualify detects determined to be primarily false positives as “R.” Qualify detects determined to have very high bias as “J.” Include a thorough discussion supporting the qualification.

8.6.1.8 Analytical Methods

The laboratory shall follow the requirements specified in the analytical methods and those specified in the applicable Statement of Work, the QSAS, and any project-specific requirements document. When these requirements are not met, reanalysis is required. In those cases where reanalysis cannot occur, the failure to reanalyze will be discussed in the case narrative. This discussion should also be included in the data validation report.

8.6.1.9 Calculations

Criteria: Laboratories use commercial software whenever possible. Spreadsheets and laboratory-developed software are required to be verified and uniquely identified and shall include a revision number (under version control). Re-verification of commercial software and other software is not routinely required. Hand-calculated data or data calculated from a spreadsheet or other software not under version control must be verified by the random recalculation of some of the results. Hand-calculated results and spreadsheets should have all required formulas and data included in the package.

Evaluation	Action
When results cannot be regenerated using reported data,	A formal corrective action by the laboratory is required.
When results are verified by recalculation using reported data,	Discussion of the verification will be included in the validation summary.

8.6.1.10 Electronic Data Deliverables

Criteria: Electronic data deliverables (EDDs) shall be delivered in the specified format, be complete and correct, and accurately reflect the contents of the analytical report.

EDDs received can be reviewed and validated using the module available in SMS.

Evaluation	Action
If the EDD is incomplete or in an incorrect format,	Request a revised EDD from the laboratory.
If the data in the EDD does not match the values in the analytical report,	Require a formal corrective action by the laboratory.

8.6.1.11 Quality Control Exemptions

Various filter materials may be submitted for analysis. Matrix spike and replicate sample analysis requirements only apply to filter materials when representative media are provided to the laboratory. All other quality control criteria shall apply to the analysis of filters.

The requirements for reanalysis for quality control failures are waived when insufficient sample remains. A detailed discussion of that condition shall be included in the laboratory case narrative when it occurs.

Acidity, alkalinity, biological oxygen demand, color, corrosivity, dissolved oxygen, gravimetric oil and grease, hardness, ignitability, pH, titrimetric sulfide, conductivity, all of the solids methods, and turbidity analyses are generally exempt from the general inorganic quality control requirements.

Criteria: These analyses shall be controlled according to the method quality control or the laboratory’s quality control policies. In general, one or more of the following should be included:

- Blank: result <5× the MDL.
- LCS: measured value within ±20 percent of known value.
- Duplicate: relative percent difference <25 percent.
- Independent calibration check standard: result within ±10 percent of true value.

Evaluation	Action
Any and all quality control data reported by the laboratory shall be evaluated according to the above guidelines.	Sample results associated with reported quality control data that do not meet the acceptance criteria shall be qualified according to the appropriate requirements in Section 4.2. Lack of quality control data is not in itself sufficient reason to qualify sample results. Quality control exemptions shall be discussed in the validation report.

8.6.2 Procedure for Gas Chromatograph/Mass Spectrometer (GC/MS) Validation

The requirements addressed in this section are applicable to all GC/MS analytical techniques.

8.6.2.1 Instrument Tuning for GC/MS

Tuning and performance criteria are established to ensure mass resolution, identification, and, to some degree, sensitivity. These criteria are not sample-specific. Conformance is determined using standard materials. Therefore, these criteria should be met in all circumstances.

Criteria: The GC/MS tune shall be checked every 12 hours during analyses. The relative abundance criteria listed in the appropriate method must be met.

Evaluation	Action
If tunes are not run daily, or if all abundance criteria are not met,	Contact the laboratory for immediate corrective action.
When it is being determined which data should be used,	Use professional judgment, and, if appropriate, qualify detects as “J.”
If multiple quality control failures also occurred,	Qualify all results as “R.”

8.6.2.2 Calibration

Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for compounds on the target analyte list. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run, and of producing an acceptable calibration curve. In the absence of, or in addition to, method-specific calibration acceptance criteria, the following general calibration acceptance criteria should be applied.

Note 1

The laboratory may establish a calibration curve using linear regression, quadratic regression, or the average response factor approach. Calibration is assessed on an analyte-by-analyte basis.

Note 2

If any quality control samples are analyzed using an initial calibration that is different from that of the field samples, the laboratory must include a calibration report for the calibration affecting the quality control samples. This calibration data shall only be used to evaluate the quality control samples, and only if the quality control samples fail to meet recovery or relative percent difference acceptance criteria.

Criteria: GC/MS instrument calibration shall be performed using a minimum of five calibration standards unless the method specifies otherwise. If calibration curves are used, five standards are required for a linear (first-order) calibration model, a quadratic (second-order) model requires six standards, and a third-order polynomial requires seven standards. Higher-order curves should not be used. If the laboratory uses a higher-order equation to establish a calibration curve, it should be evaluated for appropriate application.

Evaluation	Action
If an insufficient number of calibration standards were used,	Qualify detects as “J.”

Response Factors

Criteria: Response factors are a measure of the slope of the calibration relationship that assumes that the curve passes through the origin. Under ideal conditions, the factors will not vary with the concentration of the standard. In practice, some variation is to be expected. When the variation measured as the relative standard deviation (RSD) is less than or equal to 15 percent, the use of the linear model is appropriate, and the calibration curve can be assumed to be linear and to pass through the origin. This criterion is derived from EPA's SW-846 GC/MS methods 8260 and 8270.

As a general rule, the amount of internal standard should produce an instrument response (e.g., area counts) that is no more than 100 times that produced by the lowest concentration of the least responsive target analyte associated with the internal standard. This should result in a minimum response factor of no less than 0.01 for the least responsive target compound.

The percent RSD for the response factors obtained from the five initial calibration standards must be ≤15 percent and the average response factor shall be greater than the method-specified minimum response factor for each compound. The minimum response factor for compounds without specified minimum response factor values will be >0.01.

Evaluation	Action
If any volatile or semivolatile target compound has an average response factor less than the specified minimum response factor or <0.05,	Qualify detects for that compound as "J." Qualify non-detects for that compound as "R" if the response factor is <0.01.
If any volatile or semivolatile target analyte list compound has a %RSD:	
>15%,	Qualify detects for that compound as "J."
>15% but ≤40%,	Qualify non-detects for that compound as "J" if any other calibration criteria have been exceeded for that compound.
>40% but ≤60%,	Qualify non-detects for that compound as "J."
>60%,	Qualify non-detects for that compound as "R."

Linear Curves

Criteria: The correlation coefficient (r^2) of the initial calibration curve shall be ≥0.99 and have a slope equal to or greater than the method-specified minimum response factor for each compound. Compounds without specified minimum response factors will have a slope ≥0.01. The absolute value of the intercept shall be ≤3 times the MDL.

Evaluation	Action
If any volatile or semivolatile target analyte list compound curve has a slope less than the minimum response factor or <0.05,	Qualify detects for that compound as “J.” Qualify non-detects for that compound as “R” if the slope is <0.01.
If any volatile or semivolatile target analyte list compound has an r^2:	
<0.99,	Qualify detects for that compound as “J.”
<0.99 but ≥0.90,	Qualify non-detects as “J” if any other calibration criteria have been exceeded for that compound.
<0.90 but ≥0.80,	Qualify non-detects for that compound as “J.”
<0.80,	Qualify non-detects for that compound as “R.”
If any volatile or semivolatile target analyte list compound has an intercept with an absolute value >3 times the MDL, and:	
If the intercept is negative,	Qualify non-detects for that compound as “R”’; qualify detects <3 times the absolute value of the intercept as “J.”
If the intercept is positive,	Qualify detects <3 times the intercept as “J.” Detects for the compound that are ≥3 times the intercept value are not qualified; non-detects are not qualified.
If the MDL has not been provided by the laboratory,	Request amended data from the laboratory.

Continuing Calibration

Compliance requirements for continuing satisfactory instrument calibration are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data for target compounds. Continuing calibration establishes the 12-hour relative response factors and satisfactory performance of the instrument on a day-to-day basis.

Note

If any quality control samples are analyzed using a continuing calibration different from that of the field samples, the laboratory must include a report for the continuing calibration affecting the quality control samples. This continuing calibration data shall only be used to evaluate the quality control samples, and only if the quality control samples fail to meet recovery or relative percent difference acceptance criteria.

Criteria: If analysis continues for longer than 12 hours, a continuing calibration verification standard must be analyzed at the beginning of each additional 12-hour period. The laboratory is allowed to perform corrective action and reanalyze the continuing calibration verification once after a failure. If more than two continuing calibration verifications were analyzed to obtain a passing continuing calibration verification, then the calibration was not verified and the calibration verification frequency criteria was not met.

Evaluation	Action
If the continuing calibration verification standard was not analyzed at the proper frequency,	Qualify all detects as “J.” Qualify all non-detects as “R” if a required continuing calibration verification was not analyzed.

Response Factor Stability

Criteria: The percent difference (%D) (see Section 8.6.3) between the daily or continuing calibration standard response factors and the average response factors obtained from the initial calibration must be ≤20 percent.

Evaluation	Action
If any volatile or semivolatile target analyte list compound has a %D between initial and continuing calibration response factors >20%:	
If the %D is positive (high bias) and is >20%,	Qualify detects for that compound as “J”; do not qualify non-detects.
If the %D is negative (low bias) and is >20% but ≤40%,	Qualify detects for that compound as “J.” Qualify non-detects for that compound as “J” if any other calibration criteria have been exceeded for that compound.
If the %D is negative (low bias) and is >40% but ≤60%,	Qualify non-detects for that compound as “J.”
If the %D is negative (low bias) and is >60%,	Qualify non-detects for that compound as “R.”

Linear Curves

Criteria: The %D between the daily or continuing calibration standard concentrations and their true values must be ≤20 percent.

Evaluation	Action
If any volatile or semivolatile target analyte list compound has a %D between the measured and true concentrations >20%:	
If the %D is positive and is >20%,	Qualify detects for that compound as “J.” Do not quality non-detects.
If the %D is negative and is >20% but ≤40%,	Qualify detects for that compound as “J.” Qualify non-detects for that compound as “J” if any other calibration criteria have been exceeded for that compound.
If the %D is negative and is >40% but ≤60%,	Qualify non-detects for that compound as “J.”
If the %D is negative and is >60%,	Qualify non-detects for that compound as “R.”

8.6.2.3 Blanks

The purpose of laboratory storage blank analysis is to characterize contamination that may result during sample storage.

The criteria for evaluating blanks apply to any blank associated with the samples and include method blanks and storage blanks, if analyzed. Action in the case of unacceptable blank results depends on the circumstances surrounding and the origin of the blank. In instances where more than one blank is associated with a given sample, qualification should be based on a comparison with the associated blank having the highest concentration of a contaminant. For the purpose of evaluating multiple blanks, each preparation batch may be considered an independent event in evaluating method blanks.

The result for any compound detected in the sample (other than those listed below) that was also detected in any associated blank must be qualified when the sample concentration is <5 times the blank concentration. For the following compounds, the results are qualified when the sample concentration is <10 times the blank concentration.

Common laboratory contaminants include the following:

- Methylene chloride
- Acetone
- Toluene
- 2-butanone
- Common phthalate esters (e.g., bis(2-ethylhexyl)phthalate, di-*n*-octyl phthalate)

There may be instances where little or no contamination was present in the associated blank but qualification of the sample was deemed necessary. Contamination introduced in a diluent is one example. Although it is not always possible to determine, evidence of this occurrence can be identified when contaminants are detected in the diluted sample but are absent in the undiluted sample.

The reviewer should be aware that the blank analyses might not involve the same weights, volumes, or dilution factors as the associated samples. These factors must be taken into consideration when applying the 5 times and 10 times criteria, such that a comparison of the total amount of contamination is actually made.

Criteria: The concentration of each target analyte detected in the blank must be less than the associated PQL. The sample results must not be corrected by subtracting any blank value. If quality control problems with any blank exist, all data associated with the case must be carefully evaluated to determine whether there is an inherent variability in the data for the case, or if the problem is an isolated occurrence not affecting other data.

Evaluation	Action
If a compound is detected in a blank but not detected in any field samples,	Take no action.
If a compound is detected in a blank,	Qualify detects for that compound as “U” using the 5× or 10× rule.
If the reviewer determines that the contamination is from a source other than the sample,	Qualify the results for that compound as “R.” In this case, the 5× or 10× rule does not apply. Discuss such circumstances in the validation report.
If gross contamination exists (e.g., saturated peaks by GC/MS),	Qualify results for all affected compounds as “R.”
If inordinate numbers of target analyte list compounds are found at low levels in the blanks,	It may indicate a problem at the laboratory. Discuss the presence of these compounds in the data validation report. **Note:** Similar consideration should be given to tentatively identified compounds that are detected in both the sample and associated blanks (see Section 8.4.3.12).

8.6.2.4 Surrogate Recovery

Laboratory performance for individual samples is evaluated by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. The evaluation of results of these surrogate spikes is not necessarily straightforward. The sample itself may produce effects due to such factors as interference and high concentrations of analytes. Because the effects of the sample matrix are frequently outside the control of the laboratory and may present unique problems, the review and validation of data based on specific surrogate results is frequently subjective and requires analytical experience and professional judgment. In addition, surrogate recoveries can be influenced by the success in recoveries of the internal standards. The evaluation of surrogate recoveries and internal standards should be done concurrently. Accordingly, this section consists primarily of guidelines, in some cases with several possible approaches suggested.

Criteria: Sample and blank surrogate recoveries must be within limits determined by the laboratory. Surrogate compound recoveries shall be calculated using the procedure described in SW-846 method 8000. Reported recoveries shall be accompanied by the applicable acceptance limits. No qualification with respect to surrogate recovery is placed on data unless any one of the following conditions is present:

- At least two surrogates are out of specification in the semivolatile organic compound (SVOC) analysis,
- One surrogate is out of specification in the VOC fraction analysis, or
- Any surrogate has <10 percent recovery (%R).

Under any of these three conditions, there should be a reanalysis.

Note

When unacceptable surrogate recoveries are followed by successful re-analyses, the laboratory is required to report only the successful run.

Evaluation	Action
If surrogate recovery acceptance criteria are not reported in the packages,	Request amended data from the laboratory.
If, in the data reviewer's professional judgment, the laboratory's internal acceptance criteria are excessively wide or biased,	Request clarification from the laboratory.
If an initial dilution is performed on any sample, and some surrogates have recovery less than the lower acceptance limit but ≥10%, or all surrogates have <10%R but the results for one or more compounds were >PQL,	Qualify associated detects as "J."
If an initial dilution is performed on any sample, and all surrogate recoveries are zero, and all results are non-detect,	Qualify all sample results as "R."
If there are two or more analyses for a particular fraction at the same dilution, the reviewer must determine which are the best data to report. Considerations should include the following: • Surrogate recovery (marginal vs. gross deviation) • Holding times • Comparison of the values of the target analytes reported in each fraction • Performance of internal standards	Qualify all data from the rejected analysis as "R" and document the reason for rejecting data from one analysis in the validation report.
For surrogate recoveries out of specification, the following approaches are suggested based on a review of all data, especially considering the apparent complexity of the sample matrix:	
If at least two surrogates in the SVOC fraction, or one surrogate in the VOC fraction, are out of specification low but have recoveries ≥10%,	Qualify detects for that fraction and non-detects as "J."
If any surrogate in a fraction shows <10%R,	Qualify detects for that fraction as "J" and non-detects as "R."
If at least two surrogates in the SVOC fraction, or one surrogate in the VOC fraction, are above the upper limit,	Qualify detects for that fraction as "J"; do not qualify non-detects.

Criteria: In the case of a blank analysis with surrogates out of specification, the reviewer must give special consideration to the validity of associated sample data. The basic concern is whether there is an isolated problem with the blank alone or whether there is a fundamental problem with the analytical process. If one or more samples in the batch show acceptable surrogate recoveries, the reviewer may choose to consider the blank problem to be an isolated occurrence. However, even if this judgment allows some use of the affected data, analytical problems remain and must be corrected by the laboratory.

Evaluation	Action
If surrogate recovery in the blank does not meet acceptance criteria,	Qualify associated sample results as follows: Detects ≥PQL, not qualified. All detects <PQL and non-detects as "J." All non-detects as "UJ."

8.6.2.5 Internal Standard Performance

Internal standard criteria ensure that GC/MS sensitivity and response are stable and acceptable during each analysis.

Criteria: Sample and blank internal standard results must be within limits given in the specific method.

- Internal standard area counts must not vary by more than a factor of two (50 percent to 200 percent) from the average of those obtained from the calibration standards.
- The retention time of the internal standard must not vary more than ±30 seconds from that of the associated calibration standard.

When qualification of sample results is warranted because an internal standard fails to meet retention time or area-count acceptance criteria, results of all target compounds associated with that internal standard are qualified.

Note *Results from quality control samples that have internal standard failures cannot be used to qualify sample results.*

Evaluation	Action
If there are two analyses for a particular fraction, the reviewer must determine which are the best data to report. Considerations should include: • Magnitude of the retention time shift. • Holding times. • Comparison of the values of the target analyte list compounds reported in each fraction. • Surrogate recovery.	Qualify all data from the rejected analysis as "R" and document the reason for rejecting data from one analysis in the validation report.
If the internal standard area count is <50% of the average of that obtained from the calibration standards, **Note:** If extremely low area counts are reported, or if performance exhibits a major abrupt drop-off, then a severe loss of sensitivity is indicated. If an internal standard area count is <25% of that of the calibration standard,	Qualify associated detects as "J." Use professional judgment, and, if appropriate, qualify non-detects as "R."
If the internal standard area count is >200% of the average of that obtained from the calibration standards,	Qualify associated detects as "J."
If an internal standard retention time varies by more than 30 seconds,	Consider partial or total rejection of the data for the sample fraction. Qualify detects and non-detects for compounds associated with the internal standard retention time as "R."

8.6.2.6 Matrix Spike/Matrix Spike Duplicate

Data for matrix spikes/matrix spike duplicates are generated to determine the precision and accuracy of the analytical method as applied to samples of a specific matrix.

Criteria: The matrix spike/matrix spike duplicate data shall not be used to qualify field sample results unless the matrix spike/matrix spike duplicate sample was from the same client and of similar matrix.

A matrix spike and matrix spike duplicate sample shall be analyzed at a frequency of once per data package, once per 20 samples of similar matrix, or once per sample matrix, whichever is more frequent.

The laboratory shall not use field blank, equipment blank, or trip blank samples to satisfy these requirements, if the laboratory can identify these blanks.

Matrix spike samples that require dilution should not be used to qualify data.

Unless otherwise stated in the specific method, the matrix spike and matrix spike duplicate accuracy and precision acceptance criteria shall be those calculated by the laboratory using the procedure given in SW-846 method 8000B. If the acceptance criteria are not given, the reviewer should use 70 to 130%R and up to a 30 percent relative percent difference as the criteria. It may be appropriate to use wider default recovery acceptance criteria for SVOC analysis, based on professional judgment. For solid and waste samples, it may be appropriate to accept up to a 40 percent relative percent difference, based on the reviewer's professional judgment. Laboratories should report recoveries and relative percent difference values for matrix spike and matrix spike duplicate analyses in the quality control section of deliverables.

The data reviewer may use the matrix spike and matrix spike duplicate results in conjunction with other quality control results to determine if the data needs to be qualified. First, the data reviewer should try to determine to what extent the results of the matrix spike/matrix spike duplicate affect the associated data. This determination should be made considering the matrix spike/matrix spike duplicate sample matrix, the surrogate and internal standard recoveries, and the LCS results.

Professional judgment should be used to determine if matrix spike/matrix spike duplicate failure warrants qualification of only the results for the failed compounds, or if results for all the compounds associated with the failed matrix spike compound and its associated internal standard are affected. Generally, unless evidence exists to warrant qualification of other compounds, only the compounds in the spiking mixture should be qualified.

Evaluation	Action
If the matrix spike/matrix spike duplicate sample was from another client or of a dissimilar matrix; if the frequency of the matrix spike/matrix spike duplicate did not meet specified criteria; if no matrix spike/matrix spike duplicate was analyzed; or if field blank, equipment blank, or trip blank samples were used for matrix spike/matrix spike duplicate purposes, and no other measure of precision is available,	Use professional judgment, and, if appropriate, qualify detects and non-detects as “J” due to lack of precision information. Note this in the validation report.
If the surrogate, internal standard, and LCS recoveries are within the required acceptance criteria and the matrix spike or matrix spike duplicate does not meet the acceptance criterion for recovery, or the relative percent difference between the matrix spike and matrix spike duplicate does not meet the acceptance criterion:	
If either matrix spike or matrix spike duplicate recovery for any volatile or semivolatile target analyte list compound is greater than the upper acceptance limit,	Qualify detects for that compound as “J”; do not qualify non-detects.
If either matrix spike or matrix spike duplicate recovery for any volatile or semivolatile target analyte list compound is less than the lower acceptance limit and ≥10%,	Qualify detects and non-detects for that compound as “J.”
If either matrix spike or matrix spike duplicate recovery for any volatile or semivolatile target analyte list compound is <10%,	Qualify detects for that compound as “J” and non-detects as “R.”
If the relative percent difference for any volatile or semivolatile target analyte list compound does not meet the acceptance criteria or recoveries fail both high and low,	Qualify detects and non-detects for that compound as “J.”

Note

If a bias (high or low) is identified in one of the matrix spike samples but not the other, the relative percent difference (precision) evaluation is not used. For example, if a compound has low matrix spike recovery and the relative percent difference is not within the criterion, the data are qualified as “J.”

8.6.2.7 Replicate Sample Analysis

Replicate analyses are indicators of laboratory precision for each sample matrix. If a replicate was performed instead of a matrix spike duplicate, the following criteria are applied. If insufficient sample was submitted to analyze a matrix spike/matrix spike duplicate or replicate, the laboratory may run an LCS/laboratory control sample duplicate (LCSD) to measure precision.

Criteria: A replicate sample shall be analyzed at a frequency of once per data package, once per 20 samples of similar matrix, or once per sample matrix, whichever is more frequent. All surrogate and internal standard acceptance criteria must be met in the replicate analysis. Samples identified as field blank, equipment blank, or trip blank should not be used for replicate sample analysis.

Unless stated otherwise in the specific method, the replicate precision acceptance criteria shall be those calculated by the laboratory using the procedure given in SW-846 method 8000B. When no laboratory-derived control limits are reported, a control limit of 30 percent for the relative percent difference shall be used for sample values >5 times the PQL. For solid and waste samples, it may be appropriate to accept up to a 40 percent relative percent difference, based on the reviewer’s professional judgment.

A control limit of ±PQL shall be used for sample values <5 times the PQL, including the case when only one of the replicate sample values is <5 times the PQL.

No precision criterion applies to samples with concentrations <PQL.

Evaluation	Action
If no replicate sample, no matrix spike duplicate, and no LCS/LCSD was analyzed for each matrix or for each data package,	Qualify all detects and non-detects of the same matrix as “J.”
If a field blank, equipment blank, or trip blank was used for the replicate analysis and no matrix spike duplicate or LCSD was run,	Qualify all detects and non-detects of the same matrix as “J.”
If the original result and replicate result for any volatile or semivolatile target analyte list compound are both >5× the PQL, and the relative percent difference exceeds the appropriate control limit,	Qualify detects and non-detects for that compound of the same matrix as “J.”
If the original and/or replicate result for any volatile or semivolatile target analyte list compound is <5× the PQL, and the difference between the original result and replicate result is >PQL,	Qualify detects and non-detects for that compound of the same matrix as “J.”

8.6.2.8 Laboratory Control Samples

Data for LCSs are generated to provide information on the accuracy of the analytical method and overall laboratory performance, including sample preparation.

Criteria: An LCS shall be analyzed for all methods at a frequency of once per data package, once per matrix, or once per 20 analytical samples, whichever is most frequent. The LCS must have recovery calculated for at least one compound from each of the internal standards.

The LCS must meet all sample acceptance criteria. If surrogate and internal standard acceptance criteria are not met in the LCS analysis, the LCS must be reanalyzed. The LCS should meet all method-specific LCS requirements and acceptance criteria. If the recovery acceptance criteria are not reported, the reviewer should use 70 to 130%R as the criterion.

If the laboratory analyzed an LCS/LCSD as a measure of precision, both the LCS and LCSD must meet the acceptance criteria.

Note

*For VOCs, a successful **second-source** continuing calibration verification meets the LCS requirements.*

Evaluation	Action
If, in the data reviewer’s professional judgment, the laboratory’s internal acceptance criteria are excessively wide, or acceptable recoveries are significantly biased,	Request clarification from the laboratory.
If the frequency of the LCS does not meet the specified criteria,	Qualify all detects and non-detects as “J.”
If there was not at least one compound associated with each internal standard,	Use professional judgment, and, if appropriate, qualify associated detects and non-detects as “J” for those compounds quantified on the internal standard with no LCS compound.

If the LCS criteria were not met and reanalysis was not performed, then the laboratory's performance and method accuracy are in question. Professional judgment should be used to determine if data should be qualified for all target compounds or just those compounds associated with the failed LCS compound and associated internal standard. The following may be used as guidance in qualifying data.

If a full or large target analyte list LCS is analyzed, the following criteria may be used for LCSs that fall outside reported acceptance criteria but are >10%R:

- 70 to 74 compounds; ≤5 compounds fall outside acceptance criteria: no qualification
- 60 to 69 compounds; ≤4 compounds fall outside acceptance criteria: no qualification
- 50 to 59 compounds; ≤3 compounds fall outside acceptance criteria: no qualification
- 40 to 49 compounds; ≤2 compounds fall outside acceptance criteria: no qualification
- 30 to 39 compounds; ≤1 compound falls outside acceptance criteria: no qualification
- <30 compounds; no compounds fall outside acceptance criteria: no qualification

Evaluation	Action
If the LCS recovery is greater than the upper acceptance limit,	Qualify the associated detects as "J"; do not qualify non-detects.
If the LCS recovery is less than the lower acceptance limit,	Qualify the associated detects and non-detects as "J" if recovery is ≥10%, and as "R" if recovery is <10%.
If recovery for more than half of the compounds in the LCS analysis is below the acceptance range,	The laboratory has not shown that it can actually meet method requirements. Qualify all detects and non-detects as "J" if the failures are marginally low and as "R" if recoveries are significantly below acceptance limits.
If recovery for more than half of the compounds in the LCS analysis is above the acceptance range,	Qualify all detects as "J"; do not qualify non-detects.
If recovery for more than half of the compounds in the LCS analysis is outside the acceptance range, both above and below,	Qualify all detects and non-detects as "J."

8.6.2.9 Sample Carryover

Sample carryover may occur when a high-concentration sample is analyzed immediately prior to another field sample. Steps must be taken to avoid introduction of false positive results in the second sample analysis due to instrument contamination.

Criteria: The absence of sample carryover must be determined and verified. If examination of the run logs indicates that any samples in the analytical run of interest required dilution, and there is no documentation of a rinse or blank analysis immediately following the original undiluted analysis, then sample carryover may be suspected in the subsequent sample.

Evaluation	Action
If any target compounds detected in the sample requiring dilution exceed the concentration of the high calibration standard and are also detected in the following sample at concentrations <5× the PQL,	Qualify the results for these compounds in the second sample as "R" or "J," based on professional judgment.
If no data are available for the sample that required dilution, if the laboratory has not documented that carryover was evaluated, and if the compounds were also detected in the following sample at concentrations <5× the PQL,	Qualify the results for these compounds in the second sample as "J."

8.6.2.10 Dilutions

Criteria: The PQLs must be adjusted to reflect all sample dilutions, concentrations, splits, cleanup activities, and dry weight factors that the method does not account for.

Samples must be diluted and reanalyzed when concentrations of any analyte exceeds the upper limit of the calibration range.

Data from original samples should be included when any sample requires dilution because concentrations of one or more compounds exceed the upper limit of the calibration range.

The original undiluted results document the actual MDLs for non-detects.

Note

Refer to Section 8.4.2.4 for assessment of initially diluted samples with low surrogate recovery.

Evaluation	Action
If the PQLs have not been properly adjusted,	Request an amended report from the laboratory.
In some cases, initial dilutions are required because of expected high concentrations of non-target analytes or because the concentration of one or more target analytes is expected to greatly exceed the instrument working range. In these instances, the laboratory may not be able to analyze the undiluted sample.	Note the dilution and high MDLs in the validation report.
If the concentration of any volatile or semivolatile target analyte list compound exceeds the calibration range and:	
If the original undiluted sample result is reported,	Qualify detects that exceed the calibration range as “J.”
If the original undiluted sample data are not provided,	Request this information from the laboratory.
If data from the original sample run are unavailable,	Refer to Section 8.4.3.4 for assessment of initially diluted samples with low surrogate recovery.

Criteria: The laboratory shall strive to make dilutions in a way that places the final concentration in the midrange of the calibration curve, and results are not reported from measurements below the lowest concentration standard.

Evaluation	Action
If the instrument response (reported result ÷ dilution factor) from diluted samples is less than that of the lowest concentration standard,	Qualify detects for that compound as “J.”

Criteria: The extraction efficiency for extremely high concentrations of analytes has not been determined for most methods. If the analysis requires an extraction and dilutions of greater than 100,000:1, the efficiency of the extraction may be suspect.

Evaluation	Action
If dilutions of greater than 100,000:1 are required,	Qualify detects as “J.”

8.6.2.11 Target Compound Identification

The objective of compound identification is to minimize the number of erroneous compound identifications. An erroneous identification can either be a false positive (reporting a compound present when it is not) or a false negative (not reporting a compound that is present).

The identification criteria can be applied more easily in detecting false positives than false negatives. More information is available for false positives due to the requirement for submittal of data supporting positive identifications. Negatives, or non-detected compounds, on the other hand, represent an absence of data and are, therefore, more difficult to assess.

Criteria: The Relative Retention Times (RRTs) must be within ±0.06 RRT units of the standard RRT (Continuing Calibration Verification [CCV] or mid-point standard from initial calibration). Mass spectra of the sample compounds and the laboratory-generated reference spectra must match according to the following criteria:

- All ions present in the standard mass spectrum at a relative intensity greater than 10 percent must be present in the sample spectrum.
- The relative intensities of these ions must agree within ±20 percent between the standard and sample spectra (e.g., for an ion with an abundance of 50 percent in the standard spectrum, the corresponding sample ion abundance must be between 30–70 percent).
- Ions present at greater than 10 percent in the sample mass spectrum, but not present in the standard spectrum, must be evaluated by a reviewer experienced in mass spectral interpretation.

Evaluation: Check that the RRT of reported compounds is within ±0.06 RRT units of the standard RRT.

Check the sample compound spectra against the laboratory standard reference spectra to verify that it meets the specified criteria.

The reviewer should be aware of situations when co-elution is a possibility and should use professional judgment when evaluating mass spectra.

Common laboratory calibration practices along with limitations of some commercial software could result in compounds being detected and not reported. Review all quantitation reports to verify that all detected compounds are reported.

Evaluation	Action
If target compounds are identified on the quantitation report but are not reported,	Request corrected reports from the laboratory.
If compounds are reported but do not meet the RRT criteria,	Qualify detects as “U.”
If compounds are reported but do not meet the mass spectra criteria,	Qualify detects as “U.”

8.6.2.12 Tentatively Identified Compounds

Chromatographic peaks in VOC and SVOC analyses that are not target compounds, surrogates, or internal standards are potential tentatively identified compounds.

Criteria: For each sample, the laboratory may be requested to conduct a mass spectral library search. The laboratory may report the possible identity for up to 20 of the largest VOC peaks and the 20 largest SVOC peaks that are not surrogate, internal standard, or target compounds, but have an area >10 percent of the nearest internal standard peak area.

The reviewer should be aware of common laboratory artifacts/contaminants and their sources. They may be present in blanks and not reported as sample tentatively identified compounds. These include:

- Common laboratory contaminants: CO_2 (m/e 44), siloxanes (m/e 73), diethyl ether, hexane, certain freons (1,1,2-trichloro-1,2,2-trifluoroethane or fluoro-trichloromethane), phthalates at levels <100 micrograms per liter (µg/L) or 4,000 micrograms per kilogram.
- Solvent preservatives: cyclohexene (a methylene chloride preservative) and related byproducts (e.g., cyclohexanone, cyclohexenone, cyclohexanol, cyclohexenol, chlorocyclohexene, chlorocyclohexanol).
- Aldol condensation products of acetone (e.g., 4-hydroxy-4-methyl-2-pentanone; 4 methyl-2-penten-2-one; 5,5-dimethyl-2 (5H)-furanone).

Evaluation	Action
When a low-level non–target compound that is a common artifact or laboratory contaminant is detected in a sample, verify that tentatively identified compound peaks present in samples are not found in blanks. Blank chromatograms should be examined. Look for peaks that are <10% of the internal standard height but are present in the blank chromatogram at similar relative retention time.	
If tentatively identified compound results are not sufficiently above the level in the blank,	Do not report the results.
If the results are reported,	Use professional judgment, and, if appropriate, qualify results as “R” (dilutions and sample size must be taken into account when comparing the amounts present in blanks and samples).
If results are identified as a tentatively identified compound,	Qualify these results as “J.”
If a compound is not detected in any blanks but is a suspected artifact of a common laboratory contaminant,	Use professional judgment, and, if appropriate, qualify results as “R.” Identify all suspected artifacts of common laboratory contaminants in the validation report.

8.6.2.13 Method-Specific Analytical Requirements—Organic GC/MS

The additional analytical requirements addressed below are organized by method. These requirements should be checked if the deliverable level allows.

VOC Analysis by GC/MS

Criteria: The analysis of 2-chloroethyl vinyl ether in water must be performed using an un-acidified sample.

Evaluation	Action
If 2-chloroethyl vinyl ether is reported for an acidified water sample,	Qualify detects for this compound as “J” and non-detects for this compound as “R.”

SVOC Analysis by GC/MS

Criteria: Gel permeation chromatography cleanup shall be used as necessary to eliminate interferences. In addition, all water samples containing high molecular weight compounds that interfere with the analysis of the target compounds must also undergo gel permeation chromatography cleanup.

Evaluation	Action
If the run log notations, spectral data, internal standard recoveries, or surrogate recoveries indicate potential interferences,	Qualify all detects and all non-detects as “J.”
If appropriate extract cleanups were not performed,	Note this on the data validation report.

8.6.3 Procedure for GC and HPLC Validation

The requirements covered in this section apply to all GC and HPLC analytical techniques not utilizing mass spectrometric detection, including SW-846 methods 8081, 8082, and 8330.

8.6.3.1 Calibration

Initial Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for compounds on the target analyte list. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve.

When methods require confirmation of target analytes on a second fully calibrated column, the calibrations of both columns must be assessed.

Note 1

The laboratory may establish a calibration curve using either the linear regression (linear curve) approach or the calibration factor approach. Calibration is to be assessed on an analyte-by-analyte basis.

Note 2

If any quality control samples are analyzed using an initial calibration different from that of the field samples, the laboratory must include a calibration report for the calibration affecting the quality control samples. This calibration data shall only be used to evaluate the quality control samples, and only if the quality control samples fail to meet recovery or relative percent difference acceptance criteria.

Criteria: GC and HPLC instrument calibration shall be performed using a minimum of five calibration standards unless otherwise specified by the method. If calibration curves are used, a linear (first-order) calibration model requires five standards, a quadratic (second-order) model requires six standards, and a third-order polynomial requires seven standards. Higher-order curves should not be used. If the laboratory uses a higher-order equation to establish a calibration curve, it should be evaluated for appropriate application.

Evaluation	Action
If an insufficient number of calibration standards were used,	Qualify detects as “J.”

Calibration Factor

Criteria: In the absence of or in addition to method-specific calibration acceptance criteria, the following general calibration acceptance criteria should be applied.

The percent RSD for the calibration factors obtained from the five initial calibration standards must be ≤20 percent.

Evaluation	Action
If any target analyte list compound has a %RSD:	
>20%,	Qualify detects for that compound as “J.”
>20% but ≤40%,	Qualify non-detects for that compound as “J” if any other calibration criteria have been exceeded for that compound.
>40% but ≤60%,	Qualify non-detects for that compound as “J.”
>60%,	Qualify non-detects for that compound as “R.”

Linear Curve

Criteria: The correlation coefficient (r^2) of the initial calibration curve shall be greater than 0.99. The absolute value of the intercept shall be ≤3 times the MDL.

Evaluation	Action
If any target analyte list compound has an r^2:	
<0.99,	Qualify detects for that compound as “J.”
<0.99 but ≥0.90,	Qualify non-detects for that compound as “J” if any other calibration criteria have been exceeded for that compound.
<0.90, but ≥0.80,	Qualify non-detects for that compound as “J.”
<0.80,	Qualify non-detects for that compound as “R.”
If any compound has an absolute value of the intercept >3× the MDL, and:	
If the intercept is negative,	Qualify non-detects for that compound as “R”; qualify detects <3× the absolute value of the intercept as “J.”
If the intercept is positive,	Qualify detects <3× the intercept as “J”; do not qualify detects for that compound that are ≥3× the intercept value, or non-detects.

Continuing Calibration

Compliance requirements for continuing satisfactory instrument calibration are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data for target compounds. Continuing calibration verifies the relative calibration factors on which the quantitation is based on a day-to-day basis.

Note

If any quality control samples are analyzed using a continuing calibration different from that of the field samples, the laboratory must include a report for the continuing calibration affecting the quality control samples. This continuing calibration data shall only be used to evaluate the quality control samples, and only if the quality control samples fail to meet recovery or relative percent difference acceptance criteria.

Criteria: A continuing calibration verification must be run:

- At the beginning of each analytical run,
- At least once every 20 samples, and
- At the end of each analytical run.

The laboratory is allowed to perform corrective action and reanalyze the continuing calibration verification once after a failure. If more than two continuing calibration verifications were analyzed to obtain a passing continuing calibration verification, then the calibration was not verified, and the calibration verification frequency was not met. This applies to calibration factors and linear curves.

The evaluation of continuing calibration verification data applies to all continuing calibration verifications that bracket samples of interest.

Evaluation	Action
If the continuing calibration verification standard was not analyzed at the proper frequency,	Qualify all detects as “J.” Qualify all non-detects as “R” if no continuing calibration verification was analyzed.

Calibration Factor Stability

Criteria: The %D between the daily or continuing calibration standard calibration factors and the average calibration factors obtained from the initial calibration must be ≤15 percent.

Evaluation	Action
If any compound has a %D between initial and continuing calibration factors >15%:	
If the continuing calibration verification %D is positive (high bias),	Qualify detects for that compound as “J”; do not qualify non-detects for that compound.
If the continuing calibration verification %D is negative (low bias), >15% but ≤40%,	Qualify detects for that compound as “J.” Qualify non-detects for that compound as “J” if any other calibration criteria have been exceeded for that compound.
If the continuing calibration verification %D is negative (low bias), >40% but ≤60%,	Qualify non-detects for that compound as “J.”
If the continuing calibration verification %D is negative (low bias), >60%,	Qualify non-detects for that compound as “R.”

Linear Curves

Criteria: The %D between the daily or continuing calibration standard concentrations and their true values must be ≤15 percent.

Evaluation	Action
If any compound has a %D between the measured and true concentration of >15%:	
If the %D is positive,	Qualify detects for that compound as “J”; do not qualify non-detects for that compound.
If the %D is negative, >15% but ≤40%,	Qualify detects for that compound as “J.” Qualify non-detects for that compound as “J” if any other calibration criteria have been exceeded for that compound.
If the %D is negative, >40% but ≤60%,	Qualify non-detects for that compound as “J.”
If the %D is negative, >60%,	Qualify non-detects for that compound as “R.”

8.6.3.2 Blanks

The purpose of laboratory blank analysis is to determine the nature and magnitude of contamination that may result from laboratory activities.

The criteria for evaluating blanks apply to any blank associated with the samples and includes method blanks and storage blanks. Action in the case of unacceptable blank results depends on the circumstances surrounding and origin of the blank. In instances where more than one blank is associated with a given sample, qualification should be based on a comparison with the associated blank having the highest concentration of a contaminant. For the purpose of evaluating multiple blanks, each preparation batch may be considered an independent event in evaluating method blanks, and each sampling event may be considered an independent event for evaluating field blanks and equipment blanks.

The result of any compound detected in the sample, which was also detected in any associated blank, must be qualified when the sample concentration is <5 times the blank concentration. In addition, there may be instances where little or no contamination is present in the associated blank, but qualification of the sample is deemed necessary. Contamination introduced in a diluent is one example. Although it is not always possible to determine, evidence of this occurrence can be identified when contaminants are detected in the diluted sample but are absent in the undiluted sample.

The reviewer should be aware that the blank analyses might not involve the same weights, volumes, or dilution factors as the associated samples. These factors must be taken into consideration when applying the 5 times criteria, so that a comparison of the total amount of contamination is actually made.

Criteria: The concentration of each target analyte detected in the blank must be less than the associated PQL. The sample results must not be corrected by subtracting any blank value. If quality control problems exist with any blank, all data associated with the case must be carefully evaluated to determine whether there is an inherent variability in the data for the case, or if the problem is an isolated occurrence not affecting other data.

Evaluation	Action
If a compound is detected in a blank but not detected in the sample,	Take no action.
If a compound is detected in a blank,	Qualify detects for that compound as “U” using the 5× rule.
If the reviewer determines that the contamination is from a source other than the sample,	Qualify the results for that compound as “R.” In this case, the 5× rule does not apply. Discuss such circumstances in the validation report.
If gross contamination exists,	Qualify all compounds affected as “R,” due to contamination.
If inordinate numbers of other target analyte list compounds are detected at low levels in the blanks,	It may indicate a problem at the laboratory. Discuss the presence of these compounds in the data validation report.

8.6.3.3 Surrogate Recovery

Laboratory performance for individual samples is established by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. Evaluation of surrogate spike results is not necessarily straightforward. The sample itself may produce effects due to factors such as interference and high concentrations of analytes. Because the effects of the sample matrix are frequently outside the control of the laboratory and may present unique problems, the review and validation of data based on specific surrogate results is frequently subjective and requires analytical experience and professional judgment.

Criteria: Sample and blank surrogate recoveries must be within limits specified by the laboratory. Surrogate compound recoveries shall be calculated using the procedure described in SW-846 method 8000. Reported recoveries shall be accompanied by the applicable acceptance limits.

Evaluation	Action
If surrogate recovery acceptance criteria are not reported in the packages,	Request amended data from the laboratory.
If, in the data reviewer's professional judgment, the laboratory's internal acceptance criteria are excessively wide or biased,	Request clarification from the laboratory.
If an initial dilution is performed on any sample and at least one surrogate has recovery less than the lower acceptance limit but ≥10%, or all surrogates have <10%R but the results for one or more compounds were >PQL,	Qualify associated detects and non-detects as "J."
If an initial dilution is performed on any sample and all surrogate recoveries are zero and all results are non-detect,	Qualify all sample results as "R."
If there are two or more analyses for a particular fraction at the same dilution, the reviewer must determine which are the best data to report. Considerations should include: • Surrogate recovery (marginal vs. gross deviation). • Holding times. • Comparison of the values of the target analyte list compounds reported in each fraction.	Qualify all data from the rejected analysis as "R," and document the reason for rejecting data from one analysis in the validation report.
For surrogate recoveries out of specification, the following approaches are suggested based on a review of all data from the case, especially considering the apparent complexity of the sample matrix:	
If any surrogate recovery is below the lower specification but has recovery ≥10%,	Qualify all detects and non-detects as "J."
If any surrogate has recovery <10%,	Qualify all detects as "J" and non-detects as "R."
If a surrogate recovery is above the upper specification,	Qualify all detects as "J"; do not qualify non-detects.

Criteria: In the case of a blank analysis with surrogate recoveries out of specification, the reviewer must give special consideration to the validity of associated sample data. The basic concern is whether the problem with the blank is isolated or whether there is a fundamental problem with the analytical process.

If one or more samples in the batch show acceptable surrogate recoveries, the reviewer may choose to consider the blank problem to be an isolated occurrence. However, even if this judgment allows some use of the affected data, analytical problems remain and must be corrected by the laboratory.

Evaluation	Action
If surrogate recovery in the blank does not meet acceptance criteria, associated sample results may be qualified as follows,	Do not qualify detects ≥PQL. Qualify all detects <PQL as "J." Qualify all non-detects as "J."

8.6.3.4 Matrix Spike/Matrix Spike Duplicate

Data for matrix spikes/matrix spike duplicates are generated to determine the precision and accuracy of the analytical method as applied to samples of a specific matrix.

Criteria: The matrix spike/matrix spike duplicate data shall not be used to qualify field sample results unless the matrix spike/matrix spike duplicate sample was from the same client and of a similar matrix.

A matrix spike and matrix spike duplicate sample shall be analyzed at a frequency of once per data package, once per 20 samples of similar matrix, or once per sample matrix, whichever is most frequent.

The laboratory shall not use a field blank, equipment blank, or trip blank sample to satisfy this requirement, if the laboratory can identify these blanks.

Matrix spike samples that require dilution should not be used to qualify data.

The matrix spike and matrix spike duplicate analyses must meet all sample analysis acceptance criteria. The data reviewer may use the matrix spike and matrix spike duplicate results in conjunction with other quality control results to determine the need for qualification of the data. The data reviewer should first try to determine to what extent the results of the matrix spike/matrix spike duplicate affect the associated data. This determination should be made considering the matrix spike/matrix spike duplicate sample matrix, the surrogate recoveries, and the LCS results.

Unless stated otherwise in the specific method, the matrix spike and matrix spike duplicate accuracy and precision acceptance criteria shall be those calculated by the laboratory using the procedure given in SW-846 method 8000B. If the acceptance criteria are not given, the reviewer should use 70 to 130%R and ±30 percent relative percent difference as the criteria. For solid and waste samples, it may be appropriate to accept up to a 40 percent relative percent difference, based on the reviewer’s professional judgment. Laboratories should report recoveries and relative percent difference values for matrix spike and matrix spike duplicate analyses in the quality control section of deliverables.

Professional judgment should be used to determine if matrix spike/matrix spike duplicate failure warrants qualification of only the results for the failed compounds, or if results for all the compounds associated with the failed matrix spike compound are affected. Generally, unless evidence exists to warrant qualification of other compounds, only the compounds in the spiking mixture shall be qualified.

Note

If a bias (high or low) is identified in one of the matrix spike samples but not the other, the relative percent difference (precision) evaluation is not used. For example, if a compound has low matrix spike recovery, and the relative percent difference is not within criteria, the data are qualified as “J.”

Evaluation	Action
If the matrix spike/matrix spike duplicate sample was from another client or of a dissimilar matrix; if the frequency of the matrix spike/matrix spike duplicate did not meet specified criteria; if a matrix spike/matrix spike duplicate was not analyzed; or if field blank, equipment blank, or trip blank samples were used for matrix spike/matrix spike duplicate purposes, and no other measure of precision is available,	Use professional judgment, and, if appropriate, qualify detects and non-detects as "J" due to lack of precision information. Note the deficiency in the validation report.
If the surrogate and LCS recoveries are within the required acceptance criteria and the matrix spike or matrix spike duplicate does not meet the acceptance criterion for recovery, or the relative percent difference between the matrix spike and matrix spike duplicate does not meet the acceptance criterion:	
If either matrix spike or matrix spike duplicate recovery for any target compound is greater than the upper acceptance limit,	Qualify detects for that compound as "J"; do not qualify non-detects.
If either matrix spike or matrix spike duplicate recovery for any target compound is less than the lower acceptance limit and ≥10%,	Qualify detects and non-detects for that compound as "J."
If either matrix spike or matrix spike duplicate recovery for any target analyte list compound is <10%,	Qualify detects for that compound as "J" and non-detects as "R."
If the relative percent difference for any target analyte list compound does not meet the acceptance criteria or recoveries fail both high and low,	Qualify detects and non-detects for that compound as "J."

8.6.3.5 Replicate Sample Analysis

Replicate analyses are indicators of laboratory precision for each sample matrix. If a replicate was performed instead of a matrix spike duplicate, the following criteria apply. If insufficient sample was submitted to analyze a matrix spike/matrix spike duplicate or replicate, the laboratory may run an LCS/LCSD to measure precision.

Criteria: Replicate samples shall be analyzed at a frequency of once per data package, once per 20 samples of similar matrix, or once per sample matrix, whichever is most frequent. All surrogate acceptance criteria must be met in the replicate analysis.

Samples identified as field blank, equipment blank, or trip blank samples shall not be used for replicate sample analysis.

Unless stated otherwise in the specific method, the replicate precision acceptance criteria shall be those calculated by the laboratory using the procedure given in SW-846 method 8000B. When no laboratory-derived control limits are reported, a control limit of 30 percent for the relative percent difference shall be used for sample values >5 times the PQL. For solid and waste samples, it may be appropriate to accept up to a 40 percent relative percent difference, based on the reviewer's professional judgment.

A control limit of ±PQL shall be used for sample values <5 times the PQL, including the case when only one of the replicate sample values is <5 times the PQL.

No precision criterion applies to samples with concentrations <PQL.

Evaluation	Action
If no replicate sample, no matrix spike duplicate, and no LCS/LCSD were analyzed for each matrix or for each data package,	Qualify all detects and non-detects of the same matrix as “J.”
If a field blank or equipment blank was used for the replicate analysis and no matrix spike duplicate was run,	Qualify all detects and non-detects of the same matrix as “J.”
If the original result and replicate result are both >5× the PQL, and the relative percent difference falls outside of appropriate control limits,	Qualify detects and non-detects for that compound of the same matrix as “J.”
If the original or replicate result is <5× the PQL and the difference between the original result and replicate result is >PQL,	Qualify detects and non-detects for that compound of the same matrix as “J.”

8.6.3.6 Laboratory Control Samples

Data for LCS are generated to provide information on the accuracy of the analytical method and on laboratory performance.

Criteria: An LCS should be analyzed for all methods at a frequency of once per data package, once per matrix, or once per 20 analytical samples, whichever is most frequent.

The LCS must have recovery calculated for all single-component compounds or at least one multi-component compound.

The LCS must meet all sample acceptance criteria. If surrogate acceptance criteria are not met in the LCS analysis, the LCS must be reanalyzed. The LCS should meet all method-specific LCS requirements and acceptance criteria. If the recovery acceptance criteria are not reported, the reviewer should use the criteria of 70 to 130%R.

If the laboratory analyzed an LCS/LCSD as a measure of precision, both the LCS and LCSD must meet the acceptance criteria.

Evaluation	Action
If, in the data reviewer’s professional judgment, the laboratory’s internal acceptance criteria are excessively wide, or acceptable recoveries are significantly biased,	Request clarification from the laboratory.
If the frequency of the LCS did not meet the specified criteria,	Qualify all detects and non-detects as “J.”
If results are reported for target compounds that are not in the LCS,	Qualify detects for these compounds as “J.”

If the LCS criteria are not met and re-analysis was not performed, the laboratory performance and method accuracy are in question. Professional judgment should be used to determine if data should be qualified for all target compounds or just those compounds associated with the failed LCS compound. The following may be used as guidance in qualifying data.

Evaluation	Action
If the LCS recovery is greater than the upper acceptance limit,	Qualify detects for that compound as “J”; do not qualify non-detects.
If the LCS recovery is less than the lower acceptance limit,	Qualify detects for that compound as “J.” Qualify non-detects as “J” if the recovery is ≥10% and as “R” if recovery is <10%.
If recovery for more than half of the compounds in the LCS analysis is below the acceptance range,	The laboratory has not shown that it can actually meet program-required detection limits. Qualify all detects and all non-detects as “J” if the failures are marginally low and as “R” if recoveries are significantly below acceptance limits.
If recovery for more than half of the compounds in the LCS analysis is above the acceptance range,	Qualify all detects as “J”; do not qualify non-detects.
If recovery for more than half of the compounds in the LCS analysis is outside the acceptance range, both above and below,	Qualify all detects and non-detects as “J.”

8.6.3.7 Target Compound Identification

These criteria are established to ensure that the chromatographic system achieves adequate peak resolution and instrument sensitivity.

Criteria: The laboratory must report retention time window data for each column used to analyze samples. All calibration standards must be within the established retention time windows.

Evaluation	Action
Check data to verify that retention time windows are reported and that all calibration standards are within the established retention time windows.	
If retention time windows are not reported, or if standard retention times are not within the retention time windows,	Qualify all detects as “J” and non-detects as “R.” Emphasize the possibility of either false negatives or false positives, as appropriate, in the validation report.

8.6.3.8 Sample Carryover

Sample carryover may occur when a high-concentration sample is analyzed immediately prior to another field sample. Steps must be taken to avoid introduction of false positive results in the second sample analysis due to instrument contamination.

Criteria: The absence of sample carryover must be verified. If examination of the run logs indicates that any samples in the analytical run of interest required dilution, and there is no documentation of a rinse or blank analysis immediately following the original undiluted analysis, then sample carryover may be suspected in the subsequent sample.

Evaluation	Action
If any target compounds detected in the sample requiring dilution have concentrations that exceed the high calibration standard and are also detected in the following sample at concentrations <5× the PQL,	Qualify the results for these compounds in the second sample as “R” or “J,” based on professional judgment.
If no data are available for the sample that required dilution, if the laboratory has not documented that carryover was evaluated, and if the compounds were also found in the following sample at concentrations <5× the PQL,	Qualify the results for these compounds in the second sample as “J.”

8.6.3.9 Dilutions

Criteria: The PQLs must be adjusted to reflect all sample dilutions, concentrations, splits, cleanup activities, and dry weight factors that the method does not account for.

Samples must be diluted and reanalyzed when any analyte concentrations exceed the upper limit of the calibration range.

Data from original sample runs should be included when any sample requires dilution due to the concentration of one or more compounds exceeding the upper limit of the calibration range.

The original undiluted results document the actual MDLs for non-detects.

Note

Refer to Section 8.4.4.3 for assessment of initially diluted samples with low surrogate recovery.

Evaluation	Action
If the PQLs have not been properly adjusted,	Request an amended report from the laboratory.
In some cases, initial dilutions are required because of expected high concentrations of non-target analytes or because the concentration of one or more target analyte is expected to greatly exceed the instrument working range. In these instances, the laboratory may not be able to analyze the undiluted sample.	Note the dilution and high MDLs in the validation report.
If the concentration of any compound exceeds the calibration range and:	
If the original undiluted sample result is reported,	Qualify detects that exceeded the calibration range as "J."
If the original undiluted sample run is not provided,	Request this information from the laboratory.
If data from the original sample run are unavailable,	Refer to the initial dilution portion of Section 8.4.4.3.

Criteria: The laboratory shall strive to make dilutions in a way that places the final concentration in the midrange of the calibration curve, and results are not reported from measurements below the lowest concentration standard.

Evaluation	Action
If the instrument response (reported result ÷ dilution factor) of any detect from diluted samples is less than that of the lowest concentration standard,	Qualify detects for that compound from the diluted analysis as "J."

Criteria: The extraction efficiency for extremely high concentrations of analytes has generally not been determined for most methods. If the analysis requires an extraction and dilutions of greater than 100,000:1, the efficiency of the extraction may be suspect.

Evaluation	Action
If dilutions of greater than 100,000:1 are required,	Qualify detects as "J."

8.6.3.10 Quantification and Confirmation

Criteria: Detected compound results must be confirmed using a second GC/HPLC column.

The laboratory shall report relative percent differences between the results obtained from the two GC/HPLC columns. Relative percent differences are not evaluated if the analyte is not detected on the primary column.

Evaluation	Action
If results from the second column confirmation are not reported,	Qualify all detects as "J"; do not qualify non-detects.
If the relative percent difference between two detects is >40% and ≤75%:	
For polychlorinated biphenyl and herbicide analyses,	Report the higher result and qualify it as "J."
For pesticide analysis,	Report the lower result and qualify it as "J."
For high explosive analysis,	Report the result from the C-18 column and qualify it as "J."

A relative percent difference >75 percent may indicate a significant coelution or interference problem. As applied here, a coelution is two target analytes, or one target and one non-target analyte, that have peaks at the same retention time, and interference is a non-target analyte with a peak at a target analyte retention time. That is, a coelution is a quantity that cannot be verified, and an interference is a result that is a false positive.

Results will normally be qualified as "R" if interference predominates; however, if coelution is documented or evident in the chromatogram, qualifying the result as "J" may be appropriate. Non-detects are not qualified.

A general review of the actual chromatogram may be required to determine the best qualification. If the chromatogram includes a significant number of extraneous peaks outside of the target analyte retention time windows, interferences are likely on one or both of the columns. Nonsymmetrical peak shape is indicative of coelution, and shifts in retention times may indicate either coelution or interference. A review of the beginning and ending continuing calibration verification retention times will give the reviewer an indication of instrument stability during the analysis.

In addition, it is not uncommon to find MDLs for GC/HPLC methods as determined using 40 CFR 136, "Guidelines for Establishing Test Procedures for the Analysis of Pollutants," to be artificially low, which may result in false positives due to random instrument noise for concentrations below the PQL.

If one of the results is below the PQL and the other is much greater than the PQL, suspect interference or a false positive. Values around the PQL should be evaluated using both relative percent difference and absolute differences. For example, results of 1 µg/L and 5 µg/L have a relative percent difference of 133 percent but would not be significantly different from each other for analyses with a PQL of 2 µg/L. The validator should also attempt to determine if the peak is primarily due to interference or if the peak has a significant contribution from the target analyte.

Evaluation	Action
If the relative percent difference is >75%, and if one result is <5× the PQL and the other result is much greater than the PQL,	Qualify the result as “R”; do not qualify non-detects.
If both results are <5× PQL:	
For polychlorinated biphenyl and herbicide analyses,	Report the higher result and qualify it as “J.”
For pesticide analysis,	Report the lower result and qualify it as “J.”
For high explosive analysis,	Report the result from the C-18 column and qualify it as “J.”
If coelution is the most apparent problem,	Use professional judgment and qualify results as “J”; do not qualify non-detects.
If both results are much greater than the PQL, one or both peaks may have contribution due to coelution.	
If it is apparent that the peak is primarily due to the target analyte,	Qualify the result as “J.”
If it is not apparent that the peak is primarily due to the target analyte,	. Qualify the result as “J.”
In general, rejection of data with results much greater than the PQL will require additional supporting analytical information such as GC/MS or diode array spectral matching. If rejecting data where both results are much greater than the PQL,	Include a complete description of the justification and supporting data used in the validation report.

In waste-type samples, the separation techniques may not completely isolate the target analytes from other compounds, and the chromatogram may contain multiple extraneous peaks. The more peaks in the chromatogram, the more likely it is that false positives will be reported.

Evaluation	Action
If a large number of unidentified peaks are seen in the chromatogram, or if several additional peaks are located near a reported analyte retention time in both chromatograms,	Use professional judgment, and, if appropriate, qualify results as “J”; do not qualify non-detects.

8.6.3.11 Method-Specific Analytical Requirements—Organic GC/HPLC

The additional analytical requirements given below are organized by method. These requirements should be checked if the deliverable level allows.

Organochlorine Pesticide by GC

Criteria: The laboratory must include a discussion of any cleanup procedures performed on the samples.

An instrument blank consisting of clean solvent containing only the surrogate compounds shall be analyzed at the beginning and end of each analytical run, and once every 20 analytical samples.

Evaluation	Action
If discussion of sample cleanup procedures is missing or incorrect,	Notify the laboratory, and note the discrepancy in the validation report.
If no instrument blank was run, or if frequency criteria were not met,	Qualify detects <5× the MDL as “J”; do not qualify non-detects.

Criteria: The continuing calibration verification %D must be ≤15 percent.

The total percent breakdown for dichlorodiphenyltrichloroethane and for endrin must be ≤15 percent.

Evaluation	Action
If the continuing calibration verification %D for a component is >15%,	See Section 8.4.4.1.
If DDT breakdown is >15%, beginning with the samples following the last *in-control* standard,	Qualify all detects for DDT as "J." Qualify detects for DDD and DDE as "J."
If DDT was not detected, but DDD and DDE are detected,	Qualify results for DDT as "R."
If endrin breakdown is >15%, beginning with the samples following the last *in-control* standard,	Qualify all detects for endrin as "J," and qualify detects for endrin ketone and endrin aldehyde as "J."
If endrin was not detected, but endrin aldehyde and endrin ketone were detected,	Qualify results for endrin as "R."

DDE = dichlorodiphenyldichloroethylene DDD = dichlorodiphenyldichloroethane
DDT = dichlorodiphenyltrichloroethane

Polychlorinated Biphenyl (PCB) Aroclors by GC

Criteria: PCB analysis shall be performed according to the requirements listed in SW-846 method 8082, "Polychlorinated Biphenyls (PCBs) by Gas Chromatography."

The laboratory must include a discussion of any cleanup procedures performed on the samples.

The laboratory narrative shall include a thorough discussion of any problems encountered regarding target compound recognition or quantitation, especially addressing suspected environmental degradation of compounds. Reported results shall be justified with discussion and supporting documentation.

Evaluation	Action
If discussion of sample cleanup procedures is missing or incorrect,	Notify the laboratory, and note the discrepancy in the validation report.
If the reviewer does not feel that the discussion justifies the results reported by the laboratory,	Notify the laboratory; more supporting documentation may be required from the laboratory.
If the laboratory identifies any aroclors as degraded,	Qualify detects for these aroclors as "J."

Criteria: The continuing calibration verification %D must be ≤15 percent.

Evaluation	Action
If the continuing calibration verification %D for any aroclor is >15%,	See Section 8.4.4.1.

Chlorinated Herbicides by GC

Criteria: The LCS shall contain each of the specified target chlorinated herbicides at concentrations near the midpoint of the calibration range.

Evaluation	Action
If results are reported for target compounds that are not in the LCS,	Qualify detects and non-detects as "J."
If LCS analytes are not at concentrations near the midpoint of the calibration range,	Note the finding in the validation report, and notify the laboratory.

8.6.4 Procedure for LC/MS/MS Validation

The requirements addressed within this section are applicable to all liquid chromatography–tandem mass spectrometry (LC/MS/MS) analytical techniques.

LC/MS/MS is a powerful technique used for many applications, having very high sensitivity and specificity. LC/MS/MS combines the physical separation capabilities of liquid chromatography with the mass analysis capabilities of mass spectrometry. Separation techniques that can be used include high performance liquid chromatography (HPLC), ultra performance liquid chromatography (UPLC), or ion chromatography (IC). Mass spectrometry analysis utilizing low-energy ionization such as atmospheric pressure chemical ionization (APCI) is typically employed. Some applications may include multiple ionization/mass separation sequences.

8.6.4.1 Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the required compounds. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. In the absence of or in addition to method-specific calibration acceptance criteria, the following general calibration acceptance criteria should be applied.

Initial Calibration

Criteria: LC/MS/MS instrument calibration shall be performed using a minimum of five calibration standards. The lowest point of the curve must be at or below the practical quantitation limit. If calibration curves are used, five standards are required for a linear (first-order) calibration model, a quadratic (second-order) model requires six standards, and a third-order polynomial requires seven standards. Higher order curves should not normally be used. If the laboratory uses a higher-order equation to establish a calibration curve, it should be evaluated for appropriate application.

Generally it is not acceptable to remove points from the calibration curve unless the points are at the high or low ends of the curve. However, for the purpose of meeting calibration criteria, if a point is removed from the low end, the reporting limit must be adjusted accordingly. If a point is removed from the high end, the linear calibration range must be adjusted accordingly. Whenever a point is removed, it must be clearly documented on the instrument log. All initial calibration points must be analyzed without any changes to instrument conditions, and all points must be analyzed within 24 hours.

Evaluation	Action
If an insufficient number of calibration standards were used, the reporting limits were incorrect or all points were not analyzed within a 24 hour period:	Qualify detects and non-detects as “J.”

Note *The laboratory may establish a calibration curve using either the linear regression (linear curve) approach or the response factor (RF) approach. If both approaches are used to quantify and report target analytes within the same data package, calibration is to be assessed on an analyte-by-analyte basis.*

Criteria: The validator shall verify that the laboratory has applied the “J” qualifier to all detects that fall between the reported method detection limit and the practical quantitation limit or lowest calibration standard.

Evaluation	Action
If the laboratory has not properly qualified the data,	Request an amended report.

Response Factors

Criteria: The %RSD for the response factors obtained from the five initial calibration standards must be ≤20 percent.

Evaluation	Action
If any compound has a %RSD:	
>20%,	Qualify detects for that compound as “J.”
>20% but ≤40%,	May qualify non-detects for that compound as “J” if any other initial calibration criteria have been exceeded for that compound.
>40% but ≤60%,	Qualify non-detects for that compound as “J.”
>60%,	Qualify non-detects for that compound as “R.”

Linear Curves

Criteria: The correlation coefficient (r^2) / coefficient of determination of the initial calibration curve shall be ≥0.99 and have a slope ≥0.01 for each compound. The absolute value of the intercept shall be <3 times the MDL.

Evaluation	Action
If any compound curve has a slope <0.05:	Qualify detects and non-detects for that compound as “J” and qualify non-detects for that compound as “R” if the slope is <0.01.
If any compound has a correlation coefficient (r^2):	
<0.99	Qualify detects for that compound as “J.”
<0.99 but ≥0.90,	May qualify non-detects as “J” if any other initial calibration criteria have been exceeded for that compound.
<0.90,	Qualify non-detects for that compound as “J.”
<0.80,	Qualify non-detects for that compound as “R.”
If any compound has an intercept with absolute value >3X the MDL, and:	
if the intercept is negative,	Qualify non-detects for that compound as “R”; qualify detects <3X the absolute value of the intercept as “J.”
if the intercept is positive,	Qualify detects <3X the intercept as “J”; detects for that compound that are ≥3X the intercept value are not qualified; non-detects are not qualified.

Initial Calibration Verification

A calibration verification standard (ICV) of different origin than the calibration standards is used to verify the initial calibration. The percent difference (%D) in response between the known concentration and measured concentration for each compound in the calibration verification standard should be less than 20%.

Evaluation	Action
If any compound has a %D between the measured and true concentration of >20%:	
if the %D is >20% but ≤40%,	Qualify detects for that compound as “J.” May qualify non-detects for that compound as “J” if any other criteria have been exceeded for that compound.
if the %D >40% but ≤60%,	Qualify detects and non-detects for that compound as “J.”
if the %D >60%,	Qualify detects for that compound as “J”; qualify non-detects for that compound as “R.”

Continuing Calibration Verification

Continuing calibration verification (CCV) ensures that the instrument continues to be capable of producing acceptable qualitative and quantitative data on a day-to-day basis.

Criteria: A CCV must be run

- At the beginning of each analytical run,
- At least once every 20 samples,
- At the end of each analytical run.

The %D between the continuing calibration standard response factors and the average response factors from the initial calibration must be within ±20 percent. The evaluation of CCV data applies to all CCVs that bracket samples of interest. If multiple CCVs were analyzed to obtain a passing CCV, the calibration is not verified and no longer acceptable.

Evaluation	Action
If the average RF for any compound has a %D between initial and continuing calibration of >20%:	
if the %D >20% but ≤40%,	Qualify detects for that compound as “J.” May qualify non-detects for that compound as “J” if any other calibration criteria have been exceeded for that compound.
if the %D >40% but ≤60%,	Qualify detects and non-detects for that compound as “J.”
if the %D >60%,	Qualify detects for that compound as “J” and non-detects for that compound as “R.”
If the CCV frequency is not met:	Qualify detects and non-detects as “J.” Qualify non-detects as "R" if no CCV was analyzed.

8.6.4.2 Internal Standard Performance

Internal standard performance criteria are evaluated to ensure that instrument sensitivity and response are stable during each analysis.

Criteria: Internal standard (IS) area counts must not vary by more than 50 to 200 percent from the average of those obtained from the initial calibration standards. The retention time (RT) of the internal standard must be within ±0.5 minute of the RT established during the initial calibration.

Evaluation	Action
If there are two analyses for a particular fraction, the reviewer must determine which are the best data to report. Considerations should include: 1. Magnitude of the RT shift. 2. Holding times. 3. Comparison of the values of the compounds reported in each fraction. 4. Surrogate recovery.	Qualify all data from the rejected analysis as “R,” and document the reason for rejecting data from one analysis in the validation report.
If an IS area count is outside 50 to 200% of the associated standard,	Detects for compounds associated with the out of specification IS are qualified as “J.”
If an IS area count is <25% of the calibration standard,	Associated detects are qualified as “J.” May qualify associated non-detects as “R” based on professional judgment.
If the IS area count is >200% of the average of the calibration standards,	Associated detects are qualified as “J.”
If an IS RT is outside the applicable RT window, the reviewer should consider partial or total rejection of the data for the sample fraction.	Qualify detects and non-detects for compounds associated with the IS RT as “R.”

Note

Results from quality control samples that are qualified because of IS failures cannot be used to qualify sample results.

8.6.4.3 Blanks

The preparation batch consists of a group of no more than 20 samples of the same matrix processed on the same day. All samples in a batch must be initiated on the same day. Each batch must contain a method blank.

An initial calibration blank (ICB) is analyzed after the ICV. A continuing calibration blank (CCB) is analyzed after each CCV.

The purpose of blanks analyses is to determine the magnitude of contamination resulting from field or laboratory activities.

The criteria for evaluation of blanks apply to any blank associated with the samples and include equipment blanks and field blanks, if submitted. Action in the case of unacceptable blank results depends on the circumstances and origin of the blank. In instances where more than one blank is associated with a given sample, qualification should be based upon a comparison with the associated blank having the highest concentration of a contaminant. For purposes of evaluating multiple blanks, each preparation batch may be considered an independent event in evaluating preparation blanks, and each 12-hour run sequence may be considered an independent event for evaluating instrument blanks.

The result of any compound detected in the sample, which was also detected in any associated blank, must be qualified when the sample concentration is <5 times the blank concentration. Additionally, there may be instances where little or no contamination is present in the associated blank, but qualification of the sample is deemed necessary. Contamination introduced during dilution is one example. Although it is not always possible to determine, evidence of this occurrence can be identified when contaminants are found in the diluted sample result but are absent in the undiluted sample.

The reviewer should note that the blank analyses might not involve the same weights, volumes, or dilution factors as the associated samples. These factors must be taken into consideration when applying the 5 times criteria, so that a comparison of the total amount of contamination is actually made.

Criteria: The concentration of each target analyte found in the blank must be less than the associated PQL. The sample results must not be corrected by subtracting any blank value. If QC problems exist with any blank, all data associated with the case must be carefully evaluated to determine whether there is an inherent variability in the data for the case, or if the problem is an isolated occurrence not affecting other data.

Evaluation	Action
If a compound is detected in a blank but not detected in the sample,	Take no action.
If a compound is detected in a blank,	Qualify detects for that compound as “U” using the 5× rule.
If the reviewer determines that the contamination is from a source other than the sample,	Qualify the results for that compound as “R.” In this case, the 5× rule does not apply. Discuss such circumstances in the validation report.
If gross contamination exists,	Qualify all compounds affected as “R,” due to contamination.
If inordinate numbers of other target analyte list compounds are detected at low levels in the blanks,	It may indicate a problem at the laboratory. Discuss the presence of these compounds in the data validation report.

8.6.4.4 Surrogate Recovery

Laboratory performance on individual samples is established by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. The evaluation of the results of these surrogate spikes is not necessarily straightforward. The sample itself may produce effects due to such factors as interference and high concentrations of analytes. Because the effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique problems, the review and validation of data based on specific sample results is frequently subjective and demands analytical experience and professional judgment.

Criteria: Sample and blank surrogate recoveries must be within limits specified by the laboratory. Surrogate compound recoveries shall be calculated using the procedure described in SW-846 Method 8000. Reported recoveries shall be accompanied by the applicable acceptance limits.

Evaluation	Action
If an initial dilution is performed on any sample and the surrogate has ≥10% recovery, or the surrogate has <10% recovery, but the results for one or more compounds were >PQL,	Qualify associated detects and non-detects as "J."
If an initial dilution is performed on any sample and the surrogate recovery is zero and all results are non-detect,	Qualify all sample results as "R."
If there are two or more analyses for a particular fraction at the same dilution, the reviewer must determine which are the best data to report. Considerations should include: 1. Surrogate recovery (marginal vs. gross deviation). 2. Holding times. 3. Comparison of the values of the target analytes reported in each fraction. 4. Performance of internal standard.	Qualify all data from the rejected analysis as "R" and document the reason for rejecting data from one analysis in the validation report.
For surrogate spike recovery out of specification, the following approaches are suggested based on a review of all data from the case, especially considering the apparent complexity of the sample matrix.	
If the surrogate is out of specification low but has recovery ≥10%,	Qualify all detects and non-detects as "J."
If the surrogate has <10% recovery,	Qualify all detects as "J" and non-detects as "R."
If the surrogate is out of specification high,	Qualify all detects as "J"; non-detects are not qualified.

Criteria: In the case of a blank analysis with surrogate out of specification, the reviewer must give special consideration to the validity of associated sample data. The basic concern is whether the blank problems represent an isolated problem with the blank alone or whether there is a fundamental problem with the analytical process. If one or more samples in the batch show acceptable surrogate recovery, the reviewer may choose to consider the blank problem to be an isolated occurrence. However, even if this judgment allows some use of the affected data, analytical problems remain that must be corrected by the laboratory.

Evaluation	Action
If surrogate recovery in the blank does not meet acceptance criteria, associated sample results may be qualified as follows,	Detects >PQL are not qualified; qualify all detects <PQL and non-detects as “J.”

8.6.4.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Data for MS/MSD are generated to determine the precision and accuracy of the analytical method as applied to samples of a specific matrix.

Criteria: The MS/MSD data shall not be used to qualify field sample data unless the MS/MSD sample was from the same client and of similar matrix.

An MS and MSD sample shall be analyzed at a frequency of once per data package, once per 20 samples of similar matrix, or once per sample matrix, whichever is more frequent.

The laboratory shall not use blank samples to satisfy these requirements, if the laboratory can identify these blanks.

MS samples that require dilution should not be used to qualify data.

The MS and MSD accuracy and precision acceptance criteria shall be those calculated by the laboratory using the procedure given in SW-846 Method 8000B. Laboratories should report recoveries and RPD values for MS and MSD analyses in the QC section of deliverables. If the acceptance criteria are not given, the reviewer should use 70 to 130 percent recovery and 30 percent RPD as the criteria. For solid and waste samples, it may be appropriate to accept up to a 40 percent RPD, based on the professional judgment of the reviewer.

The data reviewer may use the MS and MSD results in conjunction with other QC results to determine the need for qualification of the data. The data reviewer should first try to determine to what extent the results of the MS/MSD affect the associated data. This determination should be made considering the MS/MSD sample matrix, the surrogate and IS recoveries, and the LCS results.

Professional judgment should be used to determine if MS/MSD failure warrants qualification of only the results for the failed compounds, or if results for all the compounds associated with the failed MS compound and its associated IS are affected. Generally, unless evidence exists to warrant qualification of other compounds, only the compounds in the MS spiking mixture shall be qualified.

Evaluation	Action
If the MS/MSD sample was from another client or of a dissimilar matrix; if the frequency of the MS/MSD did not meet specified criteria; if no MS/MSD was analyzed; or if field, equipment, or trip blank samples were used for MS/MSD purposes.	Note this in the validation report and notify the laboratory, with no qualifications applied.
If no other measure of precision (LCSD or replicate) is available,	Qualify all detects and non-detects as “J.”
If the surrogate, IS, and LCS recoveries are within the required acceptance criteria and the MS or MSD does not meet the acceptance criterion for recovery, or the RPD between the MS and MSD does not meet the acceptance criterion:	
If the MS or MSD recovery for any compound is greater than the upper acceptance limit, or less than the lower acceptance limit but ≥10%,	Qualify detects for that compound as “J”; non-detects are not qualified.
If the MS or MSD recovery for any compound is <10%,	Qualify detects for that compound as “J” and non-detects as “R.”
If the RPD for any compound does not meet the acceptance criteria or recoveries fail both high and low,	Qualify detects and non-detects for that compound as “J.”

Note

If a bias (high or low) is identified in one of the MS samples but not the other, the RPD (precision) evaluation is not used. For example, if a compound has low MS recovery and the RPD is not within criteria the data is qualified as “J.”

8.6.4.6 Replicate Sample Analysis

Replicate analyses are indicators of laboratory precision based on each sample matrix. If a replicate was performed instead of a MSD, the following criteria are applied. If insufficient sample was submitted to analyze a MS/MSD or replicate, the laboratory may run an LCSD to measure precision.

Criteria: A replicate sample shall be analyzed at a frequency of once per data package, once per 20 samples of similar matrix, or once per sample matrix, whichever is more frequent. All surrogate and IS acceptance criteria must be met in the replicate analysis.

Samples identified as blanks should not be used for replicate sample analysis.

The replicate precision acceptance criteria shall be calculated by the laboratory using the procedure given in SW-846 Method 8000B. Laboratories should report RPD values for replicate analyses in the QC section of deliverables. If the acceptance criteria are not given, the reviewer should use 30 percent RPD as the criteria. For solid and waste samples, it may be appropriate to accept up to a 40 percent RPD, based on the professional judgment of the reviewer.

Evaluation	Action
If a replicate sample, MSD, and LCS/LCSD were not analyzed for each matrix or for each data package,	Qualify all detects and non-detects of the same matrix as “J.”
If the original result and replicate result for any compound are both >5X the PQL, and the RPD exceeds the appropriate control limit,	Qualify detects and non-detects for that compound as “J.”
If the original and/or replicate result for any compound is <5X the PQL and the difference between the original result and replicate result is >PQL,	Qualify detects and non-detects for that compound as “J.”

8.6.4.7 Laboratory Control Samples

Data for LCS are generated to provide information on the accuracy of the analytical method as performed by the laboratory.

Criteria: An LCS should be analyzed for all methods at a frequency of once per data package, once per matrix, or once per 20 analytical samples, whichever is most frequent.

The LCS must meet all sample acceptance criteria and laboratory derived acceptance criteria. If the recovery acceptance criteria are not reported, the reviewer should use the criteria of 70 to 130 percent as the criterion.

If the laboratory analyzed an LCS/LCSD as a measure of precision, both the LCS and LCSD must meet the acceptance criteria.

Evaluation	Action
If the frequency of the LCS did not meet the specified criteria,	Qualify all detects and non-detects as "J."
If results are reported for target compounds that are not in the LCS,	Qualify detects and non-detects for these compounds as "J."

If the LCS criteria are not met and reanalysis was not performed, then the laboratory performance and method accuracy are in question. The following may be used as guidance in qualifying data.

Evaluation	Action
If the LCS recovery is greater than the upper acceptance limit,	Qualify detects for that compound as "J"; non-detects are not qualified.
If the LCS recovery is less than the lower acceptance limit,	Qualify detects for that compound as "J." Qualify non-detects as "J" if the recovery is ≥10% and as "R" if recovery is <10%.
If recovery for more than half of the compounds in the LCS analysis are below the acceptance range, the laboratory has not shown that it can actually meet program required detection limits.	Qualify all detects as "J" and all non-detects as "J" if the failures are marginally low and as "R" if recoveries are significantly below acceptance limits.
If recovery for more than half of the compounds in the LCS analysis are above the acceptance range,	Qualify all detects as "J"; non-detects are not qualified.
If recovery for more than half of the compounds in the LCS analysis are outside the acceptance range, both above and below,	Qualify all detects and non-detects as "J."

8.6.4.8 Analyte Identification and Quantification

The objective of analyte identification is to minimize the number of erroneous identifications. An erroneous identification can either be a false positive (reporting a compound present when it is not) or a false negative (not reporting a compound that is present).

Accurate analyte quantification requires adequate analyte peak resolution using unique combinations of retention time and ion mass. Inaccurate quantification can result from poor peak resolution of analytes that share a common ion mass.

Criteria: Analytes are identified by retention time and ion mass (or ion mass pairs). Sample analyte retention time must compare to within ± 0.5 minute of the retention time of that analyte in the initial calibration. Sample ion mass (or ion mass pairs) used to quantify an analyte must be the same as those used in the initial calibration.

Evaluation: Check that the RT of each reported compound is within the RT window established for that compound.

Verify that the ion mass used to identify a target compound is the same used during calibration.

Evaluation	Action
If target compounds are identified on the quantitation report but are not reported,	Request corrected reports from the laboratory.
If compounds are reported but do not meet the RT criteria,	Qualify detects as "U."
If compounds are reported but do not meet the ion mass criteria,	Qualify detects as "U."

Criteria: Analyte peaks that share a common ion mass must be resolved such that the height of the valley between peaks is less than 20 percent of the analyte peak height.

Evaluation: Check the peak resolution of analyte peaks that share a common ion mass.

Evaluation	Action
If valley height between peaks is greater than 20% of the analyte peak height,	Qualify the analyte result associated with that peak as "J."

8.6.4.9 Sample Carryover

Sample carry-over may occur when a high-concentration sample is analyzed immediately prior to another field sample. Steps must be taken to avoid introduction of false positive results in the second sample analysis due to instrument contamination.

Criteria: The absence of sample carry-over must be determined and verified. If examination of the run logs indicates that any samples in the analytical run of interest required dilution, and there is no documentation of a rinse or blank analysis immediately following the original undiluted analysis then sample carry-over may be suspected.

Evaluation	Action
If any compounds found in the sample requiring dilution exceed the high calibration standard and are also found in the following sample at concentrations <5X the PQL,	Qualify the results for these compounds in the second sample as "R."

8.6.4.10 Dilutions

Criteria: The PQLs must be adjusted to reflect all sample dilutions, concentrations, splits, clean-up activities, and dry weight factors that are not accounted for by the method. Samples must be diluted and reanalyzed when any analytes exceed the calibration range. Original sample runs should be included when any sample requires dilution due to one or more compounds exceeding the calibration range. The original undiluted results document the actual MDLs for non-detects.

Evaluation	Action
If the PQLs have not been properly adjusted,	Request an amended report from the laboratory.
In some cases, initial dilutions are required because of expected high concentrations of non-target analytes or because one or more target analyte is expected to greatly exceed the instrument working range. In these instances, the laboratory may not be able to analyze the undiluted sample.	Note the dilution and high MDLs in the validation report.
If any compound exceeds the calibration range and,	
If the original undiluted sample result is reported,	Qualify detects from the undiluted analysis that exceed the calibration range as “J.”
If the sample is diluted and reanalyzed, and the diluted sample data is reported,	Qualify non-detects from the diluted analysis as “J.”
If the original undiluted sample data is not provided,	Request this information from the laboratory.
If data from the original sample run are unavailable,	Refer to Section 8.6.4.4 for assessment of initially diluted samples with low surrogate recovery.

Criteria: The laboratory shall strive to make dilutions in such a way that the final concentration was measured in the mid-range of the calibration curve, and that results are not reported from measurements below the lowest concentration standard.

Evaluation	Action
If the instrument response (reported result/ dilution factor) from diluted samples is less than the lowest concentration standard,	Qualify detects for that compound as “J.”

Note

Refer to Section 8.6.4.4 for assessment of initially diluted samples with low surrogate recovery.

8.6.5 Procedure for Inorganic Data Validation

8.6.5.1 Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of the analysis run, and continuing calibration verification documents that the initial calibration is still valid.

Initial Calibration

Criteria: Instruments must be calibrated daily.

ICP/AES and ICP/MS analysis: A blank and at least one standard must be used in establishing the analytical curve.

Mercury analysis by cold vapor atomic absorption: A blank and at least four standards must be used in establishing the analytical curve.

Cyanide analysis: A blank and at least three standards, one of which must be at the PQL, must be used in establishing the analytical curve.

Ion chromatography (IC) analysis: A blank and at least three standards, one of which must be at the PQL, must be used in establishing the analytical curve. Daily calibration is not required if acceptable calibration verification is performed prior to the analytical run.

Evaluation	Action
If the minimum number of standards was not used for initial calibration,	Qualify all detects and non-detects as “J.”
If the instrument was not calibrated daily (except IC analysis) and each time the instrument was set up,	Qualify all sample results as “R.”

Criteria: The correlation coefficient (r^2) of the initial calibration curve shall be ≥0.995, and the absolute value of the intercept shall be <3 times the MDL.

The correlation coefficient assessment need only be performed on those curves established using at least three standards and a blank (four point curve).

The intercept shall be assessed for all inorganic calibration curves.

Note *The laboratory may report two calibration lines for some inorganic analytes. In this case, qualifiers should be applied if the r^2 criteria are not met for either reported calibration. The intercepts for these curves should not be evaluated.*

Evaluation	Action
If any compound has an r^2:	
<0.995,	Qualify detects for that compound as “J.”
<0.995 but ≥0.90,	Use professional judgment, and, if appropriate, qualify non-detects as “J.”
<0.90 but ≥0.80,	Qualify non-detects for that compound as “J.”
<0.80,	Qualify non-detects for that compound as “R.”
If any compound has an intercept with absolute value >3× the MDL, and:	
If the intercept is negative,	Qualify non-detects for that compound as “R” and detects <3× the absolute value of the intercept as “J.”
If the intercept is positive:	Qualify detects <3× the intercept as “J.” Do not qualify detects for that compound that are ≥3× the intercept value, or non-detects.

Calibration Verification

Criteria: An initial calibration verification standard must be analyzed after instrument calibration and prior to sample analysis. A continuing calibration verification standard must be analyzed once every 10 injections or every 2 hours, whichever is more frequent. The evaluation of continuing calibration verification data applies to all continuing calibration verifications that bracket samples of interest.

Initial calibration verification and continuing calibration verification analysis results must fall within the control limits of 90 to 110%R of the true value for all analytes except mercury and cyanide.

Initial calibration verification and continuing calibration verification analysis results for mercury must fall within the control limits of 80 to 120%R.

Initial calibration verification and continuing calibration verification analysis results for cyanide must fall within the control limits of 85 to 115%R.

Evaluation	Action
If no initial calibration verification was analyzed, or if the continuing calibration verification frequency criteria were not met,	Qualify all detects for the affected analyses as “J” and non-detects as “R.”
If the initial calibration verification or continuing calibration verification %R is within the range of 75 to 89% (mercury: 65 to 79%, cyanide: 70 to 84%),	Qualify detects and non-detects for that analyte as “J.”
If the initial calibration verification or continuing calibration verification %R is within the range of 111 to 125% (mercury: 121 to 135%, cyanide: 116 to 130%),	Qualify detects for that analyte as “J”; do not qualify non-detects.
If the initial calibration verification or continuing calibration verification %R is <75% (mercury: <65%, cyanide: <70%),	Qualify detects for that analyte as “J” and non-detects as “R.”
If the initial calibration verification or continuing calibration verification %R is >125% (mercury: >135%, cyanide: >130%),	Qualify detects for that analyte as “R”; do not qualify non-detects.

8.6.5.2 Blanks

Blank analysis results are assessed to determine the presence of contamination problems. The criteria for evaluation of blanks apply to any laboratory blank associated with the samples.

Criteria: An initial calibration blank must be analyzed to verify the baseline immediately following calibration and prior to sample analysis. A continuing calibration blank must be analyzed after each continuing calibration verification and at the end of every analytical sequence in order to bracket all sample runs. All continuing calibration blanks that bracket samples of interest shall be reported and assessed.

A minimum of one method blank shall be analyzed for every 20 samples. The same reagents used for the sample digestion must be used to prepare the method blank. In those cases in which reagents are automatically added to all samples by an auto analyzer, the initial calibration blank is equivalent to a method blank.

If any quality control problems exist with any blank, all data associated with the case must be evaluated to determine whether there is an inherent variability in the data for the case or if the problem is an anomaly not affecting other data.

If the absolute value of the initial calibration blank or continuing calibration blank result is >PQL, the analysis should have been terminated and the problem corrected by the laboratory. If any analyte concentration in the blank is >PQL, the lowest reported concentration in the associated samples must be ≥10 times the concentration in the blank. Samples having analyte concentrations <10 times the blank but >PQL shall be re-digested and reanalyzed.

When there is blank contamination and reanalysis is not possible, the data may need to be qualified. Use the blank type with the highest concentration (initial calibration blank/continuing calibration blank or method blank) associated with the samples of interest to qualify data. A sample is associated with an initial calibration blank or continuing calibration blank if it is within five samples before or five samples after the suspect blank as listed on the analysis run log.

The reviewer should note that the blank analyses might not involve the same weights, volumes, or dilution factors as the associated samples. These factors must be taken into consideration when applying the validation criteria, so that a comparison of the total amount of contamination is actually made.

The effect of method blank values versus initial calibration blank/continuing calibration blank values on sample results is not straightforward and will vary depending on analytical method. Professional judgment is required to properly assess the effect of blank data on sample results. As a general guideline, in the case of conflicting positive and negative method blank and initial calibration blank/continuing calibration blank values, the method blank values will take precedence over initial calibration blank/continuing calibration blank values when applying qualifications to associated sample results.

Evaluation	Action
If blank frequency criteria were not met,	Note the deficiency in the validation report.
If the absolute value of a blank is <MDL,	Take no action.
If a blank value is ≥MDL,	Qualify all associated detects <5× the blank concentration as "U."
In the case of *negative* blank values:	
If the absolute value of the *negative* blank is >MDL but ≤PQL,	Qualify all associated detects <5× the MDL and all non-detects as "J." Do not qualify detects ≥5× MDL.
If the absolute value of the *negative* blank is >PQL, and the analysis was not terminated by the laboratory,	Notify the laboratory, and qualify all associated detects <5× the PQL as "J" and non-detects as "R."

8.6.5.3 Matrix Spike

The matrix spike sample analysis is performed as a measure of the ability to recover analytes in a particular matrix.

Criteria: The matrix spike data shall not be used to qualify data unless the matrix spike sample was from the same client and of similar matrix.

A matrix spike must be performed for each matrix. A minimum of one matrix spike must be analyzed for each data package or once per 20 samples, whichever is more frequent.

Samples identified as field blanks cannot be used for matrix spike analysis.

Matrix spike samples that require dilution should not be used to qualify data.

Spiking levels shall be at approximately the midpoint of the calibration range.

The matrix spike %R must be within the limits of 75 to 125 percent, unless the sample concentration is >4 times the spike concentration. If sample concentration is >4 times the spike concentration, no matrix spike recovery criteria apply; however, a post-digestion spike may be used to evaluate the matrix effect.

Matrix spike analysis shall be performed for all analytes other than sodium, potassium, magnesium, and calcium.

For IC, ion-specific electrode, and colorimetric techniques for which no digestion is employed, matrix spikes shall be analyzed.

Note

For methods that require a digestion, post-digestion spikes are occasionally performed. The recovery acceptance criterion on post-digestion spikes is 85 to 115 percent. For methods that do not require digestion, such as IC, ion-specific electrode, and colorimetric, the spike may be referred to as a post spike or analytical spike. These should be evaluated using the acceptance criteria of a matrix spike, 75 to 125%R.

Evaluation	Action
If the matrix spike sample was from another client or of a dissimilar matrix, if a field blank or equipment blank was used for matrix spike analysis, or if a matrix spike was not analyzed,	Qualify all detects and all non-detects as “J.”
If the sample concentration is ≤4× the spike concentration and,	
If the matrix spike recovery is >125%,	Qualify detects for that analyte as “J”; do not qualify non-detects.
If the matrix spike recovery is 30 to 74%,	Qualify detects and non-detects for that analyte as “J.”
If the matrix spike recovery is <30%,	Qualify detects for that analyte as “J” and non-detects as “R.”
If the post-digestion spike recovery is less than the acceptance criteria but ≥10%,	Qualify detects and non-detects for that analyte as “J.”
If the post-digestion spike recovery is <10%,	Qualify detects for that analyte as “J“ and non-detects as “R.”
If the post-digestion spike recovery is >115%,	Qualify detects for that analyte as “J”; do not qualify non-detects.

For a matrix spike that does not meet the acceptance criteria, apply the qualifier to all samples of the same matrix, if the reviewer considers the samples sufficiently similar. The reviewer will need to exercise professional judgment in determining sample similarity. The reviewer shall use all available data, including site and sampling documentation (e.g., location and type of sample, descriptive data, soil classification); field test data (e.g., pH, Eh, conductivity); and laboratory data for other analytes in determining similarity. The reviewer should also use the sample data (similar concentrations of analytes) in determining similarity between samples in the sample submittal. The reviewer may determine that only some of the samples in the submittal are similar to the matrix spike sample, and that only these samples should be qualified. Or, the reviewer may determine that no samples are sufficiently similar to the sample used for the matrix spike; thus, only the sample used for the matrix spike should be qualified.

8.6.5.4 *Replicate Sample Analysis*

Replicate analyses are indicators of laboratory precision for each sample matrix.

Criteria: One replicate must be analyzed for each matrix or each batch, with a minimum frequency of one per 20 samples.

Samples identified as field blanks or equipment blanks should not be used for replicate or matrix spike duplicate analysis.

A control limit of 20 percent for the relative percent difference shall be used for sample values >5 times the PQL. For solid and waste samples, it may be appropriate to accept up to a 35 percent relative percent difference, based on the reviewer's professional judgment.

Note

Many laboratories use EPA's Contract Laboratory Program reporting protocol for replicates; that is, precision for sample values that are >5 times the reporting limit is reported as relative percent difference, but precision for sample values <5 times the reporting limit are reported as the absolute value of the difference between the two results. If the precision is reported as the absolute value of the difference, calculate the relative percent difference as defined below.

A control limit of ±PQL shall be used for sample values <5 times the PQL, including the case when only one of the replicate sample values is <5 times the PQL.

No precision criterion applies to samples with concentrations less than the PQL.

When a replicate was not performed but a matrix spike duplicate was analyzed, the preceding criteria are applied to the matrix spike duplicate results. If insufficient sample was submitted to analyze a replicate, the laboratory may run an LCS/LCSD to measure precision.

Evaluation	Action
If no replicate sample, matrix spike duplicate, or LCSD was analyzed for each matrix or for each data package, or if a field blank or equipment blank was used for the replicate analysis,	Qualify all detects and non-detects of the same matrix as "J."
If the original result and replicate result are both ≥5× the PQL, and the relative percent difference exceeds the appropriate control limits,	Qualify detects and non-detects for that analyte of the same matrix as "J."
If the original or replicate result is <5× the PQL, and the difference between the original result and replicate result is greater than the PQL,	Qualify detects and non-detects for that analyte of the same matrix as "J."

8.6.5.5 *Laboratory Control Samples*

Data for LCS are generated to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation.

Criteria: LCS shall be analyzed using the same sample preparation and analysis methods used for samples, with one LCS analyzed with each batch of up to 20 samples. Multiple LCS analyses may not be used to meet acceptance criteria; that is, if multiple LCS are analyzed for a batch and any failures occur, the failed LCS will be used to qualify the data.

All aqueous LCS results must fall within the control limits of 80 to 120 percent, except those for antimony and silver, for which control limits are laboratory-specified. LCS failures for silver and antimony shall be discussed in the validation report but shall not be subject to the reanalysis requirement.

All solid LCS results must fall within the control limits established by the agency that prepared the reference material or statistically derived limits developed by the laboratory. The laboratory should report these limits on the LCS reporting form. If solid LCS control limits are not provided, soil results are assessed on the basis of the aqueous control limits.

An aqueous LCS is not required for mercury or cyanide analyses.

Evaluation	Action
If an LCS was not analyzed,	Qualify all detects and non-detects as “J.”
Aqueous LCS	
If the LCS recovery is >120%,	Qualify detects for that analyte as “J”; do not qualify non-detects.
If the LCS recovery is within the range of 50 to 79%,	Qualify detects and non-detects for that analyte as “J.”
If the LCS recovery is <50%,	Qualify detects for that analyte as “J” and non-detects as “R.”
Solid LCS	
If the LCS result is greater than the certified control limit,	Qualify detects for that analyte as “J”; do not qualify non-detects.
If the LCS recovery is ≥30% but less than the lower control limit,	Qualify detects and non-detects for that analyte as “J.”
If the LCS recovery is <30%,	Qualify detects for that analyte as “J” and non-detects as “R.”
If an aqueous LCS was analyzed for soil matrices,	Qualify all detects and non-detects as “J.”

8.6.5.6 Reporting Limit Verification (CRI)

Criteria: CRI (ICP/AES and ICP/MS) standards are analyzed at the beginning of each analytical run as a measure of accuracy near the reporting limit. CRI standards are prepared with concentrations at twice the PQLs.

The advisory acceptance criterion for these analyses is 70 to 130%R.

Evaluation	Action
If the recovery is >130%,	Qualify detects for that analyte <5× the PQL as “J”; do not qualify non-detects and detects ≥5× PQL.
If the recovery is <70% but ≥30%,	Qualify detects for that analyte <5× PQL as “J” and non-detects as “J.” Do not qualify detects ≥5× PQL.
If the recovery is <30%,	Qualify detects for analytes that are <5× PQL as “J” and non-detects as “R.”

8.6.5.7 Method-Specific Analytical Requirements (Inorganic)

ICP/AES and ICP/MS methods

ICP Interference Check Sample

The ICP interference check samples (interference check samples A and AB) verify the instrument’s inter-element and background correction factors.

Criteria: An interference check sample A must be analyzed at the beginning of each sample analysis run.

Absolute values for all interference check sample A target analytes, except those in the interference check sample A solution, must be less than or equal to the MDL.

Evaluation	Action
If the interference check sample A is not analyzed at the required frequency,	Note the deficiency in the validation report.
If the sample concentrations of aluminum, calcium, iron, and/or magnesium are less than or equal to their respective concentrations in the interference check sample A solution,	Accept the sample results without qualification.
If the sample concentrations of aluminum, calcium, iron, and magnesium are comparable to or greater than their respective concentrations in the interference check sample A solution, the following validation criteria for interference check sample A apply:	
If the interference check sample A result for an element is greater than the MDL,	Qualify sample detects for that analyte as “J”; do not qualify non-detects.
If the interference check sample A result is negative, and the absolute value of the result is greater than the MDL for an element,	Qualify sample detects and non-detects for that analyte as “J.”
If the interference check sample A result is negative, and the absolute value of the result is >2× MDL for an element,	Qualify detects for that analyte as “J” and non-detects as “R.”

Criteria: An interference check sample AB must be analyzed at the beginning of each sample analysis run.

Interference check sample AB results for the target analytes in the interference check sample AB solution must fall within the control limit of ± 20 percent of the true value.

Evaluation	Action
If the interference check sample AB is not analyzed at the required frequency,	Note the deficiency in the validation report.
If the concentrations of aluminum, calcium, iron, and magnesium in the sample are less than or equal to their respective concentrations in the interference check sample AB solution,	Accept the sample results without qualification.
If the sample concentrations of aluminum, calcium, iron, and magnesium are comparable to or greater than their respective concentrations in the interference check sample AB solution, the following validation criteria for interference check sample AB apply:	
If the interference check sample AB recovery for an element is >120%,	Qualify detects for that analyte as "J"; do not qualify non-detects.
If the interference check sample AB recovery for an element is between 50 and 79%,	Qualify detects and non-detects for that analyte as "J."
If the interference check sample AB recovery for an element is <50%,	Qualify detects for that analyte as "J" and non-detects as "R."

If the recovery criterion is not met, the analyst may either terminate the analysis or continue and reanalyze the failed constituents later.

ICP Serial Dilution

The ICP serial dilution is performed to monitor physical or chemical interferences that may exist in each sample matrix.

Criteria: A serial dilution must be analyzed for each matrix in an analytical run. If sample results are ≥50 times the MDL, then the %D between a 5 times dilution result and the original result must agree within 10 percent. No acceptance criterion applies when the undiluted sample result is <50 times the MDL.

Evaluation	Action
If frequency requirements are not met,	Qualify all detects ≥50× the MDL as "J"; do not qualify non-detects.
If the result of the sample used for serial dilution analysis is ≥50× the MDL and the %D is >10%,	Qualify affected results as "J."

For a serial dilution that does not meet the acceptance criteria, apply the qualifier to all samples of the same matrix, if the reviewer considers the samples sufficiently similar. The reviewer will need to exercise professional judgment in determining sample similarity. The reviewer should make use of all available data, including site and sampling documentation (location and type of sample, descriptive data, soil classification); field test data (pH, Eh, conductivity); and laboratory data for other analytes in determining similarity. The reviewer should also use the sample data (similar concentrations of analytes) in determining similarity between samples in the sample submittal. The reviewer may determine that only some of the samples in the submittal are similar to the serial dilution sample, and that only these samples should be qualified. Or, the reviewer may determine that no samples are sufficiently similar to the sample used for the serial dilution; thus, only the sample used for the serial dilution should be qualified.

ICP/MS Instrument Tuning

ICP/MS instrument tuning and performance criteria are established to ensure mass calibration and resolution. These criteria are instrument (not sample) specific. These criteria must be met in all circumstances.

Criteria: ICP/MS instrument mass calibration and resolution shall be checked daily. The tuning standard must contain elements with masses throughout the mass range of interest. The mass calibration must be within 0.1 atomic mass unit (amu). The mass resolution must be verified to be less than 0.9 amu full width at 10 percent peak height.

Evaluation	Action
If the instrument tune is not checked daily or if the mass calibration or resolution criteria are not met,	Contact the laboratory for immediate corrective action.
Professional judgment should be used in determining data qualification. Generally,	Qualify associated detects and non-detects as “J.”
If additional quality control failures also occurred,	Qualify all results as “R.”

ICP/MS Internal Standard Recovery

The ICP/MS internal standard recovery indicates the stability of the instrument during the analytical run.

Criteria: The intensities of all internal standards must be monitored for every analysis. When the intensity of any internal standard fails to meet the acceptance criteria of the cited method, the following procedure is followed. The sample must be diluted fivefold (1 + 4) and reanalyzed with the addition of appropriate amounts of internal standards. This procedure must be repeated until the internal standard intensities fall within the prescribed window. The intensity levels of the internal standards for the calibration blanks (initial calibration blank, continuing calibration blank) and the instrument check standards (continuing calibration verification) must meet the acceptance criteria of the cited method.

Evaluation	Action
If %R does not meet the acceptance criteria,	Qualify all detects and non-detects as “J.”
If initial calibration blank, continuing calibration blank, or continuing calibration verification %R does not meet the acceptance criteria	Qualify detects and non-detects as “J” for affected samples.

Total Organic Carbon by SW-846 Method 9060

Criteria: Quadruplicate analyses are required. Both the average and the range are to be reported.

Evaluation	Action
If quadruplicate analyses were not run,	Qualify all detects as “J” and all non-detects as “R.”

Total and Amenable Cyanide

Criteria: If total cyanide is qualified “U,” the associated amenable cyanide should also be qualified “U.”

8.6.6 Procedure for Radiochemical Analyses Validation

8.6.6.1 Quantification

Criteria: Radiochemical analytical results shall be reported as measured and shall include the total propagated uncertainty (TPU) at the 95 percent confidence level (2-sigma). The TPU shall include both systematic and random errors. Counting uncertainties may be estimated by the square root of counts except when there are zero counts. In the case of zero counts, the counting uncertainty is assumed to be one count.

The laboratory shall report all results, regardless of concentration or sign, and shall not report any result as “less than.”

The laboratory shall include an MDC calculated correctly using sample-specific parameters for all samples.

If the result is less than the Decision Level Concentration, but not qualified with a “U,” qualify with a “U.”

If the result is less than the Determination Limit, qualify with a “J.”

Evaluation	Action
If the MDC calculation cannot be verified,	Request clarification from the laboratory. Request a corrected report if necessary.
If a TPU value of 0 is reported,	Contact the laboratory for immediate corrective action.
If the result is less than the 2-sigma TPU,	Qualify the result as “U.”
If the result is ≥MDC but <3× the MDC,	Qualify the result as “J.”
If the absolute value of a negative result is >MDC,	Qualify the result as “R.” **Note:** This action is not applied to gamma spectroscopy data.

Note 1

If the “U” qualifier is applied to a sample result, the result shall not be further qualified as “J” due to other quality control failures.

Note 2

Three times the MDC is used as an estimate of the Determination Limit at a risk level of 5 percent.

Note 3

Extremely large errors may indicate inappropriate error calculation. If large errors are reported with the results, the laboratory should verify the calculations.

8.6.6.2 Alpha Spectrometry

Criteria: The calibration of each alpha spectrometry detector used to produce data shall include energy calibration and detector efficiency calibration.

A performance check for energy calibration shall be performed weekly and the performance check for efficiency calibration shall be performed at least monthly. Background measurements shall be performed at least monthly.

Evaluation	Action
If calibrations, calibration performance checks, or background checks were not performed within the specified timeframe,	Note the deficiency in the validation report.

Criteria: Regions of interest shall be clearly indicated either graphically or in tabular form on alpha spectrometer printouts.

The full width at half maximum resolution for each sample and quality control sample tracer peak shall be ≤100 kiloelectron volt (keV).

The tracer peak energy for each sample and quality control sample shall be within ±50 keV of the expected energy.

Evaluation	Action
If peak resolution and position criteria are not met,	Qualify the result as "J" if the spectral degradation is deemed sufficient to compromise the data. Peak broadening is expected for isotopes such as thorium-229 with alpha emissions at multiple energies.

8.6.6.3 Gamma Spectrometry

Criteria: Annual efficiency calibration is required. A performance check for efficiency and energy calibration shall be performed on a day-of-use basis along with performance checks on peak resolution. Background measurements shall be performed at least monthly.

Evaluation	Action
If annual efficiency calibration was not performed,	Qualify the affected results as "J."
If calibrations, calibration performance checks, or background checks were not performed within the specified timeframe,	Note the deficiency in the validation report.

Criteria: Detectors shall be calibrated for the specific geometry and matrix considerations used in the sample analysis. The laboratory should have the capability to seal soil samples in airtight cans or equivalent to allow in-growth of radon for accurate analysis of radium-226 or its progeny by gamma spectrometry when requested.

Evaluation	Action
If samples were not sealed and allowed an in-growth period of at least 20 days before the measurement of radium-226.	Qualify the result as "R."

8.6.6.4 Gas Proportional Counting

Criteria: A performance check for counting efficiency shall be performed on a day-of-use basis. For batches of samples that uninterruptedly count for more than a day, a performance check can be performed at the beginning and end of the batch as long as this time interval is no greater than 1 week. Verification of instrument calibration does not directly verify secondary calibrations, such as the mass efficiency curve. Background measurements shall be performed at least weekly.

Evaluation	Action
If calibrations, calibration performance checks, or background checks were not performed within the specified timeframe,	Qualify the affected results as “J.”

Criteria: Plateau determinations and self-absorption curves (for both alpha and beta) performed annually are required. A crosstalk curve shall be established for alpha to beta crosstalk versus residue weight. The data used to generate self-absorption and crosstalk curves shall consist of at least seven points, well distributed throughout the mass range. The residual masses of the samples analyzed must fall within the mass range of the calibration.

Evaluation	Action
If self-absorption curves have not been established within the specified timeframe,	Qualify the affected results as “J.”
If the sample residual mass is outside the calibration range,	Qualify the affected results as “J.”

8.6.6.5 Scintillation Counting

Criteria: Efficiency calibration performed annually is required. A performance check for counting efficiency shall be performed on a day-of-use basis. For batches of samples that uninterruptedly count for more than a day, a performance check can be performed at the beginning and end of the batch as long as this time interval is no greater than 1 week. Background measurements shall be performed on the day of use.

Criteria: For analysis methods using quench curves to determine individual sample detection efficiency or background, the quench curves shall be generated at least annually. If the calibration method is constant quench, the detection efficiency shall be checked at least weekly when in use or with each counting batch.

Evaluation	Action
If calibrations, calibration performance checks, or background checks were not performed within the specified timeframe,	Qualify the affected results as “J.”
If the quench curve criteria were not met,	Qualify the affected results as “J.”

8.6.6.6 Blanks

Blank analysis results are assessed to identify contamination. The criteria for evaluation of blanks apply to all blanks associated with the samples.

Criteria: One method blank must be analyzed for each matrix and each batch, or for every 20 samples, whichever is more frequent.

Method blank analysis is required for all analyses requiring sample preparation.

When blank contamination is not expected and not characterized using a blank population, samples associated with any method blank result that is greater than the required detection limit shall be re-digested and reanalyzed. Exceptions to this requirement are:

- Sample results for which the measured concentration is ≥10 times the method blank value are not qualified.
- Sample results that are corrected for blank contamination using a blank population are not qualified.

Criteria: The method blank results shall be less than the decision level concentration (DLC).

Evaluation	Action
If one method blank was not analyzed for each batch or every 20 samples, and sample concentrations are <5× the MDC,	Qualify associated results as “J.”
If the blank result is statistically >0.0 (greater than the DLC),	Qualify results for all associated samples that are <5× the blank value as “J.”
In the case of *negative* blank values:	
If the absolute value of the negative blank is >MDC,	Qualify associated detects that are <5× the MDC as “J.”
If the absolute value of the negative blank is >5× the MDC,	Notify the laboratory and qualify sample results <5× the MDC as “J.”
For liquid scintillation analyses such as tritium where the calibration blank is subtracted from the result:	
If the absolute value of the negative blank is >5× the MDC,	Notify the laboratory and qualify sample results <5× the MDC as “R.”

Note

Negative blank criteria do not apply to gamma spectroscopy results.

8.6.6.7 Sample-Specific Chemical/Tracer Recovery

An addition of a known quantity of radioactive tracer or stable carrier material to a sample prior to chemical separation is used to determine the amount of the chemical recovery.

Criteria: Recovery guidelines for tracer and carrier results shall be 30 to 110 percent. Optionally, low tracer recoveries may be evaluated from the total area counts. Samples with low recoveries but with tracer area counts >400 may not be qualified or may be qualified using professional judgment.

The quantity of tracer material used should be adequate to provide a maximum of 10 percent uncertainty at the 95 percent confidence level in the measured recovery.

Evaluation	Action
If the recovery is ≥30 and ≤110%,	No data are qualified.
If the recovery is >110 but ≤125%,	Qualify associated results as “J.”
If the recovery is <30 but ≥20% (stable carrier),	Qualify associated results as “J.”
If the recovery is <20% (stable carrier),	Qualify associated results above the MDC as “J” and results below the MDC as “R.”
If the recovery is ≥10 but <30% (radioactive tracer),	Qualify associated results as “J.”
If the recovery is <10% (radioactive tracer),	Qualify associated results above the MDC as “J” and results below the MDC as “R.”
If the recovery is >125%,	Qualify associated results as “R.”

8.6.6.8 Matrix Spike

Matrix spike analyses are performed on samples, except as noted below, as a measure of the ability to recover the analyte from a particular matrix.

Criteria: The matrix spike data shall not be used to qualify data unless the matrix spike sample was from the same client and of similar matrix.

The matrix spike recovery control limits are ±25 percent. An exception to these control limits is made if the sample result is >4 times the spike added. No control limits are applied in this case.

One matrix spike sample shall be analyzed from each batch, with a minimum frequency of one per 20 samples.

Samples identified as field blanks or equipment blanks shall not be used to satisfy the spike analysis requirement.

Unfiltered water samples and unprepared solid samples are exempt from the reanalysis requirement. Results for unfiltered water samples and unprepared solid samples for which the matrix spike failed the recovery acceptance criteria may be reported and qualified without reanalysis.

Matrix spikes are not required for gamma spectroscopy, radon-222, or any analyses using a radioactive tracer or stable carrier that is chemically identical to the analyte. In addition, radium-226 analyses that employ a barium-133 tracer are exempt from the matrix spike requirements.

Evaluation	Action
If the matrix spike sample was from another client or of a dissimilar matrix, if the frequency criteria were not met, or if a field blank or equipment blank was used for the matrix spike,	Qualify all detects and non-detects as “J.”
If the sample concentration is >4× the spike concentration,	No action is taken.
If any radionuclide does not meet the %R criteria, and:	
The recovery is <25%,	Qualify results for that analyte greater than or equal to the MDC as “J,” and results less than the MDC as “R.”
The recovery is between 26 and 74%	Qualify results for that analyte as “J.”
The recovery is >125 but ≤150%,	Qualify results for that analyte as “J.”
The recovery is >150%,	Qualify results for that analyte as “R.”

8.6.6.9 Replicate Sample Analysis

Replicate analyses indicate laboratory precision for each sample matrix.

Criteria: One replicate sample shall be analyzed from each batch, with a minimum frequency of one per 20 samples.

The relative error ratio (RER) calculated using the 1-sigma TPU is used to determine replicate precision for radiochemical results.

The radiochemical replicate determinations shall not differ significantly when compared to their 1-sigma TPU. That is, the RER shall be <3.

Samples identified as field blanks or equipment blanks shall not be used to satisfy the replicate analysis requirement.

No precision criterion applies to samples with activities below the MDC, including those where one result is greater than the MDC and one result is less than the MDC.

Replicate analyses may not be possible in tritium analyses when the moisture content is too low or the sample size is too small. A discussion of this problem shall be included in the case narrative, with no qualifiers applied.

Evaluation	Action
If a replicate sample or matrix spike duplicate was not analyzed for each matrix or for each data package,	Qualify all detects and non-detects of the same matrix as "J."
If frequency criteria are not met, or if a field blank or equipment blank was used for the replicate,	Qualify all detects and non-detects as "J."
If the RER is >3 and ≤5,	Qualify results for that analyte as "J."
If the RER is >5,	Qualify results for that analyte as "R." **Note:** Tritium in soils are not "R" qualified when the RER is >5.

8.6.6.10 Laboratory Control Samples

The LCS serves as a measure of the overall performance of all steps in the analysis, including sample preparation.

Criteria: One LCS shall be analyzed for each batch up to 20 samples.

The aqueous LCS analytical results shall agree within ±25 percent of the true value. Solid LCS results shall fall within the control limits specified by the agency that prepared the reference material or statistically derived limits developed by the laboratory. The laboratory shall report the control limits in the quality control portion of the deliverable. Multiple LCS analyses may not be used to meet acceptance criteria; that is, if multiple LCS are analyzed for a batch, and any failures occur, the failed LCS will be used to qualify the data.

Evaluation	Action
If LCS frequency criteria are not met,	Note the deficiency in the validation report.
If the LCS %R for any analyte is <30% or >150%,	Qualify all results for that analyte as "R."
If the LCS %R for any analyte is <75 (or less than the lower control limit) but ≥30%,	Qualify associated sample results as "J."
If the LCS %R for any analyte is >125 (or greater than the upper control limit) but ≤150% and the sample result is greater than the MDC,	Qualify associated sample results as "J"; do not qualify results below the MDC.
If an aqueous LCS was used for solid matrices,	Qualify all results as "J."

8.7 Data Validation Reports

8.7.1 Data Review and Validation Report

A Data Review and Validation Report is prepared for each validation performed, documenting the quality elements examined and the outcome of the validation. This report is archived as record material along with the data package received from the laboratory. Data qualifiers resulting from the validation process are added to the results records in the environmental database once the data are loaded and validation completed.

The report includes the following sections:

8.7.1.1 General Information

A summary of samples and analyses performed. This section includes the validator's name and date the report was prepared, the laboratory name and work order number(s), reference to the data validation procedure and level applied, and a table of the analyses performed with the associated analytical procedures.

8.7.1.2 Data Qualifier Summary

A summary table of samples and all qualifiers applied to the data as a result of the validation. The table includes the sample/analyte qualification and a general description of why qualification was applied.

8.7.1.3 Validation Details

The details of the validation are presented in narrative format organized by the following topics, as applicable:

- Sample Shipping/Receiving
- Preservation and Holding Times
- Detection and Quantitation Limits
- Laboratory Instrument Calibration
- Radiochemical Analysis
- Method and Calibration Blanks
- Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis
- Matrix Spike Analysis
- Laboratory Replicate Analysis
- Laboratory Control Sample
- Metals Serial Dilution

- Completeness
- Electronic Data Deliverable
- Anion/Cation Balance

This section may also include a discussion of the following topics that are described in detail in Section 8.7.2:

- Sampling Protocol
- Field Duplicate Analysis
- Equipment and Trip Blanks
- Potential Outliers

8.7.1.4 Validation Worksheets

The SMS validation worksheets summarize the quality control performance that is the basis for data qualification. Criteria that are documented on the worksheets include holding time/preservation compliance; calibration performance, CRI, and serial dilution performance; laboratory, field, equipment, and trip blanks; field duplicate and laboratory duplicate performance; surrogate, internal standard, matrix spike/matrix spike duplicate, and LCS recoveries.

8.7.2 Data Validation Package

When required, a data validation package (DVP) is prepared to document the outcome of routine water sampling events. A DVP contains all of the elements of the Data Review and Validation Report plus a detailed review of the field activities, and a complete listing of the results of the field and laboratory measurements performed. Figure 1 shows an example DVP table of contents. The contents of a DVP are described below.

Contents

Sample 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
    Potential Outliers Report
    Anomalous Data Review Checksheet

Attachment 2 – Data Presentation
    Groundwater Quality Data
    Surface Water Quality Data
    Equipment Blank Data
    Static Water Level Data
    Time-Concentration Graphs

Attachment 3 – Sampling and Analysis Work Order

Attachment 4 – Trip Report

Figure 1. Example of Data Validation Package Contents

8.7.2.1 Sample Event Summary

The results of the sampling event are summarized in this section. The summary includes a description of the number and types of samples collected and any problems encountered during the event. The following elements are typically addressed in the summary; however, the content of this section varies based on site-specific requirements.

- Results from domestic wells that exceeded a U.S. Environmental Protection Agency (EPA) primary drinking water standard or health advisory. The appropriate notifications must be made immediately when a standard is exceeded in a sample from a domestic well.
- When applicable, all wells with results that exceed EPA groundwater standards for inactive uranium processing sites (40 CFR 192.02, Table 1 to Subpart A) are listed in the table. An exceedance at point-of-compliance wells is highlighted and the implications discussed.
- A comparison to other groundwater benchmarks that may be listed in compliance documents such as groundwater 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.
- A discussion of contaminant plume (or plumes) movement or unexpected plume movement, as evidenced by contamination in cross-gradient 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 are addressed. If there is no evidence of contaminant plume movement, and current results are consistent with historical results, then that is noted. A discussion of the progress of the natural flushing compliance strategy (if applicable) is included if results indicate an upward or downward trend. All interpretations of contaminant plume movement may be illustrated with time-concentrations graphs or plume maps (as appropriate).

- An assessment of potential impacts on surface water quality from site contamination is performed when surface water features such as rivers, streams, seeps, and ponds are sampled. The assessment is made to determine if there is statistical evidence that site-related contaminants were detected in a surface body of water in greater concentrations than in upstream or background water. This requires calculation of a statistical benchmark derived from historical data to compare with current data. Benchmark values are calculated using the following guidance, which is derived from *Data Quality Assessment: Statistical Methods for Practitioners* (EPA 2006). The approach used to determine the benchmark varies depending on the characteristics of the historical upstream data as described below.

  — If there are greater than 50 percent non-detects or less than 10 data points in the historical upstream data set.

    When the assumptions of normality and lognormality cannot be justified, especially when a significant portion of the samples are non-detects, the use of nonparametric tolerance intervals is applied. With greater than 50 percent non-detects, the benchmark value is the maximum concentration detected or the highest detection limit, whichever is greater. The calculation of a benchmark value from a limited data set (less than 10 data points) is not recommended. However, an assessment of impacts to surface water is sometimes required; therefore, the benchmark for a limited data set will also be the maximum detected value or the highest detection limit, whichever is greater.

  — If there are between 15 and 50 percent non-detects in the historical upstream data set (with greater than 10 data points).

    The application of tolerance limits preceded by Cohen’s method (EPA 2006 guidance) to adjust the mean and standard deviation of a data set cannot be used because detection limits usually vary in the historical data. Additionally, Cohen’s method assumes that the data are either normally or lognormally distributed, which is frequently not the case. Therefore, the benchmark value is the nonparametric, 95th upper tolerance limit as described above.

  — If there are less than or equal to 15 percent non-detects in the historical upstream data set (with greater than 10 data points).

    The benchmark value is derived from the 50 (or fewer) most recent data values as follows:

    [1] Test the set of non-transformed data for normality using the Shapiro-Wilk test of normality. If data are normally distributed, then

    [2] Calculate the mean and standard deviation of the data set.

    [3] Use Aitchison’s method (EPA 2006 guidance) to adjust the mean standard deviation for the number of non-detects.

[4] Compute the benchmark as the one-sided upper tolerance limit:

mean + K(standard deviation), where K is the one-sided tolerance factor.

[5] If data are not normally distributed, then log-transform the data set and test the log-transformed data for normality using the Shapiro-Wilk test of normality.

[6] If data are lognormally distributed, then calculate the mean and variance of the data set.

[7] Use Aitchison's method (EPA 2006 guidance) to adjust the mean standard deviation for the number of non-detects.

[8] Compute the benchmark as the one-sided upper tolerance limit:

exp[mean + K(standard deviation)], where K is the one-sided tolerance factor.

[9] If none of the non-transformed data or log-transformed data pass the normality or lognormality test, then compute the benchmark as the nonparametric 95% upper tolerance limit as described above.

Concentrations of site-related contaminants that exceed the benchmark are listed and discussed. The discussion will include the type of surface water feature (e.g., river, seep, or pond) and the implication of exceeding the benchmark.

- Evaluations in the summary may be modified 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) signs the summary page when completed.

8.7.2.2 Sample Location Map

This section contains a site map displaying locations planned to be sampled during the event.

8.7.2.3 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.

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 data validation process. The Water Sampling Field Activities Verification Checklist was developed primarily from criteria listed in the 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 Verification Checklist is used to document the comparison of sampling requirements 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 or the data validation lead or both. Significant discrepancies are documented in the Sampling Event Summary section.

Laboratory Performance Assessment

This section contains the General Information, Data Qualify Summary, Validation Details, and Validation worksheets from the Data Review and Validation Report described in Section 8.7.1.

Sampling Quality Control Assessment

Additional data qualifiers may be applied to the sample data based on sampling protocol, field measurements, field duplicate sample results, or 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 are qualified with an “F” flag. This includes Category I, II, and III wells as specified in the SAP. Additionally, results obtained from Category II and III wells are qualified with a “Q” flag indicating that the data are qualitative because of the sampling protocol used. Results obtained from a Category IV well (domestic well or flowing well) are not qualified based on sampling protocol. Results obtained from wells with a pH greater than 9 will be qualified with a “G” flag indicating potential grout contamination.

Field quality control sample results are evaluated as described in Section 8.5.4. Results that do not meet criteria are noted in this section along with a discussion of potential implications on overall data quality.

Certification

The data are certified as validated by the primary personnel responsible for completing the DVP. This section is signed by the laboratory coordinator and the data validation lead or their respective designee. In addition, the data are specified as available for use as final results, or specified as conditional and not available for use.

8.7.2.4 Assessment of Anomalous Data

New data are assessed for potential anomalies by comparison to the historical data set. Data are initially screened using the Potential Outliers Report. Data listed in the Potential Outliers Report are further evaluated by the data validation 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.

Potential Outliers Report

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

The Potential Outliers Report is generated using the SMS application. A module in SMS compares new data with the historical data set and lists all new data that fall outside the historical data range. A determination is also made if the data are normally distributed using the Shapiro-Wilk Test. An appropriate statistical test is then applied. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed. Further data review is required if normally distributed data are identified as potentially anomalous or if the data are otherwise suspected of being extreme values.

Anomalous Data Review Checksheet

Data listed on the Potential Outliers 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” (unusable) flag.

8.7.2.5 Data Presentation

This section of the DVP includes all of the data being validated. Environmental database reports for groundwater data, surface water data, field blank data, and static water level data are included (if applicable). Time-concentration graphs that support the interpretations and conclusions in the Sampling Event Summary are included in this section. The data validation lead determines the locations and constituents for time-concentration graphs, which can be produced from the environmental database.

8.7.2.6 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 DVP.

8.7.2.7 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 DVP.

8.8 Definitions

8.8.1 Data Qualifier Definitions

For this document, the following code letters and associated definitions are provided:

- F—Groundwater sample was collected using the low-flow sampling technique.
- G—Potential grout contamination of groundwater samples as indicated by a pH value greater than 9.
- J—The analyte was positively identified. The associated numerical value is an estimated quantity.
- Q—Groundwater sample result is qualitative due to sampling technique.
- R—The data are unusable (compound may or may not be present).
- U—For organic and inorganic analytes, the analyte was not detected at a concentration greater than the method detection limit. For radiochemistry, the analyte was not detected at a concentration greater than the decision level concentration.

Data are unqualified if the quality parameters indicate that the method was appropriate and that the reported results reflect the true value within the expected analytical uncertainty.

Data are qualified as estimated (J) if the reported results can be used to infer an estimate of the true value (with a suspected positive or negative bias), but the quality parameters indicate an uncertainty in the result that is greater than the expected analytical uncertainty.

Data are qualified as unusable (R) if the quality parameters do not support the reported results as a valid indicator of the true value.

8.8.2 Sample Quantification Limits

For this procedure, the following definitions are provided.

- DLC: Decision Level Concentration (radiochemical measurements). The minimum measured analyte concentration required to give confidence that a positive (nonzero) amount of analyte is present in the material analyzed. The DLC is sometimes called the critical level or critical value. It is the quantity of analyte at or above which an *a posteriori* decision is made that a positive quantity of the analyte is present. For this procedure, the probability of a Type I error (probability of erroneously reporting a detectable analyte in an appropriate blank or sample) is set at 0.01. The DLC is used to determine the absence or presence of analyte in a sample.
- DL: Determination limit (radiochemical measurements). The determination limit is the signal level above which a quantitative measurement can be performed with a stated relative uncertainty. As used in this procedure, the relative uncertainty is ten percent.
- MDC: Minimum detectable concentration (radiochemical measurements). The level at which there is a 5 percent probability (95 percent upper confidence limit) of reporting a false positive result for a sample containing no activity on a sample-specific basis. The MDC is used as a measure of method performance and to determine contract compliance.

- MDL: Method detection limit. The minimum concentration of a substance that can be measured (quantified) and reported with 99 percent confidence that the analyte concentration is greater than zero. This measure of instrument sensitivity takes into account all solutions that have been subjected to all sample preparation steps for the method.
- PQL: Practical quantitation limit. The lowest concentration of analyte in a sample that can be reliably determined and quantified within specified limits of precision and accuracy by the indicated method under routine laboratory operating conditions. For this procedure, the PQL is defined as five times the MDL.

8.8.3 Formulas

DLC Without Blank Population

$$DLC = 3 \times TPU_R$$

Where TPU = total propagated uncertainty (random component) at 1-sigma

As such, The DLC is approximately equal to 1.5 times the 2-sigma TPU.

DLC With Blank Population

$$DLC = \frac{(\mathrm{t} \times S_b) + R_b}{K}$$

where

t = The student t factor for appropriate degrees of freedom and the 99% confidence level
Sb = The standard deviation of a set of appropriate blank net count rate after background subtraction for blanks counted for the same length of time as the sample
K = factor to convert counts per minute to activity concentration
Rb = The average blank count rate in counts per minute

Difference

The difference, in percent (%D), for evaluating LCS and standards is calculated as follows:

$$\%D = \frac{(M - T)}{T} \times 100$$

where

%D = percent difference
M = measured value
T = true value

MDC Calculation

The MDC calculations shall be performed as specified in the QSAS.

MDC Without Blank Population

$$MDC = \frac{4.65 \times \sqrt{\frac{b}{T}}}{K} + \frac{3}{K \times T}$$

where

MDC = minimum detectable concentration
b = background count rate in counts per minute
T = count time in minutes
K = factor to convert counts per minute to activity concentration.

Use of the above equation requires that the background and sample count times are equivalent. When sample and background counts are different, the following adjustment to the equation is required.

$$MDC = \frac{3.29 \times \sqrt{\frac{b}{T_s} + \frac{b}{T_b}}}{K} + \frac{3}{K \times T_s}$$

With Blank Population

$$MDC = \frac{3.29 \times S_b}{K \times T} + \frac{3}{K \times T}$$

where

Sb = Standard deviation of the blank population where the blank population is in net blank counts in count time T.

Relative Percent Difference

The relative percent difference for replicate samples is calculated as follows:

$$RPD = \frac{[S - R]}{(S + R)/2} \times 100$$

where

RPD = relative percent difference

S = sample value (original)
R = replicate sample value

Recovery (%R)

The %R for spiked samples is calculated as follows:

$$\%R = \frac{[SSR - SR]}{SA} \times 100$$

where

SSR = spiked sample result
SR = sample result
SA = spike added

Relative Error Ratio

The RER is used to determine replicate precision for radiochemical results. The RER is given by:

$$RER = \frac{(S - R)}{\left[(TPU_S)^2 + (TPU_R)^2\right]^{\frac{1}{2}}}$$

where

RER = relative error ratio
S = sample value (original)
R = replicate sample value
TPU_S = sample uncertainty (1-sigma)
TPU_R = replicate uncertainty (1-sigma)

Linear Curve

The linear curve equation is given by:

$$y = mx + b$$

where

y = instrument response (peak area or height)
m = slope of the line (also called the coefficient of x)
x = concentration of the calibration standard
b = the y intercept

Relative Standard Deviation

The %RSD is calculated as follows:

$$\%RSD = \frac{SD}{RF} \times 100$$

where

SD = standard deviation
RF = mean response factor for each compound from the initial calibration

8.9 Terminology

2-sigma error: The error reported at the 95 percent confidence interval.

Accuracy: The closeness of agreement between an observed value and the true value. "Precision" is a measure of the reproducibility of a value, without knowledge of the true value. The classic example used to illustrate these terms is that of a dartboard: The placement of four darts thrown at a dartboard is considered accurate if the darts are each close to the bull's-eye (regardless of their proximity to one another). Hence, to be both accurate and precise the four darts would need to be grouped closely together and be close to the bull's-eye.

Analyte: An analyte is a substance, chemical constituent, or radionuclide that is determined in an analytical procedure.

Batch: A group of samples that behave similarly with respect to the sampling or the testing procedures being employed and that are processed as a unit. For quality control purposes, if there are more than 20 samples in a group, then each group of 20 samples or fewer will all be handled as a separate batch.

Bias: The difference between the reported result and the true result. Bias may be introduced through field or laboratory variability and error, or through substances in the sample that interfere with the analytical system's ability to provide an accurate measurement. Because the true concentration of an analyte in an environmental sample is generally never known, bias is estimated by using surrogates, matrix spikes, LCSs, and other indicators of analytical accuracy.

Calibration: The process of correlating instrument signal response with analyte concentration. An instrument must be properly calibrated to produce accurate results.

Chemical carrier: An identical or similar carrier material used to infer the degree to which the separation processes were effective in separating the analyte from the matrix. Measured gravimetrically or chemically.

Congener: A congener refers to any one particular compound of the same chemical family. For example, there are 209 congeners of chlorinated biphenyls.

Contamination: A component of a sample that is not representative of the environmental source of the sample. Contamination may stem from other samples, sampling equipment, from laboratory reagents, laboratory environment, or analytical instruments. Blanks (instrument blanks, method blanks, preparation blanks, trip blanks, equipment blanks, and field blanks) may be used to assess contamination.

Contract-required detection limit: A required detection limit as specified in a statement of work or related document.

Control limits: Ranges of acceptable results for each type of quality control measurement. The limits may be established on a project-specific basis, or they may be derived internally at a laboratory from historical quality control performance data.

Control sample: A quality control sample introduced into a process to monitor the performance of the system.

Correlation coefficient, r^2, or coefficient of determination: A statistical evaluation of the linearity of a calibration curve (i.e., "goodness of fit").

Decision Level Concentration: The minimum measured analyte concentration required to give confidence that a positive (nonzero) amount of analyte is present in the material analyzed. The DLC is sometimes called the critical level or critical value. It is the quantity of analyte at or above which an *a posteriori* decision is made that a positive quantity of the analyte is present. For this procedure, the probability of a Type I error (probability of erroneously reporting a detectable analyte in an appropriate blank or sample) is assumed to be set at 0.01.

Duplicates: Separate and independent samples collected as close together in space and time as possible. Duplicates are analyzed separately and are useful in documenting the precision of the sampling and analysis process. Field duplicates differ from split samples in that field duplicates are sent to the same laboratory.

Environmental sample: A sample taken unaltered (as much as possible) from the environment (as opposed to a blank, performance evaluation sample, matrix spike sample, etc.).

Equipment blank: A sample of analyte-free media (for example, clean water poured over a bailer) that has been used to rinse the sampling equipment. The equipment blank is collected after completion of decontamination and prior to collection of environmental samples. This blank is useful in documenting adequate decontamination of sampling equipment. An equipment blank also may be referred to as a "rinsate blank."

Field blank: A sample containing an analyte-free matrix that is collected and processed in exactly the same manner as an equivalent environmental sample (for example, clean water is poured into a sample container in the same physical location where the environmental sample is collected and is subsequently handled, processed, and analyzed exactly as an equivalent environmental sample). The field blank is used to identify contamination resulting from field sample collection techniques.

Holding time: The period between collection of samples by the samplers and preparation and/or analysis of samples by the laboratory (see the SAP for required holding times).

Instrument blank: A blank designed to determine the level of contamination associated with the analytical instruments.

Instrument detection limit: The lowest concentration of analyte that an instrument can detect as statistically determined from repeated measurements of a low concentration standard. Instrument detection limits are determined quarterly by direct measurement of unprocessed standards. Also see Method Detection Limit.

Integrated Contractor Procurement Team: Negotiates BOAs for use by DOE and its eligible subcontractors. The ICPT BOA for analytical laboratories is used to procure analytical services.

Internal standard: A chemical compound added to every blank, sample, and standard extract at a known concentration that is used to (1) compensate for analyte concentration changes that might occur during storage of the extract, and (2) compensate for quantification variations that can occur during analysis. Internal standards are used as the basis for quantifying target analytes.

Isomer: Compounds with the same molecular formula but different structural formulas. For example, *cis*-1,2-dichloroethene and *trans*-1,2-dichloroethene are isomers.

Isotope dilution: A means of determining a naturally occurring (native) compound by reference to the same compound in which one or more atoms has been isotopically enriched.

Laboratory control sample: A known matrix that contains compounds representative of the target analytes. A LCS is used to measure laboratory overall performance.

Matrix: The component that contains the analyte of interest (e.g., surface water, drinking water, air, soil, tissue).

Matrix interference: Bias introduced because something in the sample interferes with the analytical system's ability to provide an accurate measurement. The interference may be physical (e.g., turbidity in storm water runoff may block light transmission in an analysis based on ultraviolet absorbance) or chemical (e.g., a chemical similar to the analyte of interest may increase the response of the instrument, resulting in a positive bias).

Matrix spike: A measured amount of sample spiked with a known concentration of target analytes. The spiking occurs prior to sample preparation and analysis. A matrix spike is used to assess the bias of a method in a given sample matrix.

Matrix spike duplicate: Intra-laboratory (within the same laboratory) split samples spiked with identical concentrations of target analytes. The spiking occurs prior to sample preparation and analysis. Matrix spike duplicates are used to assess the precision and bias of a method in a given sample matrix.

Method blank: An analyte-free matrix that is prepared and processed at the laboratory in exactly the same manner as an equivalent environmental sample (i.e., all reagents are added in the same volumes or proportions as used in sample processing). The method blank is used to document contamination resulting from the analytical process.

Method detection limit: The minimum concentration of a substance that can be measured (quantified) and reported with 99 percent confidence that the analyte concentration is greater than zero. This measure of method sensitivity includes all sample preparation steps for the method. MDLs are determined annually.

Minimum detectable concentration: For radiochemical measurements, the level at which there is a 5 percent probability (95 percent upper confidence limit) of reporting a false positive result for a sample containing no activity on a sample-specific basis.

Ongoing precision and recovery: A method blank spiked with known quantities of analytes and analyzed as a sample. Its purpose is to verify that results produced by the laboratory remain within the limits specified in EPA Method 1668 for precision and recovery.

Practical quantitation limit: The lowest concentration of analytes in a sample that can be reliably determined and quantified within specified limits of precision and accuracy by the indicated method under routine laboratory operating conditions. For the purposes of this procedure, the practical quantitation limit is defined as 5 times the value of the MDL.

Precision: A measure of the reproducibility of a result. This should not be confused with "accuracy," as it does not take into account a true value. An analytical system may be very precise (gives the same result no matter how many times the analysis is run), but very inaccurate at the same time.

Quality control: The system of routine technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Radioactive tracer: An identical or similar tracer material used to infer the degree to which the separation processes were effective in separating the analyte from the matrix. Measured using radiometric counting.

Relative response factor: A measure of the relative mass spectral response of an analyte compared to its internal standard. Relative response factors are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

Relative retention time: In chromatography, relative retention time is the ratio of the retention time of a compound to that of a standard (such as an internal standard).

Replicate (also may be called "sample duplicate"): Two portions of the same sample that are prepared and analyzed separately by the laboratory. Used to evaluate laboratory precision.

Reporting limit: A required detection limit as specified in a statement of work or related document.

Required detection limit: A required detection limit as specified in a statement of work or related document. Also see Contract-Required Detection Limit and Practical Quantitation Limit.

Retention time: The time a target analyte is retained on a gas chromatograph column before elution. The identification of a target analyte depends on a target compound's retention time falling within the specified retention time window established for that compound. Retention time depends on the nature of the column's stationary phase, column diameter, temperature, flow rate, and other parameters.

Sample delivery group: A group of samples that are processed together by the laboratory. Ideally, all of the samples in a batch will be similar enough that matrix quality control measurements performed with the batch will be representative of all the samples in the batch.

Sample Management Office: Directs the distribution and tracking of laboratory samples. Offers technical support to projects in meeting regulatory requirements and maintaining sample integrity. Provides data validation services. These responsibilities are assigned to the laboratory coordinator.

Spike: Known amount of analyte that is introduced purposely into a sample (either an environmental sample or a blank) for the purpose of determining whether the analytical system can accurately measure the analyte.

Storage blank: A blank demonstrated to be analyte-free that is stored with environmental samples. The storage blank is used to determine contamination that may have occurred during sample storage.

Surrogate: A chemical that is similar to the target analytes in chemical composition and behavior in the analytical process but that is not expected to be present in the sample. Surrogates are added to all the environmental samples, blanks, and quality control samples in the analytical batch during the preparation stage of the analysis. Surrogates are used to monitor the performance of the analytical process.

Target analyte: An analyte for which results are to be reported at the conclusion of an analysis.

Tentatively identified compound: A compound that is outside the standard list of analytes in a gas chromatography/mass spectrometry method but that is reported based on a tentative match between the instrument response and the instrument's computer library. The identification and quantitation of these compounds is tentative.

Trip blank: A sample of analyte-free media (such as distilled/deionized water) taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples.

8.10 References

Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites, LMS/PLN/S04351, continually updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

DOE (U.S. Department of Energy), continually updated. *DOE Quality Systems for Analytical Services*, Current Revision, Washington, D.C.

Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

21.0 Standard Practice for Conducting Field Measurements During Water Sampling Activities

21.1 Purpose and Scope

This practice contains procedures necessary to obtain field measurements of known quality during routine water sampling activities. These measurements are useful for assessing general water quality, assessing geochemical conditions, and indicating when purging of a groundwater monitoring well is complete. This practice refers to the common field measurements taken during routine water sampling activities, which include dissolved oxygen, oxidation-reduction potential, pH, temperature, specific conductance, total alkalinity, and turbidity.

21.2 Terminology

Dissolved Oxygen: The concentration of molecular oxygen dissolved in water. Units are typically reported in milligrams per liter (mg/L) or percent (of air saturation). Dissolved oxygen data are useful as a general water quality indicator for biota, in geochemical characterization and modeling, and as an indicator parameter of stability during purging of a monitoring well.

Flow Cell: Apparatus that allows flow of water across instrument probes while excluding atmospheric contact.

In Situ: Being in the original position. When referring to field measurements, making a measurement in the original environment, such as in a stream or in a monitoring well.

Oxidation-Reduction Potential: The electromotive force developed when a noble metal electrode and a reference electrode are placed in an aqueous sample. The electromotive force relates to the potential for the water to be oxidizing or reducing. Units are typically measured in millivolts (mV). Oxidation reduction potential data are useful in geochemical characterization and modeling, and in predicting migration or attenuation of contaminants in groundwater and surface water.

pH: The negative logarithm to the base 10 of the hydrogen ion activity in moles per liter: $\mathrm{pH} = -\log [\mathrm{H}^+]$. Units are measured in standard units (s.u.). pH data are useful as a general water quality indicator, in geochemical characterization and modeling, in predicting migration and attenuation of contaminants, and as an indicator parameter of stability during purging of a monitoring well.

Specific Conductance: Conductivity is the ability of water to conduct an electrical current. Conductivity of water is related to the type and concentration of ions dissolved in the water along with the temperature. Specific conductance is conductivity adjusted to standardized conditions of electrode geometry (1 cm cube) and temperature (25 °C).

Temperature: A basic physical property that is measured by the response of matter to heat. Temperature is typically measured in units of degrees Celsius (°C) for water sampling applications, but may also be measured in units of degrees Fahrenheit (°F).

Total Alkalinity: The capacity of water to neutralize acid. Specifically, total alkalinity using a titration method is a quantitative measurement of the amount of acid required to reduce the pH of water to an established end point. Units are typically reported in mg/L as $CaCO_3$. Total alkalinity data are useful as a general indicator of water quality and are used in anion/cation balance calculations.

Turbidity: An indirect measure of the amount of particulate matter (silt, clay, organic matter) in water. Units are generally expressed in nepholometric turbidity units (NTUs), which refer to the optical properties of the sample (related to particulate matter) that causes light to be scattered/absorbed and not transmitted.

21.3 Material and Equipment

Following are the minimum specifications for instrumentation and test kits to perform the field measurements (HACH 1992; YSI 2008).

Dissolved oxygen (polarographic method)

- One point calibration capability
- Outputs in mg/L and % air saturation
- Range: 0 to 20 mg/L, 0 to 200 percent air saturation
- Accuracy: ± 2 percent of reading or 0.2 mg/L, whichever is greater; ± 2 percent of air saturation or 2 percent of reading, which ever is greater
- Rapid pulse or similar technology that does not require a specified flow rate across the probe
- Barometer specifications (if included with instrument)
    - Range: 500 to 800 millimeters mercury (mm Hg)
    - Accuracy: ± 3 mm Hg within ± 15 °C of calibration temperature
    - Resolution: 0.1 mm Hg

Oxidation-reduction potential

- One point calibration capability
- Range: -999 to 999 mV
- Accuracy: ± 20 mV
- Resolution: 0.1 mV

pH

- Two (or three) point calibration capability
- Range: 0 to 14 s.u.
- Accuracy: ± 0.2 s.u.
- Resolution: 0.01 s.u.

Specific conductance

- One point calibration capability
- Range: 0 to 100,000 µmhos/cm
- Accuracy: ± 1 percent of reading
- Resolution: 1 µmhos/cm

Temperature

- Calibration capability not required
- Range: -5 to 45 °C
- Accuracy: ± 0.15 °C
- Resolution: 0.1 °C

Total alkalinity

- Range 0 to 10,000 mg/L as $CaCO_3$
- Accuracy ± 1 percent of reading
- Resolution: 1 mg/L as $CaCO_3$

Turbidity

- Four point calibration capability
- Range: 0 to 1,000 NTUs
- Accuracy: 2 percent of reading in 0 to 500 NTU range, 3 percent of reading in 500 to 1,000 NTU range
- Resolution: 0.01 NTU

21.4 Procedure

21.4.1 Conducting Measurements

Measurements will be conducted according to the manufacturer’s instructions.

Maintenance, cleaning, and storage of instrumentation, probes, and test kits also will be conducted according to the manufacturer’s instructions. These instructions will be kept in a centralized file that is accessible to field personnel. Any deviations from these instructions will be documented in the appropriate sampling plan.

Measurements of dissolved oxygen, oxidation-reduction potential, pH, temperature, and specific conductance should be collected using a flow cell or in situ to minimize atmospheric contact that might affect the measurement and to make the measurement more representative of the environment from which the sample was collected. The flow rate through the flow cell should be less than 1 liter per minute to avoid streaming potentials that may affect readings. Streaming potentials are caused by the static charge effect of water moving through small openings.

21.4.2 Calibration and Operational Checks

A calibration/operational check schedule will be implemented for all instruments/test kits used to make field measurements. The types, frequency, and acceptance criteria of calibration/operational checks will be specified in the appropriate sampling plan. Following are some general calibration/operational check requirements for each field measurement:

- Dissolved oxygen—one point calibration check in water-saturated air.
- Oxidation-reduction potential—one point calibration in Zobell solution.
- pH—minimum of two point calibration that brackets expected pH of samples.
- Temperature—calibration not required; one point operational check against a National Institute of Standards and Technology traceable thermometer.
- Specific conductance—one point calibration with a standard that most represents expected specific conductance of samples.
- Total alkalinity—factory calibration of digital titrator (if used).
- Turbidity—four point calibration with standards bracketing the expected turbidity of samples.

21.5 Documentation

Documentation of field measurements will include:

- Recording field measurements on electronic/paper forms specified in the sampling plan, including:
    - Date and time of measurement.
    - Value of the measurement and units.
    - Instrumentation/test kits used.
    - Name of the person conducting the field measurement.
    - Last time of calibration/operational check.
- Recording calibration/operational check information including:
    - Lot numbers and expiration dates of standards.
    - Instrument readings versus acceptance criteria.
    - Calibration values.
    - Name of person conducting the calibration/checks.
    - Date and time of calibration/operational check.

21.6 References

HACH, 1992. *Water Analysis Handbook*, Loveland, Colorado.

YSI, Inc., 2008. YSI 5563 MPS Sensor Specifications, available at http://www.ysi.com/media/pdfs/W11-556-Multiparameter-System.pdf, Yellow Springs, Ohio.

24.0 Standard Practice for the Inspection and Maintenance of Groundwater Monitoring Wells

24.1 Introduction

Groundwater monitoring wells are commonly used for obtaining groundwater samples, groundwater elevation measurements, and aquifer hydraulic parameters. Because of natural processes and human activities, the condition of groundwater monitoring wells deteriorates with time. Routine inspection and maintenance of monitoring wells are required to mitigate deterioration so that decisions based upon data collected from that well are not compromised.

24.2 Purpose and Scope

The purpose of this procedure is to describe the standard practice for conducting routine inspections of groundwater monitoring wells in order to document the condition of wells, to provide guidance on preventative maintenance, and to establish criteria used to determine if and when a monitoring well should receive corrective maintenance. Corrective maintenance activities are based on the results of the routine inspections. Well maintenance includes correcting deficiencies in the surface components of a monitoring well and redevelopment.

This procedure shall be applied only to groundwater monitoring wells. Groundwater production wells and high volume extraction wells, used for water supply and in remediation systems, respectively, are beyond the scope of this procedure. Because of the limitations associated with redevelopment methods described in this procedure, the redevelopment section is not applicable to wells exceeding 6 inches in diameter.

This procedure shall be conducted on all monitoring wells at LM sites unless other procedures are specified in a site-specific planning document. This procedure may be implemented in conjunction with routine groundwater sampling and data collection activities.

24.3 Terminology

Surging: The process of forcing water into a well, in and out of the formation and filter pack. This is usually accomplished by moving an object, such as a surge block, up and down in the water column of a well.

Surge block: A round disk or cylinder with a diameter close to the inside diameter of the well casing.

Nitrogen jetting: The process of surging a well using compressed nitrogen gas to raise and lower the water column.

Air-lift pump: The process of removing water from a well using compressed gas (nitrogen) by lifting the water column.

Suction lift pump: Pump at the surface that lowers pressure in the down-hole tubing to less than atmospheric pressure. Atmospheric pressure on the water column then pushes water up the tubing. This pump is limited by atmospheric pressure (and therefore elevation) and can only lift water (depth to water) approximately 25 to 30 ft. Typical maximum flow rates are in the 1 to 2 gallons/minute range.

Foot-valve pump: A length of semi-rigid tubing with a foot-valve (check ball) on the down hole end that uses momentum or inertia of the water in the tubing as the tubing is rapidly moved up and down (also referred to as an inertial pump). Standard models of this pump are capable of lifting water 200 ft and capable of maximum flow rates up to 1 gallon/minute.

Submersible pump: Down-hole centrifugal pump (uses impeller or series of impellers to drive water) capable of pumping from deep wells (> 250 ft) and capable of high flow rates (up to 10 gallons/minute for environmental applications in 2-inch wells). These pumps are susceptible to damage when used for development because of sediment liberated during surging.

24.4 Material and Equipment

The following equipment and materials may be used during inspection and maintenance of monitoring wells.

- Monitoring well location map.
- Well inspection and maintenance form or FDCS.
- Well development log.
- Water level indicator.
- Surge block.
- Pumps—peristaltic pump, submersible pump, foot-valve pump, bladder pump.
- Bailer.
- Nitrogen tank, regulator, and associated transmission hose/pipe.
- Paint.
- Metal stamp (for labeling wells).
- Distilled or deionized water in a squeeze wash bottle.
- Paper towel.
- Containers to collect purge water.

24.5 Procedure

This procedure is composed of two sections: “Well Inspection and Maintenance,” and “Well Development/Redevelopment Procedures.”

24.5.1 Well Inspection and Maintenance

Inspection of monitoring wells includes surface and subsurface inspection and maintenance. Whenever possible, required maintenance identified during the inspection should be implemented during the same field trip. All inspected well components should be documented as acceptable or deficient, and any maintenance item identified and/or completed must be noted on an approved Well Inspection and Maintenance form or in the FDCS.

24.5.1.1 Surface Components Inspection and Maintenance

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. Examples of components that may not be present are guard posts and concrete pads.

- Check for presence of a lid on the outer protective casing. If hinged at the lid and/or hasp, check for proper operation.
- Check for the presence and proper operation of a lock on the outer protective casing. Note if a lubricant is applied to the lock. If the lock is missing or not operating properly, replace with a lock that is keyed the same as other monitoring-well locks at the site.
- Inspect the outer protective casing for damage and stability. The outer casing should be vertical and immovable when force is applied by hand. If a drain or vent hole is present in the casing, check to ensure that it is not plugged with debris. Clean the hole if necessary. Outer protective casings made of steel should have a painted finish. Paint is not required for aluminum, PVC, or galvanized-finished well casings. If painted, check the condition of the paint and repaint if needed. If steel casing is not painted, paint the casing.
- Check for presence of a casing-riser cap. If the well is a flush-mount, a watertight, expansion cap should be used unless the well vault was designed to permit drainage from the vault or a watertight lid is installed on the flush-mount well. If water is present in the well vault, remove water before removing the riser cap. Note if there is evidence that water in the well vault is flowing into the well.
- Inspect the casing riser for damage. No debris or water 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. Check weep hole to ensure it is not plugged. 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 elevation of the riser must be obtained by measurement of the difference in lengths at the time of repair or resurvey.
- Check for the presence of guard posts. If present, check if guard posts are secure and adequately painted for high visibility.
- Check for the presence of a concrete surface pad surrounding the outer protective casing. If present, check the integrity by noting major cracks and by assessing the stability of the pad.
- If a concrete surface pad is absent, check the surface seal around the outer protective casing and note any cracks that would allow surface water to flow downward along the casing. The surface seal may be bentonite, cement grout, or natural backfill.
- Check that the well identifier is present, legible, readily visible, and in agreement with the well location map. If missing, illegible, or wrong, the well must be labeled as soon as practical. Following are acceptable methods for labeling the outer protective casing of a well: stamping with a steel stamp, installing a metal tag, painting, and installing stickers.

The well identifier can be placed on the lid of the outer protective casing and/or on the outer protective casing itself. The identifier should also be written on the riser cap with a permanent marker. 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 also should be marked in a similar manner.

24.5.1.2 Subsurface Inspection and Maintenance

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 ft below the top of the inner 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. Excessive sediment accumulation could indicate a damaged well screen. If a damaged well screen is suspected, a down-hole camera should be used to visually inspect the well.

- Measure and record the depth to water to the nearest 0.01 ft. The depth shall be measured from the top of the inner casing riser, and the measurement shall be made according to ASTM D4570-87 (Reapproved 2001)—Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well).
- 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 ft. Note that if an electric water level indicator is used to measure the total depth, an additional amount needs to be added to the measurement to account for the difference between the end of the probe and the measuring point. This amount will vary with the brand of water level indicator.
- If evidence of biological growth, including roots, algae, and bacteria, is observed on the outside of the water level indicator, the well should be redeveloped.

Use a disposable tissue and distilled or deionized water to clean the cable as it is removed from the well. Additional decontamination of the probe may be required depending upon contaminant types and site-specific requirements.

24.5.2 Well Development/Redevelopment Procedures

All new monitoring wells should be developed after installation to remove remnants of drilling fluid, to remove geologic debris generated from the drilling process, and to establish hydrologic connection between the filter pack and the formation. Criteria for completion of initial monitoring well development typically involve removal of a specified volume of water and meeting a turbidity criteria used for groundwater sampling. Well development criteria are typically specified in the statement of work created to guide the well drilling and installation process. Management of water generated during monitoring well development activities also is typically specified in the statement of work.

Monitoring wells should be redeveloped periodically as part of a regular maintenance program to enhance collection of high-quality samples that are representative of the subsurface environment and to minimize localized well affects. Low-flow sampling does not provide flow rates or purge volumes necessary to remove build-up of fine-grained sediment in the filter pack and well sump, or to provide removal of biological build-up in the well; therefore, routine redevelopment is an essential component of a low-flow sampling program. Management of water generated during monitoring-well redevelopment will be conducted according to site-specific planning documents.

In addition to routine redevelopment, monitoring wells should be redeveloped if the following conditions are encountered.

- The well-inspection process indicates that excessive sedimentation is occurring.
- The capacity of the well appears to have significantly declined during the course of a sampling program.
- There is evidence of excessive biological growth in the well.

Development/redevelopment techniques include: (1) compressed-nitrogen jetting and air-lift pumping, (2) surge block and pumping or bailing, (3) pumping only.

Successful development/redevelopment requires that water be forced (or surged) from the well screen interval into the filter pack and formation, and from the formation and filter pack into the well screen interval. This is best accomplished through the use of a surge block or a bailer as a surging tool. Compressed-nitrogen jetting can also accomplish this flow reversal to some extent. Pumping only is not as effective in achieving flow reversal (although reversing the pump can be effective) and is, therefore, best used in conjunction with nitrogen jetting or surge blocking.

Before placing any redevelopment equipment in a monitoring well, the equipment shall be cleaned using decontamination procedures specified for groundwater sampling at the site. After removing redevelopment equipment from a well, the equipment shall be decontaminated again.

24.5.2.1 Nitrogen-Jetting

A discharge-control apparatus should be used to facilitate collection discharge water (if required) and to prevent discharge water from splashing on maintenance personnel. 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.

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.

Set the line pressure on the regulator at a maximum of 60 pounds per square inch. 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.

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.

Repeat the combination of pulsed jetting over the length of the well screen and air-lift pumping at least once. This process should be repeated until turbidity criterion is met. The criterion used to determine the completion of development/redevelopment should be the same as required during groundwater sampling.

24.5.2.2 Surge-Block and Pumping

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. Move the surge block up and down in the water column to create a surging action that should loosen obstructing sediment. Follow the well surging with a pumping cycle to remove the dislodged sediment from the well. Pumping can be accomplished using a suction-lift pump, submersible pump, foot-valve pump, or a bailer. The type of pump used is typically dictated by the physical and hydrologic properties of the well including depth of the well, depth to water, well diameter, and well yield.

Note

Use of a bailer may be effective in removing the majority of dislodged sediment; however, obtaining low turbidity water is not feasible because of the surging action of the bailer as it is moved through the water column. An effort should be made to remove accumulated sediment from the bottom of the well using a suction-lift pump, foot-valve pump, or bailer prior to and during development/redevelopment process.

After operating the surge block in a given depth increment followed by pumping, lower it to the next interval and repeat the surge and pumping action. This process should be repeated until surge blocking has been conducted in the entire screened interval. Cycles of surge-blocking and pumping should be repeated until turbidity criterion is met. The criterion used to determine the completion of development/redevelopment should be the same as required during groundwater sampling.

24.5.2.3 Pumping Only

Pumping only can be used to clear accumulated sediment and biological growth from a well, but has a limited effect in removing accumulated fines from the filter pack because of the lack of surging action. Some pumps have the ability to reverse the flow direction, which may have a surging effect. Pumping without surging requires a greater volume of water be removed from the well than surging and pumping.

24.6 Documentation

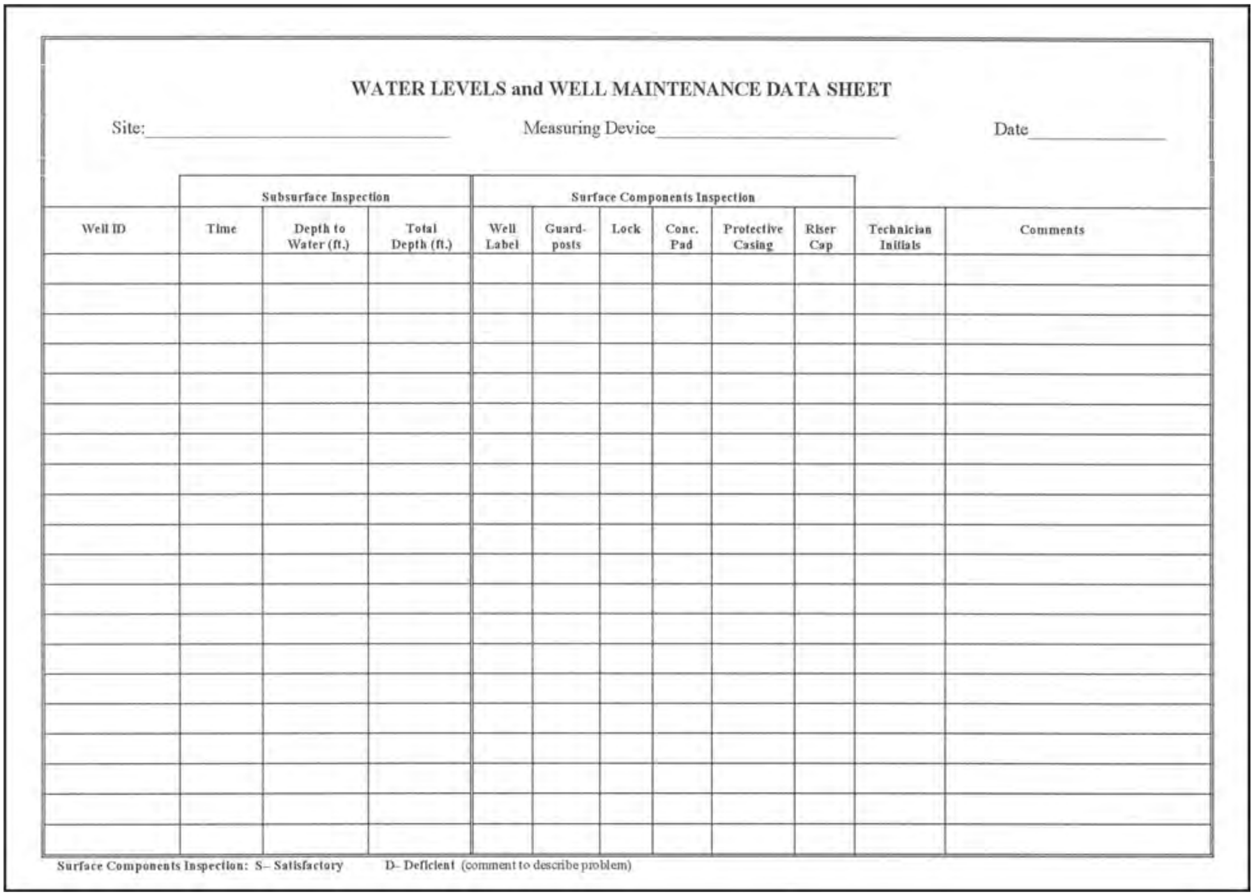
Monitoring well inspection and maintenance must be documented on an approved well inspection and maintenance form (Figure 1) or in the FDCS (Figure 2). Monitoring well components should be documented as acceptable or deficient, and any maintenance item identified and/or completed must be noted. All maintenance items completed and maintenance items required must be communicated to the site lead via a trip report.

Documentation of well development should include the following information: site, well identification, date, start and stop time of pump cycles, volume of water removed during each pump cycle, number of times surged, turbidity, water levels, and persons performing the work. An example of a well development log is shown in Figure 3.

24.7 References

Environmental Procedures Catalog, LMS/POL/SO4325, continually updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

20.0 ASTM D 4750-87 (Reapproved 2001)—Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)



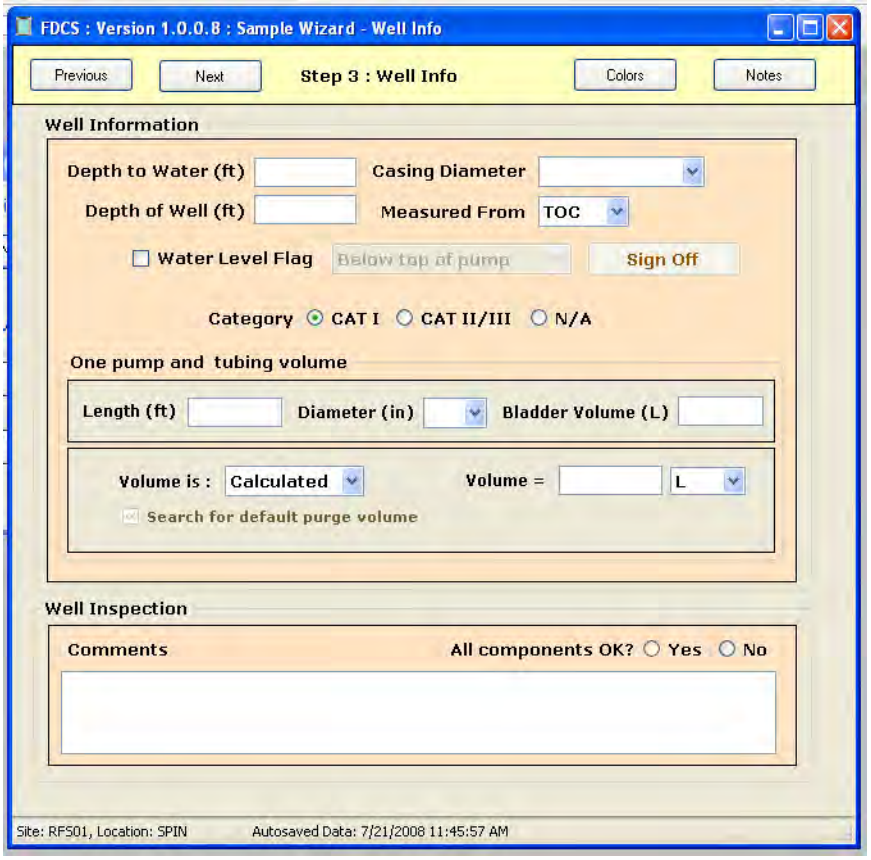
WATER LEVELS and WELL MAINTENANCE DATA SHEET

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 1. Example of a Well Inspection and Maintenance Form



FDCS : Version 1.0.0.8 : Sample Wizard - Well Info

Step 3 : Well Info

Well Information

Depth to Water (ft)

Casing Diameter

Depth of Well (ft)

Measured From: TOC

☐ Water Level Flag — Below top of pump

Category ● CAT I ○ CAT II/III ○ N/A

One pump and tubing volume

Length (ft)

Diameter (in)

Bladder Volume (L)

Volume is : Calculated

Volume = L

☒ Search for default purge volume

Well Inspection

Comments

All components OK? ○ Yes ○ No

Site: RFS01, Location: SPIN

Autosaved Data: 7/21/2008 11:45:57 AM

Figure 2. FDCS Well Inspection Form

Well Development Log

Site ____ Date___________________

Well ID	Arrival Time	Initial Water Level (ft btc)	Number of Well Surges	Final Turbidity (NTUs)	Cumulative Volume (gallons)	Flow Rate (gpm)	Comments

Conducted by ______________________________

Figure 3. Example of a Well Development Log

27.0 Standard Practice for Data Logger System Field Measurements

27.1 Purpose and Scope

This practice contains procedures necessary for the use of a data logger system for measuring level and temperature of natural groundwater and surface water, as well as industrial, waste, and other installations. Although there are several different models of data logger systems currently in use, this procedure addresses the general practice of installing and running data loggers, and retrieving logged data.

27.2 Terminology

Data Logger System: Components include the data logger, vented and non-vented cables, communication cables, external power accessories, desiccants and other installation accessories, and software.

Transducers: Vented or non-vented pressure/level sensors (gauged measurements) inside the data logger. A pressure transducer senses changes in pressure, measured in force per square unit of surface area, exerted by water or other fluid on an internal media-isolated strain gauge. Common measurement units are pounds per square inch (psi) or newtons per square meter (pascals).

Vented Cable: Vent tube within a cable that insures that atmospheric pressure is the reference pressure applied to the pressure sensor diaphragm.

Non-vented Cable: Non-vented cable may be used with non-vented transducer (absolute measurements).

27.3 Material and Equipment

Following are the minimum equipment specifications for instrument start up and collecting water level and temperature measurements.

27.3.1 Data Logger

Generally a cylindrical tube made of metal that contains and includes transducers, real-time clock, micro-processor, alkaline/lithium batteries, and memory. Options include a vented or non-vented pressure sensor in a variety of ranges.

27.3.2 Cable

The following are several basic cables used to suspend and communicate to the transducer and generally include:

- Rugged cable, TPU-jacketed (thermoplastic polyurethane)
- Vented or non-vented
- Halogen-free vented or non-vented (low smoke zero halide rated)
- Vented fluorinated ethylene propylene cable
- Stainless steel suspension wire for deployment of non-vented transducers
- Communication cables for programming the device/downloading the logged data

27.3.3 Power Components

- Internal Power: Components in the instrument body operate on 3.6 VDC, supplied by a sealed or non-sealed, non-replaceable AA lithium or alkaline batteries.
- External Power
  - External Battery Pack: A sealed submersible battery pack (lithium) supplies 14.4 volts when the power source is connected. The instrument body will use the external battery source first and switch to the internal batteries when external battery power is depleted.
  - AC Adapter: AC adapter provides 24 VDC, 0.75 amp, AC input 100−250 volts. The programming cable includes an external power input for connection to this adapter.

27.3.4 Control Software

Win-Situ is the software for programming all the data logger instruments. Win-Situ provides instrument control for direct reads and profiling, long-term data logging, data downloads, data viewing, data export to popular spreadsheet programs, choice of units and other display options, battery/memory usage tracking, interface to networks and telemetry.

Minimum system requirements: 400 MHz Pentium® II processor, 128 Mb RAM, 100 Mb free disk space, Internet Explorer® 5.0 or higher, Windows® 2000 Professional SP2 or better or Windows XP Professional SP1 or better. Win-Situ connects through a serial COM port or a USB.

27.4 Procedure

27.4.1 Installation and Logging of Data

The installation and logging of data will be conducted according to the manufacturer’s instructions. Maintenance, cleaning, and storage of data logger system equipment also will be conducted according to the manufacturer’s instructions. These instructions will be kept in a centralized file that is accessible to field personnel. Any deviations from these instructions will be documented in the appropriate sampling plan.

Installing the data logger system always requires care when lowering the data logger to the approximate desired depth. Position the data logger below the lowest anticipated water level, but not so low that its range might be exceeded at the highest anticipated level. Refer to the relevant operator’s manual for usable depth and stabilization time before continuing.

Connect the data logger system (cable quick disconnect) to the laptop computer and launch the appropriate software and follow the steps required to set up and run the data logger. A “Logging Setup Wizard” will prompt you through the configuration of a data logger—including the site, log name, parameters to measure, sample schedule, start time, stop time (optional), output (pressure, depth, or water level with a reference), and other options.

Once the process to start a data logger has been completed exit the program and disconnect the computer from the data logger system at the suspended cable connection.

27.4.2 Retrieval of Logged Data

The retrieval of logged data from the data logger will also be conducted according to the manufacturer’s instructions. The steps for retrieving the logged data are the same steps required to install and start logging data. Connect the computer to the cable and launch the same software program where data can then be extracted. Data can be viewed electronically via a report or graph and then stored automatically as a file in the computer.

27.4.3 Factory Calibration and Field Operational Check

The pressure sensor (transducer) accuracy can be adversely affected by improper care and handling, lightning strikes and similar surges, exceeding operating temperature and pressure limits, physical damage or abuse, as well as normal drift in the device’s electronic components. Aside from damage to the sensor, the need for factory recalibration is dependent upon the amount of drift. Factory calibration will be conducted if drift is greater than the specified amount described in the operator’s manual.

A field operational check of the transducer will be conducted each time the logged data are retrieved. Following are the steps required to perform an operational check for each data logger installed:

[1] Obtain water level—measure actual water level using hand held water level indicator and record.

[2] Extract logged data—connect computer to data logger and run appropriate software.

[3] View specific report—Using the software click on “View Report” and compare the most recent logged data (generally the last reading recorded on the report) to the manual water level.

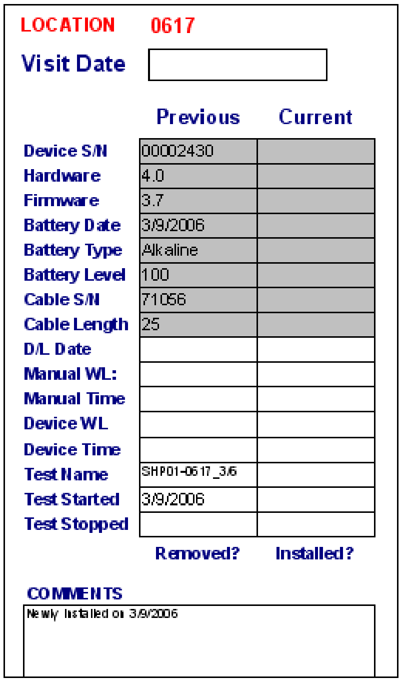
[4] Water level accuracy—after comparing water levels, the transducer is considered accurate if the measurements are within 0.3 ft of each other. If the measurements are greater than 0.3 ft then perform a field calibration described in the operator’s manual.

[5] Field calibration—to conduct a field calibration remove the transducer and conduct the field calibration. If determined that the data logger meets the acceptance criteria defined in the operator’s manual then reinstall and restart it accordingly. If the data logger does not meet the criteria then remove and send it in for a factory calibration.

27.5 Documentation

Documentation for installing/removing of data loggers and extracting logged data will include:

- Field documentation on paper forms (Data Logger Site Visit Report—refer to Data Logger Manager Technical Reference) includes:
  - Date and time−Installation/data extraction and water level taken.
  - Software and hardware used.
  - Battery−Installation date, type, and level.
  - Cable−Serial number and length.
  - Water level−Manual (measure with water level indicator) and device (last reading recorded on the report).
  - Test−Name, started, and stopped.
  - Comments−Notes regarding to other pertinent information.



LOCATION **0617**

Visit Date ☐

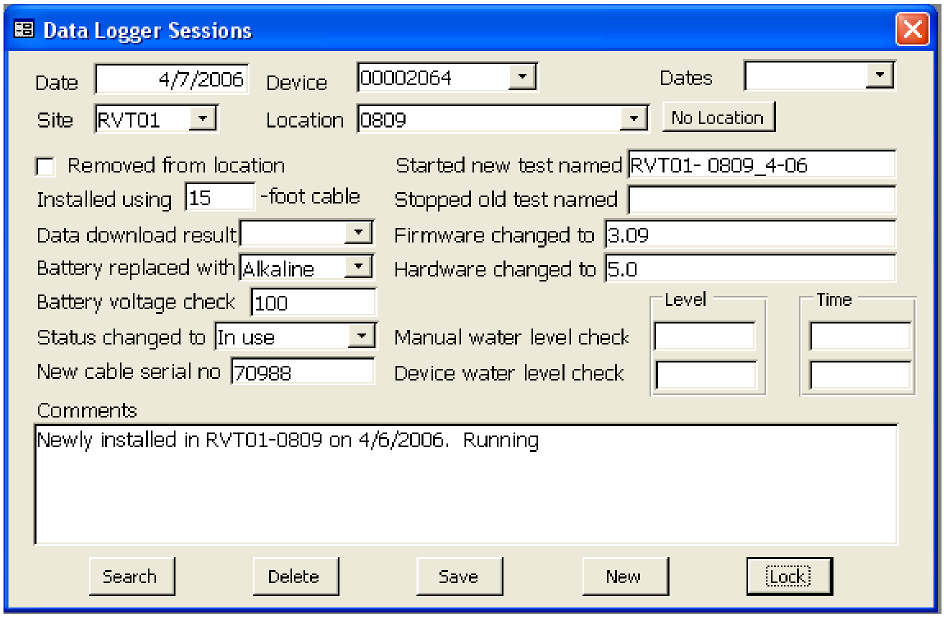
	Previous	Current
Device S/N	00002430	
Hardware	4.0	
Firmware	3.7	
Battery Date	3/9/2006	
Battery Type	Alkaline	
Battery Level	100	
Cable S/N	71056	
Cable Length	25	
D/L Date		
Manual WL:		
Manual Time		
Device WL		
Device Time		
Test Name	SHP01-0617_3/6	
Test Started	3/9/2006	
Test Stopped		
	Removed?	Installed?

COMMENTS

Newly Installed on 3/9/2006

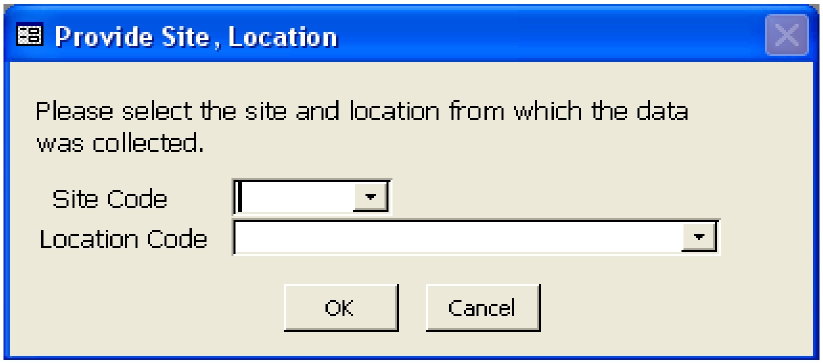
- Uploading of field documentation and extracted logged data/reports to data base using electronic forms in Data Logger Editor software application (Refer to Data Logger Manager Technical Reference) includes:

  — Edit Sessions Form−electronic form, as shown below is used to enter information that was hand written on the Site Visit Report in the field.



Date 4/7/2006
Device 00002064
Site RVT01
Location 0809
☐ Removed from location
Started new test named RVT01- 0809_4-06
Installed using 15 -foot cable
Firmware changed to 3.09
Battery replaced with Alkaline
Hardware changed to 5.0
Battery voltage check 100
Status changed to In use
New cable serial no 70988
Comments
Newly installed in RVT01-0809 on 4/6/2006. Running

  — Edit/Load Data Form−electronic form used to upload logged data/reports to the data base automatically. A location selector similar to the one show below prompts the user to provide the site code and location code for the location whose data is to be loaded and/or edited.



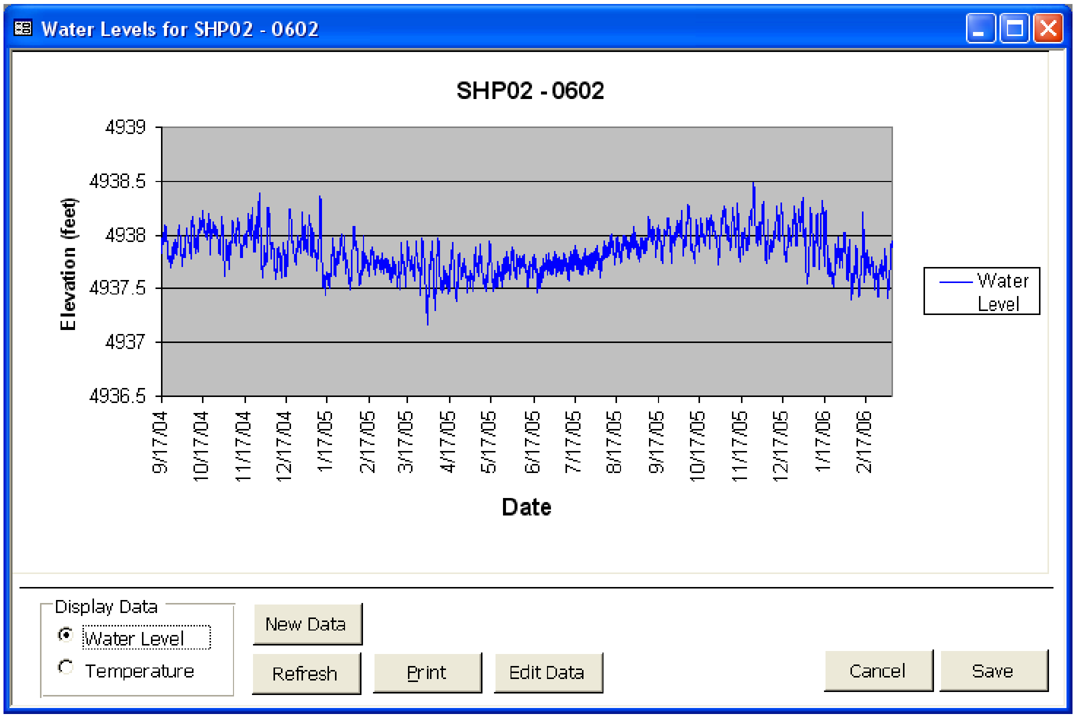
Please select the site and location from which the data was collected.

- Final reports/graphs generated using the Data Logger Editor software application (Refer to Data Logger Manager Technical Reference) includes:

  — Site Visit Report−field information.

  — Site History Report−continuous tracking report of the data logger history at each site.

  — Graph−automatically generated graph, as shown below, showing actual water levels to true elevations.



- Recording factory calibration/field operational check information includes:
  - Water level comparisons within or outside acceptance criteria.
  - Name of person conducting the calibration/checks.
  - Date and time of factory calibration/field operational check.

27.6 References

Data Logger Manager Technical Reference, available at \\crow\raapps\Data Logger Manager\Documentation.

In-Situ Inc., 2005. Level TROLL Operator’s Manual, available at www.in-situ.com.

Appendix B

Desk Instructions

Appendix B-1

Field Data Collection System–Version 1.8 Desk Instructions

Contents

Figures

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1.0 Introduction

The Field Data Collection System (FDCS) is a computer-based system designed to: (1) interface with Legacy Management (LM) databases and software programs to download needed information into the Toughbook field computer prior to a sampling event; (2) provide for electronic collection of water sampling field data at LM sites; (3) interface with LM databases to upload field data after collection; (4) provide quality control checks through the sampling process; (5) generate print and/or electronic reports for documentation; and (6) provide a paper-free method of data collection.

2.0 Purpose

The purpose of this desk instruction is to provide guidance to personnel using the FDCS during routine water sampling activities at LM sites. A copy of this desk instruction will be available on each Toughbook field computer that has the FDCS installed so that field personnel can access the instructions in the field. In addition, a copy of the FDCS Desk Instructions will be appended to the *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (SAP) (LMS/PRO/S04351).

3.0 Scope

The FDCS was designed for use in routine groundwater and surface water sampling at LM sites. It is not intended to be used for collection of soil, air, or biological samples. In addition, there may be some non-routine water sampling activities where the FDCS is appropriate to use.

4.0 Startup

Click on the FDCS icon on the desktop to start the program. The opening menu (Figure 1) has nine buttons that function as follows.

1. New Session

   This function is used to open a new file at the start of sampling activities at a well/surface water location. If a safety meeting attendance record has not been created on the current day, the user is alerted with the Safety Meeting Check window (Figure 2) before a new file is opened.

2. Recover Session

   This function is used to recover a previous session (open a file) for a location that was not completed (e.g. because of power loss or return later to sample), or to open a file to edit a location that has been completed (signed off). To view and recover locations that have been completed, the check box at the bottom must be unchecked (Figure 3). The time and date, site, and location are part of the file name to aid in the selection of the correct file.

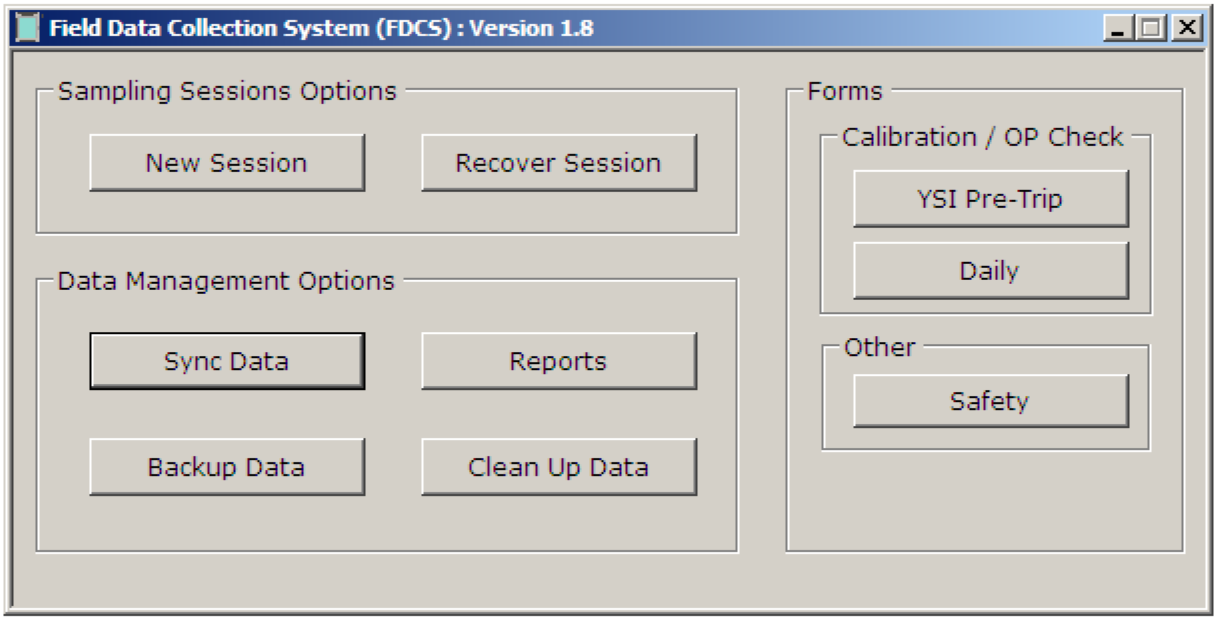
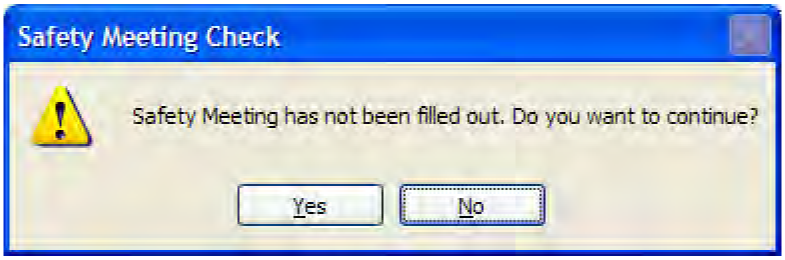
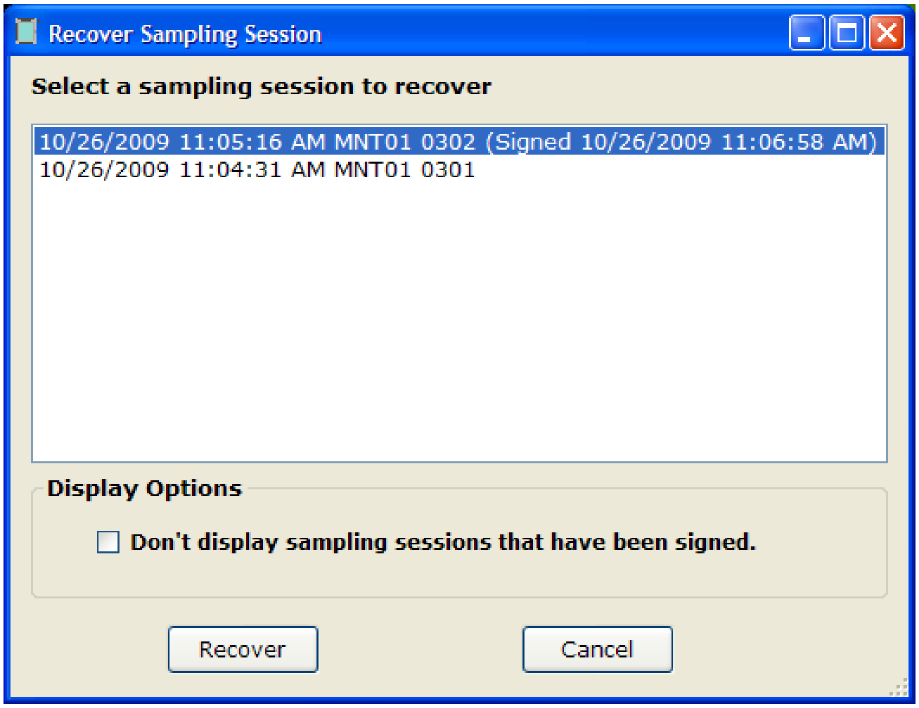


Figure 1. Opening Menu



Safety Meeting has not been filled out. Do you want to continue?

Figure 2. Safety Meeting User Alert



10/26/2009 11:05:16 AM MNT01 0302 (Signed 10/26/2009 11:06:58 AM)
10/26/2009 11:04:31 AM MNT01 0301

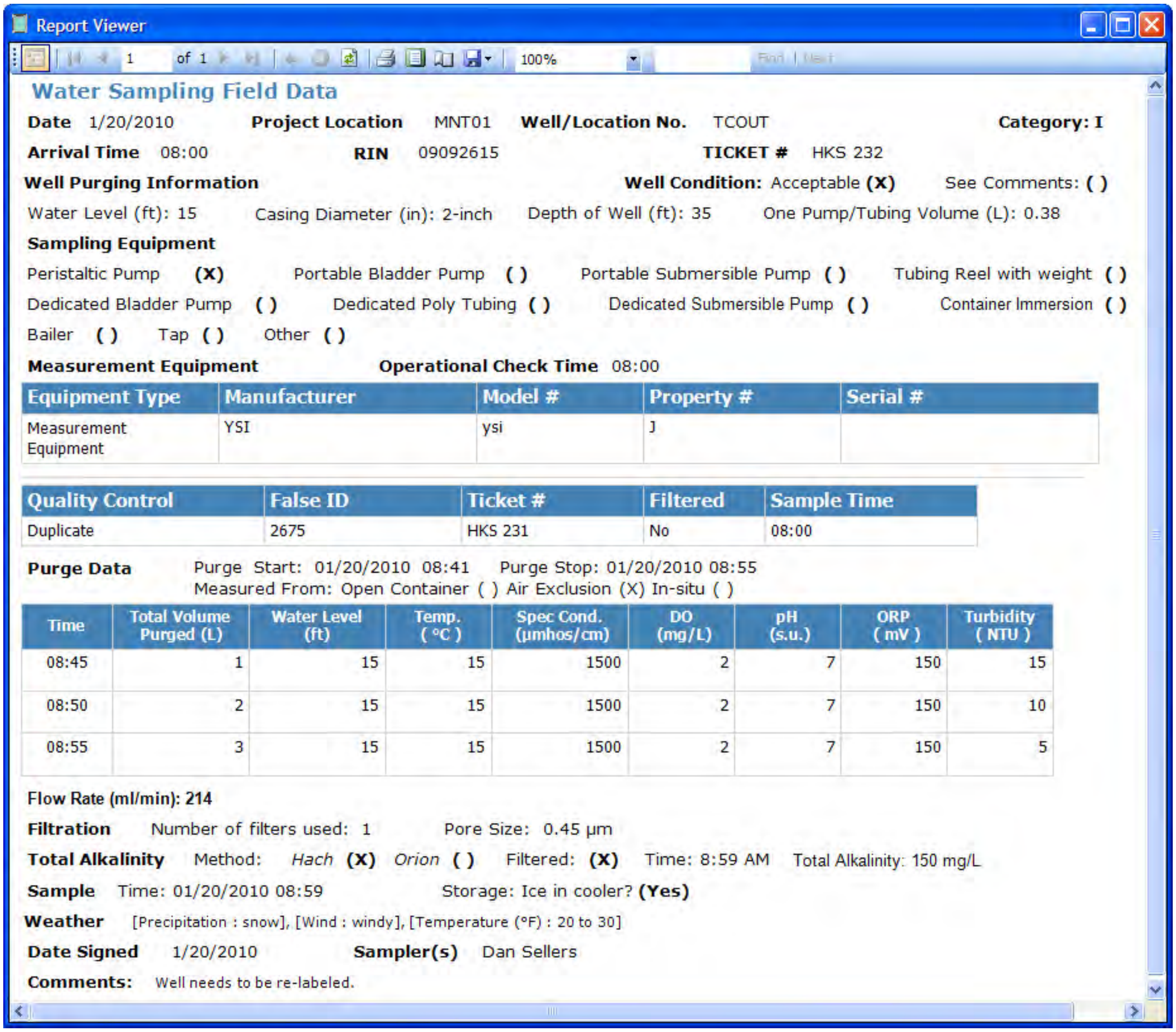
Figure 3. Recover Sampling Session

3. Sync Data

   This function is used to load data into the Toughbook field computer prior to going out to the field, and to upload field data at the end of a sampling period or end of a sampling event.

4. Reports

   This function is used to view data collected at a location after sign-off (Figure 4) or to view the Summary Report (Figure 5). These reports are for viewing only and cannot be edited. If editing is needed, the Recover Session function is used to retrieve the file, which may be edited.



Water Sampling Field Data

Date 1/20/2010 **Project Location** MNT01 **Well/Location No.** TCOUT **Category: I**

Arrival Time 08:00 **RIN** 09092615 **TICKET #** HKS 232

Well Purging Information **Well Condition:** Acceptable **(X)** See Comments: **( )**

Water Level (ft): 15 Casing Diameter (in): 2-inch Depth of Well (ft): 35 One Pump/Tubing Volume (L): 0.38

Sampling Equipment

Peristaltic Pump **(X)** Portable Bladder Pump **( )** Portable Submersible Pump **( )** Tubing Reel with weight **( )**

Dedicated Bladder Pump **( )** Dedicated Poly Tubing **( )** Dedicated Submersible Pump **( )** Container Immersion **( )**

Bailer **( )** Tap **( )** Other **( )**

Measurement Equipment **Operational Check Time** 08:00

Equipment Type	Manufacturer	Model #	Property #	Serial #
Measurement Equipment	YSI	ysi	J	

Quality Control	False ID	Ticket #	Filtered	Sample Time
Duplicate	2675	HKS 231	No	08:00

Purge Data Purge Start: 01/20/2010 08:41 Purge Stop: 01/20/2010 08:55
Measured From: Open Container ( ) Air Exclusion (X) In-situ ( )

Time	Total Volume Purged (L)	Water Level (ft)	Temp. (°C)	Spec Cond. (µmhos/cm)	DO (mg/L)	pH (s.u.)	ORP (mV)	Turbidity (NTU)
08:45	1	15	15	1500	2	7	150	15
08:50	2	15	15	1500	2	7	150	10
08:55	3	15	15	1500	2	7	150	5

Flow Rate (ml/min): 214

Filtration Number of filters used: 1 Pore Size: 0.45 µm

Total Alkalinity Method: *Hach* **(X)** *Orion* **( )** Filtered: **(X)** Time: 8:59 AM Total Alkalinity: 150 mg/L

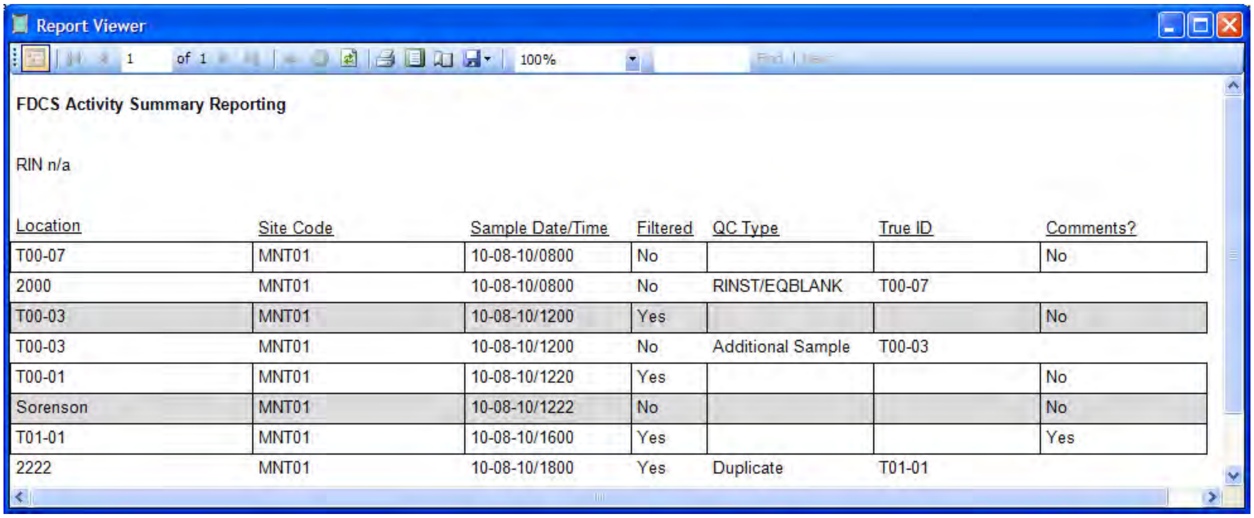
Sample Time: 01/20/2010 08:59 Storage: Ice in cooler? **(Yes)**

Weather [Precipitation : snow], [Wind : windy], [Temperature (°F) : 20 to 30]

Date Signed 1/20/2010 **Sampler(s)** Dan Sellers

Comments: Well needs to be re-labeled.

Figure 4. Example Report for a Location



FDCS Activity Summary Reporting

RIN n/a

Location	Site Code	Sample Date/Time	Filtered	QC Type	True ID	Comments?
T00-07	MNT01	10-08-10/0800	No			No
2000	MNT01	10-08-10/0800	No	RINST/EQBLANK	T00-07	
T00-03	MNT01	10-08-10/1200	Yes			No
T00-03	MNT01	10-08-10/1200	No	Additional Sample	T00-03	
T00-01	MNT01	10-08-10/1220	Yes			No
Sorenson	MNT01	10-08-10/1222	No			No
T01-01	MNT01	10-08-10/1600	Yes			Yes
2222	MNT01	10-08-10/1800	Yes	Duplicate	T01-01	

Figure 5. Example Summary Report

5. Backup Data

   This function is used to back up data collected on the Toughbook field computer to another location. Backup should be conducted daily if the sync process is not conducted.

6. Clean Up Data

   This function is used to delete locations/files that were not completed and will never be completed.

7. YSI Pre-Trip

   This function is used to create a pre-trip calibration form for the field measurement equipment.

8. Daily

   This function is used to create an operational checks form for the field measurement equipment.

9. Safety

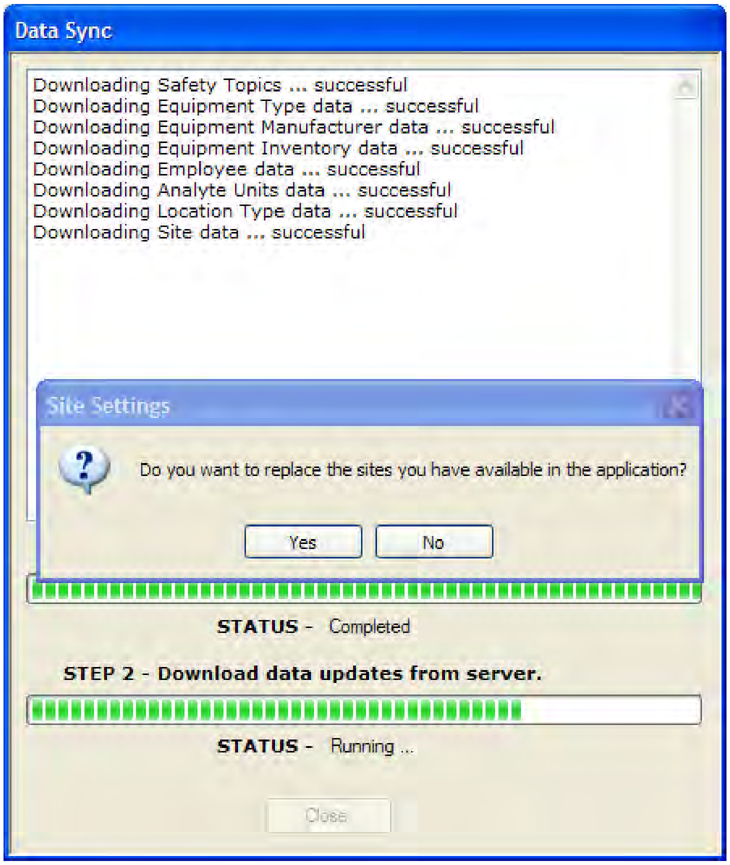
   This function is used to create a safety meeting attendance record.

5.0 Pre-Sampling Sync

Prior to sampling, the Toughbook field computer needs to be connected to the LM network, and the Sync Data function performed. The pre-sampling sync loads the site, Requisition Index Number (RIN), well information, and ticket numbers into the Toughbook field computer.

The FDCS program will ask two questions during the sync. The first question, “Do you want to replace the sites you have available in the application?” is shown in Figure 6. If you answer “Yes” to the first question, a menu of all LM sites will be displayed (Figure 7). The site (or sites) to be sampled is selected by checking the adjacent box. After site selection, the user will be asked to verify (Figure 8). If you answer “No” to the first question, you will have only sites available from the previous sync.

The second question, “Do you want to load data associated with a RIN #?” is shown in Figure 9. If you answer “Yes” to this question, the current RINs available for the sites selected will be displayed (Figure 10). The appropriate RIN (or RINs) is selected by checking the adjacent box.



Data Sync

```
Downloading Safety Topics ... successful
Downloading Equipment Type data ... successful
Downloading Equipment Manufacturer data ... successful
Downloading Equipment Inventory data ... successful
Downloading Employee data ... successful
Downloading Analyte Units data ... successful
Downloading Location Type data ... successful
Downloading Site data ... successful
```

Site Settings

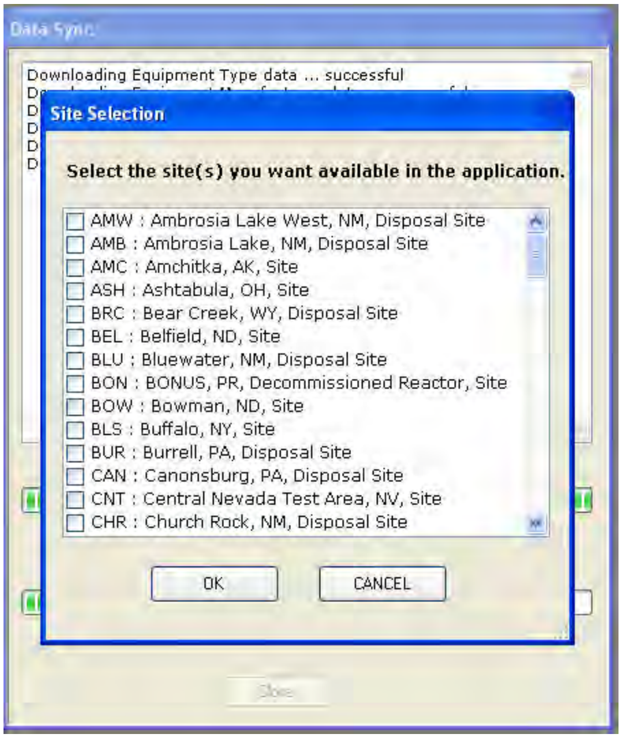
Do you want to replace the sites you have available in the application?

STATUS - Completed

STEP 2 - Download data updates from server.

STATUS - Running ...

Figure 6. Sync Question 1



Data Sync

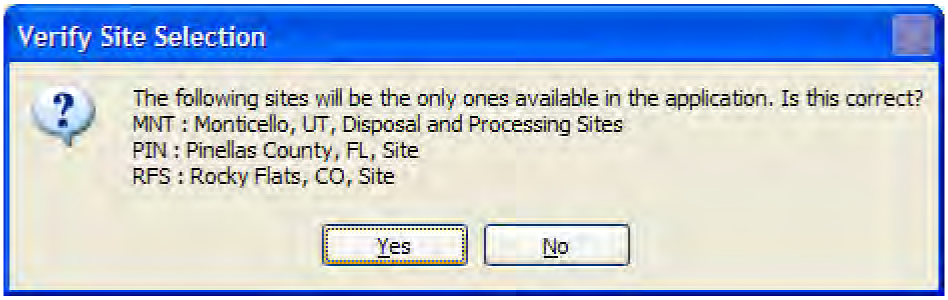
```
Downloading Equipment Type data ... successful
```

Site Selection

Select the site(s) you want available in the application.

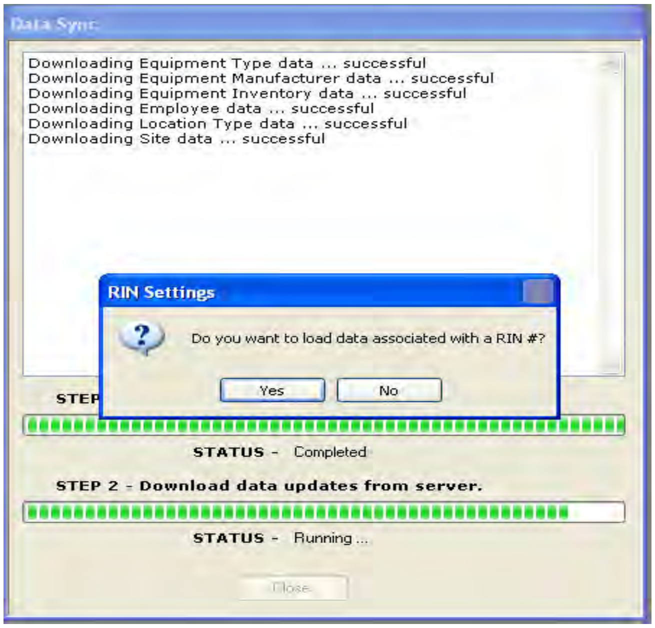
☐ AMW : Ambrosia Lake West, NM, Disposal Site
☐ AMB : Ambrosia Lake, NM, Disposal Site
☐ AMC : Amchitka, AK, Site
☐ ASH : Ashtabula, OH, Site
☐ BRC : Bear Creek, WY, Disposal Site
☐ BEL : Belfield, ND, Site
☐ BLU : Bluewater, NM, Disposal Site
☐ BON : BONUS, PR, Decommissioned Reactor, Site
☐ BOW : Bowman, ND, Site
☐ BLS : Buffalo, NY, Site
☐ BUR : Burrell, PA, Disposal Site
☐ CAN : Canonsburg, PA, Disposal Site
☐ CNT : Central Nevada Test Area, NV, Site
☐ CHR : Church Rock, NM, Disposal Site

Figure 7. Sites Menu from Sync Question 1



The following sites will be the only ones available in the application. Is this correct?
MNT : Monticello, UT, Disposal and Processing Sites
PIN : Pinellas County, FL, Site
RFS : Rocky Flats, CO, Site

Figure 8. Verify Site Selection



```
Downloading Equipment Type data ... successful
Downloading Equipment Manufacturer data ... successful
Downloading Equipment Inventory data ... successful
Downloading Employee data ... successful
Downloading Location Type data ... successful
Downloading Site data ... successful
```

Do you want to load data associated with a RIN #?

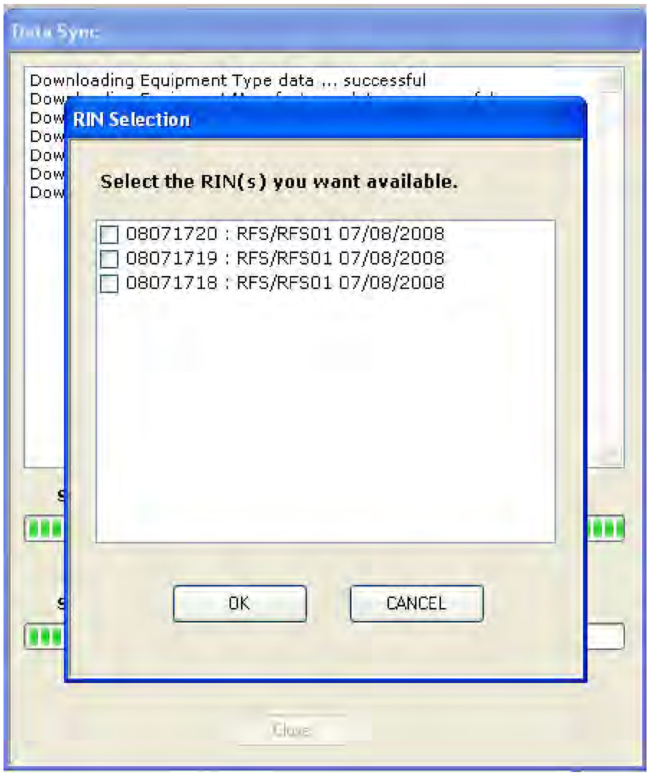
STEP

STATUS - Completed

STEP 2 - Download data updates from server.

STATUS - Running ...

Figure 9. Sync Question 2



Downloading Equipment Type data ... successful

Select the RIN(s) you want available.

☐ 08071720 : RFS/RFS01 07/08/2008
☐ 08071719 : RFS/RFS01 07/08/2008
☐ 08071718 : RFS/RFS01 07/08/2008

Figure 10. RIN Menu from Sync Question 2

6.0 Sampling a New Location

To start sampling at a new location, click on the New Session button on the opening menu. The FDCS will advance through numerous steps as the sampling process proceeds. These steps are described in this section.

Step 1: Header Information

Header information is shown in Figure 11. Throughout the FDCS, moving around to various fields can be accomplished with the mouse/cursor, or moving between adjacent fields can be accomplished by using the tab key (forward) and shift tab keys (backward). Following is the function of each field/button.

> Next—Proceed to Step 2 after Header Information is completed.
>
> Colors—Allows user to change screen colors used for quality control lights (Step 4) and for the information bar in order to make the colors visible while working in the field.
>
> Sensor—Opens the Sensor Control window, which initiates communication between FDCS and the Sonde, and displays the Opening menu for Sonde operations. This opening menu allows selection of the “Report” function to change the view of available measurements (Section 7.0).
>
> Comments—Allows addition of notes throughout the sampling process.

Arrival Date/Arrival Time—Computer date and time are captured when a new sampling location is opened. Both date and time can be edited manually by highlighting a value and using the adjacent up and down arrows.

RIN—Select the proper preloaded RIN or check the N/A box.

Site—Select sampling site.

Search Options—Can be used to help find a location ID.

Location—Select sampling location.

Add—Allows addition of a sampling location (new or existing location) that was not specified in the RIN. If a previously unsampled location is added (not in the SEEPro database), the FDCS will ask if this location is a groundwater or surface water location in order to proceed to the proper steps and/or forms.

Ticket #—The ticket number may be preloaded, entered manually if using a paper ticket, or the N/A boxed checked if a ticket number is not used.

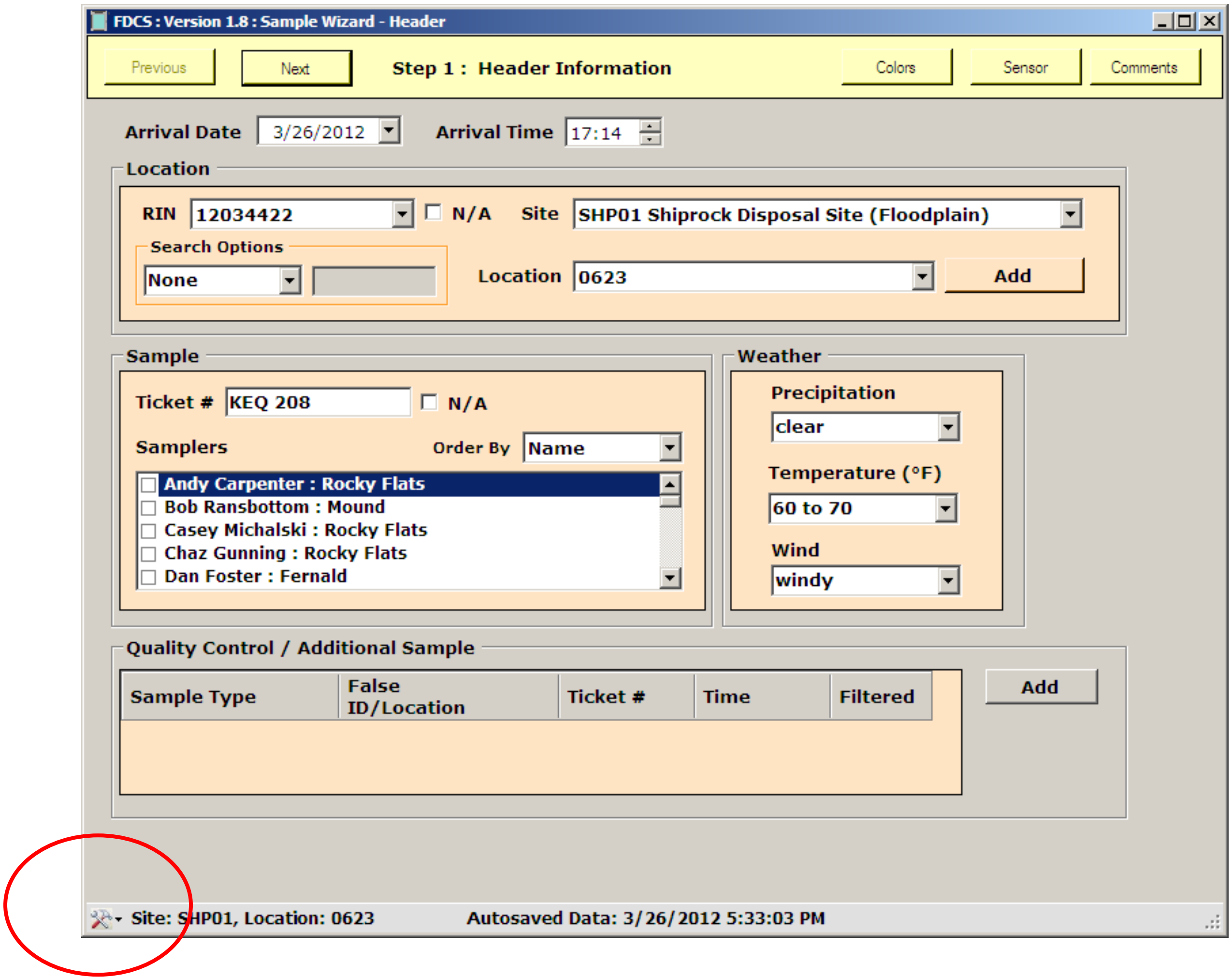
Samplers—Select samplers at the location by checking the box adjacent to the name. Sampler names selected will be carried over to the next location.

Order By—Allows sorting of sampler names.

Weather—Drop down boxes to describe weather conditions.

Quality Control/Additional Sample—List quality-control-sample information (Figure 12) in this section by clicking the Add button if quality control samples or additional samples are collected.

Moving the Navigation Bar—The small icon in the lower left corner of the window (it has been circled in Figure 11) allows the user to move the navigation bar to the bottom of the window.



FDCS : Version 1.8 : Sample Wizard - Header

Step 1 : Header Information

Arrival Date 3/26/2012
Arrival Time 17:14

Location

RIN 12034422 ☐ N/A
Site SHP01 Shiprock Disposal Site (Floodplain)
Search Options None
Location 0623

Sample

Ticket # KEQ 208 ☐ N/A
Samplers
Order By Name
☐ Andy Carpenter : Rocky Flats
☐ Bob Ransbottom : Mound
☐ Casey Michalski : Rocky Flats
☐ Chaz Gunning : Rocky Flats
☐ Dan Foster : Fernald

Weather

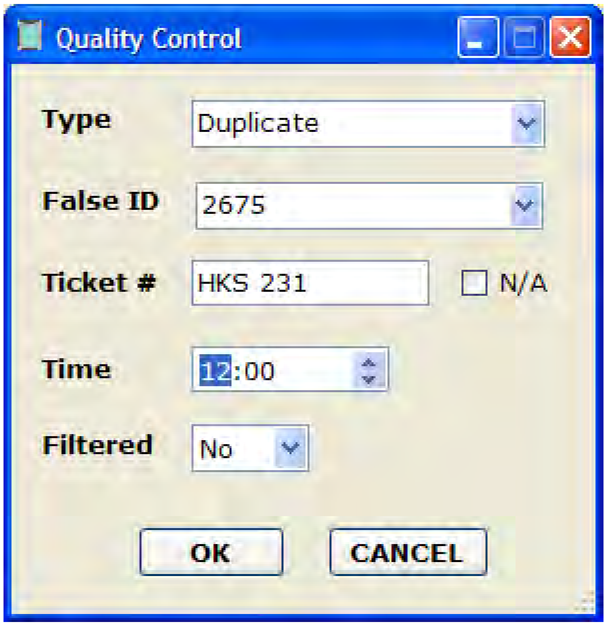
Precipitation clear
Temperature (°F) 60 to 70
Wind windy

Quality Control / Additional Sample

Sample Type	False ID/Location	Ticket #	Time	Filtered

Site: SHP01, Location: 0623
Autosaved Data: 3/26/2012 5:33:03 PM

Figure 11. Step 1: Header Information



Quality Control

Type Duplicate
False ID 2675
Ticket # HKS 231 ☐ N/A
Time 12:00
Filtered No

Figure 12. Quality Control Information

Step 2: Calibration and Equipment

Calibration and Equipment information is shown in Figure 13. Following is the function of each field/button.

Previous—Go back to Step 1.

Next—Proceed to Step 3 after Calibration and Equipment Information is completed.

Colors—Allows user to change screen colors used for quality control lights (Step 4) and for the information bar in order to make the colors visible while working in the field.

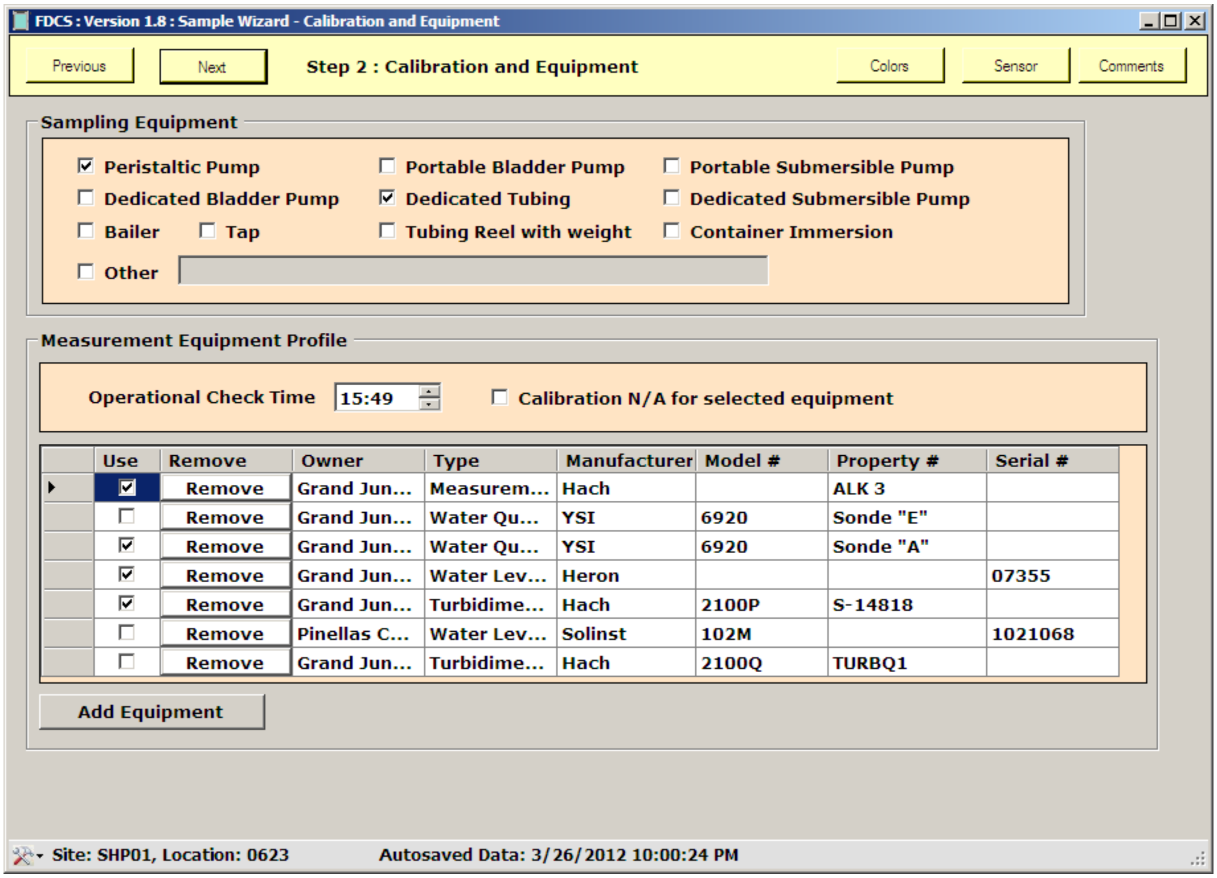
Sensor—Opens the Sensor Control window, which initiates communication between FDCS and the Sonde, and displays the Opening menu for Sonde operations. This opening menu allows selection of the "Report" function to change the view of available measurements (Section 7.0).

Comments—Allows addition of notes throughout the sampling process.

Sampling Equipment—Select sampling equipment by checking the box adjacent to the equipment.

Operational Check Time—If an operational checks form is completed using the FDCS, then the operational check time will be transferred automatically from the operational checks form. If an operational checks form is not completed, enter the time of the last operational check or calibration; if the measurement equipment used does not require an operational check or calibration, then check the "Calibration N/A for selected equipment" box.

Add Equipment—Check the box adjacent to the measurement equipment used. Use the Add Equipment button to view the master list of equipment to select from. Once equipment is selected for a sample, the equipment will be displayed in Step 2 at each subsequent location but can be removed using the Remove button. Although the measurement equipment will be displayed at each location, it may have to be selected (by checking the box in the Use column) at each new location.



Sampling Equipment

☑ Peristaltic Pump ☐ Portable Bladder Pump ☐ Portable Submersible Pump
☐ Dedicated Bladder Pump ☑ Dedicated Tubing ☐ Dedicated Submersible Pump
☐ Bailer ☐ Tap ☐ Tubing Reel with weight ☐ Container Immersion
☐ Other

Measurement Equipment Profile

Operational Check Time 15:49 ☐ Calibration N/A for selected equipment

	Use	Remove	Owner	Type	Manufacturer	Model #	Property #	Serial #
▸	☑	Remove	Grand Jun...	Measurem...	Hach		ALK 3	
	☐	Remove	Grand Jun...	Water Qu...	YSI	6920	Sonde "E"	
	☑	Remove	Grand Jun...	Water Qu...	YSI	6920	Sonde "A"	
	☑	Remove	Grand Jun...	Water Lev...	Heron			07355
	☑	Remove	Grand Jun...	Turbidime...	Hach	2100P	S-14818	
	☐	Remove	Pinellas C...	Water Lev...	Solinst	102M		1021068
	☐	Remove	Grand Jun...	Turbidime...	Hach	2100Q	TURBQ1	

Site: SHP01, Location: 0623 Autosaved Data: 3/26/2012 10:00:24 PM

Figure 13. Step 2: Calibration and Equipment

Step 3: Well Information

If a well location was selected in Step 1, this step will contain well information (Figure 14). If a surface water location was selected in Step 1, continue to the next section, Step 3: Surface Location Field Measurements. Following is the function of each field for the Well Information form.

Previous—Go back to Step 2.

Next—Proceed to Step 4 after Well Information is completed. A Category must be selected on this Step 3 screen for the Next button to be activated.

Colors—Allows user to change screen colors used for quality control lights (Step 4) and for the information bar in order to make the colors visible while working in the field.

Sensor—Opens the Sensor Control window, which initiates communication between FDCS and the Sonde, and displays the Opening menu for Sonde operations. This opening menu allows selection of the "Report" function to change the view of available measurements (Section 7.0).

Comments—Allows addition of notes throughout the sampling process.

Depth to Water—Enter the initial depth to water measurement at a well. For locations with accepted water level ranges, a red quality control light will illuminate if the measurement is out of range. See the example in Figure 14. The control light functions only to alert the user and will not prevent entry of the measurement.

Casing Diameter—Casing diameter, in inches, will be preloaded if the diameter is in the database. Otherwise, use the drop down menu or enter the value directly.

Depth of Well—Depth of well will be preloaded if it is in the database. Otherwise, enter the well depth manually.

Measured From—Use the drop down menu to enter where the water level was measured from, either TOC (top of casing) or TPC (top of protective casing).

Water Level Flag—Use the check box and drop-down list to indicate if well is dry or flowing (artesian), or if the water level is below the top of the pump. If the well is dry, select a well category (this will activate the Next button) then use the Next button to advance to step 5, where the location can be signed off.

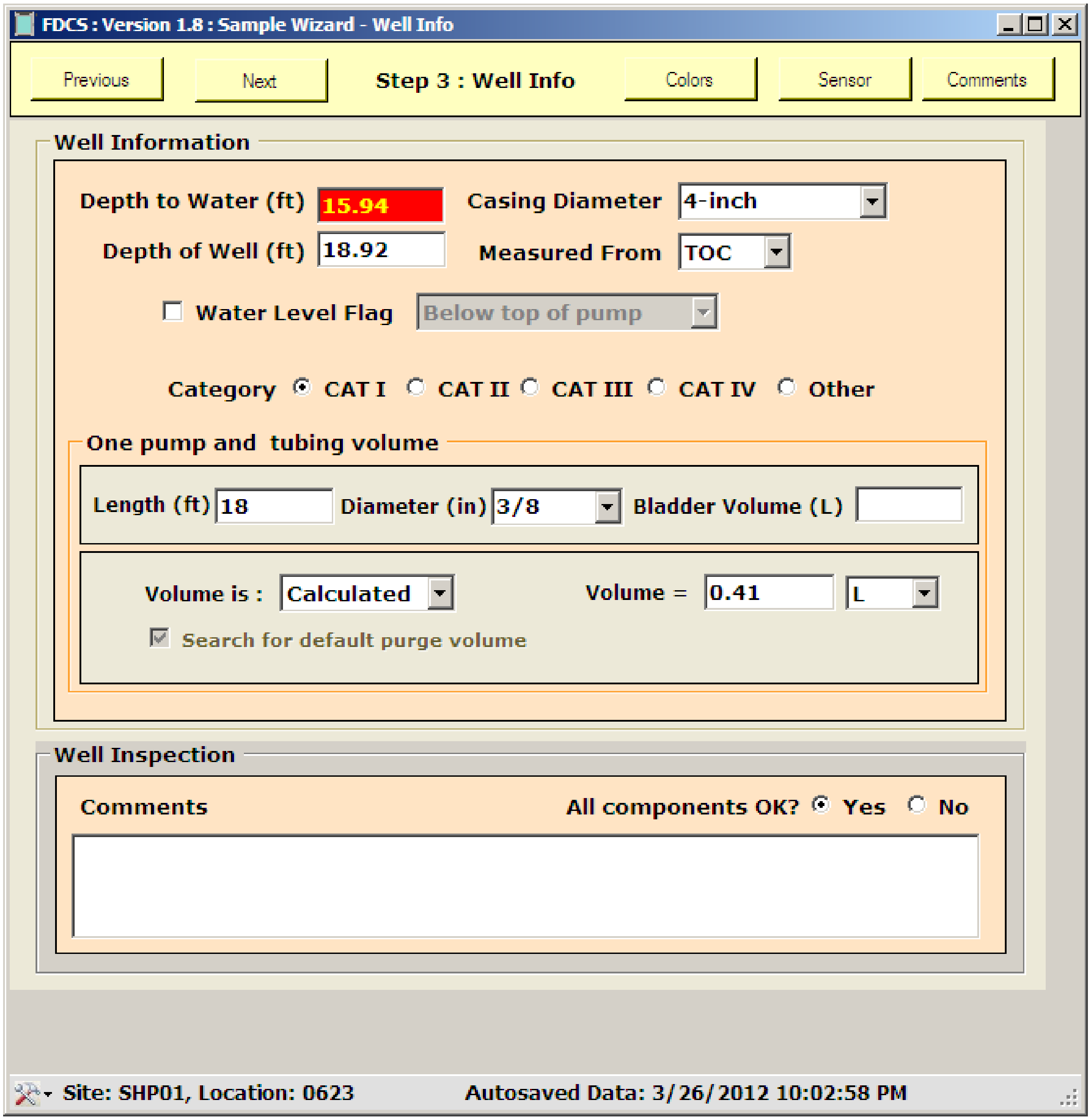
Category—Select the Category of well per SAP protocol.

Note

The FDCS will track the site from Step 1 and will go to the specific purging criteria developed for that site. Not all sites will have well categories (i.e., Pinellas and Fernald) and there will be slight differences in the required information and appearance of Steps 3 and 4. Some sites will have different purge options also (e.g., high flow).

One Pump and Tubing Volume—Enter values for tubing length, tubing diameter, and bladder volume (if applicable) and the FDCS will calculate one pump and tubing volume. The pump and tubing volume may be preloaded during the sync process for some sites. In addition, the purge volume may be provided (“Provided” in Volume is dropdown menu). To manually enter the pump and tubing volume, select “Provided” and de-select the box next to “Search for default purge volume.”

Well Inspection—Click “Yes” or “No” to answer the question if all components of a well are acceptable. Enter comments about components of the well that are deficient and need attention. These comments will be displayed in the report along with all other notes taken at a location.



Depth to Water (ft) 15.94

Casing Diameter 4-inch

Depth of Well (ft) 18.92

Measured From TOC

☐ Water Level Flag Below top of pump

Category ● CAT I ○ CAT II ○ CAT III ○ CAT IV ○ Other

Length (ft) 18 Diameter (in) 3/8 Bladder Volume (L)

Volume is : Calculated Volume = 0.41 L

☑ Search for default purge volume

Comments

All components OK? ● Yes ○ No

Site: SHP01, Location: 0623 Autosaved Data: 3/26/2012 10:02:58 PM

Figure 14. Step 3: Well Info

Step 3: Surface Location Field Measurements

If a surface water location was selected in Step 1, this step will contain surface location field measurements (Figure 15). Following is the function of each field for the Surface Location Field Measurements form.

Previous—Go back to Step 2.

Next—Proceed to Step 4 after surface location measurements are completed.

Colors—Allows user to change screen colors used for quality control lights (Step 4) and for the information bar in order to make the colors visible while working in the field.

Sensor—Opens the Sensor Control window, which initiates communication between FDCS and the Sonde, and displays the Opening menu for Sonde operations. This opening menu allows selection of the “Report” function to change the view of available measurements (Section 7.0).

Comments—Allows addition of notes throughout the sampling process.

Sonde Data Capture—Opens the Sensor Control window, which initiates communication between FDCS and the Sonde, and displays Sonde measurements in the Sensor Control window.

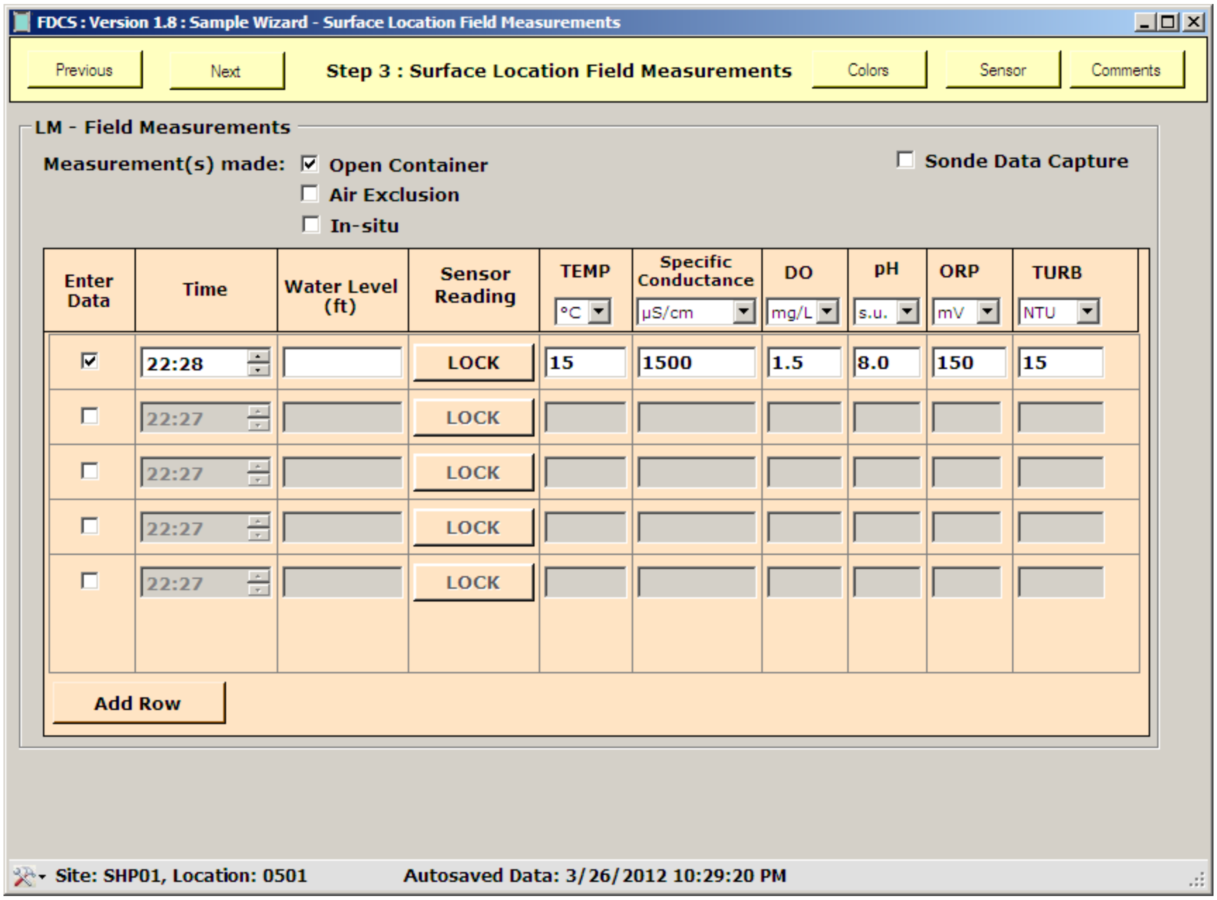
Measurement(s) made—Check the box adjacent to one of the choices to indicate how field measurements were made.

Time—Computer time is captured when a box is checked in the Enter Data column. Time may be adjusted by highlighting a value and using the adjacent up and down arrows.

Field Data—Once the Enter Data column is checked, field data (water level, temperature, specific conductance, dissolved oxygen, pH, ORP, and turbidity) will be captured by the computer or hand entered by the user into the appropriate column.

Sensor Reading—This column contains buttons that are activated if the FDCS is in communication with the Sonde (see Section 7.0, “Sonde Data Capture”). While live Sonde data are being read by FDCS, the user can lock the readings with the LOCK button. If desired, the readings can be unlocked (to resume the reading of live data) by selecting the LOCK button again.

Add Row—This button is used to add a row at the bottom of the page for additional collection of field data. As more rows are added and the screen is filled, the top rows will scroll off the screen.



LM - Field Measurements

Measurement(s) made: ☑ Open Container
☐ Air Exclusion
☐ In-situ

☐ Sonde Data Capture

Enter Data	Time	Water Level (ft)	Sensor Reading	TEMP °C	Specific Conductance µS/cm	DO mg/L	pH s.u.	ORP mV	TURB NTU
☑	22:28		LOCK	15	1500	1.5	8.0	150	15
☐	22:27		LOCK						
☐	22:27		LOCK						
☐	22:27		LOCK						
☐	22:27		LOCK						

Site: SHP01, Location: 0501 Autosaved Data: 3/26/2012 10:29:20 PM

Figure 15. Surface Location Field Measurements

Step 4: Purge Data

Purge Data is shown in Figure 16. The FDCS will track the site selected in Step 1 and will use the proper purge data form designed for that site. Figure 16 shows purge criteria for a Category I well at Rocky Flats. If a surface water location is selected, this form will be replaced with the Surface Location Field Measurement form (Figure 15). Following is the function of each field for the Purge Data form.

Previous—Go back to Step 3.

Next—Proceed to Step 5 after purge is completed.

Colors—Allows user to change screen colors used for quality control lights (see below) and for the information bar in order to make the colors visible while working in the field.

Sensor—Opens the Sensor Control window, which initiates communication between FDCS and the Sonde, and displays the Opening menu for Sonde operations. This opening menu allows selection of the “Report” function to change the view of available measurements (Section 7.0).

Comments—Allows addition of notes throughout the sampling process.

Purge Start Time—Computer time and date is captured by clicking on the Start button at the start of the purging process. The purge start time and date can be adjusted by highlighting a value and using the adjacent up and down arrows.

Sonde Data Capture—Opens the Sensor Control window, which initiates communication between FDCS and the Sonde, and displays Sonde measurements in the Sensor Control window.

Measurement(s) Made—Check the box adjacent to one of the choices to indicate how field measurements were made.

Depth to Water (DTW)—Informational only. Lets the sampler(s) know the initial depth to water.

Minimum Purge Volume—Informational only. Lets the sampler know the minimum purge volume required before sampling can commence. The quality control light will turn from red to green (or whatever color the user has selected) when the minimum volume has been obtained.

Overall Flow Rate—The average purge rate is calculated by the FDCS by dividing the overall volume by the overall time. The quality control light will turn from red to green (or whatever color the user has selected) when the flow rate is below the maximum allowed.

Time—Computer time is captured when a volume is entered. Time may be adjusted by highlighting a value and using the adjacent up and down arrows.

Total Purge Volume—The user manually enters the cumulative volume purged. A unit of either liters or gallons must be selected using the dropdown menu in the header.

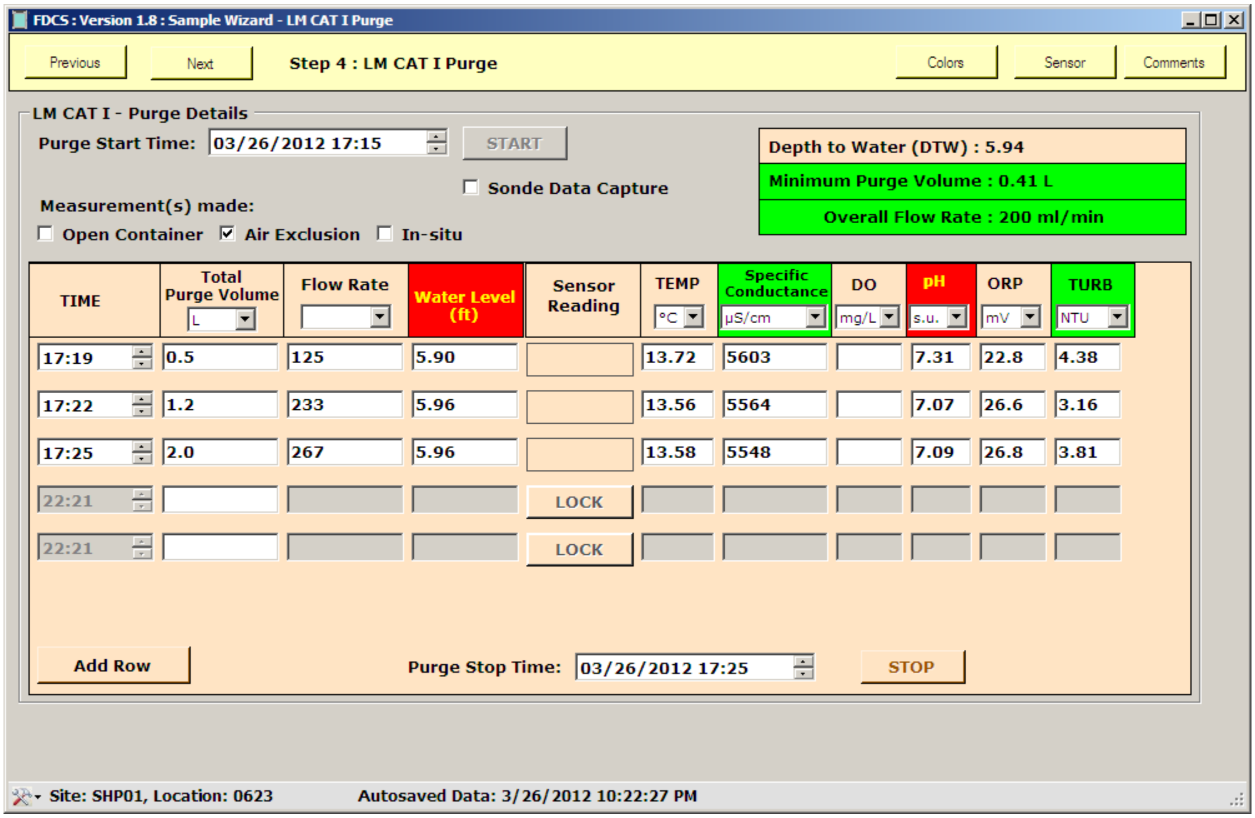
Flow Rate—The flow rate is calculated since the last set of time and volume measurements. Units of mL/min or gal/min may be selected using the dropdown menu in the header.

Field Data—Enters field data (water level, temperature, specific conductance, dissolved oxygen, pH, ORP, and turbidity) into the appropriate column. Quality control lights in the header will change from red to green (or whatever color the user has selected) as purge stabilization criteria is achieved. In addition, a red quality control light will illuminate for a particular value if it is out of the normal range for that parameter. Quality control lights for purge stability and individual parameter values function only to alert the user and will not prevent entry, continuation to the next step, or uploading of field data.

Sensor Reading—This column contains buttons that are activated if the FDCS is in communication with the Sonde (see Section 7.0, “Sonde Data Capture”). While live Sonde data are being read by FDCS, the user can lock the readings with the LOCK button. If desired, the readings can be unlocked (to resume the reading of live data) by selecting the LOCK button again.

Add Row—This button is used to add a row at the bottom of the page for additional collection of field data. As more rows are added and the screen is filled, the top rows will scroll off the screen.

Purge Stop Time—The time and date of the last row of field measurements will be captured by clicking the “Stop” button at the end of the purge. The date and time can be manually adjusted by highlighting a value and using the adjacent up and down arrows.



FDCS : Version 1.8 : Sample Wizard - LM CAT I Purge

Step 4 : LM CAT I Purge

LM CAT I - Purge Details

Purge Start Time: 03/26/2012 17:15

☐ Sonde Data Capture

Measurement(s) made:
☐ Open Container ☑ Air Exclusion ☐ In-situ

Depth to Water (DTW) : 5.94
Minimum Purge Volume : 0.41 L
Overall Flow Rate : 200 ml/min

TIME	Total Purge Volume L	Flow Rate	Water Level (ft)	Sensor Reading	TEMP °C	Specific Conductance µS/cm	DO mg/L	pH s.u.	ORP mV	TURB NTU
17:19	0.5	125	5.90		13.72	5603		7.31	22.8	4.38
17:22	1.2	233	5.96		13.56	5564		7.07	26.6	3.16
17:25	2.0	267	5.96		13.58	5548		7.09	26.8	3.81
22:21				LOCK						
22:21				LOCK						

Purge Stop Time: 03/26/2012 17:25

Site: SHP01, Location: 0623 Autosaved Data: 3/26/2012 10:22:27 PM

Figure 16. Purge Data

Step 5: Field Measurements

Note: For surface water locations, the field measurements are collected as Step 4.

Field Measurements are shown in Figure 17. Following is the function of each field.

Previous—Go back to Step 4.

Colors—Allows user to change screen colors used for quality control lights and for the information bar in order to make the colors visible while working in the field.

Sensor—Opens the Sensor Control window, which initiates communication between FDCS and the Sonde, and displays the Opening menu for Sonde operations. This opening menu allows selection of the “Report” function to change the view of available measurements (Section 7.0).

Comments—Allows addition of notes throughout the sampling process.

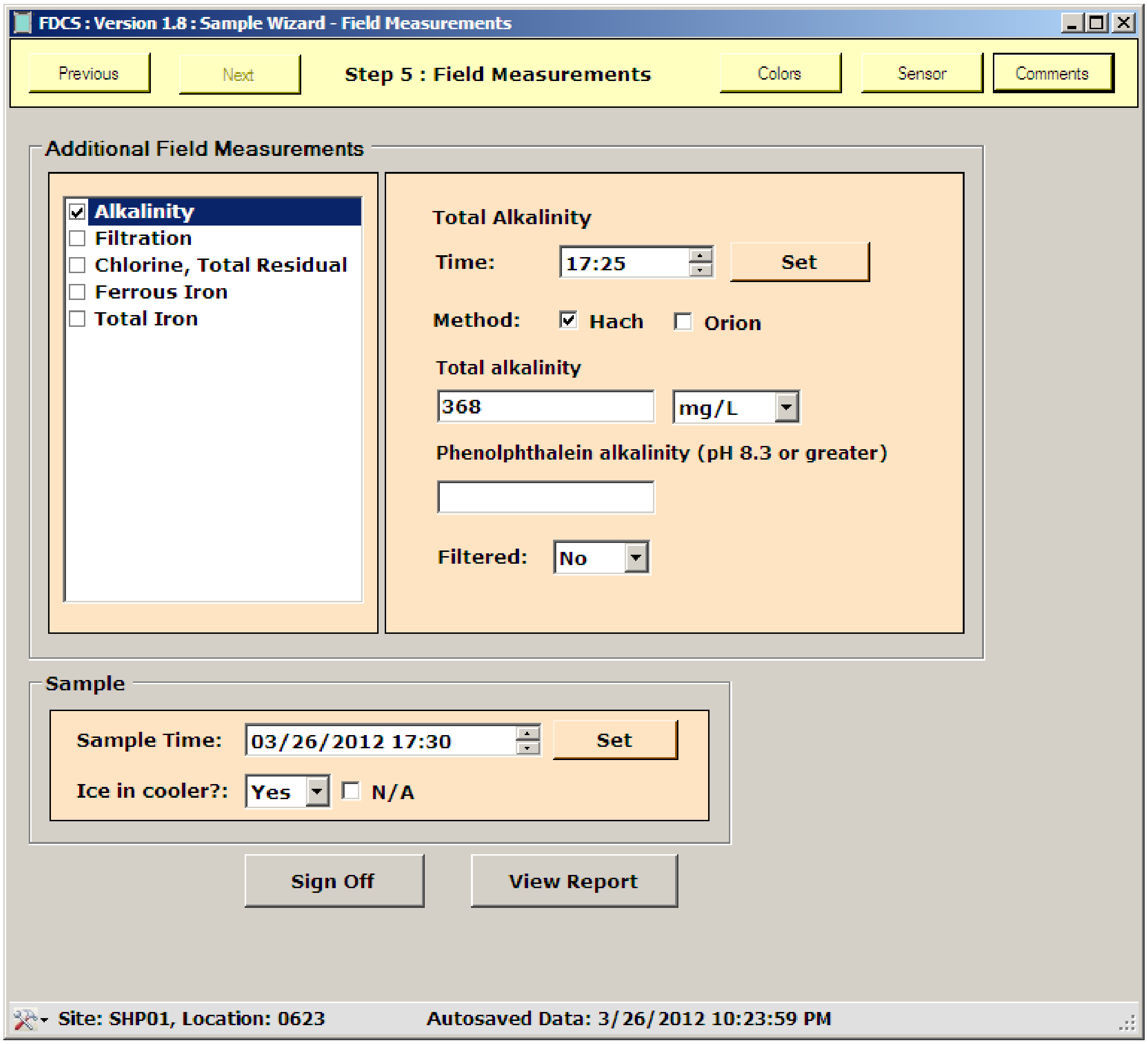
Additional Field Measurements—Check the box next to a field measurement on the left to bring up a form used to record the required information.

Sample Time—Click the Set button to indicate sample date and time. The Set button will capture computer date and time, but date and time can be adjusted by highlighting a value and using the adjacent up and down arrows.

Ice in cooler?—Use the adjacent dropdown box to indicate if ice is present (or not) in the cooler when sample aliquots require cooling, or check the N/A box if no sample aliquots require cooling.

Sign Off—The Sign Off button is used when the location is complete. This will close the file, and the FDCS will return to the opening menu.

View Report—Click on the View Report button to review all information collected at the current location (Figure 4). The Report cannot be edited here; to make changes use the Previous/Next buttons to navigate to the appropriate step. A report can be viewed after sign off using the Reports function on the opening menu.



FDCS : Version 1.8 : Sample Wizard - Field Measurements

Step 5 : Field Measurements

Additional Field Measurements

☑ Alkalinity
☐ Filtration
☐ Chlorine, Total Residual
☐ Ferrous Iron
☐ Total Iron

Total Alkalinity

Time: 17:25

Method: ☑ Hach ☐ Orion

Total alkalinity: 368 mg/L

Phenolphthalein alkalinity (pH 8.3 or greater):

Filtered: No

Sample

Sample Time: 03/26/2012 17:30

Ice in cooler?: Yes ☐ N/A

Site: SHP01, Location: 0623 Autosaved Data: 3/26/2012 10:23:59 PM

Figure 17. Step 5: Field Measurements

7.0 Sonde Data Capture

To capture live readings from the Sonde, select the “Sonde Data Capture” box (Step 4 for groundwater measurements) or in the Surface Location Field Measurements window (Step 3 for surface water measurements). The Sensor Control window (Figure 18) will open, allowing live readings from the Sonde to be captured by FDCS. Select the Sensor button at any step to open the Main menu (Figure 19). This opening menu allows selection of the “Report” function to change the view of available measurements.

For the data capture to function correctly, the following conditions must be met:

- Power must be supplied to the Sonde, either from an external source or from batteries inside the Sonde.
- The Sonde must be connected to FDCS through a COM port on the laptop and the correct COM port must be selected in the Sensor Control window (Figure 18). To select the

correct COM port, click the enable button and select the COM port from the drop down list on Sensor COM Port. Once the correct COM port is chosen (COM 1), the “Enable” box must be un-checked.

19.68 Temp C
78 SpCond uS/cm
0.0 DOsat %
0.00 DO mg/L
0.2 DOchrg
4.74 pH
125.8 pH mV
20.8 Orp mV
11.2 Battery volts

☐ Enable
Sensor COM Port COM1

Figure 18. Sensor Control Window Displaying Live Readings

Figure 19. Opening Menu for Sonde Operations

8.0 Post-Sampling Sync

The sync function at the end of the sampling period or sampling event is used to upload field data to a centralized FDCS database and to FieldPar, which is a temporary database for field data. During the data loading process, field data is merged with analytical laboratory data and entered into the SEEPro database. The sync also will file the reports of all completed locations, safety meeting reports, and pre-trip and daily calibration forms electronically in the “SMS on Condor” network location under the appropriate RIN number. **Reminder: Don’t forget the Post-Sampling Sync.** Once the post-sampling sync is performed, recovery of and edits to a sampled location are no longer possible through the FDCS.

9.0 FDCS Updates

Periodic FDCS updates will be required as adjustments are made based on user input and as new functionality is added to the FDCS. When updates are needed, all Toughbook field computers will be updated through the Information Technology group.

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Appendix B-2

Water Level Recorder
Desk Instructions

Water Recorder, DOE 2010
Software version 1.6.3

Contents

Figures

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1.0 Introduction

The Water Level Recorder is a computer-based system designed for use on a personal digital assistant (PDA) to: (1) interface with Legacy Management (LM) databases and software programs to download needed information into the PDA prior to a making water-level measurements; (2) provide for electronic collection of water-level data, well inspection observations, and well maintenance notes at LM sites; (3) interface with LM databases to upload water-level data after collection; (4) provide quality control checks through the water-level measurement process; (5) generate electronic reports for documentation; and (6) provide a paper-free method of data collection.

2.0 Purpose

The purpose of this desk instruction is to provide guidance to personnel using the Water Level Recorder when conducting water-level measurements, well inspections, or well maintenance at LM sites. A copy of the Water Level Recorder Desk Instructions will be appended to the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (SAP) (LMS/PRO/S04351).

3.0 Scope

The Water Level Recorder was designed for use when conducting routine water-level measurements at LM sites, which involves measuring water levels at numerous locations at a site over a short time-frame. It is not intended to be used to collect water-level data during groundwater sampling because the Field Data Collection System is used for that purpose. In addition, there may be some non-routine water level measurement activities, e.g., during pump tests, where the Water Level Recorder is not appropriate to use. The Water Level Recorder may also be used to record well inspection observations and to document well maintenance.

4.0 Startup

Click on the “Water Level” icon on the Start menu to start the program. The opening menu (Figure 1) has four buttons and other information that function as described below.

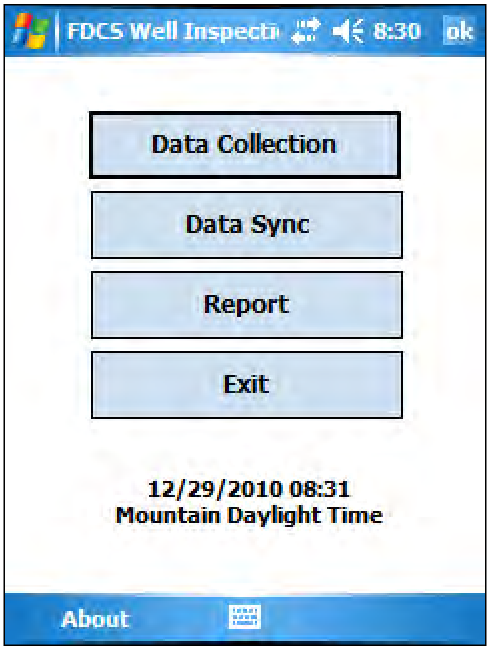


Figure 1. Opening Menu

Data Collection

This function is used to access the steps to record new water-level data, inspection observations, and well maintenance documentation.

Data Sync

Prior to taking measurements, this function is used to select the site where data will be collected and to download locations and historical data into the PDA. After taking measurements, this function is used to upload water-level data to the database.

Report

This function is used to view water-level data and/or actions performed (i.e. well inspection and well maintenance) on the PDA from locations collected since the last sync. Records may also be deleted using this function.

Exit

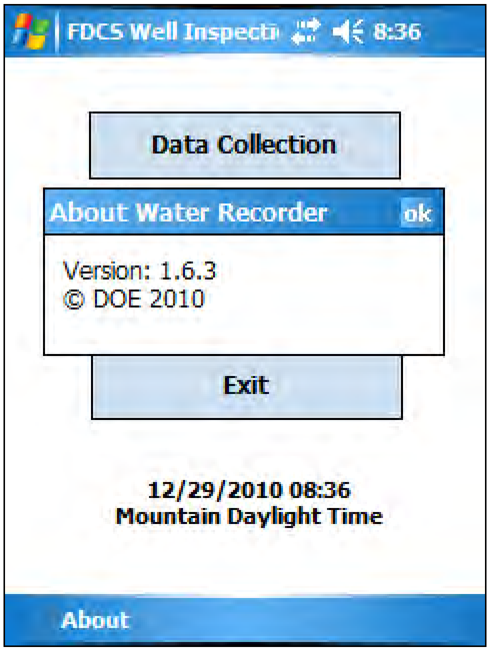
This function is used to exit the program.

Date, Time, and Time Zone

This information is intended to alert the user to the date and time the PDA is currently set to. Often, the PDA is taken to different time zones to collect water levels, so the user must change the system time to match the local time. The date and time may have to be corrected if the PDA battery runs low. The time zone, date, and time can be changed by using the “Clock and Alarms” application. From the main PDA screen, click Start, Settings, the System tab, and then click the “Clock and Alarms” icon.

About

Clicking on the “About” icon in the footer will display the version of the Water Level Recorder program (Figure 2).



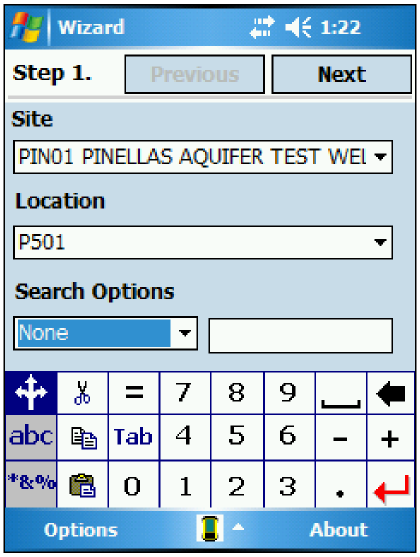
Version: 1.6.3
© DOE 2010

12/29/2010 08:36
Mountain Daylight Time

Figure 2. “About” Icon

Data Entry Keyboard

Clicking on the keyboard or Trimble icon in center of the footer (Figure 3) will maximize the keyboard to allow data entry. Clicking on the data entry icon again will minimize the keyboard.



Step 1.

Site: PIN01 PINELLAS AQUIFER TEST WEl

Location: P501

Search Options: None

Figure 3. Data Entry Keyboard Maximized

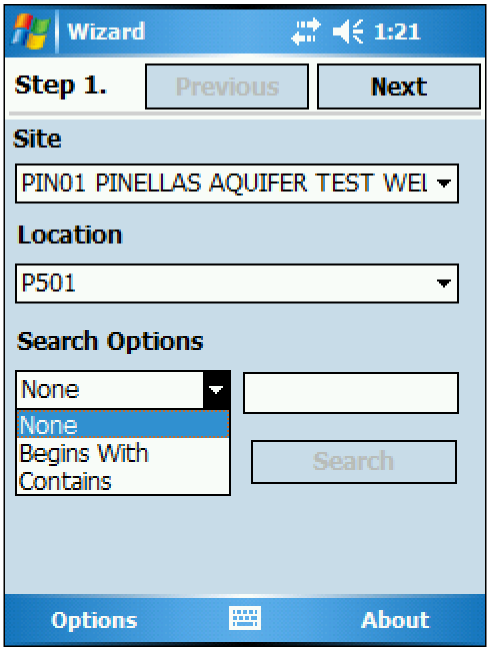
5.0 Data Collection

The remainder of this procedure is organized to provide detail for each button (in descending order) on the opening menu. Click on the “Data Collection” button to initiate recording of water-level data and well inspection/maintenance information.

Step 1. Select Location

Step 1, with the keyboard minimized, is shown in Figure 4. The features of this step are listed below.

- Previous/Next—Use the “Previous” and “Next” buttons to move backward and forward, respectively, within the program. Because this is Step 1, the “Previous” button is grayed out and going to a previous screen is not an option.
- Site—Select the site from the site dropdown list which will include the site(s) downloaded during the sync process.
- Location—Select the location identification code from the location dropdown list or use “Search Options” to find the proper location. A location can be found more quickly in the dropdown list by using the keyboard to select the first letter or number of the desired location.
- Search Options—Use search options, if needed, to quickly find the location. Search Options include “Begins With” and “Contains.” Highlight one of the two options and start to search for the location by entering letters/numbers in the field to the right using the keyboard. Click on the keyboard or Trimble icon in the middle of the footer to maximize the keyboard (Figure 5).



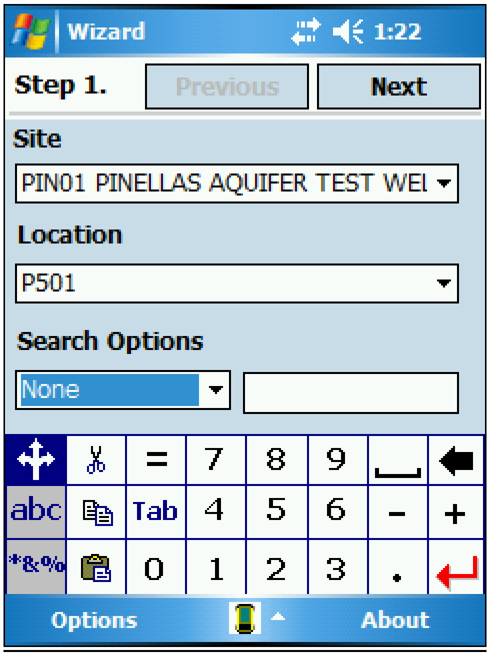
Step 1.

Site
PIN01 PINELLAS AQUIFER TEST WEI

Location
P501

Search Options
None

Figure 4. Step 1



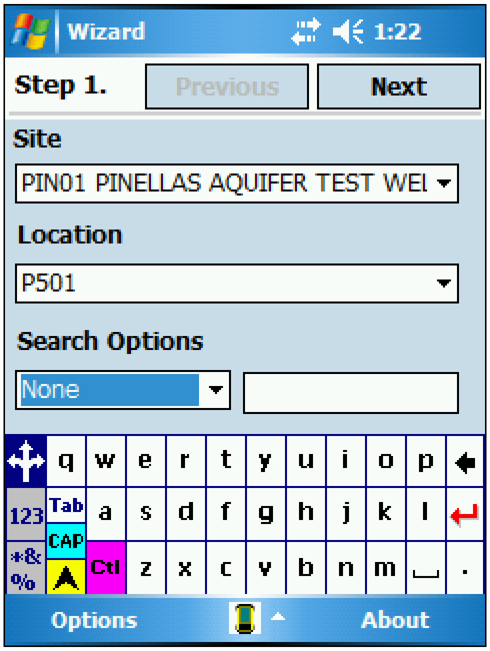
Site
PIN01 PINELLAS AQUIFER TEST WEl

Location
P501

Search Options
None

Figure 5. Numerical Recon Keyboard Maximized

- If letters need to be entered, click on the "abc" button to bring up the alpha keyboard (Figure 6). Clicking on the "123" button will toggle back to the numeric keyboard. A Recon or standard keyboard can be selected using the up-arrow next to the icon, and the keyboard can be customized by selecting "Settings," then "Input" on the PDA menu.



Site
PIN01 PINELLAS AQUIFER TEST WEl

Location
P501

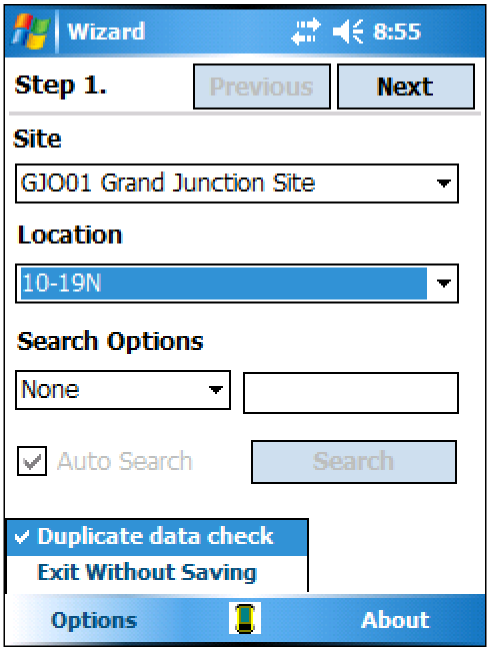
Search Options
None

Figure 6. Alpha Recon Keyboard Maximized

- Selecting "Options" on the left side of the footer will allow the user to:

    — "Exit Without Saving" which lets the user go back to the opening menu without saving any data entered at the current location.

— Turn the “Duplicate data check” off (unchecked) and on (checked) by clicking in the highlighted field (Figure 7). When the duplicate data check is on, it will alert the user if the selected location has already been measured since the last sync (Figure 8).



Site
GJO01 Grand Junction Site

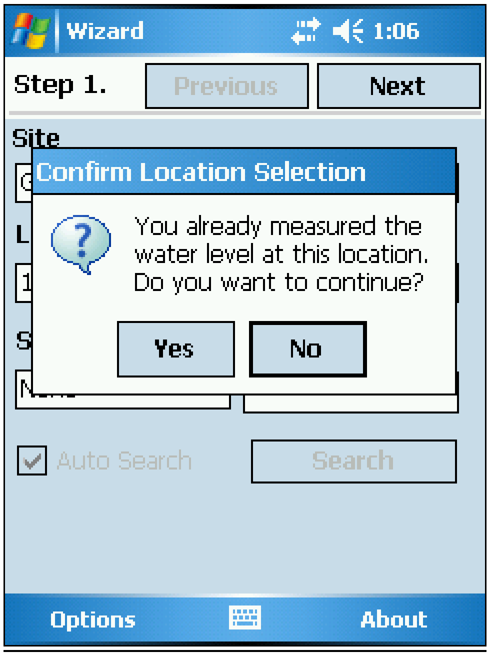
Location
10-19N

Search Options
None

☑ Auto Search

✓ Duplicate data check
Exit Without Saving

Figure 7. Duplicate Data Check Enabled



Confirm Location Selection

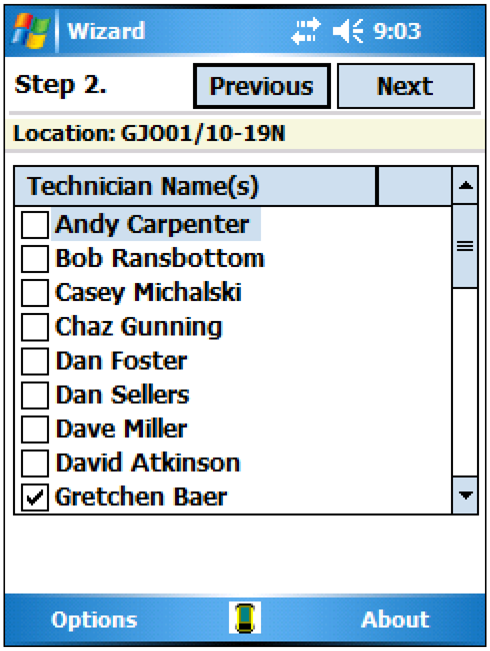
You already measured the water level at this location. Do you want to continue?

Yes No

Figure 8. Duplicate Location Selected with Duplicate Data Check Enabled

Step 2. Select Technician Name(s)

- The site code and location selected in Step 1 is displayed in the header of subsequent steps. This information is displayed to verify the correct selection. If the location or site code is incorrect, select the “Previous” button to go back to Step 1 and change the site code or location.
- The technician names can be selected by checking the appropriate boxes (Figure 9). At the first location of the day or after a sync, scroll down the entire list to ensure only the correct names have been selected. Once selected, the name(s) will remain selected at subsequent locations.



Step 2.

Location: GJ001/10-19N

Technician Name(s)

☐ Andy Carpenter
☐ Bob Ransbottom
☐ Casey Michalski
☐ Chaz Gunning
☐ Dan Foster
☐ Dan Sellers
☐ Dave Miller
☐ David Atkinson
☑ Gretchen Baer

Figure 9. Step 2

Step 3. Selecting the Type of Data That Will Be Collected

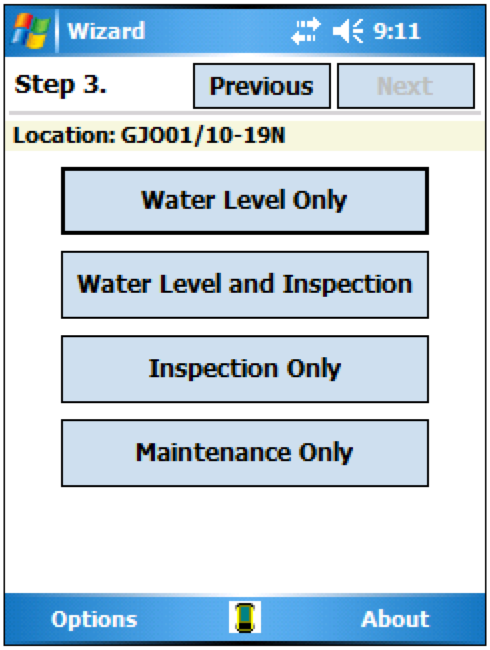
Select one of the four available options (Figure 10):

Option 1, **Water Level Only**—goes directly to the water level input page.

Option 2, **Water Level and Inspection**—goes to both the water level and the inspection programs. There is a maintenance option at the end of each inspection category to allow input for maintenance conducted while at the well.

Option 3, **Inspection Only**—goes to the inspection program only with a maintenance option the end of each inspection category to allow input for maintenance conducted while at the well.

Option 4, **Maintenance Only**—for when returning to a location to conduct maintenance.

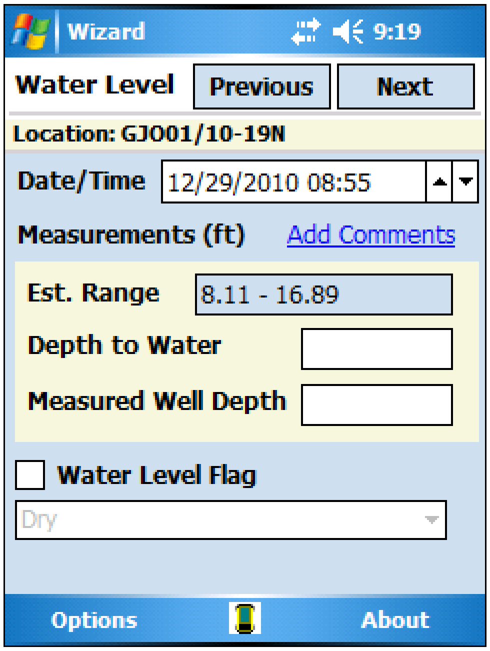


Location: GJ001/10-19N

Figure 10. Step 3

Option 1, Water Level Only (This option is selected in Step 3)

- Date/Time displayed will be the current PDA system date and time (Figure 11). If it is incorrect, highlight the incorrect number and use the up and down arrows to change the numbers or enter the correct number with the keyboard.



Location: GJ001/10-19N

Date/Time 12/29/2010 08:55

Est. Range 8.11 - 16.89

Depth to Water

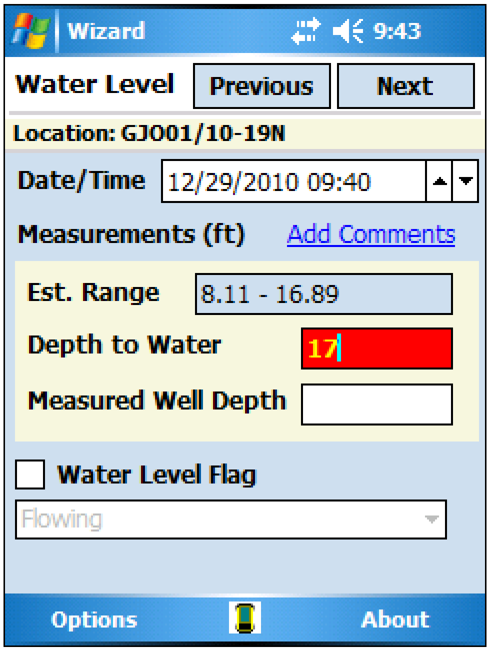
Measured Well Depth

☐ Water Level Flag

Dry

Figure 11. Water Level Entry

- Est. Range (Estimated range)—A statistical range calculated using historical data from the selected well is used as a quality control check. The range is developed by using an outlier test to remove outliers from the historical range. If a depth to water is entered that is outside the estimated range, the “Depth to Water” field will turn red alerting the user to a possible misread of the water level indicator and/or data entry error.
- Depth to Water—Enter the measured depth to water. If the depth to water field turns red (Figure 12) after entry (outside statistical range), depth to water should be re-measured and re-entered.



Location: GJ001/10-19N

Date/Time 12/29/2010 09:40

Measurements (ft)

Est. Range 8.11 - 16.89

Depth to Water 17

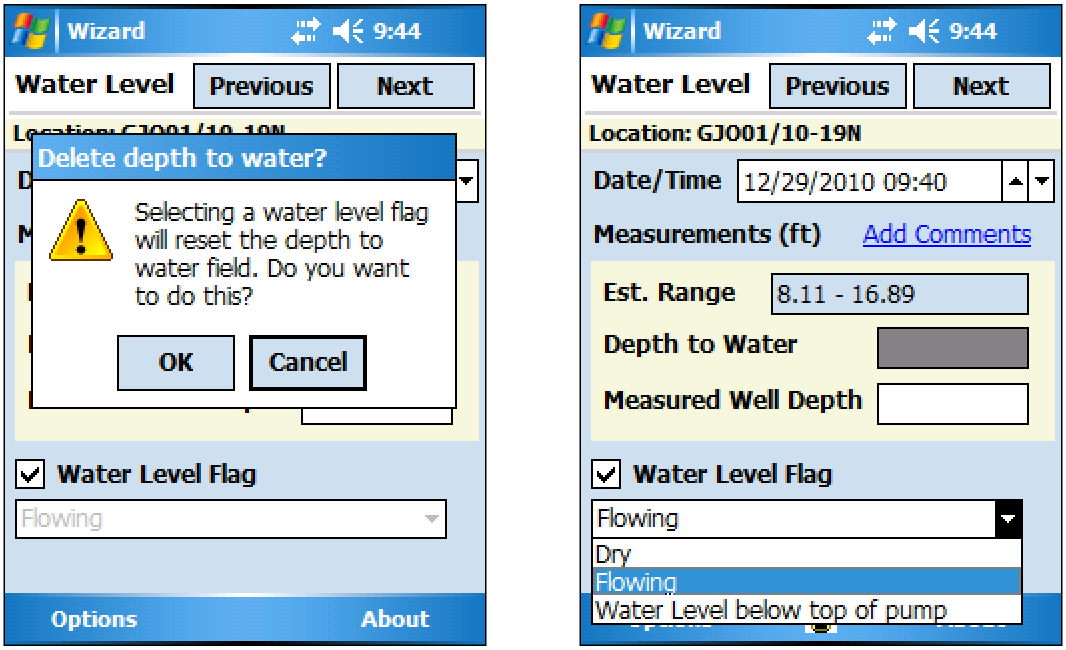
Measured Well Depth

☐ Water Level Flag

Flowing

Figure 12. Depth to Water Outside the Estimated Range

- Measured Well Depth—If the depth of the well is measured, enter the measured depth of the well.
- Water Level Flag—If the well is dry, flowing, or the water level is below the top of the pump, check the “Water Level Flag” box (Figure 13), which will enable the dropdown list with these three choices. Highlight the appropriate choice to select it. Note that selecting the “Water Level Flag” box will clear the “Depth to Water” field.
- Add Comments—Select this link to open a window that will allow comments to be entered. Enter any additional comments or information that may have an influence on the water level or indicate a problem with the integrity of the well.



Delete depth to water?

Selecting a water level flag will reset the depth to water field. Do you want to do this?

☑ Water Level Flag: Flowing

Location: GJ001/10-19N

Date/Time: 12/29/2010 09:40

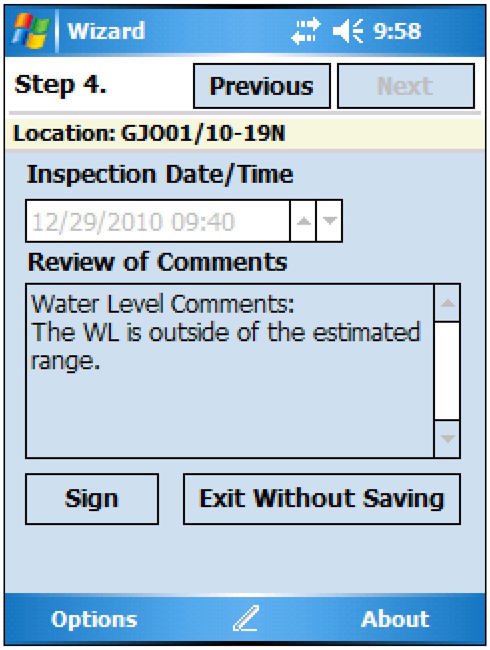
Est. Range: 8.11 - 16.89

☑ Water Level Flag: Flowing

Dry
Flowing
Water Level below top of pump

Figure 13. Water Level Flag Dropdown Box

- **Step 4**. Completion (Figure 14)
  - — Review any comments.
  - — Click on the "Sign" button to save the entered data. The data will be saved and a dialog box will open to ask the user "Do you want to enter data for another location?" Click on the "Yes" button to enter more data and the program will go back to Step 1. Click the "No" button and the program will go back to the opening menu.
  - — Click on the "Exit Without Saving" button to discard the collected data. A dialog box will come up and ask the user "Are you sure you want to exit without saving?" Click on the "Yes" button to delete the collected data and return to the opening menu. Click on the "No" button to remain in Step 4.
  - — In the Water Level Only mode, the "Inspection Date/Time" field does not apply and is inactive.



Location: GJ001/10-19N

Inspection Date/Time

12/29/2010 09:40

Review of Comments

Water Level Comments:
The WL is outside of the estimated range.

Figure 14. Step 4

Option 2, Water Level and Inspection (This option is selected in Step 3)

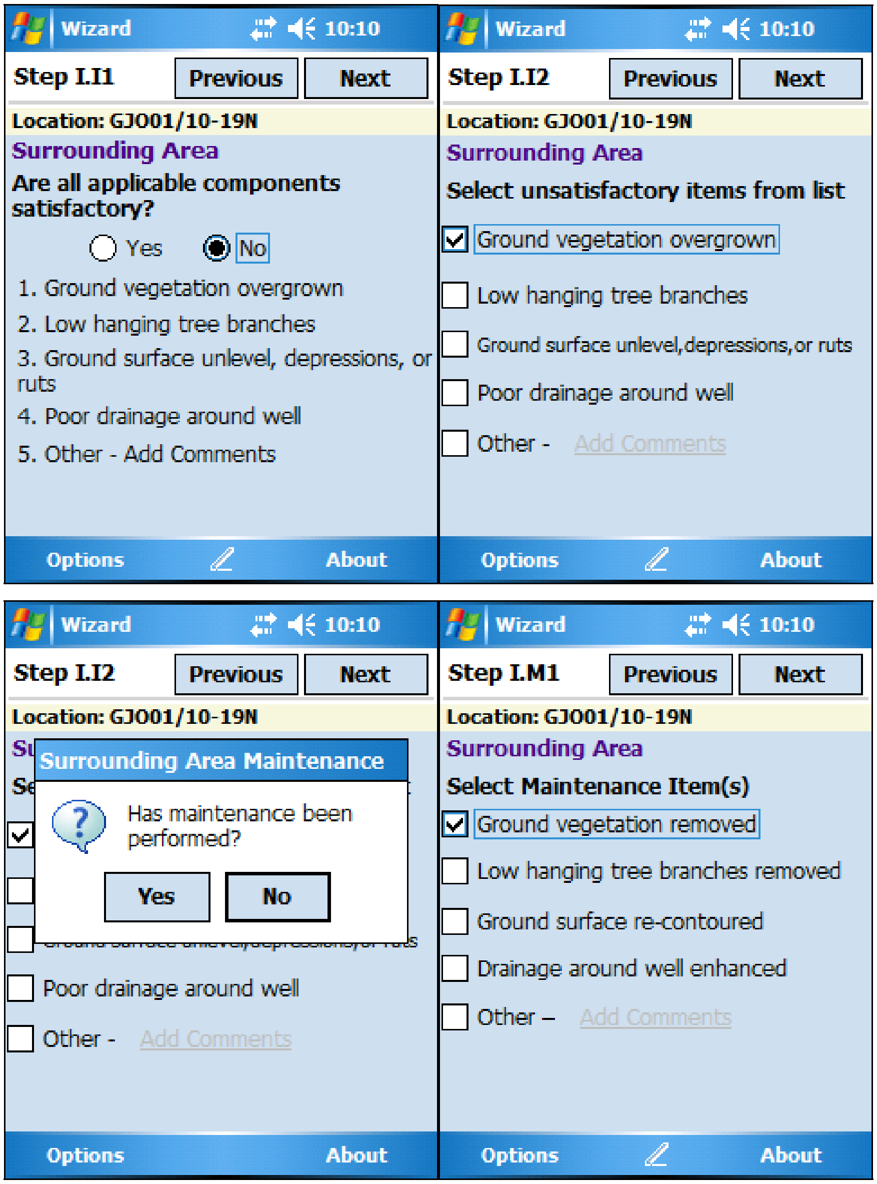
- Enter the water-level information as in Option 1, Water Level Only, described above.
- Well inspection items are separated into five categories:

1. Surrounding Area.
2. Well Integrity Components.
3. Protective Casing.
4. Well Interior–If the “Grade to Top of Casing” and/or the “Well Depth” are measured, these values are entered in this category.
5. Monitoring Equipment.

Within each category is a list of components to inspect. If the question at the beginning of each category “Are all applicable components satisfactory?” is answered with a “Yes,” then the program will proceed to the next category.

If the question at the beginning of each category “Are all applicable components satisfactory?” is answered with a “No,” then a list of components will be displayed and the unsatisfactory component(s) must be checked. If a component is selected as being unsatisfactory, a maintenance option window will open to allow the user to describe any maintenance performed. Following is a list of the categories and the associated components available for each category:

Category 1—Surrounding Area



Step I.I1

Location: GJ001/10-19N

Surrounding Area

Are all applicable components satisfactory?

○ Yes ● No

1. Ground vegetation overgrown
2. Low hanging tree branches
3. Ground surface unlevel, depressions, or ruts
4. Poor drainage around well
5. Other - Add Comments

Step I.I2

Location: GJ001/10-19N

Surrounding Area

Select unsatisfactory items from list

☑ Ground vegetation overgrown
☐ Low hanging tree branches
☐ Ground surface unlevel,depressions,or ruts
☐ Poor drainage around well
☐ Other - Add Comments

Step I.I2

Location: GJ001/10-19N

Surrounding Area Maintenance

Has maintenance been performed?

Yes No

☐ Poor drainage around well
☐ Other - Add Comments

Step I.M1

Location: GJ001/10-19N

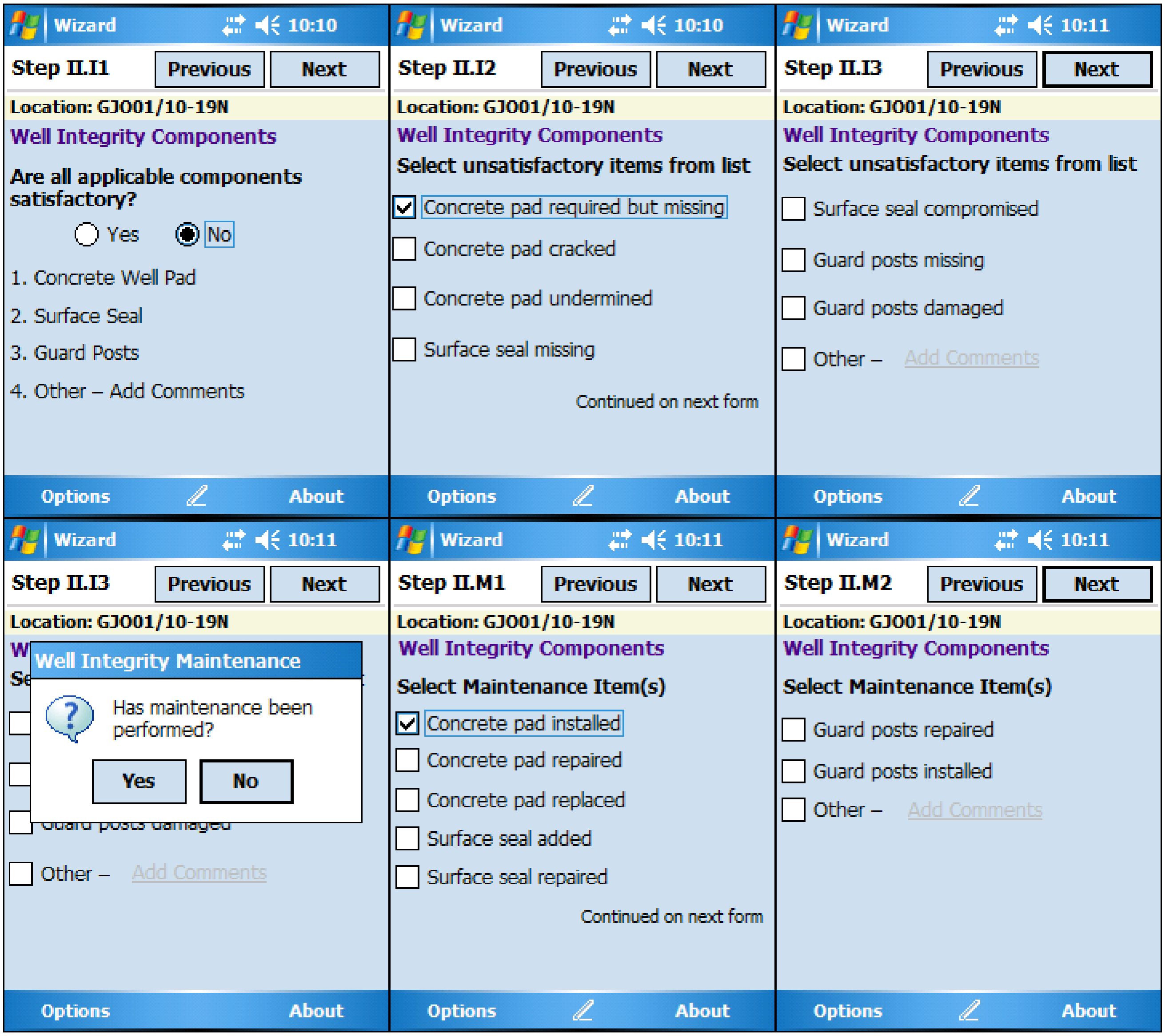
Surrounding Area

Select Maintenance Item(s)

☑ Ground vegetation removed
☐ Low hanging tree branches removed
☐ Ground surface re-contoured
☐ Drainage around well enhanced
☐ Other – Add Comments

Figure 15. Surrounding Area—Inspection and Maintenance Items

Category 2—Well Integrity Components



Location: GJ001/10-19N

Well Integrity Components

Are all applicable components satisfactory?

○ Yes ● No

1. Concrete Well Pad
2. Surface Seal
3. Guard Posts
4. Other – Add Comments

Location: GJ001/10-19N

Well Integrity Components

Select unsatisfactory items from list

☑ Concrete pad required but missing
☐ Concrete pad cracked
☐ Concrete pad undermined
☐ Surface seal missing

Continued on next form

Location: GJ001/10-19N

Well Integrity Components

Select unsatisfactory items from list

☐ Surface seal compromised
☐ Guard posts missing
☐ Guard posts damaged
☐ Other – Add Comments

Location: GJ001/10-19N

Well Integrity Maintenance

Has maintenance been performed?

☐ Other – Add Comments

Location: GJ001/10-19N

Well Integrity Components

Select Maintenance Item(s)

☑ Concrete pad installed
☐ Concrete pad repaired
☐ Concrete pad replaced
☐ Surface seal added
☐ Surface seal repaired

Continued on next form

Location: GJ001/10-19N

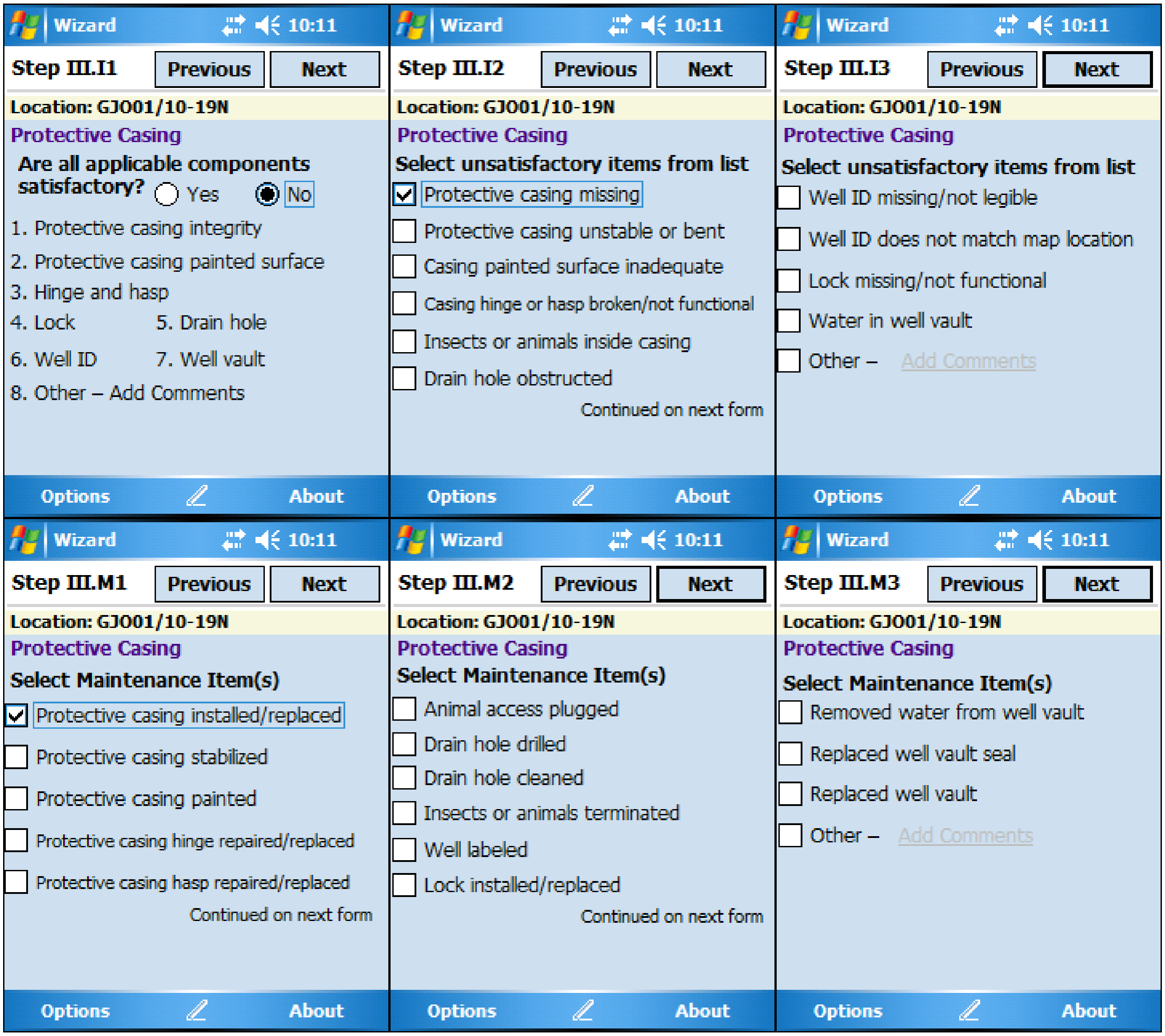
Well Integrity Components

Select Maintenance Item(s)

☐ Guard posts repaired
☐ Guard posts installed
☐ Other – Add Comments

Figure 16. Well Integrity Components—Inspection and Maintenance Items

Category 3—Protective Casing



Step III.I1

Location: GJ001/10-19N

Protective Casing

Are all applicable components satisfactory? ○ Yes ● No

1. Protective casing integrity
2. Protective casing painted surface
3. Hinge and hasp
4. Lock
5. Drain hole
6. Well ID
7. Well vault
8. Other – Add Comments

Step III.I2

Location: GJ001/10-19N

Protective Casing

Select unsatisfactory items from list

☑ Protective casing missing
☐ Protective casing unstable or bent
☐ Casing painted surface inadequate
☐ Casing hinge or hasp broken/not functional
☐ Insects or animals inside casing
☐ Drain hole obstructed

Continued on next form

Step III.I3

Location: GJ001/10-19N

Protective Casing

Select unsatisfactory items from list

☐ Well ID missing/not legible
☐ Well ID does not match map location
☐ Lock missing/not functional
☐ Water in well vault
☐ Other – Add Comments

Step III.M1

Location: GJ001/10-19N

Protective Casing

Select Maintenance Item(s)

☑ Protective casing installed/replaced
☐ Protective casing stabilized
☐ Protective casing painted
☐ Protective casing hinge repaired/replaced
☐ Protective casing hasp repaired/replaced

Continued on next form

Step III.M2

Location: GJ001/10-19N

Protective Casing

Select Maintenance Item(s)

☐ Animal access plugged
☐ Drain hole drilled
☐ Drain hole cleaned
☐ Insects or animals terminated
☐ Well labeled
☐ Lock installed/replaced

Continued on next form

Step III.M3

Location: GJ001/10-19N

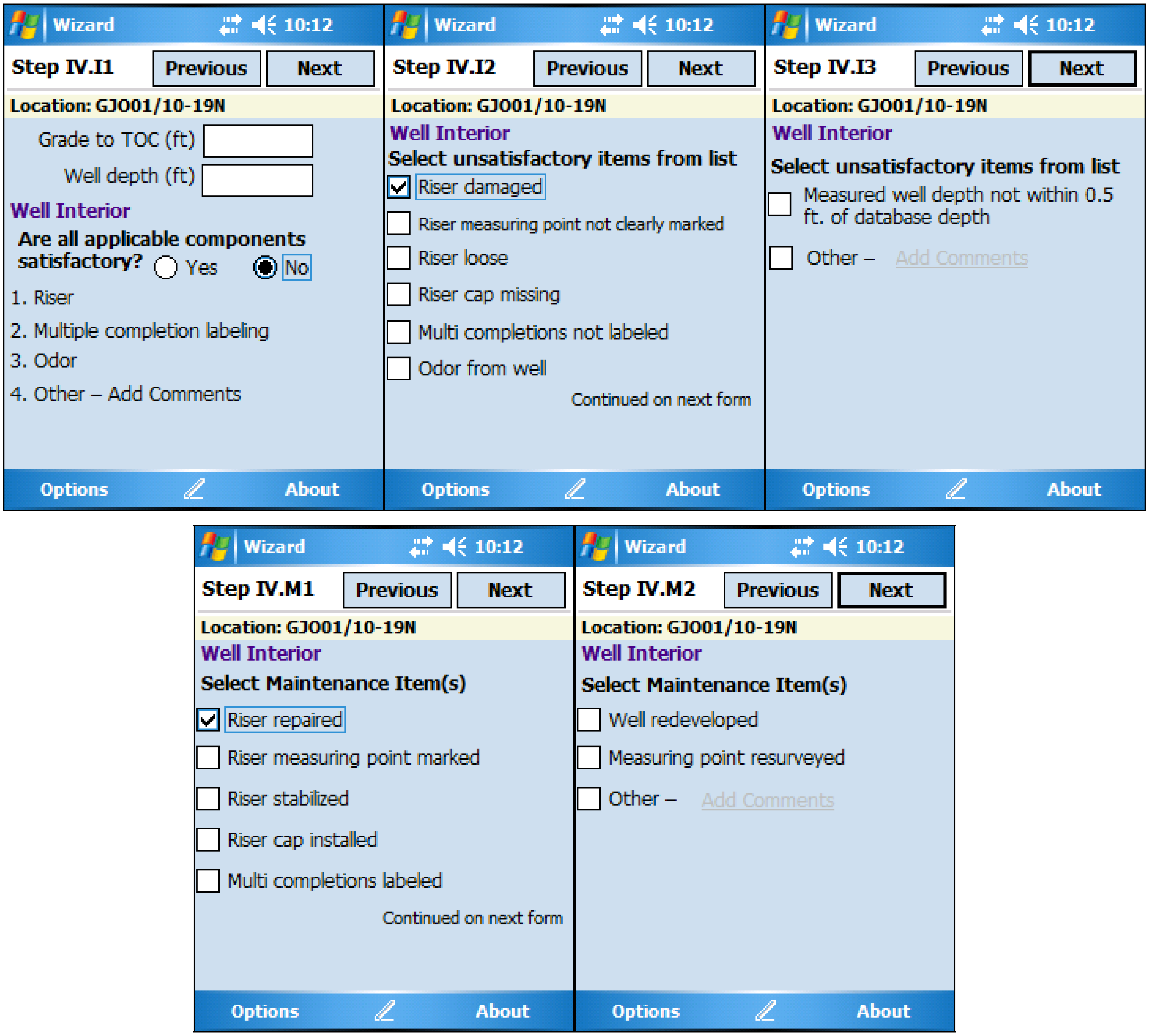
Protective Casing

Select Maintenance Item(s)

☐ Removed water from well vault
☐ Replaced well vault seal
☐ Replaced well vault
☐ Other – Add Comments

Figure 17. Protective Casing—Inspection and Maintenance Items

Category 4—Well Interior



Step IV.I1

Location: GJ001/10-19N

Grade to TOC (ft)

Well depth (ft)

Well Interior

Are all applicable components satisfactory? ○ Yes ● No

1. Riser
2. Multiple completion labeling
3. Odor
4. Other – Add Comments

Step IV.I2

Location: GJ001/10-19N

Well Interior

Select unsatisfactory items from list

☑ Riser damaged
☐ Riser measuring point not clearly marked
☐ Riser loose
☐ Riser cap missing
☐ Multi completions not labeled
☐ Odor from well

Continued on next form

Step IV.I3

Location: GJ001/10-19N

Well Interior

Select unsatisfactory items from list

☐ Measured well depth not within 0.5 ft. of database depth
☐ Other – Add Comments

Step IV.M1

Location: GJ001/10-19N

Well Interior

Select Maintenance Item(s)

☑ Riser repaired
☐ Riser measuring point marked
☐ Riser stabilized
☐ Riser cap installed
☐ Multi completions labeled

Continued on next form

Step IV.M2

Location: GJ001/10-19N

Well Interior

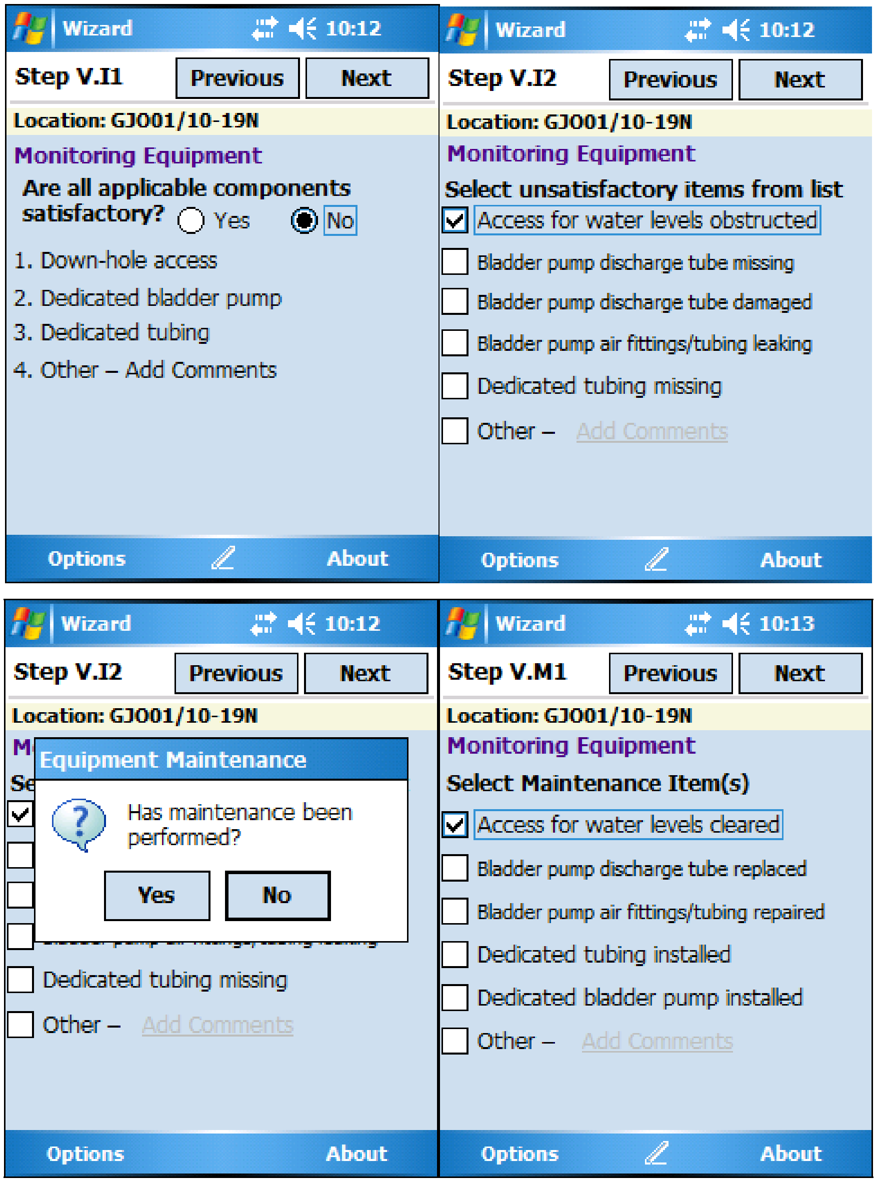
Select Maintenance Item(s)

☐ Well redeveloped
☐ Measuring point resurveyed
☐ Other – Add Comments

Figure 18. Well Interior—Inspection and Maintenance Items

Note that if “Grade to Top of Casing” and/or the “Well Depth” measurements are taken, they can be entered into Step IV.I1, pictured in Figure 18.

Category 5—Monitoring Equipment



Step V.I1

Location: GJ001/10-19N

Monitoring Equipment

Are all applicable components satisfactory? ○ Yes ● No

1. Down-hole access
2. Dedicated bladder pump
3. Dedicated tubing
4. Other – Add Comments

Step V.I2

Location: GJ001/10-19N

Monitoring Equipment

Select unsatisfactory items from list

- ☑ Access for water levels obstructed
- ☐ Bladder pump discharge tube missing
- ☐ Bladder pump discharge tube damaged
- ☐ Bladder pump air fittings/tubing leaking
- ☐ Dedicated tubing missing
- ☐ Other – Add Comments

Step V.I2

Location: GJ001/10-19N

Equipment Maintenance

Has maintenance been performed?

- ☑
- ☐
- ☐
- ☐
- ☐ Dedicated tubing missing
- ☐ Other – Add Comments

Step V.M1

Location: GJ001/10-19N

Monitoring Equipment

Select Maintenance Item(s)

- ☑ Access for water levels cleared
- ☐ Bladder pump discharge tube replaced
- ☐ Bladder pump air fittings/tubing repaired
- ☐ Dedicated tubing installed
- ☐ Dedicated bladder pump installed
- ☐ Other – Add Comments

Figure 19. Monitoring Equipment—Inspection and Maintenance Items

- **Step 4**. Completion (Figure 14)
  - — Review any comments.
  - — Enter the date and time of the Inspection.
  - — Click on the “Sign” button to save the entered data. The data will be saved and a dialog box will open to ask the user “Do you want to enter data for another location?” Click on the “Yes” button to enter more data and the program will go back to Step 1. Click the “No” button and the program will go back to the opening menu.
  - — Click on the “Exit Without Saving” button to discard the collected data. A dialog box will come up and ask the user “Are you sure you want to exit without saving?” Click on the “Yes” button to delete the collected data and return to the opening menu. Click on the “No” button to remain in Step 4.

Option 3, Inspection Only (This option is selected in Step 3)

- Well inspection items are separated into five categories:
  1. Surrounding Area.
  2. Well Integrity Components.
  3. Protective Casing.
  4. Well Interior–If the “Grade to Top of Casing” and/or the “Well Depth” are measured, these values are entered in this category.
  5. Monitoring Equipment.

  Within each category is a list of components to inspect. If the question at the beginning of each category “Are all applicable components satisfactory?” is answered with a “Yes,” then the program will proceed to the next category.

  If the question at the beginning of each category “Are all applicable components satisfactory?” is answered with a “No,” then a list of components will be displayed and the unsatisfactory component(s) must be checked. If a component is selected as being unsatisfactory, a maintenance option window will open to allow the user to describe any maintenance performed. See Option 2, Water Level and Inspection, above, for the associated components available for each category.

- **Step 4**. Completion (Figure 14)
  - — Review any comments.
  - — Enter the date and time of the Inspection.
  - — Click on the “Sign” button to save the entered data. The data will be saved and a dialog box will open to ask the user “Do you want to enter data for another location?” Click on the “Yes” button to enter more data and the program will go back to Step 1. Click the “No” button and the program will go back to the opening menu.
  - — Click on the “Exit Without Saving” button to discard the collected data. A dialog box will come up and ask the user “Are you sure you want to exit without saving?” Click on the “Yes” button to delete the collected data and return to the opening menu. Click on the “No” button to remain in Step 4.

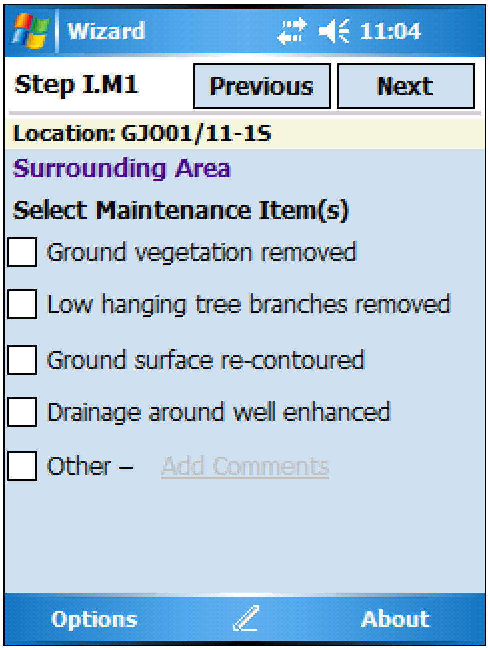
Option 4, Maintenance Only (This option is selected in Step 3)

- Well maintenance items are separated into five categories:

  1. Surrounding Area
  2. Well Integrity Components
  3. Protective Casing
  4. Well Interior
  5. Monitoring Equipment

  Within each category is a list of components. Following is a list of the categories and the associated components available for each category:

Category 1—Surrounding Area



Location: GJO01/11-1S

Surrounding Area

Select Maintenance Item(s)

☐ Ground vegetation removed

☐ Low hanging tree branches removed

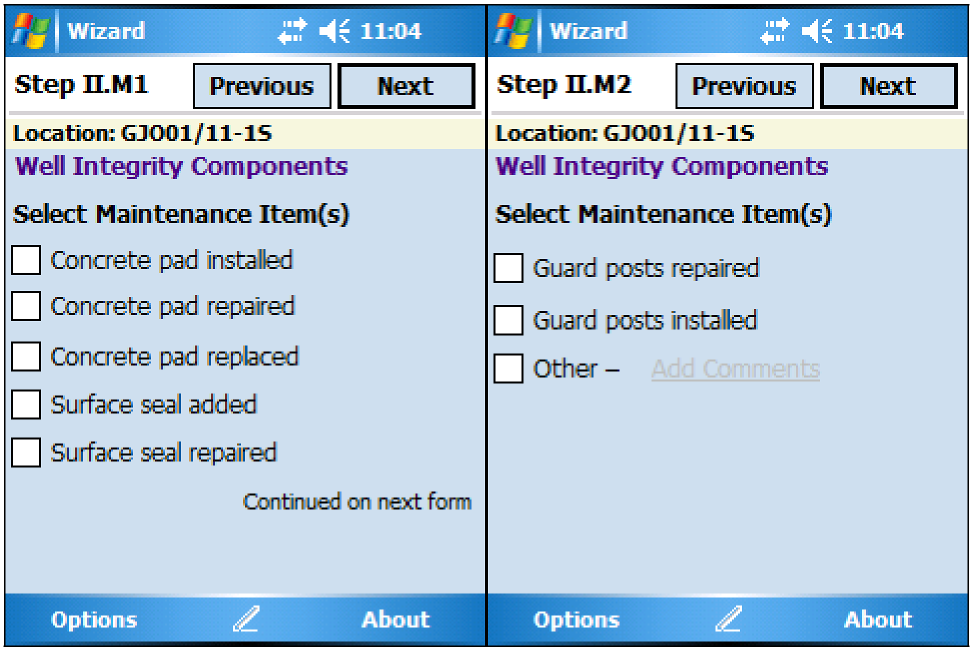
☐ Ground surface re-contoured

☐ Drainage around well enhanced

☐ Other – Add Comments

Figure 20. Surrounding Area—Maintenance Items

Category 2—Well Integrity Components



Step II.M1

Location: GJ001/11-1S

Well Integrity Components

Select Maintenance Item(s)

☐ Concrete pad installed
☐ Concrete pad repaired
☐ Concrete pad replaced
☐ Surface seal added
☐ Surface seal repaired

Continued on next form

Step II.M2

Location: GJ001/11-1S

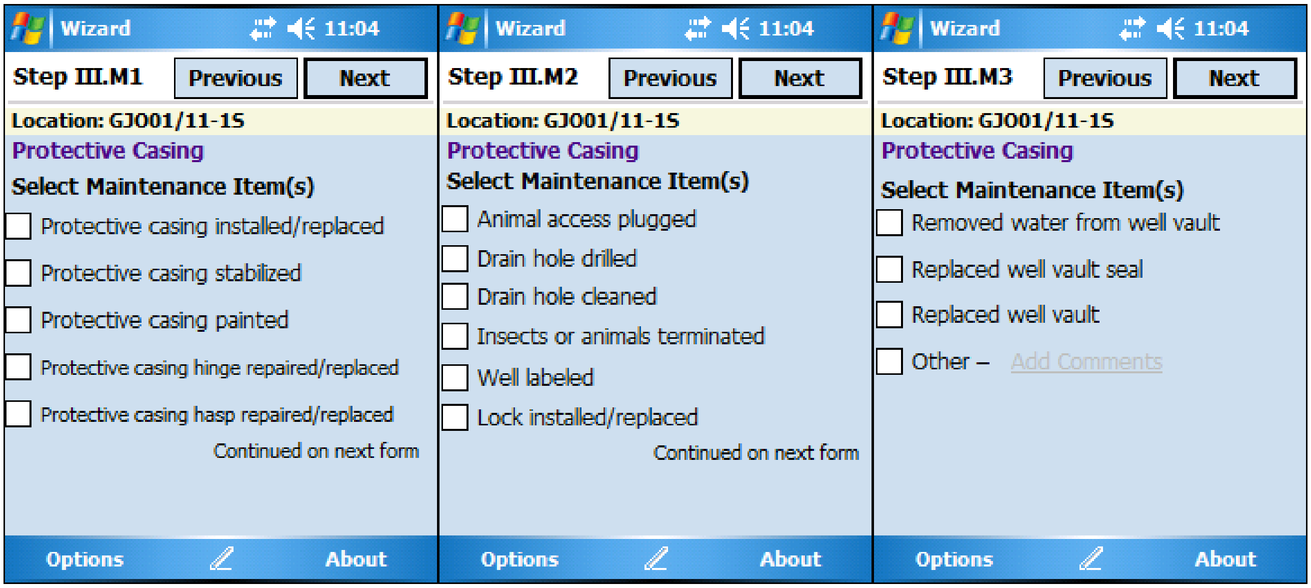
Well Integrity Components

Select Maintenance Item(s)

☐ Guard posts repaired
☐ Guard posts installed
☐ Other – Add Comments

Figure 21. Well Integrity Components—Maintenance Items

Category 3—Protective Casing



Step III.M1

Location: GJ001/11-1S

Protective Casing

Select Maintenance Item(s)

☐ Protective casing installed/replaced
☐ Protective casing stabilized
☐ Protective casing painted
☐ Protective casing hinge repaired/replaced
☐ Protective casing hasp repaired/replaced

Continued on next form

Step III.M2

Location: GJ001/11-1S

Protective Casing

Select Maintenance Item(s)

☐ Animal access plugged
☐ Drain hole drilled
☐ Drain hole cleaned
☐ Insects or animals terminated
☐ Well labeled
☐ Lock installed/replaced

Continued on next form

Step III.M3

Location: GJ001/11-1S

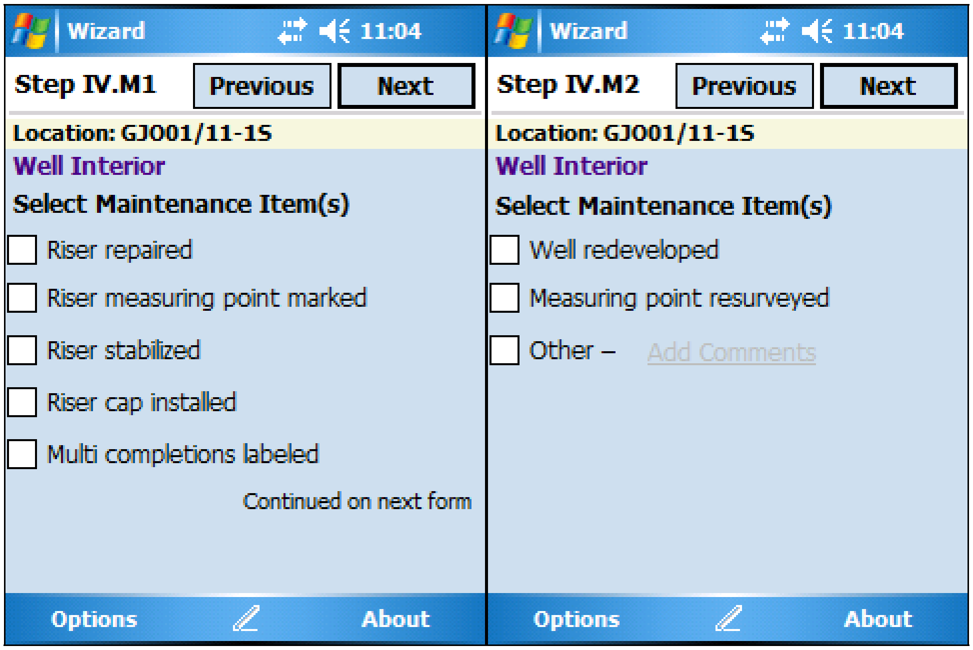
Protective Casing

Select Maintenance Item(s)

☐ Removed water from well vault
☐ Replaced well vault seal
☐ Replaced well vault
☐ Other – Add Comments

Figure 22. Protective Casing—Maintenance Items

Category 4—Well Interior



Step IV.M1

Location: GJ001/11-1S

Well Interior

Select Maintenance Item(s)

☐ Riser repaired
☐ Riser measuring point marked
☐ Riser stabilized
☐ Riser cap installed
☐ Multi completions labeled

Continued on next form

Step IV.M2

Location: GJ001/11-1S

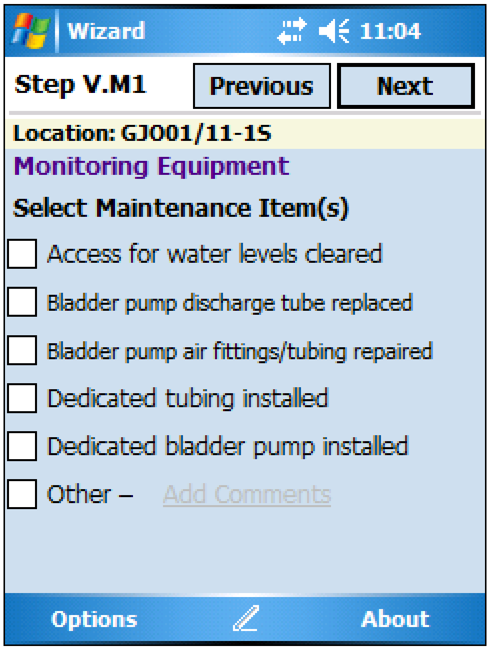
Well Interior

Select Maintenance Item(s)

☐ Well redeveloped
☐ Measuring point resurveyed
☐ Other – Add Comments

Figure 23. Well Interior—Maintenance Items

Category 5—Monitoring Equipment



Step V.M1

Location: GJ001/11-1S

Monitoring Equipment

Select Maintenance Item(s)

☐ Access for water levels cleared
☐ Bladder pump discharge tube replaced
☐ Bladder pump air fittings/tubing repaired
☐ Dedicated tubing installed
☐ Dedicated bladder pump installed
☐ Other – Add Comments

Figure 24. Monitoring Equipment—Maintenance Items

- **Step 4**. Completion (Figure 14)
    - Review any comments.
    - Enter the date and time of the Maintenance.
    - Click on the “Sign” button to save the entered data. The data will be saved and a dialog box will open to ask the user “Do you want to enter data for another location?” Click on the “Yes” button to enter more data and the program will go back to Step 1. Click the “No” button and the program will go back to the opening menu.
    - Click on the “Exit Without Saving” button to discard the collected data. A dialog box will come up and ask the user “Are you sure you want to exit without saving?” Click on the “Yes” button to delete the collected data and return to the opening menu. Click on the “No” button to remain in Step 4.

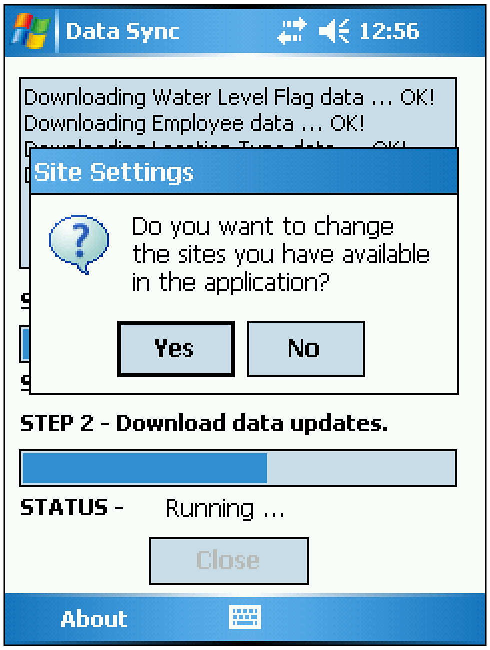
6.0 Data Sync

Click on the “Data Sync” button to start the sync process.

Pre-Measurement Data Sync

The purpose of the sync process prior to taking measurements is to download the site(s) associated well identifications and historical data from the SEEPro database to the PDA. To sync the PDA, it must be connected to a computer that is connected to the LM network, and Microsoft Active Sync software must be installed on the computer.

- Click on the “Data Sync” button. A dialog box will come up and ask the user “Do you want to change the sites you have available in the application?” (Figure 25). Click the “Yes” button to change the site(s), or click the “No” button to keep the same site(s) since the last sync.
- If the “Yes” button is clicked, the list of sites will be displayed (Figure 26). Select the site(s) by highlighting and checking the site(s).



Downloading Water Level Flag data … OK!
Downloading Employee data … OK!

Do you want to change the sites you have available in the application?

STEP 2 - Download data updates.

STATUS - Running …

Figure 25. Site Settings Dialog Box

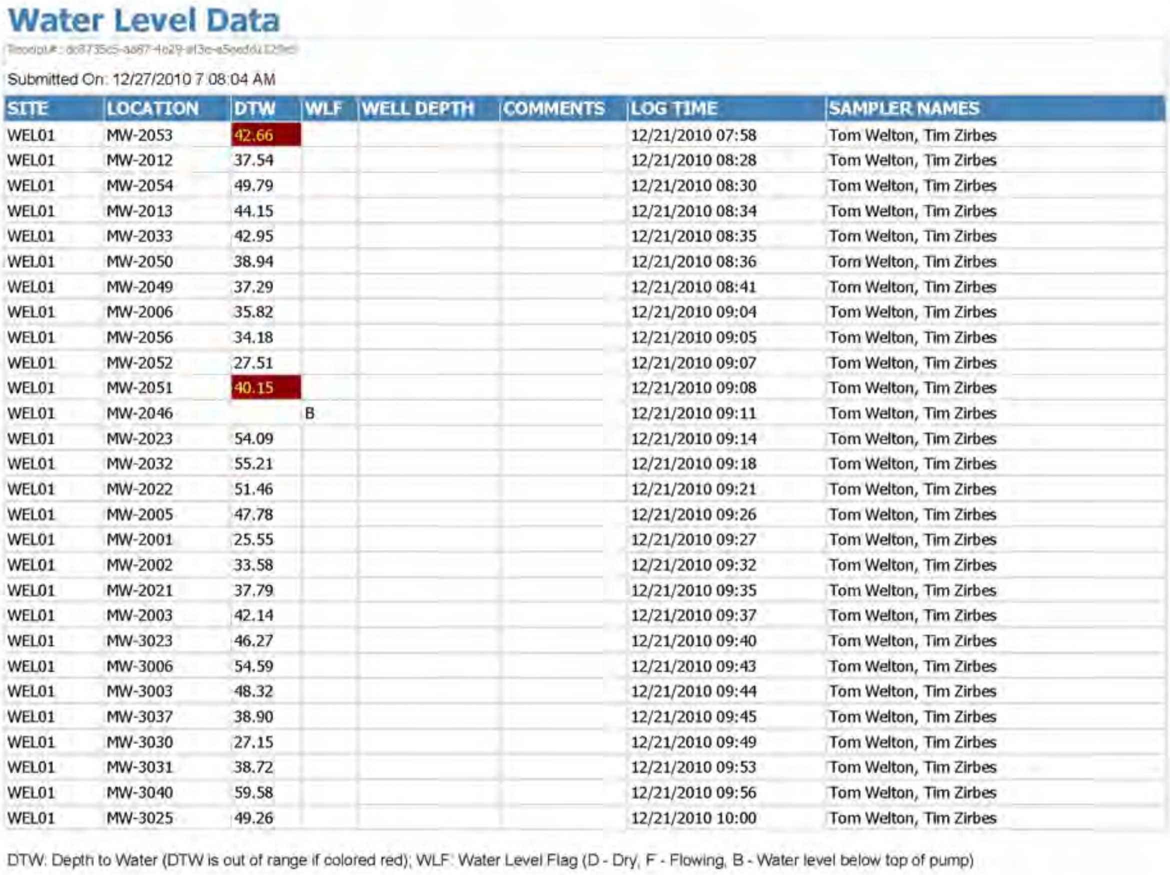
Select the site(s) you want available in the application.

- ☐ GRJ : Grand Junction, CO, Dispo…
- ☐ GJT : Grand Junction, CO, Proce…
- ☐ GJO : Grand Junction, CO, Site
- ☐ GRN : Green River, UT, Disposal …
- ☐ GUD : Gunnison, CO, Disposal Site
- ☐ GUP : Gunnison, CO, Processing …
- ☐ HAL : Hallam, NE, Decommission…

Figure 26. Site Selection Menu

Post-Measurement Data Sync

The purpose of the post-measurement sync is to upload the collected water-level and well depth data to the SEEPro database. During the sync, a PDF water level report that summarizes the data collected (Figure 27 and Figure 28) is generated and stored in the SMS directory on Condor in the FDCS/WATER LEVELS and FDCS/INSPECTION FORMS folders. The file name is coded with the site code and date. For example, water levels uploaded at the Weldon Spring site on December 27, 2010, will have the file name WEL01_12272010.pdf.



Water Level Data

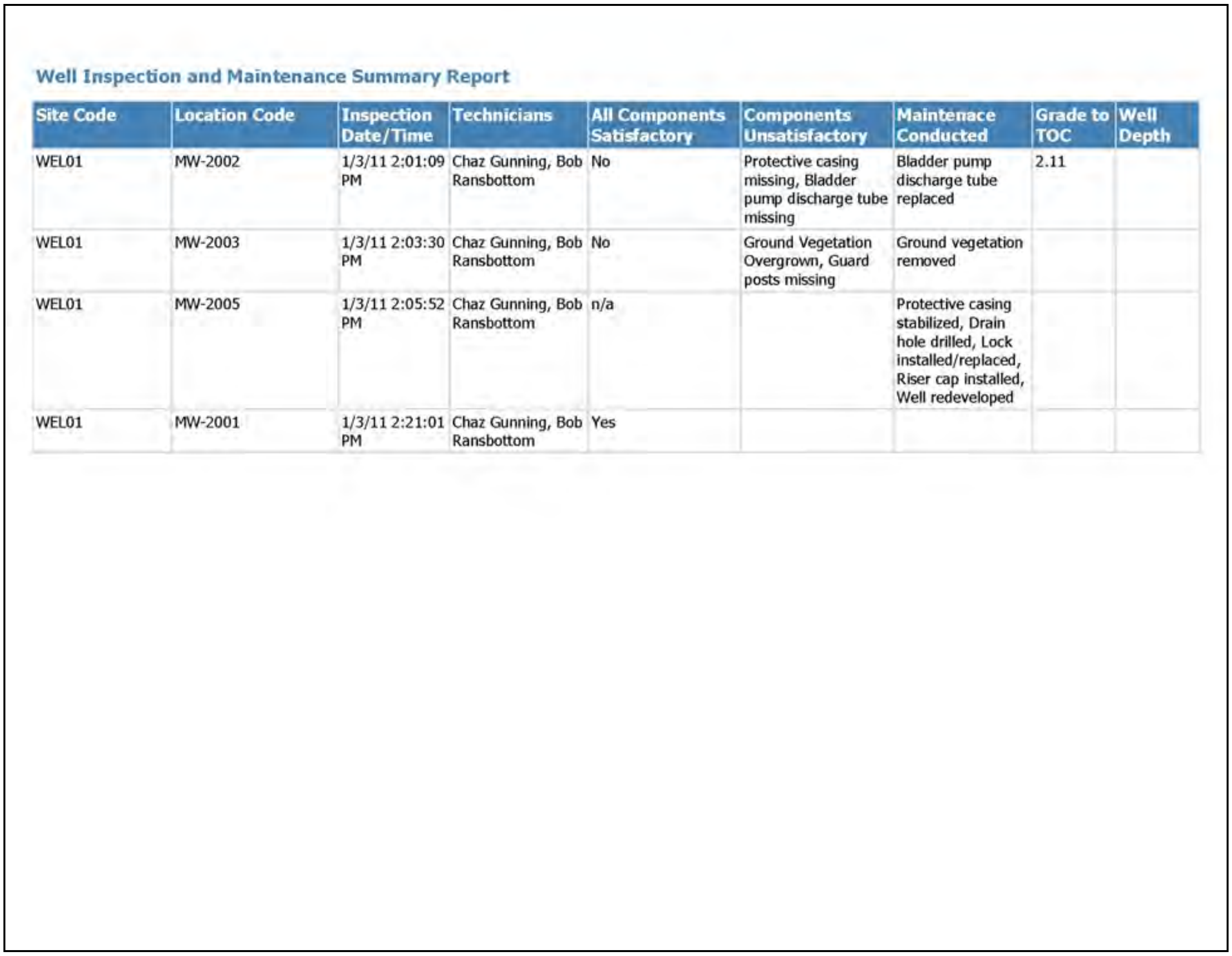
Submitted On: 12/27/2010 7:08:04 AM

SITE	LOCATION	DTW	WLF	WELL DEPTH	COMMENTS	LOG TIME	SAMPLER NAMES
WEL01	MW-2053	42.66				12/21/2010 07:58	Tom Welton, Tim Zirbes
WEL01	MW-2012	37.54				12/21/2010 08:28	Tom Welton, Tim Zirbes
WEL01	MW-2054	49.79				12/21/2010 08:30	Tom Welton, Tim Zirbes
WEL01	MW-2013	44.15				12/21/2010 08:34	Tom Welton, Tim Zirbes
WEL01	MW-2033	42.95				12/21/2010 08:35	Tom Welton, Tim Zirbes
WEL01	MW-2050	38.94				12/21/2010 08:36	Tom Welton, Tim Zirbes
WEL01	MW-2049	37.29				12/21/2010 08:41	Tom Welton, Tim Zirbes
WEL01	MW-2006	35.82				12/21/2010 09:04	Tom Welton, Tim Zirbes
WEL01	MW-2056	34.18				12/21/2010 09:05	Tom Welton, Tim Zirbes
WEL01	MW-2052	27.51				12/21/2010 09:07	Tom Welton, Tim Zirbes
WEL01	MW-2051	40.15				12/21/2010 09:08	Tom Welton, Tim Zirbes
WEL01	MW-2046		B			12/21/2010 09:11	Tom Welton, Tim Zirbes
WEL01	MW-2023	54.09				12/21/2010 09:14	Tom Welton, Tim Zirbes
WEL01	MW-2032	55.21				12/21/2010 09:18	Tom Welton, Tim Zirbes
WEL01	MW-2022	51.46				12/21/2010 09:21	Tom Welton, Tim Zirbes
WEL01	MW-2005	47.78				12/21/2010 09:26	Tom Welton, Tim Zirbes
WEL01	MW-2001	25.55				12/21/2010 09:27	Tom Welton, Tim Zirbes
WEL01	MW-2002	33.58				12/21/2010 09:32	Tom Welton, Tim Zirbes
WEL01	MW-2021	37.79				12/21/2010 09:35	Tom Welton, Tim Zirbes
WEL01	MW-2003	42.14				12/21/2010 09:37	Tom Welton, Tim Zirbes
WEL01	MW-3023	46.27				12/21/2010 09:40	Tom Welton, Tim Zirbes
WEL01	MW-3006	54.59				12/21/2010 09:43	Tom Welton, Tim Zirbes
WEL01	MW-3003	48.32				12/21/2010 09:44	Tom Welton, Tim Zirbes
WEL01	MW-3037	38.90				12/21/2010 09:45	Tom Welton, Tim Zirbes
WEL01	MW-3030	27.15				12/21/2010 09:49	Tom Welton, Tim Zirbes
WEL01	MW-3031	38.72				12/21/2010 09:53	Tom Welton, Tim Zirbes
WEL01	MW-3040	59.58				12/21/2010 09:56	Tom Welton, Tim Zirbes
WEL01	MW-3025	49.26				12/21/2010 10:00	Tom Welton, Tim Zirbes

DTW: Depth to Water (DTW is out of range if colored red); WLF: Water Level Flag (D - Dry, F - Flowing, B - Water level below top of pump)

Figure 27. Example of a Water Level Report

In the example in Figure 27, the red highlighted depths indicate values that are outside the historical range.



Well Inspection and Maintenance Summary Report

Site Code	Location Code	Inspection Date/Time	Technicians	All Components Satisfactory	Components Unsatisfactory	Maintenace Conducted	Grade to TOC	Well Depth
WEL01	MW-2002	1/3/11 2:01:09 PM	Chaz Gunning, Bob Ransbottom	No	Protective casing missing, Bladder pump discharge tube missing	Bladder pump discharge tube replaced	2.11	
WEL01	MW-2003	1/3/11 2:03:30 PM	Chaz Gunning, Bob Ransbottom	No	Ground Vegetation Overgrown, Guard posts missing	Ground vegetation removed		
WEL01	MW-2005	1/3/11 2:05:52 PM	Chaz Gunning, Bob Ransbottom	n/a		Protective casing stabilized, Drain hole drilled, Lock installed/replaced, Riser cap installed, Well redeveloped		
WEL01	MW-2001	1/3/11 2:21:01 PM	Chaz Gunning, Bob Ransbottom	Yes				

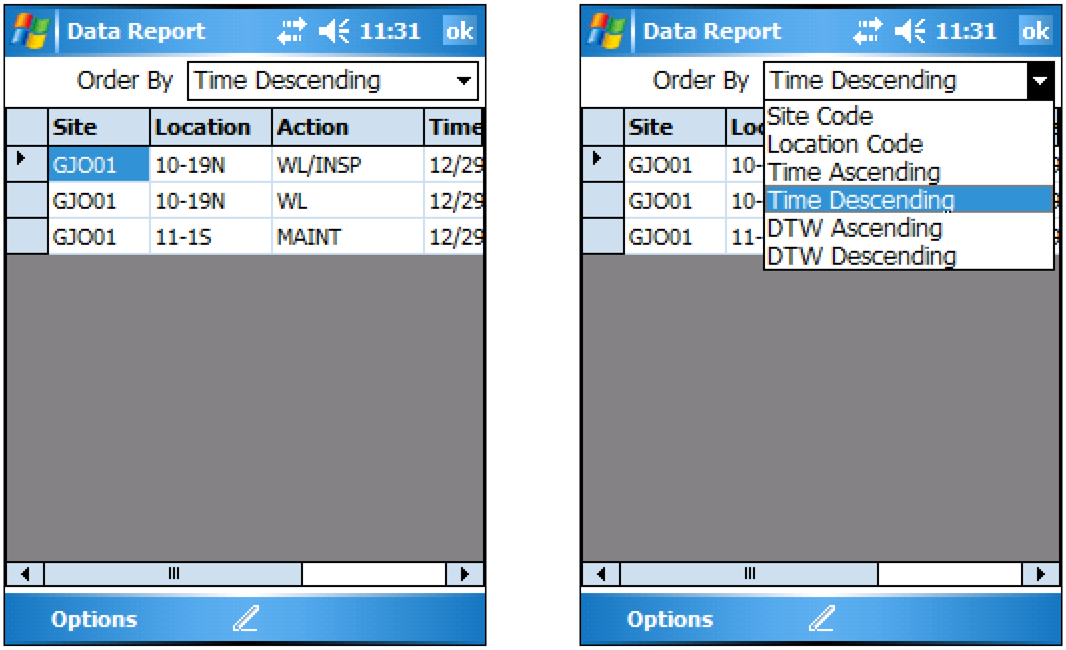
Figure 28. Example of a Well Inspection Report

7.0 Report

Click on the “Report” button to view a summary report on the PDA (Figure 29). The report displays data collected since the last sync, which allows the user to assess progress or review data. The report on the PDA is an abbreviated version of the report(s) generated during the sync process (Figure 27). It contains site, location, time, depth to water information, and actions performed, and can be sorted differently by selecting items in the “Order By” drop down menu.

A measurement can be deleted by selecting the appropriate row, then clicking on the “Options” icon in the footer (Figure 30). A dialog box will open to confirm that it is safe to delete the record.

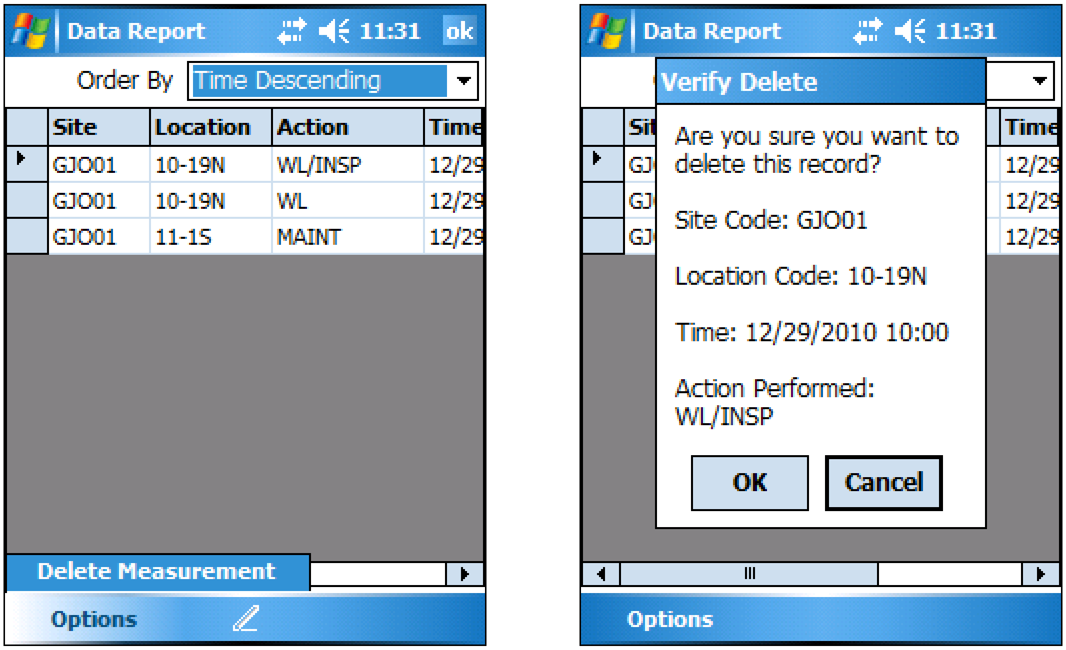
After the data sync function is performed, the summary report can no longer be viewed on the PDA, nor can a measurement be deleted on the PDA.



Order By: Time Descending

Site	Location	Action	Time
GJO01	10-19N	WL/INSP	12/29
GJO01	10-19N	WL	12/29
GJO01	11-1S	MAINT	12/29

Figure 29. Summary Report



Order By: Time Descending

Site	Location	Action	Time
GJO01	10-19N	WL/INSP	12/29
GJO01	10-19N	WL	12/29
GJO01	11-1S	MAINT	12/29

Are you sure you want to delete this record?

Site Code: GJO01

Location Code: 10-19N

Time: 12/29/2010 10:00

Action Performed: WL/INSP

Figure 30. Deleting a Record

8.0 Exit

Click on the “Exit” button to exit the program.

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Appendix B-3

Compressed Gas Operations

Desk Instructions for Environmental Monitoring Operations Using Compressed Gas

Scope

These desk instructions have been developed to aid trained personnel to fill compressed air cylinders and to use compressed gas to power groundwater bladder pumps.

Using a High-Pressure Compressor to Fill Compressed Air Cylinders

Purpose

This procedure will be used to aid authorized and trained personnel in operating a Coltri MCH-6 high-pressure compressor and filling a compressed air cylinder to 2,000 pounds per square inch (psi).

Responsibilities

Authorization to perform this operation must be obtained from the Environmental Monitoring Operations Manager**.**

Equipment

Equipment used for this procedure includes the Coltri MCH-6 high-pressure compressor, air cylinders, the fill line, and the flow/pressure control manifold. All equipment is shown in Figure 1.

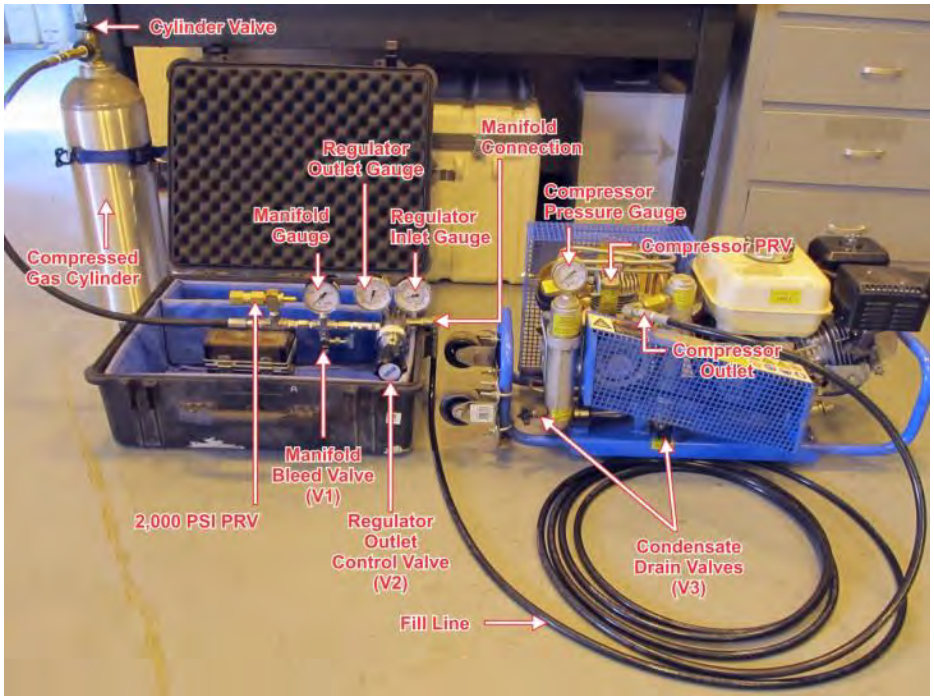


Figure 1. Cylinder Filling System

Procedure

Operation of the compressor shall be conducted outside in a well-ventilated area; cylinders being filled shall be secured. Although redundant safety controls have been engineered into the filling apparatus, a responsible person must be present during the filling operation.

A professional engineer has reviewed this assembly to ensure that all components are rated to withstand the system pressure. The engineered drawings of this assembly are attached to this procedure. Use only this approved assembly during filling operations. If a component in the assembly needs to be replaced, then consultation with the Engineering department and an update of the drawing (as needed) are required.

The following safety guidelines apply:

- When lifting the air compressor and air cylinders, use proper lifting techniques.
- Keep heavy loads close to your body, bend at your knees, and keep your back straight.
- Never rotate your back while handling a heavy load, and never carry a load that blocks your vision.
- Fuel the gasoline motor before starting the compressor.
- Use only National Fire Protection Association–approved gasoline containers, have a fire extinguisher nearby, and do not smoke or have other spark-producing objects within 50 feet of the compressor.
- Contact the Environmental Compliance and Health and Safety groups for cleanup and reporting guidance for all spills from equipment.
- Ensure that the cylinder inspection due date has not expired; if the inspection date has passed or is illegible, take the cylinder out-of-service and tag them “Do Not Use.”

Perform cylinder filling to 2,000 psi using the following steps:

[1] Place the compressor on a level, clean, and hard surface outdoors in a well-ventilated area. Do not use the compressor in dusty areas.

[2] Assemble the components for filling the air cylinders:

  [a] Attaching the fill line from the compressor to the manifold.

  [b] Remove the protective cap from the cylinder.

  [c] Ensure that the cylinder is secure and that the cylinder valve is closed.

  [d] Attach the manifold to the cylinder; avoid cross-threading the manifold nut when attaching the manifold to the cylinder.

[3] Open the compressor condensate drain valves (V3) and manifold bleed valve (V1).

CAUTION *Wear hearing protection and safety glasses when operating and working within 20 feet of the compressor.*

[4] Start the compressor gasoline motor. Starting and operation of compressor engine instructions can be referenced in the manufacturer's instructions located at \\crow\Projects\SamplingProg\Equipment Manuals and Procedures\Air Cylinders and Pressure Systems. The file name is "High Pressure Air Compressor-Aerotecnica-MCH-6.pdf."

[5] Once the motor has started and is running at full speed, close the condensate drain valves.

[6] Once air begins to vent from the manifold bleed valve, perform the following steps:

  [a] Turn the regulator outlet control valve (V2) counterclockwise until the regulator outlet gauge reads zero.

  [b] Close the manifold bleed valve.

[7] Ensure that the compressor pressure-relief valve (PRV) is venting at 2,700 psi (±100 psi) by monitoring the compressor pressure gauge.

  [a] IF the PRV does not vent at the prescribed pressure (2,700 psi ±100 psi), THEN turn the compressor off and diagnose the problem.

Note

Since this is an adjustable spring loaded PRV, it is possible that the PRV has loosened, thereby changing the PRV setting.

  [b] Once the problem is solved, restart the compressor, and recheck the PRV.

[8] **Before** opening the cylinder valve to fill the cylinder, a safety check of the 2,000 psi manifold PRV must be performed:

CAUTION

During the safety check of the 2,000 psi manifold PRV, be aware of any unexpected leaks in the manifold assembly.

  [a] Adjust the regulator outlet control valve clockwise until the regulator outlet gauge indicates 2,000 psi.

  [b] With the compressor running, monitor the manifold gauge and ensure that the PRV begins to vent at 2,000 psi (±100 psi).

  [c] IF the PRV does not vent at the prescribed pressure (2,000 psi ±100 psi), THEN turn the compressor off and diagnose the problem.

[9] IF the PRV vents at the proper pressure, THEN open the cylinder valve to begin cylinder filling.

Note

The opening of these condensate drain valves and the resultant release of air and moisture could cause sand and other fine particles to become airborne.

CAUTION

- *Do not stand in front of the condensate drain valve to drain accumulated condensate.*
- *Wear leather gloves to drain accumulated condensate.*
- *Wear safety glasses to drain accumulated condensate.*

[10] During the filling process, briefly open both condensate drain valves every 10 minutes to drain accumulated condensate. Depending on the starting tank pressure, cylinder filling can take up to 1 hour.

[11] When the manifold gauge reaches 2,000 psi, close the cylinder valve and shut off the compressor motor.

[12] Open the condensate drain valves and manifold bleed valve to relieve pressure in the fill line and manifold.

[13] Detach the manifold from the cylinder and replace the protective cap on the cylinder.

[14] Detach the fill line from the compressor and carefully store the manifold and fill line in a protected area.

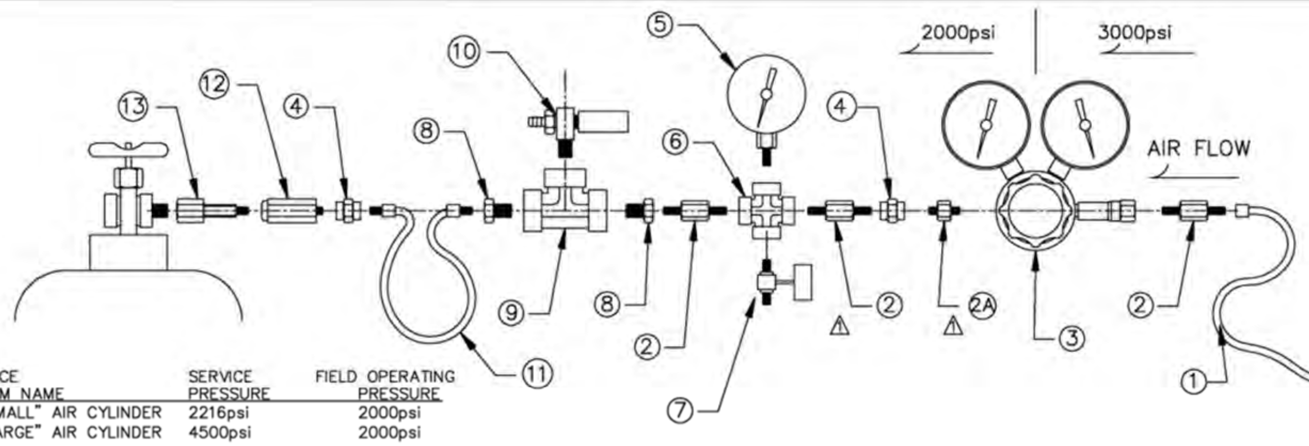
[15] Air cylinders must be stored in a secure manner with the protective cap in place. When transporting cylinders in a vehicle, the cylinders must be securely stowed with the protective caps on.

[16] Allow the compressor to cool, and store the compressor in a protected area. Both the compressor and the gasoline motor need periodic maintenance; refer to the Coltri use and maintenance manual for proper operation, care, maintenance, inspection, and troubleshooting. The Coltri manual can be found at \\crow\Projects\SamplingProg\Equipment Manuals and Procedures\Air Cylinders and Pressure Systems. The file name is “High Pressure Air Compressor-Aerotecnica-MCH-6.pdf.”

Using Compressed Gas to Operate Groundwater Bladder Pumps

Only personnel who have received Water Sampling Training (WS-300) and been briefed on, read, and signed the “Water Sampling and Minor Well Maintenance at LM Sites” job safety analysis are authorized to perform this function.

When using compressed gas to operate groundwater bladder pumps, use only the regulator-hose-control box assemblies as shown in the attached engineering drawings. A professional engineer has reviewed these assemblies to ensure that all components are rated to withstand the system pressures of each assembly. The engineered drawings of all assemblies are attached. If a component in the assemblies needs to be replaced, then consultation with the Engineering department and an update of the drawing (as needed) are required.



AEROTECNICA COLTRI COMPRESSOR (MCH-6/SH)
WORKING PRESSURE(psi): 3200-4300-4700
DIRECTIVES: 2006/42/CE, 2004/108/CE
STANDARDS: EN12100-1, EN12100-2, ENISO14121-1, ENISO13857, EN60204-1, EN61000-6-2, EN61000-6-4

NOTE:
BUILT IN RELIEF VALVE SET FOR 3000psi

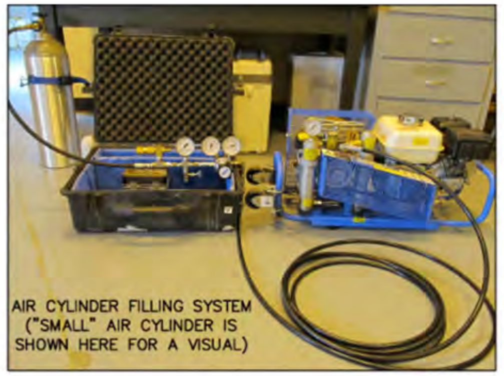
SOURCE DEVICE NO.	ITEM NAME	SERVICE PRESSURE	FIELD OPERATING PRESSURE
14	"SMALL" AIR CYLINDER	2216psi	2000psi
15	"LARGE" AIR CYLINDER	4500psi	2000psi

PARTS LIST

	NO.	ITEM	MATERIAL TYPE	PRESSURE RATING	OPERATING PRESSURE	PRODUCT INFORMATION	NATIONAL RECOGNIZED TESTING LAB (NRTL)
	1	1/4"ø AIR HOSE	RUBBER	RATED FOR 5000psi (STAMPED ON HOSE)	3000psi	PROVIDED BY AEROTECNICA COLTRI WITH COMPRESSOR	NOT AVAILABLE
	2	1/4" HEX 2" LONG NIPPLE	STAINLESS STEEL	RATED FOR 7500psi @72°F	3000psi, 2000psi AFTER REGULATOR	McMASTER-CARR PART NUMBER: 48805K23	ANSI B31.1, B31.3, ANSI/ASME B1.20.1
⚠	2(A)	1/4" HEX NIPPLE	STAINLESS STEEL	RATED FOR 7500psi @72°F	3000psi, 2000psi AFTER REGULATOR	McMASTER-CARR PART NUMBER: 48805K81	ANSI B31.1, B31.3, ANSI/ASME B1.20.1
	3	AIRGAS 0-6000 HIGH PRESSURE REGULATOR	STAINLESS STEEL/BRASS	MAX PRESSURE: 6000psi (IN), 6000psi (OUT)	3000psi (IN) 2000psi (OUT)	AIRGAS 0-6000, MODEL Y11-N198K	FACTORY TESTED, CGA STANDARD V-11, CGA STANDARD 022
	4	1/4" COUPLING	STAINLESS STEEL	RATED FOR 6000psi	2000psi	PARKER 1/4"GG, SAE 140138, HPD BASE #0202	NOT AVAILABLE
	5	PRESSURE GAUGE	BRASS/ ABS THERMOPLASTIC DIAL	OPERATING PRESSURE RANGE 0-4000psi	2000psi	McMASTER-CARR PART NUMBER: 9796T314	FACTORY CALIBRATED, NIST TESTED AND CERTIFIED, ASME B40.1
	6	1/4"x1/4"x1/4"x1/4" FEMALE CROSS	STAINLESS STEEL	RATED FOR MAX 7500psi @72°F	2000psi	McMASTER-CARR PART NUMBER: 48805K631	ANSI B31.1, B31.3, ANSI/ASME B1.20.1
⚠	7	1/4" PRESSURE RELIEF VALVE (VENT VALVE)	STAINLESS STEEL	RATED FOR 6000psi	2000psi	AIRGAS, PART CAME WITH 0-6000psi REGULATOR	NOT AVAILABLE
	8	3/8"x1/4" HEX REDUCING BUSHING	STAINLESS STEEL	RATED FOR MAX 5300psi @72°F	2000psi	McMASTER-CARR PART NUMBER: 48805K525	ANSI B31.1, B31.3, ANSI/ASME B1.20.1
	9	3/8"x3/8"x3/8" FEMALE TEE	STAINLESS STEEL	RATED FOR MAX 5000psi @72°F	2000psi	McMASTER-CARR PART NUMBER: 48805K49	ANSI B31.1, B31.3, ANSI/ASME B1.20.1
	10	3/8" MPT BRASS SAFETY RELIEF VALVE	BRASS	RATED FOR 2000psi	2000psi	J.E. ADAMS, MODEL NUMBER: 7416	FACTORY CALIBRATED (NON-ADJUSTABLE)
	11	1/4" AIR HOSE WITH DUAL MALE NPT ENDS	WIRE BRAIDED RUBBER HYDRAULIC HOSE, STAINLESS STEEL MALE NPT ENDS	RATED FOR 5800psi (STAMPED ON HOSE) MALE NPT FITTINGS RATED FOR 5076psi	2000psi	MANULI ROCK MASTER, 2SN-4EN, 853, 2SN, DN6WP MSHA IC 126/8-FRAS-2008 (MANUFACTURED BY MUNRO SUPPLY INC.)	NOT AVAILABLE
	12	HIGH PRESSURE CHECK VALVE MALE(INLET)xFEMALE(OUTLET)	BRASS, STAINLESS STEEL	RATED FOR 3000psi @ 180°F	2000psi	McMASTER-CARR PART NUMBER: 8549T25	FACTORY TESTED
	13	STANDARD AIR TANK NUT/NIPPLE CONNECTOR	STAINLESS STEEL	NUT-347-2, 5000psi NIPPLE-347-3, 5000psi	2000psi	MANUFACTURE-WESTERN (FROM AIR GAS)	NOT AVAILABLE
	14	"SMALL" AIR CYLINDER (9156-P)	6061-T6 ALUMINUM ALLOY	TC TEST PRESSURE 3324psi, DOT TEST PRESSURE 3693psi, SERVICE PRESSURE 2216psi	2000psi	CATALINA CYLINDERS, 9156-P (60FT³)	5YR RE-TEST PERIOD, DOT-3AL, TC-3ALM
	15	"LARGE" AIR CYLINDER (NUVT 4500)	STEEL	TEST PRESSURE 6750psi, SERVICE PRESSURE 4500psi	2000psi	NUVAIR, NUVT 4500 (437FT³)	10YR RE-TEST PERIOD, ISO 9809, DOT-E10869 4500psi, TC-SU4369-310

WHIP CHECK: ⚠
1) WHIP CHECKS ARE NOT REQUIRED BY OSHA FOR HOSE SIZES NEEDED IN THIS OPERATION (Standards 29 CFR, 1926.302, 30 CFR §56/57.13021, 30 CFR §75.1730, 30 CFR §77.412)

NOTE:
SAFETY VALVE MANUALLY ADJUSTED TO 3000psi BY MANUFACTURER



AIR CYLINDER FILLING SYSTEM
("SMALL" AIR CYLINDER IS SHOWN HERE FOR A VISUAL)

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL
⚠	2/22/11	NEEDLE VALVE WAS SWITCHED TO AN AIRGAS PRESSURE RELIEF VALVE, UPDATED TABLE/NOTES	SP	MM	MM	SC

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by
S.M. Stoller Corporation
Under DOE Contract
No. DE-AM01-07LM00060

PROJECT LOCATION
GRAND JUNCTION
GRAND JUNCTION, CO

REFERENCE

APPROVALS		
DRAWN BY	S. PITTON	2/22/11
ENGINEER	S. PITTON	2/22/11
PROJECT ENGINEER	A. PATTON	2/22/11
ENGINEERING MANAGER	M. MADRIL	2/22/11
PROJECT LEAD	S. CAMPBELL	2/22/11
SITE MANAGER/LEAD		

WELL MONITORING EQUIPMENT MODIFICATIONS

AIR TANK
FILLING COMPONENTS
AND DETAILS

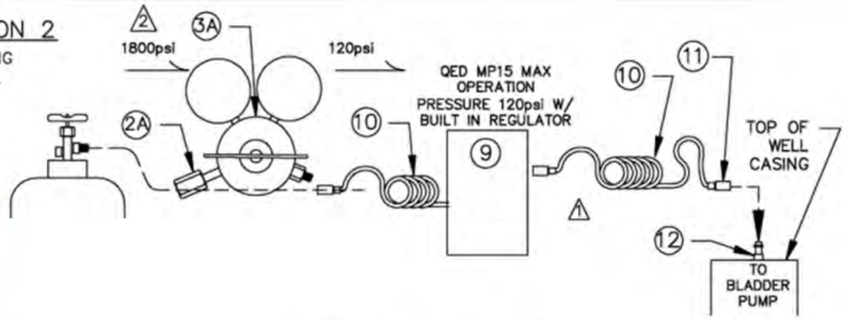
PROJECT NO. LTS-111-0001-17-000
DRAWING NO. S07328-R00-C01-C+
SHT. 1 OF 3

M:\LTS\111\0001\17\000\S0732801.DWG 02/23/11 10:21am pittons

SOURCE DEVICE OPTION 2

NO.	ITEM NAME	FIELD OPERATING PRESSURE
1(C)	CO_2 CYLINDER	120psi

△1



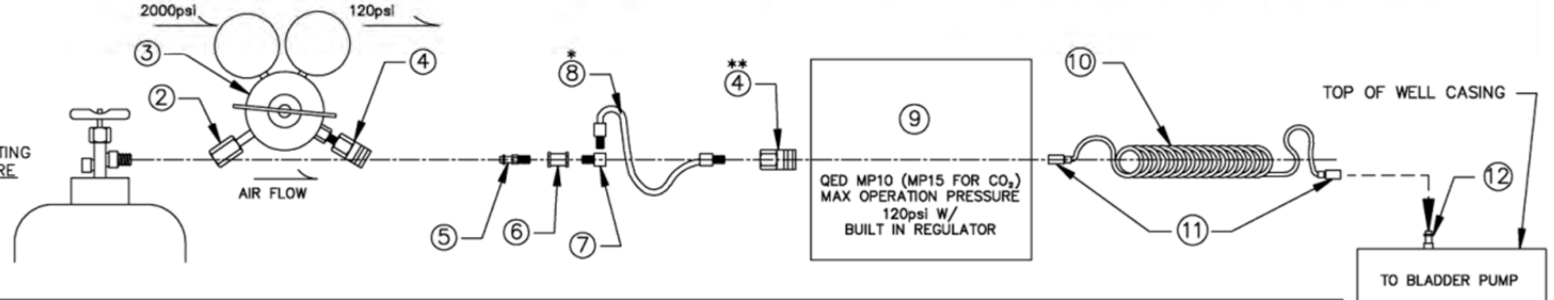
△1 SOURCE DEVICE OPTION 3

NO.	ITEM NAME	FIELD OPERATING PRESSURE
1(D)	MP40 AIR COMPRESSOR	125psi

NOTE:
COMPRESSOR SYSTEM WILL CONNECT TO QED MP10 WITH THE SAME TYPE OF QUICK COUPLING USED IN "OPTION 1". THE SYSTEM WILL REMAIN THE SAME FOR ALL OPTIONS FROM THE QED MP10 CONTROL BOX.

SOURCE DEVICE OPTION 1

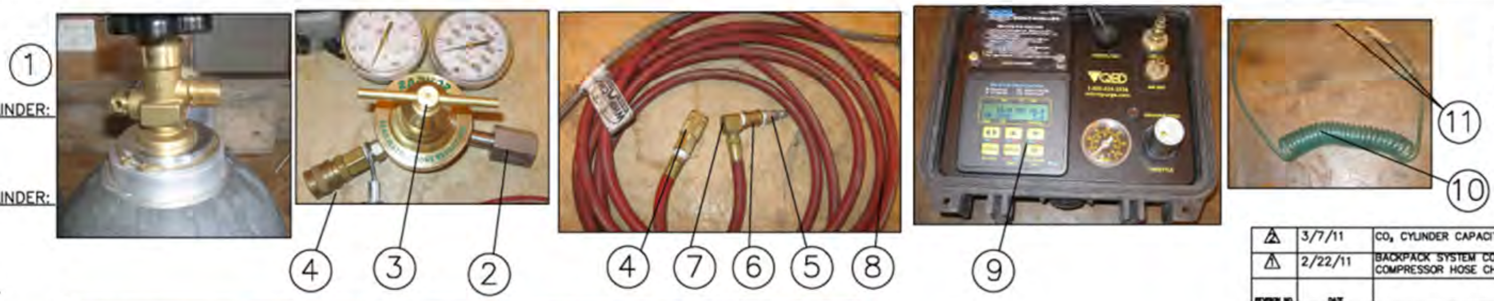
NO.	ITEM NAME	FIELD OPERATING PRESSURE
1(A)	"SMALL" AIR CYLINDER	2000psi
1(B)	"LARGE" AIR CYLINDER	2000psi



PARTS LIST

	NO.	ITEM NAME	MATERIAL TYPE	PRESSURE RATING	OPERATING PRESSURE	PRODUCT INFORMATION	NATIONAL RECOGNIZED TESTING LAB (NRTL) OR CERTIFICATION
OPTION 1	1(A)	"SMALL" AIR CYLINDER (9156–P)	6061–T6 ALUMINUM ALLOY	TC TEST PRESSURE 3324psi, DOT TEST PRESSURE 3693psi, SERVICE PRESSURE 2216psi	2000psi	CATALINA CYLINDERS, 9156–P (60FT³)	5YR RE–TEST PERIOD, DOT–3AL, TC–3ALM
	1(B)	"LARGE" AIR CYLINDER (NUVT 4500)	STEEL	TEST PRESSURE 6750psi, SERVICE PRESSURE 4500psi	2000psi	NUVAIR, NUVT 4500 (437FT³)	10YR RE–TEST PERIOD, ISO 9809, DOT–E10869 4500psi, TC–SU4369–310
OPTION 2	1(C)	CO_2 TANK	3ALM ALUMINUM ALLOY	RATED FOR 1800psi △2	1800psi	TC–3ALM124 LUXFER T3.5KG	DOT–3AL 1800 X688876 M4141 05A03 5#
OPTION 3	1(D)	MP40 AIR COMPRESSOR	–	MAX PRESSURE 125psi △2	120psi	QED MP40, 4.0HP HONDA	NOT AVAILABLE
	2	STANDARD AIR TANK NUT/NIPPLE CONNECTOR	STAINLESS STEEL	NUT–347–2, 5000psi NIPPLE–347–3, 5000psi	2000psi	MANUFACTURE–WESTERN (FROM AIR GAS)	NOT AVAILABLE
	2(A)	STANDARD CO_2 NUT/NIPPLE CONNECTOR	STAINLESS STEEL	MIN PRESSURE RATING 1800psi	1800psi	NOT AVAILABLE, PROVIDED WITH HARRIS REGULATOR	NOT AVAILABLE
	3	* RADNOR COMPRESSED GAS REGULATOR WITH AIR TANK CONNECTOR	STAINLESS STEEL AND BRASS	RATED FOR MAX INLET PRESSURE 3000psi, MAX OUTLET PRESSURE 125psi	120psi	RADNOR, MODEL NO. 350–125–540–06	ASME B40.100, SA568 DATE CODE KL, UL LISTED 54IL
△2	3(A)	REGULATOR FOR CO_2 SYSTEM	STAINLESS STEEL AND BRASS	RATED FOR MAX INLET PRESSURE 3000psi	120psi	HARRIS MODEL 25–125PS	FACTORY PRE SET TO 125psi, UL CGA E–4
	4	¼"–QUICK COUPLING	BRASS	MAX WORKING PRESSURE 300psi	120psi	PARKER 30 SERIES PART NO. B30–3B	FACTORY TESTED, ISO–7241–1, SERIES B
	5	¼" QUICK COUPLING MALE PORT CONNECTION	STEEL	MAX WORKING PRESSURE 300psi	120psi	PARKER 30 SERIES	FACTORY TESTED, ISO–9001:2000, ISO–14001:2004
	6	¼" COUPLING	BRASS	MINIMUM RATING FOR 300psi	120psi	NOT AVAILABLE	NOT AVAILABLE
	7	¼" STREET ELBOW	BRASS	MINIMUM PRESSURE RATING 200psi	120psi	NOT AVAILABLE	NOT AVAILABLE
	8	¼" AIR HOSE (MNPT,MNPT)	THERMOPLASTIC	RATED FOR 300psi	120psi	KURITEC K1134 POLY AIR, CANADA K061208	ISO 9001:2000, 21CFR177.1350, RoHS–EU DIRECTIVE 2002/95/EC
△1	9	MICRO PURGE CONTROL BOX	–	RATED FOR MAX INPUT 120psi (125psi per QED)	120psi	QED MP10 (MP15 FOR CO_2)	NOT AVAILABLE
	10	¼" PARAFLEX NoMor FAST–STOR	POLYURETHANE	RATED FOR MAX 125psi	120psi	PARKER PARAFLEX SERIES 385132	NOT AVAILABLE
	11	¼" QUICK COUPLING	BRASS	RATED FOR 200psi	120psi	PARKER P200 SERIES NO. P201–1A	FACTORY TESTED, ISO–9001:2000, ISO–14001:2004
	12	¼" QUICK COUPLING MALE PORT CONNECTION	BRASS	RATED FOR 200psi	120psi	PARKER P200 SERIES	FACTORY TESTED, ISO–9001:2000, ISO–14001:2004
	13	5/16" AIR HOSE	RUBBER–NYLON FIBER BRAID	SERVICE PRESSURE 400psi	120psi	WEATHERHEAD H75706	SAE J2064, TYPE C CLASS 1

* RADNOR REGULATOR IS DESIGNED FOR OXYGEN BUT IS COMPATIBLE WITH AIR AND ACCEPTABLE FOR THIS USE PER AIRGAS INC. RECOMMENDATION.



MARKINGS ON SMALL AIR CYLINDER:
DOT–3AL2216 E10013968
10 TC–ALM1530
UL18 EN849

MARKINGS ON LARGE AIR CYLINDER:
RIN C6A347 0608
EN849 6V V26
P625–19N, 6750

MARKINGS ON CO_2 CYLINDER:
TC-3ALM 124 DOT-3AL 1800

WHIP CHECK: △1
WHIP CHECKS ARE NOT REQUIRED BY OSHA FOR HOSE SIZES NEEDED IN THIS OPERATION (Standards 29 CFR, 1926.302, 30 CFR §56/57.13021, 30 CFR §75.1730, 30 CFR §77.412)

RADNOR REGULATOR STAMPED IDENTIFICATION

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REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL
△2	3/7/11	CO_2 CYLINDER CAPACITY, REGULATOR INLET PRESSURE	SP	MM	MM	SC
△1	2/22/11	BACKPACK SYSTEM COMPONENTS ADJUSTED, COMPRESSOR HOSE CHANGED, TABLE/NOTES UPDATED	SP	MM	MM	SC

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by
S.M. Stoller Corporation
Under DOE Contract
No. DE–AM01–07LM00060

PROJECT LOCATION
GRAND JUNCTION
GRAND JUNCTION, CO

APPROVALS	
S. PITTON	2/11/11
S. PITTON	2/11/11
[illegible]	2/11/11
M. MADRIL	2/11/11
S. CAMPBELL	2/11/11

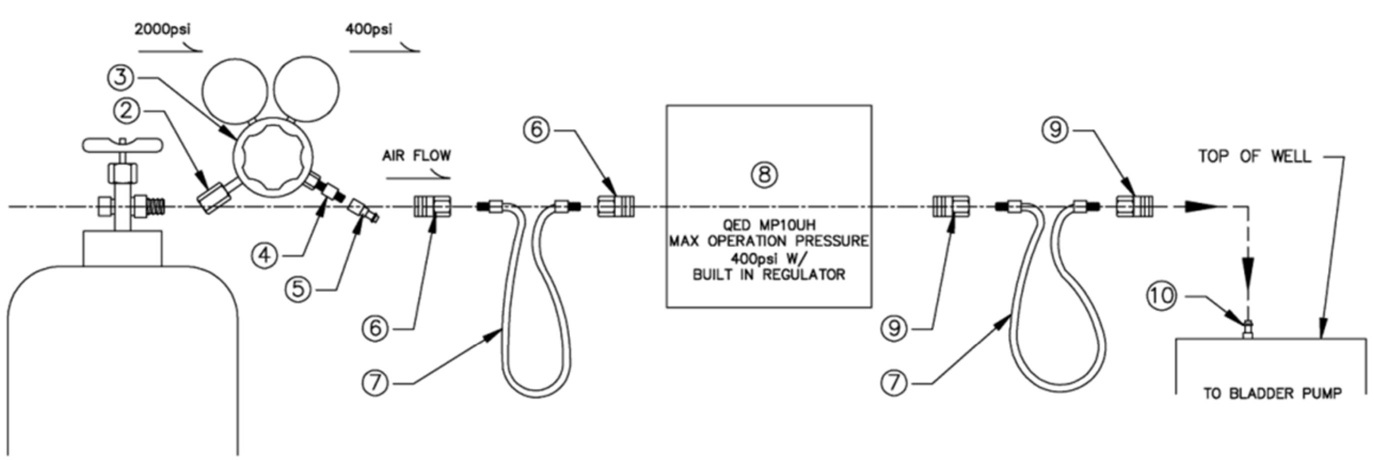
WELL MONITORING EQUIPMENT MODIFICATIONS

LOW PRESSURE
BLADDER PUMP
OPERATING SYSTEM

PROJECT NO. LTS–111–0001–17–000
DRAWING NO. S07329–R02–C02–C+
SHT. 2 OF 3

⚠

WHIP CHECK:
WHIP CHECKS ARE NOT REQUIRED BY OSHA FOR HOSE SIZES NEEDED IN THIS OPERATION (Standards 29 CFR, 1926.302, 30 CFR §56/57.13021, 30 CFR §75.1730, 30 CFR §77.412)



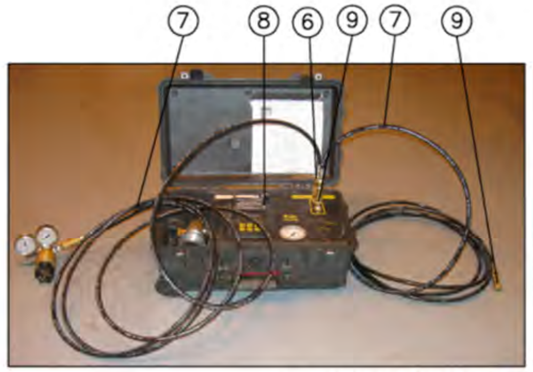
SOURCE DEVICE

NO.	ITEM NAME	FIELD OPERATING PRESSURE
1(A)	"SMALL" AIR CYLINDER	2000psi
1(B)	"LARGE" AIR CYLINDER	2000psi

PARTS LIST

	ITEM	MATERIAL TYPE	PRESSURE RATING	OPERATING PRESSURE	PRODUCT INFORMATION	NATIONAL RECOGNIZED TESTING LAB (NRTL) OR CERTIFICATION
1(A)	"SMALL" AIR CYLINDER (9156–P)	6061–T6 ALUMINUM ALLOY	TC TEST PRESSURE 3324psi, DOT TEST PRESSURE 3693psi, SERVICE PRESSURE 2216psi	2000psi	CATALINA CYLINDERS, 9156–P (60FT³)	5YR RE–TEST PERIOD, DOT–3AL, TC–3ALM
1(B)	"LARGE" AIR CYLINDER (NUVT 4500)	STEEL	TEST PRESSURE 6750psi, SERVICE PRESSURE 4500psi	2000psi	NUVAIR, NUVT 4500 (437FT³)	10YR RE–TEST PERIOD, ISO 9809, DOT–E10869 4500psi, TC–SU4369–310
2	STANDARD AIR TANK NUT/NIPPLE CONNECTOR	STAINLESS STEEL	NUT–347–2, 5000psi NIPPLE–347–3, 5000psi	2000psi	MANUFACTURE–WESTERN (FROM AIR GAS)	NOT AVAILABLE
3	HIGH PRESSURE SYSTEM REGULATOR	BRASS, STAINLESS STEEL	RATED FOR MAX INLET PRESSURE 6000psi, MAX OUTLET PRESSURE 400psi	2000psi (INLET), 400psi (OUTLET)	AQUA ENVIRONMENT MODEL 4515–400	ASME VESSEL CODE SECTION 8, ISO09001
4	¼" HEX NIPPLE	STAINLESS STEEL	RATED FOR 1000psi	400psi	PARKER PART NUMBER: **216P-4**	SAE J530, SAE J531, ASA
5	⅜" HYDRAULIC QUICK COUPLING MALE PORT CONNECTION	BRASS	RATED FOR 5000psi	400psi	PARKER 60 SERIES PART NO. BH3–60	FACTORY TESTED, ISO–9001:2000, ISO–14001:2004
6	⅜"–HYDRAULIC QUICK COUPLING	BRASS	MAX SERVICE PRESSURE 5000psi	400psi	PARKER 60 SERIES PART NO. BH3–61	FACTORY TESTED, ISO–7241–1, SERIES B
7	¼" AIR HOSE (MNPT,MNPT)	TEFLON, STEEL WIRE BRAID CORE	MAX SERVICE PRESSURE RATING 2785psi	400psi	EVERFLEX H43604	SAE 100R14, ISO3949/R7–1
8	MICRO PURGE CONTROL BOX	–	RATED FOR MAX INPUT 500psi	400psi	QED MP10UH	FACTORY TESTED, TEST AMERICA APPROVED FOR IN–HOUSE TESTING
9	¼"–HYDRAULIC QUICK COUPLING	BRASS	MAX SERVICE PRESSURE 5000psi	400psi	PARKER 60 SERIES PART NO. BH2–60	FACTORY TESTED, ISO–7241–1, SERIES B
10	¼"–HYDRAULIC QUICK COUPLING MALE PORT CONNECTION	BRASS	MAX SERVICE PRESSURE 5000psi	400psi	PARKER 60 SERIES PART NO. BH2–61	FACTORY TESTED, ISO–7241–1, SERIES B

"LARGE" AIR CYLINDER IS SHOWN ABOVE



INTERNAL REGULATOR FOR THE QED MP10UH

MARKINGS ON SMALL AIR CYLINDER:
DOT–3AL2216 E10013968
10 TC–ALM1530
UL18 EN849

MARKINGS ON LARGE AIR CYLINDER:
RIN C6A347 0608
EN849 6V V26
P625–19N, 6750

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL
⚠	2/22/11	UPDATED NOTES	SP	MM	MM	SC

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by
S.M. Stoller Corporation
Under DOE Contract
No. DE–AM01–07LM00060

PROJECT LOCATION
GRAND JUNCTION
GRAND JUNCTION, CO

REFERENCE

APPROVALS	
DRAWN BY S. PITTON	2/11/11
CHECKED S. PITTON	2/11/11
PROJECT ENGINEER A. PATTON	2/11/11
ENGINEERING MANAGER M. MADRIL	2/11/11
PROJECT LEAD S. CAMPBELL	2/11/11
SITE MANAGER/LEAD	

WELL MONITORING EQUIPMENT MODIFICATIONS

HIGH PRESSURE
BLADDER PUMP
OPERATING SYSTEM

PROJECT NO. LTS–111–0001–17–000
DRAWING NO. S07330–R01–C03–C+
SHT. 3 OF 3

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Appendix B-4

Desk Instructions for Using the Trailer-Mounted 20-Kilowatt Olympian Generator

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Desk Instructions for Using the Trailer-Mounted 20-Kilowatt Olympian Generator

Introduction and Purpose

This procedure will be used to aid a properly trained and authorized individual to operate the trailer-mounted 20-kilowatt Olympian generator. This generator is primarily used to power deep submersible groundwater pumps at the Shoal, Nevada, Site and the Central Nevada Test Area. However, this generator (Figure 1) could be used at other sites, as needed. This generator can only be used as a portable generator and is not designed to be connected to a permanent structure.

Figure 1. Olympian 20-Kilowatt Generator

Safety

This generator set is designed to be safe when used as a portable generator. However, responsibility for safety rests with properly trained and authorized personnel who use the generator. The following safety precautions will minimize the possibility of accidents.

1. *Electrocution is the greatest risk to human health associated with operation of any generator.*
2. *Always use a ground-fault circuit interrupter (GFCI).*
3. *Never start or operate the generator unless it is safe to do so.*
4. *If an unsafe condition is identified, remove the generator from service.*
5. *Before towing the generator, complete a Pre-Trip Towing Checklist (form LMS 2164).*

This generator set power distribution system (i.e., breaker panel, disconnect switches, bonding of generator to trailer frame) has been constructed by competent licensed electricians; no unauthorized alteration of the distribution system or of the generator is allowed.

Grounding Requirements

According to the Occupational Safety and Health Administration (29 CFR 1926.404(f)(3)(i)), the frame of the generator need not be grounded (connected to earth), and the frame may serve as the ground, under the following conditions:

- The generator supplies equipment mounted on the generator, cord-end and plug-connected equipment, or both through receptacles mounted on the generator.
- The noncurrent-carrying metal parts of equipment (such as the fuel tank, the internal combustion engine, and the generator’s housing) are bonded to the generator frame, and the equipment grounding conductor terminals (of the power receptacles that are a part of, and mounted on, the generator) are bonded to the generator frame.

Current configuration and specified use of this generator meets this Occupational Safety and Health Administration definition for grounding requirements.

Operation

The Environmental Monitoring Operations group is responsible for keeping the generator maintained and in proper operating condition. However, before each use, the generator should be inspected by the user as follows:

[1] Check fluid levels in the generator motor, including motor oil, fuel, and coolant levels. The fuel tank is mounted below the generator; the fill port is at the rear of the tank, below the control panel. All other fluid levels can be assessed by opening the side panels.

[2] Ensure that the trailer is free from unnecessary equipment or other loose items that could become tripping hazards or inhibit safe operation.

[3] Visually inspect the entire generator for signs of fuel, coolant, or lubricant leakage.

[4] Inspect power cords and cord-end connectors for signs of excessive wear or damage.

[5] Check the onboard fire extinguisher.

[6] Check the generator for any general wear and tear.

[7] Ensure that the generator trailer is as level as possible before operating the generator.

Start and operate the generator as follows:

[1] Open the engine compartment on the right and turn the battery isolation switch to the RUN position (Figure 2). Close the compartment.

[2] Loosen the fuel tank fill cap, but do not remove it.

[3] Open the control panel’s clear plastic door, and depress the GLOW PLUGS button for 15 seconds (Figure 3).

[4] Turn the start switch to the START/RUN position, which will start the generator.

[5] Allow the engine to run for 5 minutes before placing a load on it.

CAUTION *Never connect the generator cord-end connector to the pump cord-end connector (or disconnect the generator cord-end connector from it) unless the disconnect switch is in the OFF position (Figure 4). Doing so could cause an arc-flash reaction.*

Figure 2. Battery Isolation Switch

Figure 3. Control Panel

Figure 4. Typical Disconnect Switch

CAUTION *To stop the generator in the event of an emergency, press the red button below the control panel (Figure 5).*

Figure 5. Emergency Stop Button

- Before energizing the disconnect switch, connect the cord-end connectors after ensuring that a portable GFCI is in place.

CAUTION *Always use a GFCI when powering pumps or other equipment.*

- Turn the disconnect switch to the ON position to power the pump.
- De-energize the pump by turning the disconnect switch to the OFF position.

CAUTION *Never connect or disconnect cord-end connectors unless the disconnect switch is in the OFF position.*

Storage

Successful long-term use and operation of the generator depends on the generator’s being stored properly during long periods of nonuse. Before storing the generator, complete the following actions:

[1] Ensure that the battery isolation switch is in the OFF position.

[2] Clear the trailer of all extra supplies and equipment that may have accumulated during use.

[3] Wash the generator and trailer.

[4] Refill the fuel tank; add diesel fuel conditioner/stabilizer to the fuel during the filling operation.

[5] Park the trailer in a level position.

More detailed maintenance and operations information can found in the owner's manual located at \\GJO\Projects\SamplingProg\Equipment Manuals and Procedures.

Appendix C

Job Safety Analysis

Job Safety Analysis (JSA)

Descriptive Title: Sampling and Minor Maintenance at Office of Legacy Management (LM) sites

General LMS ☒ or Specific Site: Numerous LM sites

Issuance Date: 1/23/2015 Expiration Date: 1/23/2016

Work Scope	
1.	Work involves routine water sampling, radon detector collection, soil sampling, water level measurements, pressure transducer downloads, and minor maintenance. Routine water sampling tasks include collection, preservation, and shipping of water samples and collection of field measurements, including water levels and water-quality measurements. Routine maintenance tasks include painting well casings; repairing or replacing hinges, hasps, and locks on well casings; repairing well casings; replacing concrete well pads; redeveloping wells; abandoning wells; and removing vegetation in the vicinity of sample locations. Driving to sites and sample locations, on and off-road, is required along with periodic use of an all-terrain vehicle (ATV) or RZR (Razor).
2.	Work will be conducted at most LM sites that require sampling.
3.	Work will be conducted outside during all seasons of the year.
4.	The following equipment may be used: ATVs, RZRs, compressors, generators, compressed gas cylinders, hand tools, paint sprayers, truck-mounted winches, weed eaters, batteries, sample pumps, and concrete mixers.
5.	Work will be performed by Contractor personnel.
6.	Under the Environmental Management System (EMS), workers will minimize impacts to the environment by reusing and recycling materials to the extent practical, using less or nonhazardous or bio-based paints, solvents, and other chemical products, and using concrete with recycled content per the environmentally preferable purchasing “green 3800 series” cost element requirements.

(Use a separate sheet if more space is necessary)

Define the Scope of Work by Individual Tasks (ISMS Core Function #1)	Analyze the Safety and Environmental Hazards (ISMS Core Function #2)	Develop and Implement Controls (ISMS Core Function #3)
Working outdoors	Heat or cold exposure	• Watch for signs of heat and cold stress in self and others; these include unusual redness or profuse sweating or uncontrollable shivering. Take breaks as necessary to cool down or warm up. • Wear adequate clothing for weather conditions. • Drink sufficient fluids—approximately 8 ounces every hour of active work.
Working Outdoors	Medical Emergency	• At least one person in the group shall have current first aid and CPR training. • Carry a first aid kit that meets the Legacy Management Support (LMS) requirements. • Some form of external communication should be available for use. This may be a cell phone or personal locator beacon. Verify that radios work before taking them to a site. Cell phones may require a booster at remote locations. • Workers must be paired per the two-person policy. For most tasks, at least two workers must be present on the site and they must either have visual or voice contact at all times, or they must communicate at regularly scheduled intervals via

Job Safety Analysis (JSA) (continued)

Define the Scope of Work by Individual Tasks (ISMS Core Function #1)	Analyze the Safety and Environmental Hazards (ISMS Core Function #2)	Develop and Implement Controls (ISMS Core Function #3)
Working outdoors	Medical emergency	phone or radio. For minor maintenance activities requiring no mechanical equipment and groundwater-level measurement tasks that are performed at locations with phone coverage, workers may be paired by communication between the site and the office via phone.
Working outdoors	Slips, trips, and falls over uneven terrain and equipment	• Be aware of uneven terrain and remove slip and trip hazards, if possible. • Establish an equipment lay-down area and keep all items neatly in this area when they are not in use. • Wear sturdy work boots that provide ankle support. • Follow designated routes and trails when possible. • When crossing rock-armored features, be aware of the potential for the rock to move—concentrate on each step and do not carry items that obscure vision.
Working outdoors	Falls to lower level	• When working near escarpments that are more than 4 feet directly above a lower surface, stay at least 6 feet from the edge. Use caution and judgment when working adjacent to ledges and steep slopes. Keep a safe distance from the edges of steep slopes. Work in pairs, ensure footing is secure, and practice good housekeeping. Be aware of changing conditions that may affect traction on slopes.
Working outdoors	Hunting activities	• Wear high-visibility clothing or vests when conducting field work. • Notify or alert hunters that you are working in the area if possible.
Working outdoors	Inclement weather (wind, lightning, tornados)	• If thunder is audible, evaluate the need to seek shelter. Use the 30/30 rule at a minimum (30 seconds between flash of lighting and bang of thunder). Cease field activities when lightning is within 6 miles (i.e., when there is less than 30 seconds between flash and bang). Field activities can resume 30 minutes after the last audible thunder. Suspend outdoor work when a severe thunderstorm or tornado warning has been issued. • Cease field activities when wind is strong enough to move equipment or materials unexpectedly and in an unsafe manner. • Follow site-specific guidelines of occupied sites for working in adverse weather conditions, including high winds and temperature extremes. • Identify a tornado shelter location before it is needed. • Be aware of the potential for flash flooding; know the topography around the site and have an exit route planned when working in a wash or low area. Avoid streams, gullies, arroyos, or other drainage features when storms are occurring in the drainage basin upgradient of the site.
Working outdoors	Roaming or aggressive domestic or wild animals	• Workers shall visually assess the work area when they arrive to look for the presence of animals. If animals are in the work area and are determined to pose a potential hazard, work will be suspended at that location until the animals have moved out of the area. • If aggressive animals enter the work area, workers shall stop all work, attempt to leave the area immediately without disturbing the animals, and notify site

Job Safety Analysis (JSA) (continued)

Define the Scope of Work by Individual Tasks (ISMS Core Function #1)	Analyze the Safety and Environmental Hazards (ISMS Core Function #2)	Develop and Implement Controls (ISMS Core Function #3)
Working outdoors	Roaming or aggressive domestic or wild animals	management immediately. • The use of a deterrent spray (pepper spray) is authorized in the event of workers being unable to leave the area of the aggressive animal or feel that there is an imminent threat. • Site workers who choose to carry pepper spray must complete the training for its use (course HS 380). All manufacturer instructions shall be followed when using deterrent sprays.
Working near a public roadway	Vehicle striking people or equipment	• Park as far off the road surface as possible, putting the vehicle between the road and the work area if possible. • Use the vehicle flashers until the vehicle leaves the location. • Workers and observers shall wear high-visibility clothing or vests at all times. • No work will be performed before or after sunset, or when visibility is low.
Operating a vehicle	Vehicle accidents	• Inspect vehicle prior to use and understand how to use the vehicle functions before operating. • Do not use any two-way communication device while operating a vehicle. • Do not operate a vehicle while fatigued. Do not work a total of more than 12 consecutive hours in a single day, driving and onsite time combined. Alternate driving duties with a partner to prevent driving while fatigued. • Do not attempt to cross moving water that is more than 6 inches deep.
Towing a trailer	Trailer incidents and accidents	• Complete *Pre-Trip Towing Checklist* (LMS Form 2164) prior to towing a trailer to document load assessment and inspection requirements. • Prior to driving in tight, congested, or unknown areas, assess the area to ensure there is sufficient room to turn around or to back out safely. • Use a spotter when backing into an area other than an open field.
Jump starting a vehicle	Chemical exposure, battery explosion, electric burns	• Wear ANSI ZA87.1 approved safety glasses. • Do not allow vehicles to touch. • Ensure both vehicles' electrical systems are the same voltage. • Cover battery caps with a damp cloth if available. 1. Clamp one end of red cable to + terminal of dead battery. 2. Clamp other end of red cable to + terminal of good battery. 3. Clamp one end of black cable to – terminal of good battery. 4. Clamp other end of black cable to metal on vehicle with dead battery (any metal away from battery, carburetor, fuel line, tubing, or moving parts). 5. Observers stand back from both vehicles. 6. Start vehicle with good battery, then start vehicle with dead battery. 7. Remove clamps in reverse order, beginning with the metallic ground.
Driving off-road—sampling vehicle	Vehicle accidents, rollovers, getting stuck, damaging road surfaces	• Watch for rough road conditions including rocks, brush, and well heads. • Use high-clearance four-wheel drive vehicle when necessary. • Use a spotter when backing into obscure or tight areas.

Job Safety Analysis (JSA) (continued)

Define the Scope of Work by Individual Tasks (ISMS Core Function #1)	Analyze the Safety and Environmental Hazards (ISMS Core Function #2)	Develop and Implement Controls (ISMS Core Function #3)
Driving off-road—sampling vehicle	Vehicle accidents, rollovers, getting stuck, damaging road surfaces	• Do not attempt to cross extreme surfaces. • Drive vehicles on established roads or tracks when possible. Do not drive on roads or tracks that are extremely muddy or sandy. Instead, use an ATV or walk to the sampling location.
Driving off-road—sampling vehicle	Inadvertently destroying threatened or endangered species or their habitat, disturbing wetlands or cultural or archaeological artifacts	• Report any spills of fuel or chemicals to the Environmental Compliance (EC) point of contact (POC). • Contact EC to determine if threatened and endangered species or protected areas exist on the site. • Contact the Ecology group to determine if wetlands areas exist on the site.
Driving off-road—sampling vehicle	Grass fires	• Use discretion when traveling in grassy areas. If grass is 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 instead. • A fire extinguisher or shovel (for grass fires) may be used to extinguish small fires based on personnel training. If a fire extinguisher is used, scoop up fire-extinguisher residual from the ground and place it in a trash bag for disposal at a sanitary landfill. • Evacuate the site if there is a large fire.
Driving off-road—sampling vehicle	Injury from use of a winch	• Wear leather gloves when handling winch cable and hook. • Inspect winch before use. Do not use winch if cable is kinked or frayed or the hook is damaged; tag and remove from service. • Never hook the wire rope back onto itself - this damages the wire rope • Use hook strap whenever spooling cable in or out. • Do not operate winch if less than five wraps of cable are left around the drum. • Cover middle of steel cable with blanket or other covering. • Secure winch cable to an anchor of adequate size and strength. • Stand clear of cable and load (as far as the remote control allows) during winching operations. Observers must stand clear by at least a distance equal to the length of the winch cable. • Stop winching operation if the winch drum stops turning. • Do not touch the cable or hook when the remote control is plugged in. • Secure the cable and engage the drum clutch when in transport. • Refer to manufacturer's instructions for operation and safety.
Driving off-road—ATVs and Ranger RZRs	Rollovers, cuts, abrasions, scratches, head and bodily injury	• Riders must wear an approved safety helmet for the RZR and for ATVs without roll protection. • Trailer must be attached to the tow vehicle when loading and unloading ATVs and RZRs. • Wear gloves while operating ATV or RZR. • Inspect ATV or RZR prior to operating. • Operators must complete the ATV and RZR safe operations training courses. • Avoid steep terrain.

Job Safety Analysis (JSA) (continued)

Define the Scope of Work by Individual Tasks (ISMS Core Function #1)	Analyze the Safety and Environmental Hazards (ISMS Core Function #2)	Develop and Implement Controls (ISMS Core Function #3)
Driving off-road—ATVs and Ranger RZRs	Rollovers, cuts, abrasions, scratches, head and bodily injury	• Driving speeds should be maintained as appropriate for the conditions. • Report any spills of fuel or chemicals to the EC POC. • Operators and passengers of RZRs must use the seat belts and cab nets.
Crossing wire fences	Cuts to hand or body	• Use a gate when possible. • Cover barbed wire fencing with a rug, coat, or other material to prevent cuts, or have a partner spread the wires if possible. Use work gloves when handling barbed wire.
Opening wells/well vaults and accessing sample locations	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, and blisters as necessary.
Opening wells/well vaults and accessing sample locations	Insect bites and irritating plants	• Wear appropriate clothing, covering as much exposed skin as possible. • Wear insect repellent or ivy block as necessary. • Beware of insects when opening a well; wear gloves and consider spraying an insecticide. • If exposed to irritating plants or ticks, take a shower and examine body when activities are completed. • Do not reach into dark or obscured places without wearing gloves.
Opening wells/well vaults and accessing sample locations	Snakes and animals	• Do not attempt to capture or handle snakes or animals. • Maintain a safe distance from snakes or animals. • Be aware of placement of hands and feet in areas with thick vegetation and in well vaults. • Wear snake chaps in areas with a high density of poisonous snakes.
Opening wells/well vaults and accessing sample locations	Injury or death from **Permit-Required Confined-Space Entry (**posted as “Permit-Required Confined Space”)	• **Prior to entering ANY confined space, notify Health and Safety.** Confined-Space Entry Permit required for entry; entrants and attendants must be current in confined-space entry training and follow permit-required confined-space entry protocol. An emergency rescue team must be available. • Contact Health and Safety for guidance.
Opening wells/well vaults and accessing sample locations	Injury or death from **Non-Permit-Required Confined-Space Entry** (posted as “Non-Permit Required Confined Space”)	• This task is for inspection, maintenance, and sampling only. **Prior to entering ANY confined space, notify Health and Safety** and **f**ollow these steps: 1. Open and secure the lid to prevent inadvertent closure. 2. Vent the space for a minimum of 5 minutes. 3. Test the atmosphere at the top, middle, and bottom of the space using a multi-gas meter. 4. Ensure the buddy system is in place. 5. Enter the space if the atmosphere is safe, as determined by the multi gas-meter. If the atmosphere is not safe, continue to vent the space and retest again after 5 minutes. If the atmosphere still is not safe, DO NOT ENTER.

Job Safety Analysis (JSA) (continued)

Define the Scope of Work by Individual Tasks (ISMS Core Function #1)	**Analyze the Safety and Environmental Hazards (ISMS Core Function #2)**	**Develop and Implement Controls (ISMS Core Function #3)**
Opening wells/well vaults and accessing sample locations	Injury or death from **Non-Permit-Required Confined-Space Entry** (posted as “Non-Permit Required Confined Space”)	• Be aware that a confined space may become permit-required due to the introduction of items as simple as PVC glue, water, or exhaust from a generator or vehicle. Use caution during ingress and egress, particularly when using a ladder. For additional information, refer to *Health and Safety Manual*, Standard 7.5, “Confined-Space Entry.”
Opening wells/well vaults and accessing sample locations	Eye injury from working in vegetation	• Wear ANSI ZA87.1 approved safety glasses when working in vegetated areas.
Opening wells/well vaults and accessing sample locations	Radiological	• Contact Health and Safety and follow the Radiological Work Permit if galvanized pipe is to be disconnected. Fixed contamination likely will be encountered. • Contaminated components shall be stored and disposed of per radiological control technician direction. Whenever possible, galvanized components shall be replaced with PVC or stainless steel to alleviate future contamination hazards.
Opening wells/well vaults and accessing sample locations	Hantavirus	• Avoid areas with signs of rodent activity (e.g., nests, droppings, food piles). • Inform the line supervisor of any work areas with rodent activity and of any unprotected exposure to potential hantavirus-containing materials. • Before attempting to clean up dead rodents, nests, droppings, urine, or food piles, contact Health and Safety for guidance in accordance with *Health and Safety Manual* Standard 2.2., “Hantavirus Precautions,” which includes use of respiratory protection and disinfectant.
Opening wells/well vaults and accessing sample locations	Falls from ladders	• Inspect ladders prior to use and remove and tag those found unserviceable. • Use only ladders that are rated for the weight and the work situation. • Maintain three points of contact when ascending and descending.
Sample collection and preservation; field measurements	Radiological	• Use nitrile gloves when collecting samples or conducting field measurements. Contact Health and Safety and follow the Radiological Work Permit when accessing wells that penetrate directly into a disposal cell or when posted as a Radiological Contamination Area. • Radiological Worker II training is required for sampling wells that penetrate directly into the disposal cell.
Sample collection and preservation; field measurements	Chemical exposure and spills	• Review Safety Data Sheets (SDSs) for all chemicals being used onsite. • Use nitrile gloves and ANSI ZA87.1 approved safety glasses with side shields when dispensing sample preservatives (acids and bases) or using calibrations solutions or field test reagents. • Spills of chemicals should be cleaned up as soon as possible and EC must be notified. • Acids must be transported in quantities no greater than 500 milliliters per container; containers must be leak proof and must be secured during transportation to limit spill potential and to qualify as U.S. Department of Transportation Materials of Trade.
Sample collection and preservation; field measurements	Drowning	• Drowning hazard exists if still water is more than 2 feet deep at the edge or the water is more than 1 foot deep and is moving rapidly.

Job Safety Analysis (JSA) (continued)

Define the Scope of Work by Individual Tasks (ISMS Core Function #1)	Analyze the Safety and Environmental Hazards (ISMS Core Function #2)	Develop and Implement Controls (ISMS Core Function #3)
Sample collection and preservation; field measurements	Drowning	• Use the buddy system, wear a life vest, and have a ring buoy with a minimum of 90 feet of line for emergency rescue when working within 5 feet of water where a drowning hazard exists.
Sample collection and preservation; field measurements	Back injury	• Get help with heavy or awkward items and use a hand truck or other mechanical assistance when possible. • No person shall lift more than 50 pounds without assistance. • Use proper lifting form (keep 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. • Use correct bending form (bend at the knees or kneel, turn entire body rather than just torso) when working close to ground or when lowering body position.
Sample collection and preservation; field measurements	Noise exposure	• Reduce noise exposure by placing generators and compressors away from work areas using extension cord or extra air hose. • Based on a noise survey performed by Health and Safety on sampling equipment, hearing protection is required only when using the Honda 3500 generator if personnel are within 20 feet of the generator for more than the time it takes to start it. • In general, always wear hearing protection if the noise levels prevent a normal conversation between 2 people standing 3 feet apart.
Sample collection and preservation; field measurements	Electric shock from generators and electrical equipment	• Inspect equipment prior to use and remove unserviceable cords and tools. • Use only double-insulated tools. • Use ground fault circuit interrupter (GFCI) protection when using outdoor outlets and generators. • Ground generators per manufacturer's recommendations. • If the manufacturer recommends connecting to a ground rod that must be installed (i.e., driven in) then ensure that Penetration Permit requirements from H&S Manual, standard 5.4 are implemented.
Sample collection and preservation; field measurements	Injury from flying particles, pinch points, and cuts from power tools	• Inspect all power tools prior to use; remove from service and tag those that are unserviceable. • Wear ANSI ZA87.1 approved safety glasses with side shields when potential exists for flying particles. • Wear a face shield, ANSI ZA87.1 approved safety glasses, and leather boots when using a weed eater. • Wear leg chaps and safety-toe boots when using a weed eater with a metal cutting blade. • 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.
Sample collection and preservation; field measurements	Fires/explosions from refueling	• Vehicles and equipment shall not be fueled with the engine running. • Allow equipment to cool prior to fueling.

Job Safety Analysis (JSA) (continued)

Define the Scope of Work by Individual Tasks (ISMS Core Function #1)	**Analyze the Safety and Environmental Hazards (ISMS Core Function #2)**	**Develop and Implement Controls (ISMS Core Function #3)**
Sample collection and preservation; field measurements	Fires/explosions from refueling	• Cigarettes, open flames, or other ignition sources are not allowed within 100 feet of the fueling location. • Flammable and combustible liquids shall be handled and used in National Fire Protection Association–approved safety cans that have flame arresters (screens), spring-closing (self-closing) lids, and spout covers. • Ensure that at least one fire extinguisher, minimum of 10ABC, is present and available at the point of refueling. • Fuel spills shall be cleaned up immediately and EC shall be notified. • Spills of greater than 25 gallons or spills to waterways have special reporting requirements; notify EC immediately. • Do not overfill or top off tanks when refueling equipment. • Equipment surface area shall be kept clean and free of fuel or other liquid build up. • If practical, use a plastic tub or other secondary containment, such as a drop cloth, to contain spills when refueling. • Set generator and gas can on the ground prior to refueling, and touch gas can and generator together prior to refueling to neutralize static charge. • Do not re-enter vehicles or equipment during refueling.
Sample collection and preservation; field measurements	Unexpected pressure releases from gas cylinders, compressors, and pneumatic equipment	• Only individuals trained in the safe use of compressed gas cylinders may use them. • Cylinders shall be secured with the regulator removed and protective cap in place during transport (for cylinders designed to accept a protective cap). • Acetylene must be transported upright. • Use a properly rated regulator for the control of gas flow. • Maintain all fittings and connections; keep free from dirt, grease, and oil. • Check for leaks after regulator and fittings are in place. • Examine hoses regularly, replace if damaged. Keep hoses away from sharp objects. • Use whip checks on pressurized hoses with greater than ½ inch inside diameter. • Use only approved pressure system configurations as shown in "Desk Instructions for Environmental Monitoring Operations Using Compressed Gas" located in Appendix B of the *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites.* • Never put any part of your body in front of the pressure discharge of the system. • Wear ANSI ZA87.1 approved safety glasses.
Sample collection and preservation; field measurements	Chemical exposure, explosion, electric burn from battery charging	• Wear safety goggles, nitrile gloves, and apron when handling batteries. • Inspect charger and battery for deficiencies; if found, correct prior to charging. Connect charger cables to battery before plugging charger into AC power supply. • Charge battery with caps in place. • Connect positive cable to positive terminal first and negative cable to negative

Job Safety Analysis (JSA) (continued)

Define the Scope of Work by Individual Tasks (ISMS Core Function #1)	Analyze the Safety and Environmental Hazards (ISMS Core Function #2)	Develop and Implement Controls (ISMS Core Function #3)
Sample collection and preservation; field measurements	Chemical exposure, explosion, electric burn from battery charging	terminal last. After charging, disconnect in reverse sequence. • Always plug charger into a GFCI-protected outlet. • Set charger to appropriate voltage for battery being charged. • Follow manufacturer's instructions for the charging unit. • Ensure that there are no spark- or flame-generating sources near. • Ensure good ventilation to area. • Provide secondary containment for battery during charging, and have a spill kit available.
Sample collection and preservation; field measurements	Chemical exposure from prepping and painting well casing	• When scraping rust or paint from well casing, wear ANSI ZA87.1 approved safety glasses with side shields. • When painting, review SDSs prior to use. • When painting with a brush, wear nitrile gloves and ANSI ZA87.1 approved safety glasses with side shields. • When painting with a sprayer, wear nitrile gloves and a face shield. • Only paint in open areas with good ventilation. • A dust mask may be worn for employee comfort if approved by a supervisor and the employee is briefed on the use and limitations of the dust mask.
Sample collection and preservation; field measurements	Fire from paint spray	Keep the spray gun at least 25 feet away from the generator while in use.
Sample collection and preservation; field measurements	Overhead hazards	• Wear hard hat when working in areas where overhead work is being performed or head-bump hazards exist – overhead hazards may be padded/protected/covered as an additional control.
Sample collection and preservation; field measurements	Asphyxiation from gas-powered equipment	• Use gas-powered equipment in ventilated areas to avoid carbon monoxide inhalation or accumulation. • Place equipment away or downwind from vaults and other confined spaces.
Sample collection and preservation; field measurements	Chemical exposure from concrete or bentonite	• Review SDSs prior to use. • Wear nitrile gloves and ANSI ZA87.1 approved safety glasses with side shields. • A dust mask may be worn for employee comfort if approved by a supervisor and the employee is briefed on the use and limitations of the dust mask. • Minimize generation of dust by pouring slowly. • Stand upwind. • Rinse concrete dust or cement off skin surfaces.
Sample collection and preservation; field measurements	Rotational hazard and pinch points from a concrete mixer	• Ensure all manufacturer's guards are in place and functional. • Stand clear of drum when it is rotating. Keep all tools away from drum when it is rotating. • Refer to manufacturer's instructions for operation and safety. • Secure loose clothing, hair, and jewelry so it cannot become caught in rotating equipment.

Job Safety Analysis (JSA) (continued)

Define the Scope of Work by Individual Tasks (ISMS Core Function #1)	**Analyze the Safety and Environmental Hazards (ISMS Core Function #2)**	**Develop and Implement Controls (ISMS Core Function #3)**
Managing purge water and investigation derived waste	Improper/illegal management	Refer to the *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (Table 4) for controls in place to manage purge water and investigation-derived waste. Field-testing wastes, including standards and samples to which any amount of any chemical is added, shall be containerized and returned to the home-office facility for proper management and disposal.
Managing purge water and investigation derived waste	Environmental releases	Contact the EC and Health and Safety groups for clean-up and reporting guidance for all spills from equipment, leaks from gas containers, and chemical spills. If directed, report the spill on the *Incident Report* form.
Unplanned community interactions	Residents within the area may be uninformed of site activity occurring	• At sites on the Navajo Reservation, activities conducted within fenced or private property of any local residence shall be coordinated through the U.S. Department of Energy site lead and Navajo Nation UMTRA Department representatives prior to the start of work. If workers are confronted by residents, they shall leave the area and contact the site manager immediately. • Work activities shall be performed in a manner that allows for maximum visibility to others. This includes wearing high-visibility clothing or vests and the use of flashing lights or flags on ATVs. • Park vehicles and place equipment in areas that are prominent and open. When possible, avoid parking vehicles or performing work behind obstructions such as fences or other structures. • All small utility vehicles used for performing work at these sites (Gators, Mules, ATVs) will be required to have reflective tape on all four sides and have a high-visibility flag mounted on the vehicle. Utility vehicles with roll cages or roofs will have a high-visibility light installed that will be required to be turned on during use within the site.
Unplanned community interactions	Discharge of firearms	• If the shooting of any gun within the site or within close proximity of the site is witnessed by site workers, all work shall immediately stop and workers must seek immediate shelter. As soon as workers believe it is safe to access their vehicle they shall immediately leave the site. • Any close-proximity shooting activity must be immediately reported to the site management from an offsite location. Workers will not return to the site until approval to resume work is provided by LMS Health and Safety.

Job Safety Analysis (JSA) (continued)

JSA Review/Approval

Sam Campbell	Sam Campbell Sam Campbell 2015.01.23 11:08:55 -07'00'	
Line Supervisor (Print Name)		Date
Andria Dutcher	Andria Dutcher Andria Dutcher 2015.01.23 11:11:09 -07'00'	
H&S Representative (Print Name)		Date
Darlene DePinho	Darlene M DePinho Darlene Depinho 2015.01.23 11:54:38 -07'00'	
Environmental Compliance Representative (Print Name)	Signature	Date
Subcontractor/Worker Representative (Print Name)	Signature	Date

Job Safety Analysis (JSA) (continued)

I have reviewed, thoroughly understand, and will comply with this ISMS Core Functions Work Planning and Control document, as acknowledged by my signature below.

Print Name	Signature	Company	Date

Job Safety Analysis (JSA) (continued)

Field Change Authorization and Review

Field Management Changes (use a separate sheet if more space is necessary)

Define New or Changed Scope of Work by Tasks (ISMS Core Function #1)	Analyze the New or Changed Hazards (ISMS Core Function #2)	Develop and Implement New Controls (ISMS Core Function #3)	Date

Line Supervisor (Print Name) Signature Date

Worker or Subcontractor Representative (Print Name) Signature Date

I acknowledge I have had the opportunity to provide input to the field change and am aware of the scope change, new or changed hazards, and associated work controls.

Print Name	Signature	Company	Date

Provide Feedback and Improvement Suggestions (ISMS Core Function #5)

Appendix D

Site-Specific Information and Program Directives

Current Index of Site-Specific Program Directives as of January 2015

Directive No.	Effective Date	Expiration Date	Initiated By	Subject
BLU-2014-01	06/27/2014	06/27/2016	Gretchen Baer	Groundwater Sampling
CNT-2013-02	11/01/2013	11/01/2015	Rick Findlay	High-Flow Sampling
DUD-2015-01	10/03/2014	10/03/2017	Sam Campbell	Radon Monitoring at the Durango Disposal Site
DUR-2014-01	12/09/2013	09/30/2016	Sam Campbell	Sampling of Monitoring Well 0879
GSB-2015-01	10/31/2014	10/31/2017	Sam Campbell	Natural Gas Sampling at a Natural Gas Production Well
PIN-SAP-2015-02	02/01/2015	02/01/2018	Sam Campbell	Sampling of Monitoring Wells Affected by Soybean-Oil Injections
PIN-2014-02	09/01/2014	09/01/2017	Julian Caballero	Groundwater Sampling Procedures
RFL-2013-01	07/01/2013	07/01/2016	Sam Campbell	Sampling of CMT Wells
RBL-2015-01	10/31/2014	10/31/2017	Sam Campbell	Natural Gas Sampling at a Natural Gas Production Well
RFS-2015-01	11/19/2014	11/19/2017	Sam Campbell	Miscellaneous Sampling Activities
RFS-2015-02	11/19/2014	11/19/2017	Sam Campbell	Disposition of Excess Water
RFS-2015-03	10/31/2014	10/31/2017	Sam Campbell	Processing Composite Surface Water Samples
RUL-2015-01	10/31/2014	10/31/2017	Sam Campbell	Natural Gas Sampling at a Natural Gas Production Well
SAL-2013-02	09/24/2013	09/24/2016	Sam Campbell	High-Flow Sampling
SHP-2015-01	10/31/2014	10/31/2017	Sam Campbell	Filtration of Surface Water Samples
SHL-2015-01	11/30/2014	11/30/2017	Sam Campbell	Miscellaneous Sampling Activities
TUB-2015-01	10/31/2014	10/31/2017	Sam Campbell	Sampling of the Tuba City Evaporation Pond
WEL-2015-01	10/01/2014	10/01/2017	Sam Campbell	Sampling Activities
WEL-2014-01	6/09/2014	6/09/2017	Sam Campbell	Weldon Spring, Missouri, Site Purge Water Disposition

Sampling Frequencies for Locations at Ambrosia Lake, New Mexico

Location ID	Quarterly	Semiannually	Annually	Triennially	Not Sampled	Notes
Monitoring Wells						
409			X			Usally dry; sample if water is present
675			X			
678			X			

Sampling conducted in November

Constituent Sampling Breakdown

Site	Ambrosia Lake				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	2	0			
Field Measurements					
Alkalinity					
Dissolved Oxygen	X				
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Arsenic	X		0.0001	SW-846 6020	LMM-02
Calcium	X		5	SW-846 6010	LMM-01
Chloride	X		0.5	SW-846 9056	WCH-A-039
Iron					
Lead					
Magnesium	X		5	SW-846 6010	LMM-01
Manganese					
Molybdenum	X		0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X		0.05	EPA 353.1	WCH-A-022
Potassium	X		1	SW-846 6010	LMM-01
Radium-226					
Radium-228					
Selenium	X		0.0001	SW-846 6020	LMM-02
Silica					
Sodium	X		1	SW-846 6010	LMM-01
Strontium					
Sulfate	X		0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	X		10	SM2540 C	WCH-A-033
Total Organic Carbon					
Tritium					
Uranium	X		0.0001	SW-846 6020	LMM-02
U-234, -238					
Vanadium					
Zinc					
Total No. of Analytes	12	0			

Note: All analyte samples are considered unfiltered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

BLU-2014-01

Effective Date: 06/27/2014
Expiration Date: 06/27/2016

Program Directive

Initiated By: Gretchen Baer

Directive Subject: Groundwater Sampling

Directive and Associated Task Changes:
Groundwater sampling at wells S(SG), OBS-3, and HMC-951 will be conducted with high-volume submersible pumps using a high-flow procedure.

- For wells that will yield sufficient water, three casing volumes will be purged. Measurements of field parameters will then be made every ~¼ casing volume until pH, specific conductance, and turbidity have stabilized. Stabilization criteria for these parameters are the same as for a Category I well. There are no maximum flow-rate or water level drawdown requirements. After the stabilization criteria have been met, samples can be collected.
- For low yielding wells, wells will be purged down to the pump intake and sampled when sufficient recovery has occurred. Field parameter stability is not required prior to sampling. A single measurement of field parameters will be made before sampling.

The casing volumes are calculated as:

	S(SG)	OBS-3	HMC-951
Well Inside Diameter (inches)	8.62	5.56	10
Well Depth (feet [ft])	282	358	275
Static Water Level (ft, estimated)	190	180	150
Water Column Height (ft)	92	178	125
One Casing Volume (gallons [gal])	279	225	510
Three Casing Volumes (gal)	***837***	***674***	***1,530***
¼ Casing Volume (gal)	70	56	127

Organization(s) Affected: Environmental Monitoring Operations, Projects/Programs.

Affected Documents: *Sampling and Analysis Plan for the U.S. Department of Energy Office Management Sites* (LMS/PRO/S04351, current version).

Justification:
Wells OBS-3 and S(SG) were constructed with hand-slotted steel casing that has deteriorated over time, causing the slots to close off, which has restricted water flow into the well. This has resulted in stagnant water in the well with prolonged contact with the steel casing. The goal of

this procedure is to purge stagnant water from the casing prior to sampling in order to minimize impacts to groundwater-sample quality caused by the deteriorating steel casing.

Well HMC-951 has steel casing down to the top of the aquifer and is open borehole below the steel casing. The bottom of the well casing is damaged, and sample tubing cannot be extended into the open borehole. Therefore, to obtain a representative sample, the sample pump is set in the casing, and the water column will be purged prior to sampling.

Review and Concurrence:

Richard K. Johnson
2014.06.24 13:52:10
-06'00'

Dick Johnson, Site Lead

Linda S. Tegelman
2014.06.25 08:55:01 -06'00'

Linda Tegelman, Quality and Performance Assurance

Manager Approval:

Sam Campbell

Sam Campbell
2014.06.25 10:19:02
-06'00'

Sam Campbell, Environmental Monitoring Operations

Electronic Distribution:
Record File ADM 130.10

Sampling Frequencies for Locations at Bluewater, New Mexico

Location ID	Quarterly	Semiannually	Annually	Triennially	Not Sampled	Notes
Monitoring Wells						
E(M)		X				PCBs in November only
Y2(M)		X				PCBs in November only
F(M)		X				PCBs in November only
T(M)		X				PCBs in November only
X(M)		X				
L(SG)		X				
S(SG)		X				
OBS-3		X				
I(SG)		X				
11(SG)		X				
13(SG)		X				
14(SG)		X				
15(SG)		X				
16(SG)		X				
18(SG)		X				
20(M)		X				
21(M)		X				
22(M)		X				
23(M)		X				May be dry
Private Wells						
HMC-951		X				

Sampling conducted in May and November.

Constituent Sampling Breakdown

Site	Bluewater				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	21	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)					
Arsenic	X		0.0001	SW-846 6020	LMM-02
Bicarbonate					
Calcium	X		5	SW-846 6010	LMM-01
Carbonate					
Chloride	X		0.5	SW-846 9056	WCH-A-039
Lead					
Magnesium	X		5	SW-846 6010	LMM-01
Manganese					
Molybdenum	X		0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X		0.05	EPA 353.1	WCH-A-022
Oxygen-18					
PCBs	E(M), Y2(M), F(M), T(M), and X(M) only (November only)		0.0005	SW-846 8082	PEP-A-006
Potassium	X		1	SW-846 6010	LMM-01
Radium-226					
Radium-228					
Selenium	X		0.0001	SW-846 6020	LMM-02
Silica					
Sodium	X		1	SW-846 6010	LMM-01
Strontium					
Sulfate	X		0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	X		10	SM2540 C	WCH-A-033
Tritium			3 pCi/L	HASL 300 H-02-RC	LMR-17
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	13	0			

Note: All analyte samples are considered unfiltered 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 Burrell, Pennsylvania

Location ID	Quarterly	Semiannually	Annually	Biennially	Every 5 Years	Notes
Monitoring Wells						
420					X	Next in October 2018
422					X	Next in October 2018
423					X	Next in October 2018
424					X	Next in October 2018
520					X	Next in October 2018
522					X	Next in October 2018
523					X	Next in October 2018
524					X	Next in October 2018
Surface Locations						
611					X	SEEP on cell; next in 10/18
612					X	SEEP on cell; next in 10/18

Sampling conducted in October
Based on LTSP dated April 2000

Constituent Sampling Breakdown

Site	**Burrell**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
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	X			
Temperature	X	X			
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Calcium	X	X	5	SW-846 6010	LMM-02
Chloride	X	X	0.5	SW-846 9056	MIS-A-039
Chromium					
Gross Alpha					
Gross Beta					
Iron	X	X	0.05	SW-846 6020	LMM-02
Lead	X	X	0.002	SW-846 6020	LMM-02
Magnesium	X	X	5	SW-846 6010	LMM-01
Manganese	X	X	0.005	SW-846 6010	LMM-01
Molybdenum	X	X	0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	0.05	EPA 353.1	WCH-A-022
Potassium	X	X	1	SW-846 6010	LMM-01
Radium-226					
Radium-228					
Selenium	X	X	0.0001	SW-846 6020	LMM-02
Silica					
Sodium	X	X	1	SW-846 6010	LMM-01
Strontium					
Sulfate	X	X	0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	X	X	10	SM2540 C	WCH-A-033
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	14	14			

Note: 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	Every 5 Years	Not Sampled	Notes
Monitoring Wells						
0406A				X		Next in 10/2018
0412				X		Next in 10/2018
0413				X		Next in 10/2018
0414B				X		Next in 10/2018
0424				X		Next in 10/2018
Surface Locations						
0602				X		Next in 10/2018

Sampling conducted in October
Based on LTSP dated 2008

Constituent Sampling Breakdown

Site	**Canonsburg**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	5	1			
Field Measurements					
Alkalinity					
Dissolved Oxygen	X	X			
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)					
Calcium					
Chloride					
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	1	1			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

CNT-2013-02

Effective Date: 11/01/2013
Expiration Date: 11/01/2015

Program Directive

Initiated By: Rick Findlay

Directive Subject: High-Flow Sampling

Directive and Associated Task Changes:

Samples will be collected from wells MV-6, UC-1-P-1SRC, and HTH-2 using the dedicated high-flow submersible electric pumps after the minimum purge volume has been removed, and thereafter field parameters have stabilized (i.e., pH within 0.2 units and conductivity/temperature within 10% over final three readings and turbidity less than 10 NTUs). The minimum purge volume is the volume of water contained in the pump riser-pipe plus the total volume of the water column in the well. As shown in the table, calculated minimum purge volumes are 749, 324, and 1,748 gallons for wells MV-6, UC-1-P-1SRC, and HTH-2, respectively. A least three field parameter measurements will be recorded a minimum of every 50 gallons after the minimum purge volume is removed. Purge times for wells MV-6, UC-1-P-1SRC, and HTH-2 are expected to be approximately 65, 30, and 30 minutes, respectively, based on historical pump flow-rates.

Well ID	Interval Description	Depth Interval (ft)	Length (ft)	Inside Diameter (in)	Conversion Factor (gal/ft)	Well Casing Volume (gal)
MV-6	Pump riser pipe above water	0–315	315	1.5	0.092	29
	Water column in well	315–1,021	706	5	1.020	720
MV-6 Total Minimum Purge Volume (gallons)						**749**
UC-1-P-1SRC	Pump riser pipe above water	0–282	282	1.5	0.092	26
	Water column in well	282–574	292	5	1.020	298
UC-1-P-1SRC Total Minimum Purge Volume (gallons)						**324**
HTH-2	Pump riser pipe above water	0–556	556	3.5	0.500	278
	Water column in well	556–1,001	445	9	3.305	1,471
HTH-2 Total Minimum Purge Volume (gallons)						**1,748**

Organization(s) Affected: Environmental Monitoring Operations, Projects/Programs.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (SAP) (LMS/PRO/S04351, current version).

Justification: The current dedicated pump configuration is designed for high-flow sampling, and the SAP does not address high-flow sampling. Use of the specific purging and sampling methods will continue because it is consistent with the sample collection process historically used at the site.

Review and Concurrence:

Richard Hutton Rick Hutton
2013.11.04 08:45:11 -07'00'

Rick Hutton, Nevada Off-Sites Project Manager

Richard C. Findlay Rick C. Findlay
2013.11.04 08:35:42 -07'00'

Rick Findlay, Project Technical Lead

Linda S. Tegelman
2013.11.04 08:27:16 -07'00'

Linda Tegelman, Quality and Performance Assurance

Manager Approval:

Sam Campbell Sam Campbell
2013.11.04 09:45:23 -07'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
rc-nevada (ADM 130.10)
Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites

Sampling Frequencies for Locations at Central Nevada Test Area, Nevada

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
MV-1			X			
MV-2			X			
MV-3			X			
HTH-1RC			X			
HTH-2			X			
UC-1-P-1SRC			X			
MV-4			X			
MV-5			X			
MV-6			X			

Sampling conducted in October

Constituent Sampling Breakdown

Site	Central Nevada Test Area					Laboratory	
Analyte	Groundwater	Surface Water	Required Detection Limit (mg/L)	Analytical Method	Line Item Code	ALS	University of Arizona
Approx. No. Samples/yr	8	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)							
Bromide							
Calcium							
Chloride							
Chromium							
Gamma Spec							
Gross Alpha							
Gross Beta							
Iodine-129							
Iron							
Lead							
Magnesium							
Manganese							
Molybdenum							
Nickel							
Nitrate + Nitrite as N (NO3+NO2)-N							
Potassium							
Selenium							
Silica							
Sodium							
Strontium							
Sulfate							
Sulfide							
Tritium	X		400 pCi/L	Liquid Scintillation	LSC-A-001	X	
Tritium, enriched							
Uranium							
Vanadium							
Zinc							
Total No. of Analytes	1	0					

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

DUD-2015-01

Effective Date: 10/03/2014
Expiration Date: 10/03/2017

Program Directive

Initiated By: Sam Campbell

Directive Subject: Radon Monitoring at the Durango Disposal Site

Directive and Associated Task Changes: Radon will be monitored at the Durango Disposal Site according to the *Sampling and Analysis Plan for Radon Monitoring at the Durango, Colorado, Disposal Site* (LMS/DUD/S06204, April 2010).

Organization(s) Affected: Environmental Monitoring Operations, Projects/Programs

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (SAP) (LMS/PRO/S04351, current version).

Justification: The SAP states that air monitoring will be specified in a Program Directive located in the site-specific tabbed section in Appendix D.

Review and Concurrence:

David E. Miller
2014.10.20 12:51:04 -06'00'

David Miller, Site Lead

Linda S. Tegelman
2014.10.20 11:19:16 -06'00'

Linda Tegelman, Quality and Performance Assurance

Manager Approval:

Sam Campbell
Sam Campbell
2014.10.20 10:54:40 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File ADM 130.10

LMS/DUD/S06204

Durango Beneficial Reuse Project

Sampling and Analysis Plan for Radon Monitoring at the Durango, Colorado, Disposal Site

April 2010

U.S. DEPARTMENT OF ENERGY | Legacy Management

LMS/DUD/S06204

Durango Beneficial Reuse Project

Sampling and Analysis Plan for Radon Monitoring at the Durango, Colorado, Disposal Site

April 2010

Contents

Figure

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1.0 Introduction

This Sampling and Analysis Plan describes the procedure that the U.S. Department of Energy (DOE) will follow to conduct radon monitoring at the Durango, CO, Disposal Site. The purpose of the monitoring is to evaluate radon levels before and during a beneficial reuse project at the Durango disposal cell.

1.1 Location

The Durango disposal site is located near the north edge of the San Juan Basin, above the west end of Bodo Canyon. The disposal cell is irregularly shaped and measures approximately 2,400 feet on its long axis by 1,300 feet across, including a surrounding rock apron (see Figure 1). The cell contains about 2.5 million cubic yards of contaminated materials, including tailings, building debris from demolished mill structures, and material from contaminated vicinity properties. The total activity of the contaminated materials within the cell is estimated to be 1,400 curies of radium-226.

1.2 Climate

The Durango area has a semiarid mountain climate. Total annual precipitation is approximately 20 inches, and the annual average temperature is approximately 47 °F. The wettest months are August through October, and June is the driest month. The winters are cold with an annual average snowfall of approximately 68 inches.

Annually, the prevailing wind at the Durango disposal site is from the north, although winds from the southwest and west occur in the spring. Wind speed averages about 6 miles per hour (mph) annually. Spring is the windy season with averages as high as 7.9 mph.

2.0 Objectives

The objective of this Sampling and Analysis Plan is to describe the procedure that DOE will follow to measure radon concentrations at the Durango disposal site perimeter and at off-site background locations. Information gathered from this monitoring will be used to (1) compare radon levels along the site perimeter to the background concentration, (2) track radon levels along the site perimeter over time, and (3) provide a baseline to evaluate the impact of future site activities on radon concentrations.

3.0 Strategy

Because the most frequent wind direction is from the north, and west-southwest winds occur in the spring, the primary point of exposure would be in the downwind direction, south-southeast. A total of nine monitoring locations (DUR-1 through DUR-9) will be established. Two upwind perimeter locations (DUR-1 and DUR-2) will be placed along the west and north perimeter fences. Four downwind perimeter locations (DUR-3 through DUR-6) will be placed on the east and south fences at central locations and in line with the southeast and south outflows (drainage channels). Background locations (DUR-7 through DUR-9) will be placed northwest of the site off County Road 212.

As shown in Figure 1, the monitoring stations will be located on all four sides of the site centrally in the fence line, and two additional stations will be placed on the downwind sides of the site near the outflows. The background monitoring stations will be established upwind of the site, at a sufficient distance from the disposal cell and in an area with physiographic characteristics similar to those of the site. The background locations have not yet been identified, but will be determined prior to the start of monitoring, pending access agreements with the land owners.

4.0 Field Sampling Procedures

4.1 Radon Monitoring

Radon will be measured by using a single Landauer Radtrak alpha-sensitive detector (radon cup) placed in a protective housing at each sampling location. The housing is attached to a fence line or to a metal T-post. The radon cups will be stored and used in areas that do not exceed 160 °F, and sealed in protective film-foil bags until use. The radon cups will not be placed in duplicate.

DOE contractor personnel will establish monitoring locations, change out the radon cups quarterly, and return the exposed cups to the analytical laboratory. Radon monitoring will continue for the duration of the photovoltaic project.

4.2 Sample Identification and Handling Procedures

Radon cups are identified by a pre-assigned, unique number printed on the detector. The cups will also be identified with a site location number DUR-1 through DUR-9.

The radon cups will remain in the manufactures radon proof foil-film bags until use. The protective canisters will be attached to the fence line (5 foot steel T-post for DUR-7 through DUR-9) with steel hose clamps at 1 meter above ground level. The cups will be removed from the protective bag, inspected for damage, and fastened to the bottom of the clear cup portion of the protective canister. The clear cup is then installed inside the protective canister.

Approximately every 90 days, sampling personnel will remove exposed radon cups from the monitoring points and replace them with unexposed cups. After the exposed radon cup is removed from its protective housing, an adhesive metal foil will be immediately placed over the open portion of the radon cup, and the cups will be stored in a radon-free chamber to prevent further exposure. After the exposed radon cups have been collected and sealed, sampling personnel will pack the monitors according to the vendor’s instructions and ship the monitors to the laboratory by express service.

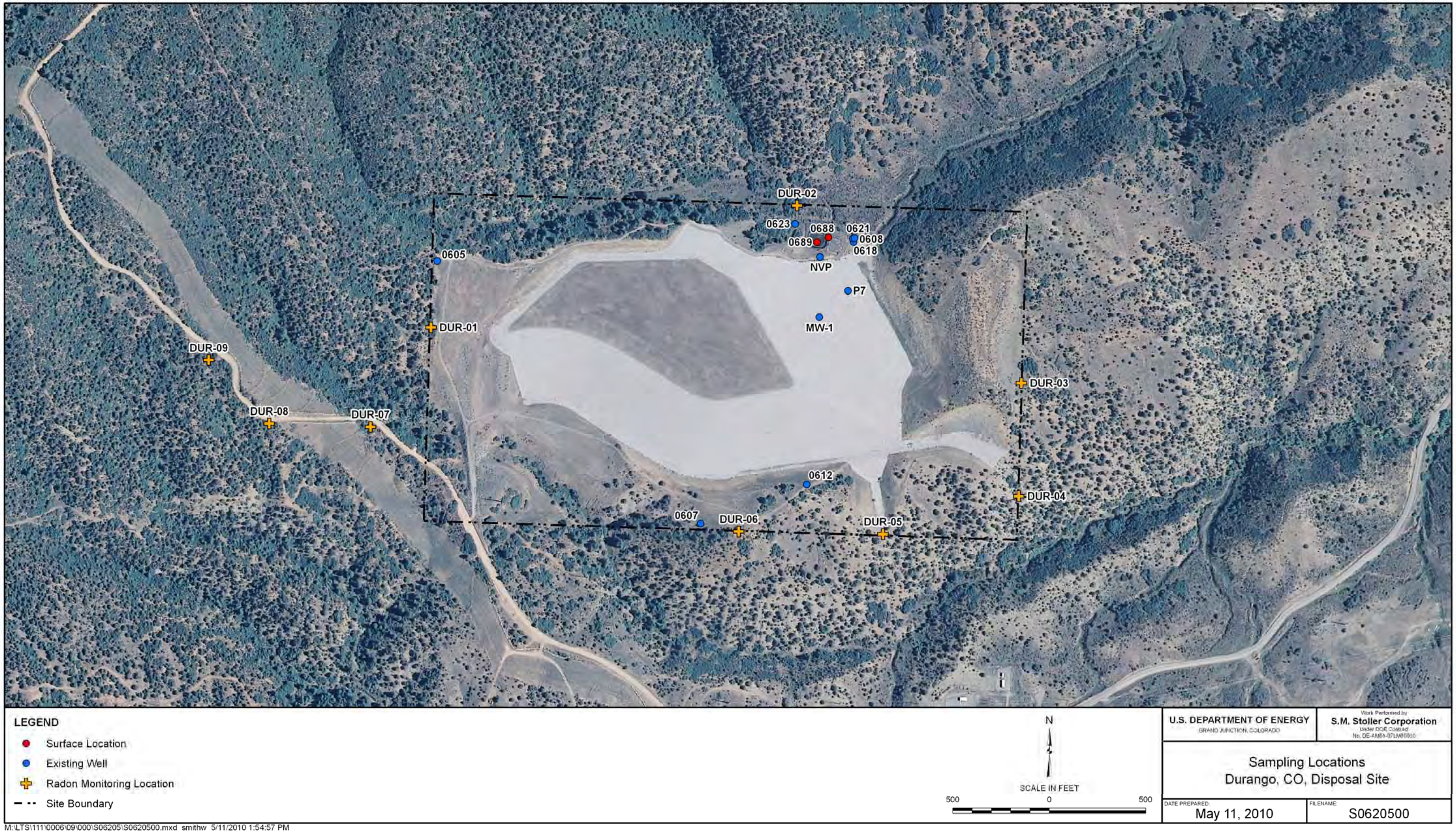

Figure 1. Sampling Locations, Durango, Colorado, Site

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Sampling personnel will maintain a sample log to document information relevant to the monitoring activities, including detector number, location identifier, date of placement, duration of exposure, date of removal, date of shipment, and relevant comments.

4.3 Analytical Procedures

Landauer, Inc. will analyze the exposed radon cups for alpha particle emissions using computer assisted image analysis equipment. Within 7 to 10 days after receiving the cup, Landauer will send an analytical report of the radon gas measurement in picocuries per liter of air.

5.0 Data Review and Reporting

Data will be tabulated quarterly and compared to the applicable standard for the duration of the project. The Legacy Management Support contractor will submit a report to DOE at the conclusion of the monitoring period.

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U.S. Department of Energy Office of Legacy Management

DUR-2014-01

Effective Date: 12/09/2013
Expiration Date: 09/30/2016

Program Directive

Initiated By: Sam Campbell

Directive Subject: Sampling of Monitoring Well 0879

Directive and Associated Task Changes: Monitoring well 0879 will be purged and sampled using a high-flow purging protocol. Samples will be collected three casing volumes have been purged followed by stabilization of field parameters. The pump intake will be placed near the top of the water column during purging and sampling. Measurements of pH, specific conductance, and turbidity will be made approximately every ¼ casing volume after three casing volumes have been removed; stabilization criterion for these parameters is the same as for a Category I well. There are no maximum flow-rate or water level drawdown requirements.

Organization(s) Affected: Environmental Monitoring Operations and Programs and Projects.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (LMS/PLN/S04351-current version).

Justification: A low-flow sampling technique requires that the pump intake be placed in the screened interval of the well. Construction activities in the vicinity of monitoring well 0879 caused debris to fall in the well, which wedged the dedicated bladder pump in place. After the bladder pump quit working, there was no way to remove the bladder pump and to set another pump with the intake into the screened interval; therefore, a high-flow purging technique must be used to remove stagnant water from the well.

Review and Concurrence:

David Miller, Site Lead

Linda Tegelman, Quality and Performance Assurance

Manager Approval:

Sam Campbell
Sam Campbell
2013.12.09 12:47:14 -07'00'

Sam Campbell, Environmental Monitoring Operations

Electronic Distribution:

Distribution: rc-gand.junction (ADM 130.10)
Sampling and Analysis Plan for U. S. DOE LM Sites

Sampling Frequencies for Locations at Durango, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
DUR01 Mill Tailings						
612			X			
617			X			
622			6/14 only			One-time only
629			6/14 only			One-time only
630			X			
631			X			Download datalogger
633			X			Download datalogger
634			X			
635			X			
857			6/14 only			One-time only
859					X	Download datalogger
863			X			Download datalogger
866			6/14 only			One-time only
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	Unsafe
678			X			RIVER; new location; replaces 0656

Groundwater sampling conducted in June; surface water sampling conducted in September.

Constituent Sampling Breakdown

Site	Durango				
Analyte	Groundwater	Surface Water	Required Detection Limit (mg/L)	Analytical Method	Line Item Code
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)					
Cadmium	0612 & 0863 only	X	0.001	SW-846 6020	LMM-02
Calcium	DUR03 only		5	SW-846 6010	LMM-01
Chloride	DUR03 only		0.5	SW-846 9056	MIS-A-039
Chromium					
Gross Alpha					
Gross Beta					
Iron	DUR03 only		0.1	SW-846 6020	LMM-01
Lead					
Magnesium	DUR03 only		5	SW-846 6010	LMM-01
Manganese	All Mill Tailings Areas and Bodo Canyon locations		0.005	SW-846 6010	LMM-01
Molybdenum	All Mill Tailings Areas and Bodo Canyon locations	X	0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium	DUR03 only		1	SW-846 6010	LMM-01
Radium-226					
Radium-228					
Selenium	X	X	0.0001	SW-846 6020	LMM-02
Silica					
Sodium	DUR03 only		1	SW-846 6010	LMM-01
Strontium					
Sulfate	All Mill Tailings Areas and Bodo Canyon locations		0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	DUR03 only		10	SM2540 C	WCH-A-033
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	13	4			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Falls City, Texas

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
709			X			
858			X			
862			X			
880			X			
886			X			
891			X			**Collect duplicate from this well**
906			X			
908			X			
916			X			
921			X			
924			X			
963			X			

Annual sampling conducted in April
Based on LTSP dated March 2008

Constituent Sampling Breakdown

Site	**Falls City**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	12	0			
Field Measurements					
Alkalinity					
Dissolved Oxygen	X				
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Calcium					
Chloride					
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	1	0			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

GSB-2015-01

Effective Date: 10/31/2014
Expiration Date: 10/31/2017

Program Directive

Initiated By: Sam Campbell

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: Environmental Monitoring Operations, Projects/Programs

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (SAP) (LMS/PRO/S04351, current version).

Justification: Procedures for sampling natural gas are not addressed in the SAP. This Program Directive will be used to guide sample collection.

Review and Concurrence:

Rick Hutton
Digitally signed by Rick Hutton
DN: c=us, o=u.s. government, ou=department of energy, ou=Energy IT Services, ou=Legacy Management, ou=People, cn=Rick Hutton
Date: 2014.11.17 14:25:03 -07'00'

Rick Hutton, Nevada Off-Sites Project Manager

J.E. Price
Jeff Price
2014.11.04 08:32:28 -07'00'

Jeff Price, Site Lead

Millie J. Birrenbach
2014.11.13 12:40:04
-07'00'

Millie Birrenbach, Quality and Performance Assurance

Manager Approval:

Sam Campbell
Digitally signed by Sam Campbell
DN: c=us, o=u.s. government, ou=department of energy, ou=Energy IT Services, ou=Legacy Management, ou=People, cn=Sam Campbell
Date: 2014.11.13 14:51:28 -07'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File ADM 130.10

High Pressure Natural Gas Sampling Using a Propane Tank

Introduction and Purpose

The following procedure will be used to collect samples from privately owned natural gas production wells for analysis of carbon-14 and tritium. The work will be conducted at several natural gas production facilities near the Rulison, Colorado, Site; Rio Blanco, Colorado, Site; and Gasbuggy, New Mexico, Site. Site elevations vary from approximately 6,000 feet (ft) to 9,500 ft.

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 and incorporates contractor health and safety integrated safety management system control measures.

Health and Safety

See Table 1, “Tasks, Analyzed Hazards, and Control Measures.”

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. Additional tools include traffic cones or pin flags, and a non-sparking wrench.

Personal protective equipment (PPE) required includes a fire retardant shirt, hardhat, safety glasses, and sturdy work shoes. Hearing protection, leather work gloves**,** and nitrile gloves may also be required as determined by individual tasks and hazards. Additional PPE or safety training may be required by some well field operators.

The propane tank is provided by Isotech Laboratories and is purged and evacuated prior to delivery.

Caution

All tools must be non-sparking.

Sampling team members must wear a 4-gas personal detector at all times. *The “high alarm” must be set at 5% (full scale) of the lower explosive limit (LEL) for methane. Check handheld monitors for methane levels; if levels exceed LEL minimums follow well field operator’s instructions for moving away from the site.*

Prerequisite Actions

Hazard Classification per National Electrical Code, NFPA 70, Ch. 5 Article 500: Class 1 (flammable methane gas, hazardous by nature and ignitable), Division 1 (methane is present). Request that the well field operator conduct an initial sweep of the dog house and sampling area to monitor gas levels. If an explosive condition exists, follow the operator's requirements and leave the area immediately.

Sampling team members must "bump check" the 4-gas personal detectors at least once a week.

Procedure

Gas samples will be collected from pressurized well head collection systems, through a sampling regulator and tubing system, into a small propane tank. Samples will be taken from an existing sampling port; the port may be inside or outside the operator's "dog house." The well field operator will determine the location of the gas sampling port to be used.

[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] Inspect pressure fittings, regulators, and hoses for signs of wear, cracks, and breakage. Ensure sampling hoses, fittings, and pressure reducing regulators are rated to handle the gas delivery pressures at the sampling port.

[3] Verify acceptable line pressure from an inline pressure gauge or the LCD monitor readouts, or install a high pressure gauge (5,000 psi) at the sampling port. Ensure the port is free of debris prior to connection. Wear protective gloves as needed. Use Teflon tape at all threaded connections.

[4] **IF** the pressure is greater than 2,500 psi, **THEN** do not attempt to sample from that location.

[5] If the pressure is less than 2,500 psi, install the inlet side of the pressure regulator directly to the sample port via a properly sized threaded bushing. Use the spark-free bronze wrench to make this and all other connections.

Caution

Do not *use any flame or carry any device capable of creating a spark (e.g., cell phone) when connecting sampling hardware. Keep such items inside the vehicle. Park and turn off the vehicle at least 50 ft away from the sampling port or where the well field operator directs.*

Do not *operate any valves, chokes, or switches unless specifically requested by the well field operator. No smoking anywhere on the well field operator's site. Only non-sparking tools shall be used.*

[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 counterclockwise to tighten.* ***Do not*** *over tighten.*

[7] Open the control valve at the sampling port.

[8] Adjust the outlet pressure on the pressure regulator to 20 psi.

[9] Place bypass vent line exhaust end downwind from sampling assembly. When purging sample lines use a 25-ft extension line with the discharge located downwind of samplers.

[10] Establish a C1D2 exclusion zone as a 15-ft-radius exclusion zone around the vent line discharge point using pin flags or cones. When an operator is venting natural gas from the well or piping system, stop sampling activities and move at least 100 ft upwind from the discharge point until venting is complete.

[11] Open the bypass valve on the propane tank for approximately 10 seconds to purge the air space in the pressure regulator and flexible tubing; close the bypass valve.

[12] 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.

[13] 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).

[14] Close the valve on the propane tank. Do not over tighten.

[15] Close the control valve at the sample port.

[16] Open the bypass valve on the propane tank to release the pressure and then close the bypass valve.

[17] Disconnect the flexible tubing/pressure regulator assembly.

[18] 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. Contact a Certified Shipper to complete and sign the required documentation and oversee the shipment. The gas collection tank must be secure and upright when transporting the sampling container.

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 10/10/2011.

Figure 1. Flexible Tubing/Pressure Regulator Assembly and Propane Tank

Table 1. Tasks, Analyzed Hazards, and Control Measures

Task	Hazard	Controls
Driving to and from the gas well sites	1) Slippage and loss of control due to steep grades and wet road conditions	1) Conform to the well field operator's speed limit requirements. If road conditions make driving unsafe, postpone the sampling event. Use 4WD vehicle and carry tire chains, tow-chain, and shovel.
	2) Vehicle accidents	2) When approaching sharp corners slow down, move to the right, and pay attention to driving conditions. Pull over to allow oncoming traffic to pass if road is too narrow. Keep vehicles a safe distance from drop offs. The driver will not use two-way communication devices while vehicle is in motion. Be very alert to the potential for wildlife or livestock on the roads.
	3) Driving hazards caused by well field operator activities	3) Follow the well field operator to the designated parking area. Follow their instructions for parking. When leaving or backing up, have a spotter assist in backing out of parking space if there is other vehicle traffic or equipment in the area. Obey all well field operator restrictions.
Hazards common to all site activities	1) Slips, trips, falls	1) Keep work area uncluttered; remove tripping hazards if possible. Drill rigs, platforms and associated equipment have many tripping hazards; be cautious, use hand rails, especially on stairways when carrying sampling equipment and samples; pay attention to surroundings. Use extra caution on stairways and platforms when ice, snow, or muddy conditions exist.
	2) Head, eye, or foot injury, burns	2) PPE shall be worn in accordance with the well field operators' requirements; at a minimum wear hard hat, eye protection, sturdy work boots, and fire retardant shirt at all times outside the vehicle. Hearing protection and nitrile gloves may be required during sample collection. Adhere to noise area postings and procedure requirements.
	3) Injury to hands	3) Keep hands and fingers out of pinch points and crush areas. Wear leather work gloves if there is a potential for cuts, abrasions, blisters etc. (e.g., installing chains on the vehicle).
	4) Inclement weather and lightning strikes	4) Seek shelter when weather conditions present a threat to safe working conditions. Use the 30/30 rule to assess a threat. Cease field activities when lightning is within 6 miles (30 seconds between flash and bang). Field activities can resume 30 minutes after the last audible thunder. Suspend work if strong winds cause a hazard.
	5) Biological hazards—snakes, insects, and bears	5) Remain alert for snakes and avoid them. Do not put hands into dark or obscured areas. Remain alert for bears—if a bear enters the work area, get inside a vehicle or the dog house as quickly as possible.
	6) Explosion caused by spark or fire in the work area	6) Samplers must not use any flame or carry any device capable of creating a spark (e.g., cell phone) when connecting sampling hardware. Keep such items inside the vehicle. Keep vehicle 50 ft away from sampling port or where well field operator directs. Keep vehicle ignition off during gas sampling activities. Do not operate any valves, chokes, or switches unless specifically requested by the well field operator. No smoking anywhere on the well field operators' site. Only non-sparking tools shall be used.
	7) Explosive atmosphere within work area	7) Request that the well field operator conduct an initial sweep of the dog house and sampling area to monitor gas levels. If an explosive condition exists, follow the well field operator's requirements and leave the area immediately. Sampling team members will wear a 4-gas personal detector at all times while sampling. The high alarm should be set at 5% (full scale) of the lower explosive limit (LEL) for methane. When purging sample lines use a 25-foot extension line with the discharge located downwind of the samplers. Establish a C1D2 exclusion zone as a 15-foot radius around the purging hose discharge point. Cones or pin flags should be used to define the C1D2 zone. When the well field operator is venting natural gas from well or piping system, stop sampling activities and move at least 100 ft upwind from the discharge point until venting is complete.

Task	Hazard	Controls
Gas Sample Collection	Methane release due to equipment failure such as (1) blockage of sampling regulator causing sampling line break, or (2) regulator damage or breakage from higher than anticipated inline pressure	Prior to sampling, inspect pressure fittings, regulators, and hoses for signs of wear, cracks, and breakage. Ensure sampling hoses, fittings, and pressure reducing regulators are rated to handle the gas delivery pressures at the sampling port. Verify acceptable pressures at a pressure gauge or the LCD monitor readout before sample collection in accordance Step 2 of the "High Pressure Natural Gas Sampling Procedure." The well field operator will inform the sampling team which sample port to use for gas collection. The sampling team will check to make sure the port is free of debris prior to connection.
	Explosive atmosphere created during sampling	When purging sample lines use a 25-ft extension line with the discharge located downwind of samplers. Establish a C1D1 exclusion zone as a 15-ft radius around the discharge point. Cones or pin flags should be used to define the C1D1 zone. When an operator is venting natural gas from a well or piping system, stop sampling activities and move at least 100 ft upwind from the discharge point until venting is complete. Hazard Classification per National Electrical Code, NFPA 70, Ch. 5 Art. 500: Class 1 (flammable methane gas, hazardous by nature and ignitable), Division 1 (methane is present). Check handheld monitors for methane levels; if levels exceed LEL minimums, follow operators' instructions for moving away from the site. Samplers must not use any flame or carry any device capable of creating a spark (e.g., cell phone) when connecting sampling hardware. Keep such items inside the vehicle. Keep vehicle 50 ft away from sampling port or where operator directs. Keep vehicle ignition off during gas sampling activities. Do not operate any valves, chokes, or switches unless specifically requested by the well field operator. No smoking anywhere on the well field operators' site. Only non-sparking tools shall be used.
Transporting Natural Gas Samples	Explosive atmosphere created by damage to cylinder valve during transport, causing gas leak	When transporting a sampling container, the gas collection tank must be secure and upright.

Sampling Frequencies for Locations at Gasbuggy, New Mexico

Location ID	Quarterly	Semiannually	Annually	Every 5 Years	Not Sampled	Notes
Monitoring Wells						
Jicarilla Well 1				X		Windmill; next in 6/2014
Lower Burro Canyon				X		Windmill; next in 6/2014
Well 30.3.32.343 (N)				X		Windmill; next in 6/2014
Well 28.3.33.233 (S)				X		Windmill; next in 6/2014
Windmill #2				X		Windmill; next in 6/2014
Surface Locations						
Bubbling Springs				X		Next in 6/2014
Cave Springs				X		Next in 6/2014
Cedar Springs				X		Next in 6/2014
La Jara Creek				X		Next in 6/2014
Pnd N WL 30.3.32.343				X		Next in 6/2014
Gas and Produced Water Locations						
30-039-21744			X			
30-039-21620			X			
30-039-29988			X			
30-039-30161			X			
30-039-21743			X			
30-039-07525			X			
30-039-21647			X			

Annual GAS sampling conducted in June; water sampling every 5 years

Constituent Sampling Breakdown

Site	**Gasbuggy**						
Analyte	**Groundwater**	**Surface Water**	**Gas**	**Produced Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	5	5	7	7			
Field Measurements							
Alkalinity							
Dissolved Oxygen	X	X					
Redox Potential							
pH	X	X					
Specific Conductance	X	X					
Turbidity	X						
Temperature	X	X					
Laboratory Measurements							
Aluminum							
Ammonia as N (NH3-N)							
Calcium							
Carbon-14			X		NA	Accelerator Mass Spectrometry	LMR-16
Chloride							
Chromium							
Gamma Spec	X			X	10 pCi/L	Gamma Spectrometry	GAM-A-001
Gross Alpha				X	2 pCi/L	EPA 900.0	GPC-A-001
Gross Beta				X	4 pCi/L	EPA 900.0	GPC-A-001
Iron							
Lead							
Magnesium							
Manganese							
Molybdenum							
Nickel							
Nickel-63							
Nitrate + Nitrite as N (NO3+NO2)-N							
Potassium							
Radium-226							
Radium-228							
Selenium							
Silica							
Sodium							
Strontium							
Total Dissolved Solids							
Total Organic Carbon							
Tritium	X	X	X	X	400 pCi/L	Liquid Scintillation	LSC-A-001
Uranium							
Vanadium							
Zinc							
Total No. of Analytes	2	1	2	4			

Note: 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
Monitoring Wells						
LRL-7					X	Bladder pump; not sampled per R. Findlay, 1/11/12
USGS-1			X			Electric pump
USGS-4			X			Bladder pump
USGS-8			X			Bladder pump

Annual sampling conducted in January

Constituent Sampling Breakdown

Site	**Gnome-Coach**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	3	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)					
Calcium					
Chloride					
Chromium					
Gamma Spec	X		10 pCi/L	Gamma Spectrometry	GAM-A-001
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium-90	X		1 pCi/L	Gas Proportional Counter	GPC-A-009
Sulfate					
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Tritium	X		400 pCi/L	Liquid Scintillation	LSC-A-001
Enriched Tritium	USGS-1 only		10 pCi/L	Liquid Scintillation	LMR-15
Uranium					
Vanadium					
Zinc					
Total No. of Analytes	4	0			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Grand Junction Disposal Site, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
731			X			Download data logger
732			X			Download data logger
733			X			Download data logger

Sampling conducted in August

Constituent Sampling Breakdown

Site	**Grand Junction Disposal**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
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)					
Calcium					
Chloride					
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum	X		0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X		0.05	EPA 353.1	WCH-A-022
PCBs	X		0.0005	SW-846 8082	PEP-A-006
Potassium					
Radium-226					
Radium-228					
Selenium	X		0.0001	SW-846 6020	LMM-02
Silica					
Sodium					
Strontium					
Sulfate	X		0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	X		10	SM2540 C	WCH-A-033
Total Organic Carbon					
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium	X		0.0003	SW-846 6020	LMM-02
Zinc					
Total No. of Analytes	8	0			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Grand Junction Office Site, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring 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	Grand Junction Office				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	7	6			
Field Measurements					
Alkalinity					
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)					
Calcium					
Chloride					
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese	X		0.005	SW-846 6010	LMM-01
Molybdenum	X	X	0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium	X	X	0.0001	SW-846 6020	LMM-02
Silica					
Sodium					
Strontium					
Sulfate	X	X	0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	5	4			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Grand Junction Processing Site, Colorado

Location ID	Quarterly	Semiannually	Annually	Every 5 Years	Not Sampled	Notes
Monitoring Wells						
590				X		Download data logger; next sampling in 1/2016
748				X		Next sampling in 1/2016
1001				X		Download data logger; next sampling in 1/2016
1014					X	In Parkway; safety hazard
1036				X		Next sampling in 1/2016
Surface Locations						
423				X		Next sampling in 1/2016
427				X		Next sampling in 1/2016

Sampling conducted in January

Constituent Sampling Breakdown

Site	**Grand Junction Processing**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
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	0.1	EPA 350.1	WCH-A-005
Calcium					
Chloride					
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum	X	X	0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids	X	X	10	SM2540 C	WCH-A-033
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	4	4			

Note: 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
Monitoring Wells						
171			X			Telemetry
173			X			Telemetry
176			X			Telemetry
179			X			Telemetry
180					X	Telemetry
181			X			
182			X			Telemetry
183					X	Telemetry; WL only
184			X			Telemetry;
185			X			Telemetry
188			X			
189			X			
192			X			
194			X			
582					X	Telemetry; WL only
588			X			Telemetry
707			X			
813			X			Telemetry
817					X	Telemetry; WL only
Surface Locations						
801			X			
846			X			
847			X			

Annual sampling conducted in June

Site-wide water levels. Do water levels first prior to sampling. Record exact time that water levels are measured.

Constituent Sampling Breakdown

Site	**Green River**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	15	3			
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)	X	X	0.1	EPA 350.1	WCH-A-005
Arsenic	X	X	0.0001	SW-846 6020	LMM-02
Calcium					
Chloride					
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	0.05	EPA 353.1	WCH-A-022
Potassium					
Radium-226					
Radium-228					
Selenium	X	X	0.0001	SW-846 6020	LMM-02
Silica					
Sodium					
Strontium					
Sulfate	X	X	0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	6	6			

Note: 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
Monitoring Wells						
GUN01						
002			X			
005			X			
006			X			
012R			X			
013			X			
062			X			
063			X			
064			X			
065			X			
066			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 2016
630					X	WLs ONLY; next in 2016
634					X	WLs ONLY; next in 2016
663					X	WLs ONLY; next in 2016
709					X	WLs ONLY; next in 2016
710					X	WLs ONLY; next in 2016
712					X	WLs ONLY; next in 2016
714					X	WLs ONLY; next in 2016
715					X	WLs ONLY; next in 2016
716				X after 5/15		BKGD; next in 2016
720				X after 5/15		POC; next in 2016
721				X after 5/15		POC; next in 2016
722				X after 5/15		POC; next in 2016
723				X after 5/15		POC; next in 2016
724				X after 5/15		POC; next in 2016
725				X after 5/15		POC; next in 2016

Sampling Frequencies for Locations at Gunnison, Colorado

Location ID	Quarterly	Semiannually	Annually	Every 5 years	Not Sampled	Notes
Surface Locations						
GUN01						
248			X			
250			X			
777			X			
780			X			
792			X			
795			X			
Domestic Wells						
GUN01						
476			X			
477			X			
478			X			
667			X			
683			X			

GUN01 (Processing site) Sampling conducted in April

GUN08 (Disposal site) sampling must not be conducted before May 15th due to CDOW requirements regarding access to this site during Sage Grouse mating.

Constituent Sampling Breakdown

	Gunnison					
Analyte	**Groundwater**		**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	33 (41 every 5th year)		6			
Field Measurements						
Alkalinity						
Dissolved Oxygen						
Redox Potential	X	X	X			
pH	X	X	X			
Specific Conductance	X	X	X			
Turbidity	X	X	X			
Temperature	X	X	X			
Laboratory Measurements	*GUN01*	*GUN08*	*GUN01*			
Aluminum						
Ammonia as N (NH3-N)						
Calcium		X		5	SW-846 6010	LMM-01
Chloride		X		0.5	SW-846 9056	WCH-A-039
Chromium						
Gross Alpha						
Gross Beta						
Iron		X		0.05	SW-846 6020	LMM-02
Lead						
Magnesium		X		5	SW-846 6010	LMM-01
Manganese	X	X	X	0.005	SW-846 6010	LMM-01
Molybdenum						
Nickel						
Nickel-63						
Nitrate + Nitrite as N (NO3+NO2)-N						
Potassium		X		1	SW-846 6010	LMM-01
Radium-226						
Radium-228						
Selenium						
Silica						
Sodium		X		1	SW-846 6010	LMM-01
Strontium						
Sulfate		X		0.5	SW-846 9056	MIS-A-044
Sulfide						
Total Dissolved Solids		X		10	SM2540 C	WCH-A-033
Total Organic Carbon						
Uranium	X	X	X	0.0001	SW-846 6020	LMM-02
Vanadium						
Zinc						
Total No. of Analytes	2	10	2			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Hallam, Nebraska

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
1A				X		Next in 6/2014
1B				X		Next in 6/2014
2A				X		Next in 6/2014
2B				X		Next in 6/2014
2B2				X		Next in 6/2014
2C2				X		Next in 6/2014
3A				X		Next in 6/2014
3B				X		Next in 6/2014
4A				X		Next in 6/2014
4B				X		Next in 6/2014
4C				X		Next in 6/2014
5A				X		Next in 6/2014
5B				X		Next in 6/2014
6A					X	Water level; micropurge if possible
6B					X	Water level; micropurge if possible
7B				X		Next in 6/2014
7C				X		Next in 6/2014
8B				X		Next in 6/2014
8C				X		Next in 6/2014

Sampling conducted in June

Based on LTSP dated June 2008

Constituent Sampling Breakdown

Site	**Hallam**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
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)					
Calcium					
Chloride					
Chromium					
Gamma Spec	X		10 pCi/L	Gamma Spectrometry	GAM-A-001
Gross Alpha	X		2 pCi/L	EPA 900.0	GPC-A-001
Gross Beta	X		4 pCi/L	EPA 900.0	GPC-A-001
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63	X		700 pCi/L	Liquid Scintillation	LSC-A-009
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Tritium	X		400 pCi/L	Liquid Scintillation	GPC-A-001
Uranium					
Vanadium					
Zinc					
Total No. of Analytes	5	0			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at L-BAR, New Mexico

Location ID	Quarterly	Semiannually	Annually	Triennially	Not Sampled	Notes
Monitoring Wells						
1A				X		Next sampling November 2013
17B				X		Next sampling November 2013
29A				X		Next sampling November 2013
61				X		Next sampling November 2013
62				X		Next sampling November 2013
63				X		Next sampling November 2013
69				X		Next sampling November 2013
72				X		Next sampling November 2013
81				X		Next sampling November 2013
100				X		Next sampling November 2013
Moquino - Old				X		Next sampling November 2013; Water users backup well.*
Moquino - New				X		Next sampling November 2013; Water users supply well.*

Sampling conducted in November

*Obtain a sample if the well is in operation and access is granted; otherwise, do not sample and document accordingly.

Constituent Sampling Breakdown

Site	**L-Bar**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr.	12	0			
Field Measurements					
Alkalinity					
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Calcium					
Chloride	X		0.5	SW-846 9056	MIS-A-039
Chromium					
Magnesium					
Manganese					
Molybdenum					
Nitrate + Nitrite as N (NO3+NO2)-N	X		0.05	EPA 353.1	WCH-A-022
Potassium					
Radium-226					
Radium-228					
Selenium	X		0.0001	SW-846 6020	LMM-02
Silica					
Sodium					
Sulfate	X		0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	X		10	SM2540 C	WCH-A-033
Total Organic Carbon					
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	6	0			

Note: All analyte samples are considered unfiltered 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 Lakeview, Oregon

Location ID	Quarterly	Semiannually	Annually	Biennially	Every 5 years	Notes
Monitoring Wells						
LKV01 - Processing Site						
503				Even year		Next sampling in 5/2014
505				Even year		Next sampling in 5/2014
509				Even year		Next sampling in 5/2014
540				Even year		Next sampling in 5/2014
LKV02 - Disposal Site						
515					X	Every 5 years; next in 5/2014
602					X	Every 5 years; next in 5/2014
603					X	Every 5 years; next in 5/2014
604					X	Every 5 years; next in 5/2014
605					X	Every 5 years; next in 5/2014
606					X	Every 5 years; next in 5/2014
607					X	Every 5 years; next in 5/2014
608					X	Every 5 years; next in 5/2014
609					X	Every 5 years; next in 5/2014
Private Wells						
LKV01 - Processing Site						
543				Even year		Next sampling in 5/2014

Sampling conducted in May.

Constituent Sampling Breakdown

Site	**Lakeview**				
Analyte	**Groundwater**		**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	5 every 2 yrs; 14 every 5 yrs				
Field Measurements					
Alkalinity	X				
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements	***Disposal Site***	***Processing Site***			
Aluminum					
Ammonia as N (NH3-N)					
Arsenic	X		0.0001	SW-846 6020	LMM-02
Cadmium	X		0.001	SW-846 6020	LMM-02
Calcium	X		5	SW-846 6010	LMM-01
Chloride	X		0.5	SW-846 9056	WCH-A-039
Gross Alpha					
Gross Beta					
Iron	X		0.05	SW-846 6020	LMM-02
Lead					
Magnesium	X		5	SW-846 6010	LMM-01
Manganese	X	X	0.005	SW-846 6010	LMM-01
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium	X		1	SW-846 6010	LMM-01
Radium-226					
Radium-228					
Selenium					
Silica	X		0.1	SW-846 6010	LMM-01
Sodium	X		1	SW-846 6010	LMM-01
Strontium					
Sulfate	X	X	0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	X		10	SM2540 C	WCH-A-033
Total Organic Carbon					
Uranium	X	0509 and 0540 only	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	13	3			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

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)						
0202		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				
PRB 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

Sampling Frequencies for Locations at Monticello, Utah

Location ID	Quarterly	Semi-annually	Annually	Every 5 Years	Not Sampled	Notes
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				
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				
SW92–09		X				
SW94-01		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 next in October 2016.

The wells listed below are inactive and are not included in the monitoring program. However, water levels will be collected from these locations in October 2013. 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 PRB Wells

R1-M2
R1-M5
R2-M1
R2-M2
R2-M3
R2-M5
R2-M6
R2-M8
R2-M9
R2-M10
R3-M1
R3-M4
R4-M1
R4-M2
R4-M4
R4-M5
R4-M7
R4-M8
R5-M1
R5-M2
R5-M3
R5-M4
R5-M5
R5-M6
R5-M7
R5-M8
R5-M9
R5-M10
R7-M2
T1-D
T1-S
T2-D
T2-S
T3-D
T3-S
T4-S
T4-D
T5-D
T5-S
T6-S
T7-D
TW-01
TW-02
TW-03
TW-04
TW-05
TW-06
TW-07
TW-08
TW-09
TW-10
TW-11
TW-12
TW-13
TW-14

Constituent Sampling Breakdown

Site	**Monticello**						
Analyte	**Groundwater**	**PRB Wells**	**Surface Water**	**Seeps**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	57	18	16	14			
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)							
Arsenic	X	X	X	X	0.0001	SW-846 6020	LMM-02
Calcium	X	X	X	X	5	SW-846 6010	LMM-01
Chloride	X	X	X	X	0.5	SW-846 9056	WCH-A-039
Chromium							
Fluoride	X	X	X	X	0.5	SW-846 9056	MIS-A-040
Gross Alpha							
Gross Beta							
Iron	X	X	X	X	0.05	SW-846 6020	LMM-02
Lead							
Magnesium	X	X	X	X	5	SW-846 6010	LMM-01
Manganese	X	X	X	X	0.005	SW-846 6010	LMM-01
Molybdenum	X	X	X	X	0.003	SW-846 6020	LMM-02
Nickel							
Nickel-63							
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	X	X	0.05	EPA 353.1	WCH-A-022
Potassium	X	X	X	X	1	SW-846 6010	LMM-01
Radium-226							
Radium-228							
Selenium	X	X	X	X	0.0001	SW-846 6020	LMM-02
Silica							
Sodium	X	X	X	X	1	SW-846 6010	LMM-01
Strontium							
Sulfate	X	X	X	X	0.5	SW-846 9056	MIS-A-044
Sulfide							
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	10	SM2540 C	WCH-A-033
Total Organic Carbon							
Uranium	X	X	X	X	0.0001	SW-846 6020	LMM-02
Vanadium	X	X	X	X	0.0003	SW-846 6020	LMM-02
Zinc							
Total No. of Analytes	16	15	16	16			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Monument Valley, Arizona

Location	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
402		X				
602		X				
603		X				
604		X				
605		X				
606		X				
618		X				
619		X				
648		X				
650		X				
651		X				
652		X				
653		X				
655		X				
656		X				
657		X				
662		X				
669		X				
711		X				
715		X				
719		X				
727		X				
733		X				
734		X				
735		X				
738		X				
739		X				
740		X				
741		X				
742		X				
743		X				
744		X				
760		X				
761		X				
762		X				
764		X				
765		X				
766		X				
767		X				
768		X				
770		X				
771		X				
772		X				
774		X				
775		X				
776		X				
Surface Locations						
623		X				

Sampling conducted in December and June

Constituent Sampling Breakdown

Site	**Monument Valley**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	68	1			
Field Measurements					
Alkalinity					
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)	X	X	0.1	EPA 350.1	WCH-A-005
Arsenic			0.0001	SW-846 6020	LMM-02
Calcium					
Chloride	X	X	0.5	SW-846 9056	MIS-A_039
Chromium					
Gross Beta					
Iron			0.05	SW-846 6020	LMM-02
Lead					
Magnesium			5	SW-846 6010	LMM-01
Manganese			0.005	SW-846 6010	LMM-01
Molybdenum			0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	0.05	EPA 353.1	WCH-A-022
Potassium			1	SW-846 6010	LMM-01
Selenium					
Silica					
Sodium			1	SW-846 6010	LMM-01
Strontium					
Sulfate	X	X	0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium	X	X	0.0003	SW-846 6020	lMM-02
Zinc					
Total No. of Analytes	6	6			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Naturita, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
NAT01						
715			X			
718			X			
NAT01-1			X			
NAT02			X			
NAT08			X			
NAT26			X			
MAU07			X			
MAU08			X			
DM1			X			
NAT14						
BR95-1				Even year		On hold
BR95-2				Even year		On hold
BR95-3				Even year		On hold
Surface Locations						
531			X			
533			X			
SM2			X			
SM4			X			

Annual sampling conducted in July
Biennial sampling conducted in July

Constituent Sampling Breakdown

Site	**Naturita**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	14	5			
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)					
Arsenic	X	X	0.0001	SW-846 6020	LMM-02
Calcium					
Chloride					
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum	BR and CM wells only		0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids	X	X	10	SM2540 C	WCH-A-033
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium	X	X	0.0003	SW-846 6020	LMM-02
Zinc					
Total No. of Analytes	5	4			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Parkersburg, West Virginia

Location ID	Quarterly	Semiannually	Annually	Every 5 years	Not Sampled	Notes
Monitoring Wells						
MW-1					X	Water levels
MW-2					X	Water levels
MW-3					X	Water levels
MW-4					X	Water levels
MW-5				X		Next sampling 10/13
MW-6				X		Next sampling 10/13

Sampling conducted in October

Based on LTSP dated September 1995

Constituent Sampling Breakdown

Site	**Parkersburg**				
Analyte	**Ground Water**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	2	0			
Field Measurements					
Alkalinity					
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Alkalinity, total as CaCO3	X		10	SM2320 B	WCH-A-002
Ammonia as N (NH3-N)					
Antimony	X		0.003	SW-846 6020	LMM-02
Arsenic					
Barium	X		0.02	SW-846 6010	LMM-01
Beryllium	X		0.0008	SW-846 6010	LMM-01
Bromide					
Cadmium	X		0.001	SW-846 6020	LMM-02
Calcium	X		5	SW-846 6010	LMM-01
Chloride	X		0.5	SW-846 9056	MIS-A-039
Chromium	X		0.002	SW-846 6010	LMM-01
Gamma Spec					
Gross Alpha	X		2 pCi/L	EPA 900.0	GPC-A-001
Gross Beta	X		4 pCi/L	EPA 900.0	GPC-A-001
Iron					
Lead	X		0.002	SW-846 6020	LMM-02
Lead-210					
Magnesium	X		5	SW-846 6010	LMM-01
Manganese					
Mercury	X		0.0001	SW-846 7470	LMM-01
Molybdenum					
Nickel	X		0.02	SW-846 6010	LMM-01
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X		0.05	EPA 353.1	WCH-A-022
Nitrite	X		0.5	EPA 354.1	WCH-A-021
PCBs					
Potassium	X		1	SW-846 6010	LMM-01
Radium-226	X		1 pCi/L	Gas Proportional Counter	GPC-A-018
Radium-228	X		1 pCi/L	Gas Proportional Counter	GPC-A-020
Selenium	X		0.0001	SW-846 6020	LMM-02
Silica					
Sodium	X		1	SW-846 6010	LMM-01
Strontium					
Sulfate	X		0.5	SW-846 9056	MIS-A-044
Sulfide					
Thallium	X		0.004	SW-846 6020	LMM-02
Thiocyanate	X		0.1	EPA 300.0	MIS-A-045
Tritium					
Uranium	X		0.0001	SW-846 6020	LMM-02
Zinc			0.02	SW-846 6010	LMM-01
Zirconium	X		0.001	SW-846 6010	LMM-02
Total No. of Analytes	25	0			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

NOTE: Hafnium was removed from the analyte list in 2008. The 1994 sampling plan lists hafnium as a process related analyte. The zirconium ores processed at the site contained approximately 2-3% hafnium. Zirconium is expected to be a better indicator of contamination originating from the disposal cell because of its higher concentration in the ores processed.

PIN-SAP-2015-02

Effective Date: 2/1/2015
Expiration Date: 2/1/2018

Program Directive

Initiated By: Sam Campbell

Directive Subject: Sampling of Monitoring Wells Affected by Soybean-Oil Injections.

Directive and Associated Task Changes: Because past soybean-oil injections at the 4.5-acre site have impacted groundwater chemistry, numerous monitoring wells (Table 1) will be purged without using a YSI water quality instrument, which is used to measure dissolved oxygen, oxidation-reduction potential, pH, specific conductance, and temperature at the Pinellas site. Completion of the purging process will be determined by meeting turbidity, water level, and purge-volume criteria only. Additional monitoring wells at the 4.5-acre site may be impacted in the future as groundwater migrates.

Numerous additional wells across the Pinellas site and off-site may be impacted by the soybean-oil injections that occurred in October/November of 2014 and by future soybean-oil injections (planned for February 2015); therefore, additional wells across the site that appear to have been impacted by the soybean-oil injection at the time of sampling will be sampled using the criteria listed above, noted in the field notes, included in the Trip Report, and added to Table 1 of this Program Directive. Water that has been impacted may have a distinctive odor and may be grayish or black in color. In the absence of these indicators, the dissolved oxygen measurements may show that a well has been impacted. If the dissolved oxygen measurements are decreasing to negative values, the purging should be interrupted so that the YSI instrument can be removed, then the purge should be completed using the criteria of this directive. Any measurements that had been recorded for dissolved oxygen, oxidation-reduction potential, pH, specific conductance, and temperature should be deleted from the field notes.

Table 1. Monitoring Wells Affected by Soybean-Oil Injection

Area	Well ID	Comments
PIN-20	M001, M18D, M035, M053, M056, M057, M058, M059, M067, and M068	4.5-acre site
PIN-12	-	None identified to date
PIN-21	-	None identified to date

Organization(s) Affected: Environmental Monitoring Services, Programs and Projects, and Environmental Sciences – Expert Services.

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, current version).

Justification: The water chemistry in the immediate vicinity of numerous monitoring wells has been affected by injection of soybean oil. The injection resulted in changes in groundwater chemistry that adversely affect the YSI instrumentation by causing probes to malfunction and not read accurately. Prolonged exposure to this groundwater has destroyed probes in past sampling events. Because most of the measurements made by the YSI are used as stability criteria for purging, this Program Directive functions to amend the required purging protocol. The soybean oil injection may affect other wells as time passes.

Review and Concurrence:

J. Daniel
Joseph H. Daniel
2015.01.22 12:51:30
-05'00'
Joe Daniel, Pinellas Site Manager

Digitally signed by
Julian P. Caballero
Date: 2015.01.22
12:46:58 -05'00'
Julian Caballero, Site Hydrogeologist

Michael B.
Hoge
Digitally signed by Michael B. Hoge
DN: c=us, o=u.s. government,
ou=department of energy, ou=Energy IT
Services, ou=Legacy Management,
ou=People, cn=Michael B. Hoge
Date: 2015.01.22 12:56:05 -05'00'
Mike Hoge, Quality and Performance Assurance

1-22-15
Charles Tabor, Site Geochemist

Manager Approval:

Sam Campbell
Sam Campbell
2015.01.22 10:04:58 -07'00'
Sam Campbell, Environmental Monitoring Services Manager

Electronic Distribution:

rc-grand.junction (ADM 130.10)
Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites

U.S. Department of Energy Office of Legacy Management

PIN-2014-02

Effective Date: 09/01/2014
Expiration Date: 09/01/2017

Program Directive

Initiated By: Julian Caballero

Directive Subject: Groundwater Sampling Procedures

Directive and Associated Task Changes: The *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (SAP) will be used as the applicable document for groundwater sampling procedures at the Pinellas site. The attached protocol for purging and sampling, instrument calibration, maintenance documentation, decontamination, and equipment blank collection will modify the SAP to reflect Florida Department of Environmental Protection (FDEP) requirements.

Organization(s) Affected: Environmental Monitoring Operations, Programs and Projects, and Ecology/Hydrology.

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, current version)

Justification: The Pinellas Environmental Restoration Project is required to follow FDEP procedures; this Program Directive modifies the criteria in the SAP to reflect FDEP requirements found at http://www.dep.state.fl.us/water/sas/sop/sops.htm. This Program Directive was updated to reflect new FDEP requirements that went into effect on July 30, 2014.

Review and Concurrence:

Digitally signed by Julian P. Caballero
Date: 2014.08.13 15:36:05 -04'00'

Julian Caballero, Site Hydrologist

8-13-14

Charles Tabor, Project Technical Lead

Michael B. Hoge

Digitally signed by Michael B. Hoge
DN: c=us, o=u.s. government, ou=department of energy, ou=Energy IT Services, ou=Legacy Management, ou=People, cn=Michael B. Hoge
Date: 2014.08.13 16:09:13 -04'00'

Mike Hoge, Quality and Performance Assurance

Joseph H. Daniel
2014.08.13 15:59:26 -04'00'

Joe Daniel, Site Manager

Manager Approval:

Sam Campbell
2014.08.13 11:09:22 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File ADM 130.10

Micropurge Sampling[1]

Sampling Method

	Requirement
Pump/tubing intake placement	For wells with a fully submerged screen, tubing is placed in the middle of the screened interval. Pull tubing up until the mark on the tubing is at the top of the inner casing. For wells with a partially submerged screen (PIN12-0554A and PIN12-0555A), tubing is placed within the middle of the saturated portion of the screened interval [Figure FS 2200-2]. Pull tubing up until the mark on the tubing is at the top of the inner casing.
Purging	For wells with a fully submerged screen, purge one <u>pump/tubing/flow cell volume</u> after stabilizing water level, and then take readings at least 2 minutes apart. Purge until the following criteria below are met [FS 2212 2.4]. For wells with a partially submerged screen (PIN12-0554A and PIN12-0555A), purge a minimum of <u>one casing volume</u> after stabilizing water level, and then take readings at least 2 minutes apart [FDEP Figure FS 2200-2]. Purge until the following criteria below are met.
Sampling VOCs (including 1,4-dioxane) by peristaltic pump	Collect samples directly from the discharge of the pump. If samples for additional analytes other than VOCs will be collected, fill the VOC sample containers last, if possible [FS 2200 1.1.1]. Collect VOC samples at a rate in the range of 100–400 mL/minute [FS 2221 1.1.1.1].

Primary Purging Criteria

Parameter	Criteria [FS 2212 3.1]
Temperature	± 0.2 °C [a,c]
pH	± 0.2 pH standard units [a,c]
Specific conductance	± 5% of reading [a,c]
Turbidity	≤ 20 NTUs[a,b]
Dissolved oxygen	≤ 20% saturation[a]
Water level	Stable water level
Purge volume	3 pump/tubing/flow cell volumes prior to sample collection (fully submerged screen) or one casing volume (partially submerged screen)

[a] Criterion is for three consecutive measurements.

[b] Nephelometric turbidity unit (NTU).

[c] The range between the highest and the lowest values for the last three measurements cannot exceed the stated limits. For example, if the last three temperature readings are 20.0, 20.3, and 20.1, criterion has NOT been met.

Secondary Purging Criteria

Parameter	Criteria [FS 2212 3.5.1 and 3.6]
Turbidity	± 5 NTUs or 10% (whichever is greater)[a]
Dissolved oxygen	± 0.2 mg/L or 10% (whichever is greater)[a]

[a] Criterion is for three consecutive measurements. The range between the highest and the lowest values for the last three measurements cannot exceed the stated limits. For example, if the last three turbidity readings are 25, 26, and 20, secondary criterion of ± 5 NTUs has NOT been met.

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[1] Applicable FDEP references are in brackets throughout the document.

CMT Wells—Conventional Sampling

Sampling Method

	Requirement
Tubing	Place intake at top of water column. Use new tubing for each sampling event.
Purging	Purge one casing volume after stabilizing the water level, then take readings no sooner than every 1/4 casing volume [FS 2212 2.3]. Purge until the following criteria below are met.
Stabilizing water level (WL) during purge	If needed, take an initial WL measurement. Begin pumping with the tubing above the water table. Slowly lower the tubing into the water. As bubbles appear, continue to slowly lower the tubing. When a steady stream of water in the tubing (no bubbles) is obtained, the well yield is equal to the pump rate indicating water level stabilization. When WL is stable, start measuring purge volume.
Sampling VOCs (including 1,4-dioxane) by peristaltic pump	Collect samples directly from the discharge of the pump. If samples for additional analytes other than VOCs will be collected, fill the VOC sample containers last, if possible [FS 2200 1.1.1]. Collect VOC samples at a rate in the range of 100–400 mL/minute [FS 2221 1.1.1.1].

Primary Purging Criteria

Parameter	Criteria [FS 2212 3.1]
Temperature	± 0.2 °C [a,c]
pH	± 0.2 pH standard units [a,c]
Specific conductance	± 5% of reading [a,c]
Turbidity	≤ 20 NTUs[a,b]
Dissolved Oxygen	≤ 20% saturation[a]
Water Level	Stable water level (No air in tubing as it is lowered from top of water column)

[a] Criterion is for three consecutive measurements.

[b] Nephelometric turbidity unit (NTU).

[c] The range between the highest and the lowest values for the last three measurements cannot exceed the stated limits. For example, if the last three temperature readings are 20.0, 20.3, and 20.1, criterion has NOT been met.

Secondary Purging Criteria

Parameter	Criteria [FS 2212 3.5.1 and 3.6]
Turbidity	± 5 NTUs or 10% (whichever is greater)[a]
Dissolved Oxygen	± 0.2 mg/L or 10% (whichever is greater) [a]
Purge Volume	Purging complete after 5 casing volumes at the discretion of the sampling lead

[a] Criterion is for three consecutive measurements. The range between the highest and the lowest values for the last three measurements cannot exceed the stated limits. For example, if the last three turbidity readings are 25, 26, and 20, secondary criterion of ± 5 NTUs has NOT been met.

Field Instrumentation

Calibration and Operational Check Specifications for Field Instrumentation

Parameter	Calibration	ICV/CCV[a] Frequency	ICV/CCV Acceptance Criteria [FT 1000]	Corrective Actions
pH [FT 1100]	3-point calibration with 4, 7, and 10 pH buffers at start of sampling event	ICV—immediately after calibration	1-point check ± 0.2 pH units	If the CCV does not meet criteria Repeat the CCV. If still out of range recalibrate and read new ICV. J-flag data as estimated between last successful CCV and failed CCV.
		CCV—start of each day and end of sampling event		
Specific Conductance [FT 1200]	1-point calibration (~1,000 µmhos/cm[b]) at start of sampling event	ICV—immediately after calibration	2-point check (~100 and ~10,000 µmhos/cm) to bracket the expected sample range ± 5%	
		CCV—start of each day and end of sampling event	1-point check (~10,000 µmhos/cm) ± 5%	
Temperature [FT 1400]	No calibration required	ICV—start of sampling event	± 0.5 °C from corrected NIST thermometer reading at three temperatures in the expected sample range	
		CCV—end of sampling event		
Dissolved Oxygen [FT 1500]	Calibrate in water-saturated air at beginning of sampling event and every membrane change-out	ICV—immediately after calibration	± 0.3 mg/L of theoretical DO in water-saturated air	
		CCV—start of each day and end of sampling event		
Turbidity [FT 1600]	Calibrate at start of sampling event. Perform either a 3-point or 4-point calibration according to instrument specifications	ICV—immediately after calibration. Must use primary standard for ICV	1-point check: 0 to 10 NTU ± 10% 10 to 40 NTU ± 8% 41 to 100 NTU ± 6.5% >100 NTU ± 5%	
		CCV—start of each day and end of sampling event. Use either primary or secondary (Gelex) standard.	3-point check: 0 to 10 NTU ± 10% 10 to 40 NTU ± 8% 41 to 100 NTU ± 6.5% >100 NTU ± 5%	
Oxidation-Reduction Potential	One-point calibration at start of sampling event	ICV—immediately after calibration	1-point check ± 10%	
		CCV—start of each day and end of sampling event		

[a] Initial calibration verification/continuing calibration verification

[b] micromhos per centimeter

Other Requirements

Sampling VOCs through a Peristaltic Pump: VOCs samples can be collected through the peristaltic pump (after water goes through the pump head) provided that: (1) silicone tubing is used in the pump head; (2) The silicone tubing is no more than 1 foot long; and (3) The pump head tubing is used for one sampling event and then discarded. [FS 2213 2.1, FS 2221 1.1.1, and Table FS 1000-3]

Down-hole Tubing; Down-hole tubing in conventional (non-CMT) monitoring wells will be dedicated to the well and stored in the well by setting the tubing on the bottom of the well. Each piece of dedicated tubing (except at monitoring wells PIN12-0554A & PIN12-0555A) will be marked with a permanent marker such that when the tubing is pulled up to where the mark meets the top of the inner casing, the intake of the tubing will be in the middle of the screen. At monitoring wells PIN12-0554A and PIN12-0555A, will be marked with a permanent marker such that when the tubing is pulled up to where the mark meets the top of the inner casing, the intake of the tubing will be in the middle of the water column (requirement because the screen is partially submerged). Purging and sampling will be conducted at all wells with the mark on the tubing at the top of the inner casing.

Instrument Maintenance: Maintenance of field instrumentation must be documented in the FDCS on a Pre-trip Calibration or a Daily Calibration/Operational Check form. [FD 3000]

Include:

- Routine cleaning procedures
- Corrective actions performed during calibrations or verifications
- Parts replacement for instrument probes
- Date for the procedures performed
- Names of personnel performing the maintenance or repair
- Description of malfunctions necessitating repair or service

Record the following for rented equipment:

- Equipment type and model, inventory number, or other description

Water Level Meter Decontamination:

- Decontaminate water level meter with—at minimum—detergent/tap water/analyte-free water sequence before use. When measuring water level only, decontaminate the probe. When measuring total depth, decontaminate the length of tape that will contact the groundwater in the well. [FS 2211.3.1.1 and FC 1000]

Equipment Blanks

- Tubing will be purchased in bulk and a pre-cleaned equipment blank will be collected through the bulk tubing reel. If the pre-cleaned equipment blank has no analytes detected, then no further action is required. If there are analytes detected in the equipment blank, then Pinellas project personnel will evaluate potential impacts to data quality and document the evaluation along with any additional actions taken, if necessary. [FC 1000 1.3]

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RFL-2013-01

Effective Date: 07/01/2013
Expiration Date: 07/01/2016

Program Directive

Initiated By: Sam Campbell

Directive Subject: Sampling of CMT Wells

Directive and Associated Task Changes: CMT wells will be purged and sampled using modified protocols. After measuring an initial water level, purging will be conducted by placing the tubing at the top of the water column to facilitate removal of all water in the CMT port. Purging and sampling will be conducted at a flow-rate of less than 500 mL/min, and a minimum of 1.5 L of water will be purged prior to recording field parameters. The required purge volume is calculated to be greater than three casing volumes for the CMT ports with the most water. Sampling can commence after 1.5 L of water has been purged, and stability of field parameters has been achieved. Normal stability requirements will apply for pH, specific conductance, and turbidity; water-level stability is not required. Measurement of field parameters will occur at a minimum of every 3 minutes for determination of stability.

Organization(s) Affected: Environmental Monitoring Operations

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites*, LMS/PRO/S04351 (current version).

Justification: Purging and sampling of CMT wells using a low-flow sampling protocol is not possible because the small diameter casing does not allow monitoring of water level during the purging process.

Review and Concurrence:

Richard D. Dayvault
Richard D. Dayvault
2013.06.27 09:27:46
-06'00'

Richard Dayvault, Site Lead

Linda S. Tegelman
2013.06.26 15:44:30
-06'00'

Linda Tegelman, Q & PA Specialist

Manager Approval:

Sam Campbell
Sam Campbell
2013.06.26 14:28:33 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File ADM 130.10

Sampling Frequencies for Locations at Rifle, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
New Rifle						
169		X				Background well
170		X				Far downgradient
172		X				Far downgradient
195		X				Downgradient
201		X				Data logger; downgradient
215		X				Onsite
216		X				Onsite
217		X				Downgradient
590		X				Data logger; downgradient
620		X				Far downgradient
635		X				Downgradient
658		X				Onsite
659		X				Onsite
664		X				Onsite
669		X				Onsite
670		X				Onsite
855		X				Onsite
Old Rifle						
292A		X				Background well
304		X				Onsite
305		X				Onsite
309		X				Onsite
310		X				Data logger; onsite
655		X				Data logger; onsite
656		X				Onsite
658		X				Background well
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				River, upstream
395		X				Seep, upgradient
396		X				River
398		X				Ditch, onsite
741		X				River
Disposal Cell						
RFL08-Disposal Cell Effluent						
MW03			X			July

Semi-annual sampling conducted in June and November; annual sampling conducted for Rifle Disposal Cell in July

Constituent Sampling Breakdown

Site	**Rifle**							
Analyte	**Groundwater**		**Surface Water**			**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	57		24					
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	**RFO*	**RFN*	*RFO*	*RFN*	*RFL*			
Aluminum								
Ammonia as N (NH3-N)		X		X		0.1	EPA 350.1	WCH-A-005
Arsenic		X		X		0.0001	SW-846 6020	LMM-02
Calcium	X	X	X	X		5	SW-846 6010	LMM-01
Chloride	X	X	X	X		0.5	SW-846 9056	MIS-A_039
Chromium								
Gross Alpha								
Gross Beta								
Iron								
Lead								
Magnesium	X	X	X	X		5	SW-846 6010	LMM-01
Manganese								
Molybdenum		X		X		0.003	SW-846 6020	LMM-02
Nickel								
Nickel-63								
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	X	X		0.05	EPA 353.1	WCH-A-022
Potassium	X	X	X	X		1	SW-846 6010	LMM-01
Radium-226								
Radium-228								
Selenium	X	X	X	X	X	0.0001	SW-846 6020	LMM-02
Silica								
Sodium	X	X	X	X		1	SW-846 6010	LMM-01
Strontium								
Sulfate	X	X	X	X		0.5	SW-846 9056	MIS-A-044
Sulfide								
Total Dissolved Solids								
Total Organic Carbon								
Uranium	X	X	X	X	X	0.0001	SW-846 6020	LMM-02
Vanadium	X	X	X	X	X	0.0003	SW-846 6020	LMM-02
Zinc								
Total No. of Analytes	10	13	10	13	3			

*RFN = New Rifle; *RFO = Old Rifle

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

U.S. Department of Energy Office of Legacy Management

RBL-2015-01

Effective Date: 10/31/2014
Expiration Date: 10/31/2017

Program Directive

Initiated By: Sam Campbell

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: Environmental Monitoring Operations, Projects/Programs

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (SAP) (LMS/PRO/S04351, current version).

Justification: Procedures for sampling natural gas are not addressed in the SAP. This Program Directive will be used to guide sample collection.

Review and Concurrence:

Rick Hutton
Digitally signed by Rick Hutton
DN: c=us, o=u.s. government, ou=department of energy, ou=Energy IT Services, ou=Legacy Management, ou=People, cn=Rick Hutton
Date: 2014.11.17 14:24:03 -07'00'

Rick Hutton, Nevada Off-Sites Project Manager/Rulison Site Lead

Millie J. Birrenbach
2014.11.13 12:41:50
-07'00'

Millie Birrenbach, Quality and Performance Assurance

Manager Approval:

Sam Campbell
Digitally signed by Sam Campbell
DN: c=us, o=u.s. government, ou=department of energy, ou=Energy IT Services, ou=Legacy Management, ou=People, cn=Sam Campbell
Date: 2014.11.13 14:54:09 -07'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File ADM 130.10

High Pressure Natural Gas Sampling Using a Propane Tank

Introduction and Purpose

The following procedure will be used to collect samples from privately owned natural gas production wells for analysis of carbon-14 and tritium. The work will be conducted at several natural gas production facilities near the Rulison, Colorado, Site; Rio Blanco, Colorado, Site; and Gasbuggy, New Mexico, Site. Site elevations vary from approximately 6,000 feet (ft) to 9,500 ft.

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 and incorporates contractor health and safety integrated safety management system control measures.

Health and Safety

See Table 1, "Tasks, Analyzed Hazards, and Control Measures."

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. Additional tools include traffic cones or pin flags, and a non-sparking wrench.

Personal protective equipment (PPE) required includes a fire retardant shirt, hardhat, safety glasses, and sturdy work shoes. Hearing protection, leather work gloves**,** and nitrile gloves may also be required as determined by individual tasks and hazards. Additional PPE or safety training may be required by some well field operators.

The propane tank is provided by Isotech Laboratories and is purged and evacuated prior to delivery.

Caution

All tools must be non-sparking.

Sampling team members must wear a 4-gas personal detector at all times. *The "high alarm" must be set at 5% (full scale) of the lower explosive limit (LEL) for methane. Check handheld monitors for methane levels; if levels exceed LEL minimums follow well field operator's instructions for moving away from the site.*

Prerequisite Actions

Hazard Classification per National Electrical Code, NFPA 70, Ch. 5 Article 500: Class 1 (flammable methane gas, hazardous by nature and ignitable), Division 1 (methane is present). Request that the well field operator conduct an initial sweep of the dog house and sampling area to monitor gas levels. If an explosive condition exists, follow the operator's requirements and leave the area immediately.

Sampling team members must "bump check" the 4-gas personal detectors at least once a week.

Procedure

Gas samples will be collected from pressurized well head collection systems, through a sampling regulator and tubing system, into a small propane tank. Samples will be taken from an existing sampling port; the port may be inside or outside the operator's "dog house." The well field operator will determine the location of the gas sampling port to be used.

[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] Inspect pressure fittings, regulators, and hoses for signs of wear, cracks, and breakage. Ensure sampling hoses, fittings, and pressure reducing regulators are rated to handle the gas delivery pressures at the sampling port.

[3] Verify acceptable line pressure from an inline pressure gauge or the LCD monitor readouts, or install a high pressure gauge (5,000 psi) at the sampling port. Ensure the port is free of debris prior to connection. Wear protective gloves as needed. Use Teflon tape at all threaded connections.

[4] **IF** the pressure is greater than 2,500 psi, **THEN** do not attempt to sample from that location.

[5] If the pressure is less than 2,500 psi, install the inlet side of the pressure regulator directly to the sample port via a properly sized threaded bushing. Use the spark-free bronze wrench to make this and all other connections.

⚠

Caution

***Do not** use any flame or carry any device capable of creating a spark (e.g., cell phone) when connecting sampling hardware. Keep such items inside the vehicle. Park and turn off the vehicle at least 50 ft away from the sampling port or where the well field operator directs.*

***Do not** operate any valves, chokes, or switches unless specifically requested by the well field operator. No smoking anywhere on the well field operator's site. Only non-sparking tools shall be used.*

[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 counterclockwise to tighten.* ***Do not*** *over tighten.*

[7] Open the control valve at the sampling port.

[8] Adjust the outlet pressure on the pressure regulator to 20 psi.

[9] Place bypass vent line exhaust end downwind from sampling assembly. When purging sample lines use a 25-ft extension line with the discharge located downwind of samplers.

[10] Establish a C1D2 exclusion zone as a 15-ft-radius exclusion zone around the vent line discharge point using pin flags or cones. When an operator is venting natural gas from the well or piping system, stop sampling activities and move at least 100 ft upwind from the discharge point until venting is complete.

[11] Open the bypass valve on the propane tank for approximately 10 seconds to purge the air space in the pressure regulator and flexible tubing; close the bypass valve.

[12] 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.

[13] 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).

[14] Close the valve on the propane tank. Do not over tighten.

[15] Close the control valve at the sample port.

[16] Open the bypass valve on the propane tank to release the pressure and then close the bypass valve.

[17] Disconnect the flexible tubing/pressure regulator assembly.

[18] 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. Contact a Certified Shipper to complete and sign the required documentation and oversee the shipment. The gas collection tank must be secure and upright when transporting the sampling container.

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 10/10/2011.

Figure 1. Flexible Tubing/Pressure Regulator Assembly and Propane Tank

Table 1. Tasks, Analyzed Hazards, and Control Measures

Task	Hazard	Controls
Driving to and from the gas well sites	1) Slippage and loss of control due to steep grades and wet road conditions	1) Conform to the well field operator's speed limit requirements. If road conditions make driving unsafe, postpone the sampling event. Use 4WD vehicle and carry tire chains, tow-chain, and shovel.
	2) Vehicle accidents	2) When approaching sharp corners slow down, move to the right, and pay attention to driving conditions. Pull over to allow oncoming traffic to pass if road is too narrow. Keep vehicles a safe distance from drop offs. The driver will not use two-way communication devices while vehicle is in motion. Be very alert to the potential for wildlife or livestock on the roads.
	3) Driving hazards caused by well field operator activities	3) Follow the well field operator to the designated parking area. Follow their instructions for parking. When leaving or backing up, have a spotter assist in backing out of parking space if there is other vehicle traffic or equipment in the area. Obey all well field operator restrictions.
Hazards common to all site activities	1) Slips, trips, falls	1) Keep work area uncluttered; remove tripping hazards if possible. Drill rigs, platforms and associated equipment have many tripping hazards; be cautious, use hand rails, especially on stairways when carrying sampling equipment and samples; pay attention to surroundings. Use extra caution on stairways and platforms when ice, snow, or muddy conditions exist.
	2) Head, eye, or foot injury, burns	2) PPE shall be worn in accordance with the well field operators' requirements; at a minimum wear hard hat, eye protection, sturdy work boots, and fire retardant shirt at all times outside the vehicle. Hearing protection and nitrile gloves may be required during sample collection. Adhere to noise area postings and procedure requirements.
	3) Injury to hands	3) Keep hands and fingers out of pinch points and crush areas. Wear leather work gloves if there is a potential for cuts, abrasions, blisters etc. (e.g., installing chains on the vehicle).
	4) Inclement weather and lightning strikes	4) Seek shelter when weather conditions present a threat to safe working conditions. Use the 30/30 rule to assess a threat. Cease field activities when lightning is within 6 miles (30 seconds between flash and bang). Field activities can resume 30 minutes after the last audible thunder. Suspend work if strong winds cause a hazard.
	5) Biological hazards—snakes, insects, and bears	5) Remain alert for snakes and avoid them. Do not put hands into dark or obscured areas. Remain alert for bears—if a bear enters the work area, get inside a vehicle or the dog house as quickly as possible.
	6) Explosion caused by spark or fire in the work area	6) Samplers must not use any flame or carry any device capable of creating a spark (e.g., cell phone) when connecting sampling hardware. Keep such items inside the vehicle. Keep vehicle 50 ft away from sampling port or where well field operator directs. Keep vehicle ignition off during gas sampling activities. Do not operate any valves, chokes, or switches unless specifically requested by the well field operator. No smoking anywhere on the well field operators' site. Only non-sparking tools shall be used.
	7) Explosive atmosphere within work area	7) Request that the well field operator conduct an initial sweep of the dog house and sampling area to monitor gas levels. If an explosive condition exists, follow the well field operator's requirements and leave the area immediately. Sampling team members will wear a 4-gas personal detector at all times while sampling. The high alarm should be set at 5% (full scale) of the lower explosive limit (LEL) for methane. When purging sample lines use a 25-foot extension line with the discharge located downwind of the samplers. Establish a C1D2 exclusion zone as a 15-foot radius around the purging hose discharge point. Cones or pin flags should be used to define the C1D2 zone. When the well field operator is venting natural gas from well or piping system, stop sampling activities and move at least 100 ft upwind from the discharge point until venting is complete.

Task	Hazard	Controls
Gas Sample Collection	Methane release due to equipment failure such as (1) blockage of sampling regulator causing sampling line break, or (2) regulator damage or breakage from higher than anticipated inline pressure	Prior to sampling, inspect pressure fittings, regulators, and hoses for signs of wear, cracks, and breakage. Ensure sampling hoses, fittings, and pressure reducing regulators are rated to handle the gas delivery pressures at the sampling port. Verify acceptable pressures at a pressure gauge or the LCD monitor readout before sample collection in accordance Step 2 of the "High Pressure Natural Gas Sampling Procedure." The well field operator will inform the sampling team which sample port to use for gas collection. The sampling team will check to make sure the port is free of debris prior to connection.
	Explosive atmosphere created during sampling	When purging sample lines use a 25-ft extension line with the discharge located downwind of samplers. Establish a C1D1 exclusion zone as a 15-ft radius around the discharge point. Cones or pin flags should be used to define the C1D1 zone. When an operator is venting natural gas from a well or piping system, stop sampling activities and move at least 100 ft upwind from the discharge point until venting is complete. Hazard Classification per National Electrical Code, NFPA 70, Ch. 5 Art. 500: Class 1 (flammable methane gas, hazardous by nature and ignitable), Division 1 (methane is present). Check handheld monitors for methane levels; if levels exceed LEL minimums, follow operators' instructions for moving away from the site. Samplers must not use any flame or carry any device capable of creating a spark (e.g., cell phone) when connecting sampling hardware. Keep such items inside the vehicle. Keep vehicle 50 ft away from sampling port or where operator directs. Keep vehicle ignition off during gas sampling activities. Do not operate any valves, chokes, or switches unless specifically requested by the well field operator. No smoking anywhere on the well field operators' site. Only non-sparking tools shall be used.
Transporting Natural Gas Samples	Explosive atmosphere created by damage to cylinder valve during transport, causing gas leak	When transporting a sampling container, the gas collection tank must be secure and upright.

Sampling Frequencies for Locations at Rio Blanco, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
On-Site						
RB-D-01			X			
RB-D-03			X			
RB-S-03			X			
RB-W-01			X			
Off-Site						
Johnson Artesian WL			X			
Brennan Windmill			X			
Surface Locations						
On-Site						
Fawn Creek 500ft Dwn			X			
Fawn Creek 500ft Ups			X			
Off-Site						
B-1 Equity Camp			X			
CER #1 Black Sulphur			X			
CER #4 Black Sulphur			X			
Fawn Creek #1			X			
Fawn Creek #3			X			
Fawn Creek 6800ft Up			X			
Fawn Creek 8400ft Dw			X			

Sampling conducted in May

Constituent Sampling Breakdown

Site	**Rio Blanco**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	6	9			
Field Measurements					
Alkalinity					
Dissolved Oxygen					
Redox Potential					
pH	X	X			
Specific Conductance	X	X			
Turbidity	X				
Temperature	X	X			
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Calcium					
Chloride					
Chromium					
Gamma Spec	X	X	10 pCi/L	Gamma Spectrometry	GAM-A-001
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Tritium	X	X	400 pCi/L	Liquid Scintillation	LSC-A-001
Tritium, enriched	25% of the samples	25% of the samples	10 pCi/L	Liquid Scintillation	LMR-15
Uranium					
Vanadium					
Zinc					
Total No. of Analytes	3	3			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Riverton, Wyoming

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring 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	WL only; Data logger
710		X				
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
736					X	WL only
784		X				
788		X				
789		X				Data logger
824		X				
825					X	Not drilled yet
826		X				
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				

Sampling Frequencies for Locations at Riverton, Wyoming

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
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
460		X				140 Goes in Lodge Road
828		X				33 St Stephens Road
841		X				22 Whitetail Dr
842		X				14 Whitetail Dr
Alternate Water Supply System						
813		X				
814		X				
815		X				
816		X				
818		X				
819		X				
820		X				
821		X				
829		X				
830		X				
834		X				
837		X				
843		X				

Semiannual groundwater and surface water sampling conducted in June and November.

Semiannual hydrant flushing and sampling conducted in October and March

Constituent Sampling Breakdown

Site	**Riverton**					
Analyte	**Groundwater**	**Surface Water**	**AWSS**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	138	36	38			
Field Measurements						
Alkalinity	X	X				
Dissolved Oxygen	X	X	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)						
Calcium	X	X		5	SW-846 6010	LMM-01
Chloride	X	X		0.5	SW-846 9056	MIS-A-039
Chromium						
Gross Alpha						
Gross Beta						
Iron						
Lead						
Magnesium	X	X		5	SW-846 6010	LMM-01
Manganese	X	X		0.005	SW-846 6010	LMM-01
Molybdenum	X	X		0.003	SW-846 6020	LMM-02
Nickel						
Nickel-63						
Nitrate + Nitrite as N (NO3+NO2)-N						
Potassium	X	X		1	SW-846 6010	LMM-01
Radium-226		0822 only	X	1 pCi/L	roportional C	GPC-A-018
Radium-228		0822 only	X	1 pCi/L	roportional C	GPC-A-020
Selenium						
Silica						
Sodium	X	X		1	SW-846 6010	LMM-01
Strontium						
Sulfate	X	X		0.5	SW-846 9056	MIS-A-044
Sulfide						
Total Dissolved Solids						
Total Organic Carbon						
Uranium	X	X	X	0.0001	SW-846 6020	LMM-02
Vanadium						
Zinc						
Total No. of Analytes	9	11	3			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

U.S. Department of Energy Office of Legacy Management

RFS-2015-01

Effective Date: 11/19/2014
Expiration Date: 11/19/2017

Program Directive

Initiated By: Sam Campbell

Directive Subject: Miscellaneous Sampling Activities

Directive and Associated Task Changes:

1. Samples for the analysis of volatile organic compounds (VOC) may be collected through a peristaltic pump.
2. Holding time for unpreserved (i.e., not chemically preserved, but chilled to 4 °C) VOCs will be a maximum of 14 days.
3. Groundwater samples collected for americium, plutonium, uranium, and metals analyses will be field-filtered through a 0.45 µm pore-size filter regardless of sample turbidity.

Organization(s) Affected: Environmental Monitoring Operations, Projects/Programs, and Hydrology.

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351 current version), *Rocky Flats Legacy Management Agreement*, Attachment 2 (2012), *Rocky Flats Site Operations Guide*, (LMS/RFS/S03037, current version).

Justification:

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 may be 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. Filtration of americium, plutonium, uranium, and metals has been conducted historically at the site to ensure that groundwater samples are not biased by suspended particulate matter. Studies at the site have shown that americium and plutonium are not very soluble but attach to particulate matter.

Review and Concurrence:

Linda L. Kaiser
Linda Kaiser, Rocky Flats Site Manager

George Squibb
George Squibb, Surface Water Lead

John Boylan, Groundwater Lead

Teresa Nash, Quality and Performance Assurance

Manager Approval:

Sam Campbell
Sam Campbell
2014.11.18 17:06:29 -07'00'
Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File 130.10

U.S. Department of Energy Office of Legacy Management

RFS-2015-02

Effective Date: 11/19/2014
Expiration Date: 11/19/2017

Program Directive

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 Operations, Projects/Programs, and Hydrology.

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351 current version).

Justification: 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, Rocky Flats Site Manager

George Squibb

George Squibb, Surface Water Lead

John Boylan, Groundwater Lead

Teresa Nash, Quality and Performance Assurance

Manager Approval:

Sam Campbell

Sam Campbell
2014.11.18 17:10:28 -07'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File 130.10

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 groundwater wells and surface water sampling locations based on 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 applicable surface water standards per Table 1 of RLMA Attachment 2.
   b. If historic contaminant levels from a particular well or sample location are below applicable 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 applicable 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 on site treatment system. An appropriate on site treatment system is one whose capacity and maximum allowable concentration limit are not exceeded by the contaminant levels in the water being treated. Water with contaminant concentrations greater than applicable 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 applicable 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 indicate otherwise. New data for that particular location will be evaluated in accordance with procedures specified in the RFLMA Attachment 2 (DOE 2011) before the water will be considered to be consistently greater than applicable surface water standards.
   e. When data from four consecutive sampling events (or the most recent year's worth of data) indicate concentrations of constituents of interest in water from a particular location are greater than applicable surface water standards, the water will be placed into an appropriate on site treatment system, until new data indicate otherwise. New data for that particular location will be evaluated in accordance with the procedures specified in the RFLMA Attachment 2 (DOE 2011) before the water will be considered to be consistently less than applicable surface water standards.

3. If water collected from any well location appears to contain immiscible liquids, 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.

4. The ultimate disposition option selected for each sample location is based on best professional judgment, considering 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. Minimization of investigative derived waste; and
    h. Natural background levels.

5. See attached Table 1 for proposed disposition path including supporting Table 2 (groundwater well locations) and Table 3 (surface water monitoring locations).

6. Disposition of excess water associated with sample collection at other locations will be evaluated by the environmental compliance specialist and may be added to this directive if appropriate.

Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water

Table 1. Disposition of water from groundwater and surface water sampling activities

Location	Water Type	Disposition	Basis
Groundwater			
All wells	Decon Water	Pour onto the ground[a]	Contaminant concentrations in decon water would be less than applicable 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 applicable surface water standards. Using an on site treatment system eliminates the need to characterize individual wells.[b]
Surface water			
All surface water locations	Excess Sample[c]	Place into Solar Ponds Plume Treatment System (see Table 3).	Contaminants may be present in concentrations greater than applicable 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[a]	Contaminant concentrations in decon water would be less than applicable surface water standards.

[a] Poured onto the ground in a manner that minimizes erosion and avoids direct discharge to surface water

[b] 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.

[c] An excess sample may only exist at continuous flow-paced sampling locations and not at locations where grab samples are collected.

Table 2. Water monitoring locations and classifications

Location	Frequency	Class	Plume or Area	Treatment System	Purpose
00191	Biennial	Evaluation	903 Pad	ETPTS	Monitor eastward flow of 903 Pad Plume
00193	Semiannual	AOC	Woman Creek Drainage	ETPTS	Monitor groundwater in Woman Creek drainage downgradient of groundwater plumes
00203	Biennial	Evaluation	Solar Ponds	SPPTS	Monitor southeast flow from 700 Area and SEPs
00491	Biennial	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	Biennial	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	Biennial	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	Biennial	Evaluation	East Trenches	ETPTS	Monitor East Trenches Plume source area
07391	Biennial	Evaluation	903 Pad/Ryan's Pit	ETPTS	Monitor Ryan's Pit source area
3687	Biennial	Evaluation	East Trenches	ETPTS	Monitor East Trenches Plume source area
4087	Semiannual	AOC	Present Landfill	PLFTS	Monitor downgradient Present Landfill/Landfill Pond groundwater quality
10304	Semiannual	AOC	Woman Creek Drainage	ETPTS	Monitor flowpath of Ryan's Pit/903 Pad Plume toward Woman Creek
10594	Semiannual	AOC	North Walnut Creek Drainage	SPPTS	Monitor North Walnut Creek drainage below former Pond A-1
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 groundwater quality
18199	Biennial	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	Biennial	Evaluation	700 Area	SPPTS	Monitor downgradient of IHSS 118.1 and 700 Area
21505	Biennial	Evaluation	North IA	SPPTS	Monitor downgradient of 700 Area
22205	Biennial	Evaluation	North IA	SPPTS	Monitor downgradient (north) tip of SEP VOC plume toward North Walnut Creek
22996	Biennial	Evaluation	B886	SPPTS	Monitor groundwater flowing east from 800 Area
23296	Semiannual	Sentinel	South Walnut Creek	ETPTS	Monitor groundwater downgradient of ETPTS
30002	Semiannual	Sentinel	North Walnut Creek	SPPTS	Monitor groundwater in North Walnut Creek drainage below PU&D Yard Plume
30900	Biennial	Evaluation	PU&D	ETPTS	Monitor PU&D Yard Plume source area
33502	Biennial	Evaluation	Oil Burn Pit #1	MSPTS	Monitor VOC Plume source area in buried drainage south of B371

Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water

Location	Frequency	Class	Plume or Area	Treatment System	Purpose
33604	Biennial	Evaluation	Oil Burn Pit #1	MSPTS	Monitor VOC Plume source area in buried drainage south of B371
33711	Semiannual	Sentinel	Oil Burn Pit #1	MSPTS	Monitor VOC Plume front in buried drainage south of B371
33905	Biennial	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	Biennial	Evaluation	B444	SPPTS	Monitor South IA Plume at VOC source area near B444
40205	Biennial	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
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
45608	Semiannual	Sentinel	Southwest of B991	MSPTS	Monitor adjacent to interrupted perforated line feeding former SW056
50299	Biennial	Evaluation	903 Pad/Lip Area	ETPTS	Monitor Ryan's Pit/903 Pad Plume
51605	Biennial	Evaluation	North Walnut Creek	SPPTS	Monitor downgradient of Solar Ponds Plume at former Pond A-1; also supports associated groundwater treatment system
52505	Semiannual	Sentinel	North Walnut Tributary Drainage	SPPTS	Monitor FC-2 drainage between B371/B771
55905	Biennial	Evaluation	B559	SPPTS	Monitor downgradient of B559, 700 Area, North IA Plume
56305	Biennial	Evaluation	B559	SPPTS	Monitor downgradient of B559, 700 Area, and North IA Plume near drainage between B371 and B559
70099	Semiannual	Sentinel	SPPTS	SPPTS	Monitor groundwater near western end of SPPTS
70193	Quarterly	RCRA	Present Landfill	ETPTS	Monitor upgradient Present Landfill groundwater quality
70393	Quarterly	RCRA	Present Landfill/PU&D	ETPTS	Monitor upgradient Present Landfill groundwater quality
70693	Quarterly	RCRA	Present Landfill/PU&D	ETPTS	Monitor upgradient Present Landfill/downgradient PU&D Yard groundwater quality
70705	Biennial	Evaluation	700 Area	SPPTS	Monitor 700 Area, North IA Plume
73005	Quarterly	RCRA	Present Landfill	PLFTS	Monitor downgradient Present Landfill groundwater quality
73105	Quarterly	RCRA	Present Landfill	PLFTS	Monitor downgradient Present Landfill groundwater quality
73205	Quarterly	RCRA	Present Landfill	PLFTS	Monitor downgradient Present Landfill groundwater quality
79102	Biennial	Evaluation	Solar Ponds	SPPTS	Monitor SEP VOC and uranium/nitrate plumes source area
79202	Biennial	Evaluation	Solar Ponds	SPPTS	Monitor SEP VOC and uranium/nitrate plumes source area
79302	Biennial	Evaluation	Solar Ponds	SPPTS	Monitor SEP uranium/nitrate plume source area
79402	Biennial	Evaluation	Solar Ponds	SPPTS	Monitor SEP uranium/nitrate plume source area
79502	Biennial	Evaluation	Solar Ponds	SPPTS	Monitor SEP uranium/nitrate plume source area
79605	Biennial	Evaluation	Solar Ponds	SPPTS	Monitor SEP uranium/nitrate plume source area
80005	Quarterly	RCRA	Original Landfill	SPPTS	Monitor downgradient Original Landfill groundwater quality
80105	Quarterly	RCRA	Original Landfill	SPPTS	Monitor downgradient Original Landfill groundwater quality

Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water

Location	Frequency	Class	Plume or Area	Treatment System	Purpose
80205	Quarterly	RCRA	Original Landfill	SPPTS	Monitor downgradient Original Landfill groundwater quality
88104	Semiannual	Sentinel	B881	SPPTS	Monitor flow from B881, 800 Area toward Woman Creek
88205	Biennial	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	Biennial	Evaluation	OU1	ETPTS	Monitor OU1 Plume source area
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	Biennial	Evaluation	903 Pad	ETPTS	Monitor southeastward flow of 903 Pad Plume
90804	Biennial	Evaluation	Ryan’s Pit/903 Pad	ETPTS	Monitor Ryan's Pit/903 Pad Plume
91105	Biennial	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	AOC	Present Landfill	PLFTS	Monitor downgradient Present Landfill/Landfill Pond groundwater quality
B210489	Biennial	Evaluation	North Walnut Creek	SPPTS	Monitor Solar Pond Plume at North Walnut Creek
P114689	Biennial	Evaluation	IA	SPPTS	Monitor IA Plume near B559
P115589	Biennial	Evaluation	IA	SPPTS	Monitor IA Plume near B551
P208989	Biennial	Evaluation	Solar Ponds	SPPTS	Monitor SEP VOC and uranium/nitrate plumes source area
P210089	Semiannual	Sentinel	North Walnut Creek	SPPTS	Monitor Solar Pond Plume between SEPs and SPPTS
P210189	Biennial	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	Biennial	Evaluation	IA	SPPTS	Monitor downgradient of B444 and South IA Plume
P419689	Biennial	Evaluation	B444	SPPTS	Monitor South IA Plume downgradient of VOC source area near B444

ETPTS = East Trenches Plume Treatment System; MSPTS = Mound Site Plume Treatment System; PLFTS = Present Landfill 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	Woman Creek at Indiana St.	SPPTS	Surface water leaving Federal property
GS03	CFP	POC	Walnut Creek at Indiana St.	SPPTS	Surface water leaving Federal property
GS05	CFP; qtrly grabs	OLF surface water	Woman Creek at west fenceline	SPPTS	Surface water entering Federal property upgradient of OLF
GS10	CFP; semiannual grabs	POE, Treatment system	S. Walnut Creek above former B-Ponds	SPPTS	Surface water entering former B-Ponds; MSPTS
GS13	CFP; semiannual grabs	Treatment system	N. Walnut Creek above former A-Ponds	SPPTS	Surface water entering former A-Ponds; SPPTS
GS51	CFP	Investigative	903 Pad/Lip Hillside	SPPTS	Surface water runoff to SID
GS59	CFP; qtrly grabs	OLF surface water	Woman Creek south of former B850	SPPTS	Surface water downgradient of OLF
WALPOC	CFP	POC	Walnut Creek at Indiana St.	SPPTS	Surface water leaving DOE-retained property
WOMPOC	CFP	POC	Woman Creek at Indiana St.	SPPTS	Surface water leaving DOE-retained property
ET INFLUENT	Semiannual	Treatment system	ETPTS influent	ETPTS	ETPTS
ET EFFLUENT	Semiannual	Treatment system	ETPTS effluent	ETPTS	ETPTS
GWISINFNORTH	None specified	Treatment system	Present Landfill: North GWIS influent	PLFTS	GWIS quality; App VIII
GWISINFSOUTH	None specified	Treatment system	Present Landfill: South GWIS influent	PLFTS	GWIS quality; App VIII
MOUND R1-O	Semiannual	Treatment system	MSPTS influent	MSPTS	MSPTS
MOUND R2-E	Semiannual	Treatment system	MSPTS effluent	MSPTS	MSPTS
NNG01	as needed	Treatment system	East end of former Landfill Pond	PLFTS	Water quality entering historic No Name Gulch drainage
PLFPONDINF	as needed	Performance	West end of former Landfill Pond	PLFTS	Former Landfill Pond quality
PLFSEEPINF	qtrly grabs	Treatment system	PLFTS seep influent	PLFTS	PLFTS
PLFSYSEFF	qtrly grabs	Treatment system	PLFTS effluent	PLFTS	PLFTS
POM2	semiannual grabs	Treatment system	S. Walnut Creek at former Pond B-4 Outlet	ETPTS	ETPTS
SPIN	Semiannual	Treatment system	SPPTS influent	SPPTS	SPPTS
SPOUT	Semiannual	Treatment system	SPPTS effluent	SPPTS	SPPTS
SPP DIS GALLERY	semiannual grabs	Performance	Discharge from SPPTS	NA	SPPTS
SW018	CFP; semiannual grabs	Surface water performance	West of former B771 on N. Walnut Creek tributary	NA	IHSS 118.1 and surface water to SW093
SW027	CFP	POE	SID above Pond C-2	SPPTS	Surface water entering Pond C-2
SW093	CFP	POE	N. Walnut Creek above SPPTS	SPPTS	Surface water entering A-Ponds

Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water

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; PLFTS = Present Landfill Treatment System; S = south; N = north; OLF = Original Landfill; PLF = Present Landfill; GWIS = Groundwater Intercept System; App = Appendix; SID = South Interceptor Ditch; IHSS = Individual Hazardous Substance Site.
NA = An excess sample may only exist at continuous flow-paced sampling locations and not at locations where grab samples are collected.

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U.S. Department of Energy Office of Legacy Management

RFS-2015-03

Effective Date: 10/31/2014
Expiration Date: 10/31/2017

Program Directive

Initiated By: Sam Campbell

Directive Subject:

Directive and Associated Task Changes: Composite surface water samples will be processed using the attached instructions.

Organization(s) Affected: Environmental Monitoring Operations, Projects/Programs, and Hydrology.

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351 current version).

Justification: 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 T. Kaiser
Linda Kaiser, Rocky Flats Site Manager

Teresa Nash, Quality and Performance Assurance

George Squibb
George Squibb, Surface Water Lead

Manager Approval:

Sam Campbell
Sam Campbell
2014.12.12 08:32:24 -07'00'
Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File 130.10

Guidelines for the Processing of Automated Surface-Water Composite Samples at the Rocky Flats Site

The purpose of these instructions is to describe the techniques and methods used for the processing of Rocky Flats automated surface-water composite samples. These samples are flow- paced composites collected continuously using automated samplers. These instructions contain 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 installed at locations throughout the Site and collect composite samples in dedicated 15-, 22-, or 50-liter carboys. The number of carboys and water volume collected will vary by location and be determined by streamflow rates. All carboys will be retrieved from the field, transported, 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 Westminster sample prep room 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, aliquots to be analyzed for filtered analytes, total suspended solids, and any other analyte that would be adversely affected by acidification, will be extracted via a peristaltic pump from the carboy into the appropriate sample container. Silicon tubing used in this process is dedicated to each unique carboy and will be disposed of after use.

The remaining carboy water will then be preserved with nitric acid (HN03) to a pH just above two (2.0). The carboy will sit 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 remaining preserved aliquots will be pumped using new tubing into the appropriate sample containers.

All aliquot 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 with the Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water program directive. Carboys will then be de-contaminated with dedicated (by sampling location) cleaning equipment in accordance with the LM SAP for subsequent re-use in the field.

RUL-2015-01

Effective Date: 10/31/2014
Expiration Date: 10/31/2017

Program Directive

Initiated By: Sam Campbell

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: Environmental Monitoring Operations, Projects/Programs

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (SAP) (LMS/PRO/S04351, current version).

Justification: Procedures for sampling natural gas are not addressed in the SAP. This Program Directive will be used to guide sample collection.

Review and Concurrence:

Rick Hutton
Digitally signed by Rick Hutton
DN: c=us, o=u.s. government, ou=department of energy, ou=Energy IT Services, ou=Legacy Management, ou=People, cn=Rick Hutton
Date: 2014.11.17 14:22:32 -07'00'

Rick Hutton, Nevada Off-Sites Project Manager/Rulison Site Lead

Millie J. Birrenbach
2014.11.13 12:43:09
-07'00'

Millie Birrenbach, Quality and Performance Assurance

Manager Approval:

Sam Campbell
Digitally signed by Sam Campbell
DN: c=us, o=u.s. government, ou=department of energy, ou=Energy IT Services, ou=Legacy Management, ou=People, cn=Sam Campbell
Date: 2014.11.13 15:01:24 -07'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File ADM 130.10

High Pressure Natural Gas Sampling Using a Propane Tank

Introduction and Purpose

The following procedure will be used to collect samples from privately owned natural gas production wells for analysis of carbon-14 and tritium. The work will be conducted at several natural gas production facilities near the Rulison, Colorado, Site; Rio Blanco, Colorado, Site; and Gasbuggy, New Mexico, Site. Site elevations vary from approximately 6,000 feet (ft) to 9,500 ft.

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 and incorporates contractor health and safety integrated safety management system control measures.

Health and Safety

See Table 1, “Tasks, Analyzed Hazards, and Control Measures.”

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. Additional tools include traffic cones or pin flags, and a non-sparking wrench.

Personal protective equipment (PPE) required includes a fire retardant shirt, hardhat, safety glasses, and sturdy work shoes. Hearing protection, leather work gloves**,** and nitrile gloves may also be required as determined by individual tasks and hazards. Additional PPE or safety training may be required by some well field operators.

The propane tank is provided by Isotech Laboratories and is purged and evacuated prior to delivery.

Caution

All tools must be non-sparking.

Sampling team members must wear a 4-gas personal detector at all times. *The “high alarm” must be set at 5% (full scale) of the lower explosive limit (LEL) for methane. Check handheld monitors for methane levels; if levels exceed LEL minimums follow well field operator’s instructions for moving away from the site.*

Prerequisite Actions

Hazard Classification per National Electrical Code, NFPA 70, Ch. 5 Article 500: Class 1 (flammable methane gas, hazardous by nature and ignitable), Division 1 (methane is present). Request that the well field operator conduct an initial sweep of the dog house and sampling area to monitor gas levels. If an explosive condition exists, follow the operator's requirements and leave the area immediately.

Sampling team members must "bump check" the 4-gas personal detectors at least once a week.

Procedure

Gas samples will be collected from pressurized well head collection systems, through a sampling regulator and tubing system, into a small propane tank. Samples will be taken from an existing sampling port; the port may be inside or outside the operator's "dog house." The well field operator will determine the location of the gas sampling port to be used.

[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] Inspect pressure fittings, regulators, and hoses for signs of wear, cracks, and breakage. Ensure sampling hoses, fittings, and pressure reducing regulators are rated to handle the gas delivery pressures at the sampling port.

[3] Verify acceptable line pressure from an inline pressure gauge or the LCD monitor readouts, or install a high pressure gauge (5,000 psi) at the sampling port. Ensure the port is free of debris prior to connection. Wear protective gloves as needed. Use Teflon tape at all threaded connections.

[4] **IF** the pressure is greater than 2,500 psi, **THEN** do not attempt to sample from that location.

[5] If the pressure is less than 2,500 psi, install the inlet side of the pressure regulator directly to the sample port via a properly sized threaded bushing. Use the spark-free bronze wrench to make this and all other connections.

Caution

***Do not** use any flame or carry any device capable of creating a spark (e.g., cell phone) when connecting sampling hardware. Keep such items inside the vehicle. Park and turn off the vehicle at least 50 ft away from the sampling port or where the well field operator directs.*

***Do not** operate any valves, chokes, or switches unless specifically requested by the well field operator. No smoking anywhere on the well field operator's site. Only non-sparking tools shall be used.*

[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 counterclockwise to tighten.* ***Do not*** *over tighten.*

[7] Open the control valve at the sampling port.

[8] Adjust the outlet pressure on the pressure regulator to 20 psi.

[9] Place bypass vent line exhaust end downwind from sampling assembly. When purging sample lines use a 25-ft extension line with the discharge located downwind of samplers.

[10] Establish a C1D2 exclusion zone as a 15-ft-radius exclusion zone around the vent line discharge point using pin flags or cones. When an operator is venting natural gas from the well or piping system, stop sampling activities and move at least 100 ft upwind from the discharge point until venting is complete.

[11] Open the bypass valve on the propane tank for approximately 10 seconds to purge the air space in the pressure regulator and flexible tubing; close the bypass valve.

[12] 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.

[13] 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).

[14] Close the valve on the propane tank. Do not over tighten.

[15] Close the control valve at the sample port.

[16] Open the bypass valve on the propane tank to release the pressure and then close the bypass valve.

[17] Disconnect the flexible tubing/pressure regulator assembly.

[18] 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. Contact a Certified Shipper to complete and sign the required documentation and oversee the shipment. The gas collection tank must be secure and upright when transporting the sampling container.

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 10/10/2011.

Figure 1. Flexible Tubing/Pressure Regulator Assembly and Propane Tank

Table 1. Tasks, Analyzed Hazards, and Control Measures

Task	Hazard	Controls
Driving to and from the gas well sites	1) Slippage and loss of control due to steep grades and wet road conditions	1) Conform to the well field operator's speed limit requirements. If road conditions make driving unsafe, postpone the sampling event. Use 4WD vehicle and carry tire chains, tow-chain, and shovel.
	2) Vehicle accidents	2) When approaching sharp corners slow down, move to the right, and pay attention to driving conditions. Pull over to allow oncoming traffic to pass if road is too narrow. Keep vehicles a safe distance from drop offs. The driver will not use two-way communication devices while vehicle is in motion. Be very alert to the potential for wildlife or livestock on the roads.
	3) Driving hazards caused by well field operator activities	3) Follow the well field operator to the designated parking area. Follow their instructions for parking. When leaving or backing up, have a spotter assist in backing out of parking space if there is other vehicle traffic or equipment in the area. Obey all well field operator restrictions.
Hazards common to all site activities	1) Slips, trips, falls	1) Keep work area uncluttered; remove tripping hazards if possible. Drill rigs, platforms and associated equipment have many tripping hazards; be cautious, use hand rails, especially on stairways when carrying sampling equipment and samples; pay attention to surroundings. Use extra caution on stairways and platforms when ice, snow, or muddy conditions exist.
	2) Head, eye, or foot injury, burns	2) PPE shall be worn in accordance with the well field operators' requirements; at a minimum wear hard hat, eye protection, sturdy work boots, and fire retardant shirt at all times outside the vehicle. Hearing protection and nitrile gloves may be required during sample collection. Adhere to noise area postings and procedure requirements.
	3) Injury to hands	3) Keep hands and fingers out of pinch points and crush areas. Wear leather work gloves if there is a potential for cuts, abrasions, blisters etc. (e.g., installing chains on the vehicle).
	4) Inclement weather and lightning strikes	4) Seek shelter when weather conditions present a threat to safe working conditions. Use the 30/30 rule to assess a threat. Cease field activities when lightning is within 6 miles (30 seconds between flash and bang). Field activities can resume 30 minutes after the last audible thunder. Suspend work if strong winds cause a hazard.
	5) Biological hazards—snakes, insects, and bears	5) Remain alert for snakes and avoid them. Do not put hands into dark or obscured areas. Remain alert for bears—if a bear enters the work area, get inside a vehicle or the dog house as quickly as possible.
	6) Explosion caused by spark or fire in the work area	6) Samplers must not use any flame or carry any device capable of creating a spark (e.g., cell phone) when connecting sampling hardware. Keep such items inside the vehicle. Keep vehicle 50 ft away from sampling port or where well field operator directs. Keep vehicle ignition off during gas sampling activities. Do not operate any valves, chokes, or switches unless specifically requested by the well field operator. No smoking anywhere on the well field operators' site. Only non-sparking tools shall be used.
	7) Explosive atmosphere within work area	7) Request that the well field operator conduct an initial sweep of the dog house and sampling area to monitor gas levels. If an explosive condition exists, follow the well field operator's requirements and leave the area immediately. Sampling team members will wear a 4-gas personal detector at all times while sampling. The high alarm should be set at 5% (full scale) of the lower explosive limit (LEL) for methane. When purging sample lines use a 25-foot extension line with the discharge located downwind of the samplers. Establish a C1D2 exclusion zone as a 15-foot radius around the purging hose discharge point. Cones or pin flags should be used to define the C1D2 zone. When the well field operator is venting natural gas from well or piping system, stop sampling activities and move at least 100 ft upwind from the discharge point until venting is complete.

Task	Hazard	Controls
Gas Sample Collection	Methane release due to equipment failure such as (1) blockage of sampling regulator causing sampling line break, or (2) regulator damage or breakage from higher than anticipated inline pressure	Prior to sampling, inspect pressure fittings, regulators, and hoses for signs of wear, cracks, and breakage. Ensure sampling hoses, fittings, and pressure reducing regulators are rated to handle the gas delivery pressures at the sampling port. Verify acceptable pressures at a pressure gauge or the LCD monitor readout before sample collection in accordance Step 2 of the "High Pressure Natural Gas Sampling Procedure." The well field operator will inform the sampling team which sample port to use for gas collection. The sampling team will check to make sure the port is free of debris prior to connection.
	Explosive atmosphere created during sampling	When purging sample lines use a 25-ft extension line with the discharge located downwind of samplers. Establish a C1D1 exclusion zone as a 15-ft radius around the discharge point. Cones or pin flags should be used to define the C1D1 zone. When an operator is venting natural gas from a well or piping system, stop sampling activities and move at least 100 ft upwind from the discharge point until venting is complete. Hazard Classification per National Electrical Code, NFPA 70, Ch. 5 Art. 500: Class 1 (flammable methane gas, hazardous by nature and ignitable), Division 1 (methane is present). Check handheld monitors for methane levels; if levels exceed LEL minimums, follow operators' instructions for moving away from the site. Samplers must not use any flame or carry any device capable of creating a spark (e.g., cell phone) when connecting sampling hardware. Keep such items inside the vehicle. Keep vehicle 50 ft away from sampling port or where operator directs. Keep vehicle ignition off during gas sampling activities. Do not operate any valves, chokes, or switches unless specifically requested by the well field operator. No smoking anywhere on the well field operators' site. Only non-sparking tools shall be used.
Transporting Natural Gas Samples	Explosive atmosphere created by damage to cylinder valve during transport, causing gas leak	When transporting a sampling container, the gas collection tank must be secure and upright.

Sampling Frequencies for Locations at Rulison, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
Off-Site						
CER Test Well			X			
Daniel Gardener			X			
Kevin Whelan			X			
Morrissania Ranch			X			
Patrick McCarty			X			
Tim Jacobs Ranch New			X			
On-Site						
Cary Weldon House W			X			
Wesley Kent House W			X			
Municipal Water Supply						
City Springs			X			
Surface Locations						
On-Site						
Spr 300 Yrd N Of GZ			X			
Sprg 500ft E of GZ			X			
Off-Site						
Battlement Creek			X			
Potter Ranch			X			

Sampling conducted in May

Constituent Sampling Breakdown

Site	**Rulison**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	9	4			
Field Measurements					
Alkalinity					
Dissolved Oxygen					
Redox Potential					
pH	X	X			
Specific Conductance	X	X			
Turbidity	X				
Temperature	X	X			
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Calcium					
Chloride					
Chromium					
Gamma Spec	X	X	10 pCi/L	Gamma Spectrometry	GAM-A-001
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Tritium	X	X	400 pCi/L	Liquid Scintillation	LSC-A-001
Tritium, enriched	25% of the samples	25% of the samples	10 pCi/L	Liquid Scintillation	LMR-15
Uranium					
Vanadium					
Zinc					
Total No. of Analytes	3	3			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

U.S. Department of Energy Office of Legacy Management

SAL-2013-02

Effective Date: 09/24/2013
Expiration Date: 09/24/2016

Program Directive

Initiated By: Sam Campbell

Directive Subject: High-Flow Sampling

Directive and Associated Task Changes: Samples will be collected from wells SA5-4-4 and SA5-5-4 with high-flow, dedicated submersible pumps after the minimum purge volume is removed, and, thereafter, field parameters have stabilized (i.e., pH within 0.2 units and specific conductance within 10% over final three readings, and turbidity less than 10 NTUs). The minimum purge volume includes the volume contained in the pump drop-pipe plus three casing volumes from beneath the packer. As shown in the table, calculated minimum purge volumes are 1,070 gallons and 1,049 gallons for SA5-4-4 and SA5-5-4, respectively. Field parameter measurements will be recorded a minimum of every 50 gallons after the minimum purge volume is removed. Purge times for SA5-4-4 and SA5-5-4 are expected to be approximately 2.5 and 3 hours, respectively, based on historical flow rates.

Well ID	Interval Description	Depth Interval (ft)	Length (ft)	Diameter (in)	Conversion Factor (gal/ft)	Volume (gal)
SA5-4-4	Pump drop-pipe	0–1768	1,768	2 3/8	0.23	407
	Fiberglass casing	1,770.–1,777.2	6.7	7	2	13 x 3
	PVC well screen and sump	1,777.2–2,098	320.8	4	0.65	208 x 3
					Total Volume	**1,070**
SA5-5-4	Pump drop-pipe	0–1768	1,768	2 3/8	0.23	407
	Fiberglass casing	1,770.5–1,778.3	7.8	7	2	16 x 3
	PVC well screen and sump	1,778.3–2,083	304.7	4	0.65	198 x 3
					Total Volume	**1,049**

Organization(s) Affected: Projects/Programs, Environmental Monitoring Operations.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites*, LMS/PRO/S04351 (current version).

Justification: The SAP does not address high-flow sampling, and the current dedicated pump configuration in these wells is designed for high-flow sampling; therefore, a Program Directive is required. It is assumed that the packers installed in these wells will effectively isolate the water column above the screen, so casing volumes are calculated from the bottom of the packers to the bottom of the well.

Review and Concurrence:

Cassandra Gauthier Cassandra Gauthier
2013.09.25 14:54:45 -06'00'

Cassie Gauthier, Site Lead

Rex Hodges

Rex Hodges, Site Hydrologist

Linda S. Tegelman
2013.09.25 14:50:59 -06'00'

Linda Tegelman, Q&PA Specialist

Manager Approval:

Sam Campbell Sam Campbell
2013.09.25 14:34:24 -06'00'

Sam Campbell, Environmental Monitoring Operations, Manager

Electronic Distribution:
Record File ADM 130.10

Sampling Frequencies for Locations at Salmon, Mississippi

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
On-Site						
Source Area 1						
SA1-1-H			X			
SA1-2-H			X			
SA1-3-H			X			
SA1-4-H			X			
SA1-5-H			X			
SA1-6-H			X			
SA1-7-H			X			
SA1-12-H			X			
HMH-5R			X			
HMH-16R			X			
HM-S			X			
SA1-8-L			X			
HM-L			X			
HM-1			X			
HM-2A			X			
HM-2B			X			
HM-3			X			
SA1-11-3			X			
Source Area 2						
SA2-1-L			X			
SA2-2-L			X			
SA2-4-L			X			
Source Area 3						
SA3-4-H			X			
E-7			X			
SA3-11-3			X			
Source Area 4						
HM-L2			X			
SA4-5-L			X			
Source Area 5						
SA5-4-4			X			
SA5-5-4			X			

Sampling Frequencies for Locations at Salmon, Mississippi

Location ID	Quarterly	Semiannually	18 Months	Biennially	Not Sampled	Notes
Surface Locations						
On-Site						
HALFMOON CREEK			X			
HALFMOONCRK OVERFLOW			X			
Pond west of GZ			X			
REECo Pit (A)			X			
REECo Pit (B)			X			
REECo Pit (C)			X			
Grantham Ck Entry					X	
Half Moon Ck Entry					X	
Hick Hollow Ck Entry					X	
Half Moon Ck Exit			X			
Off-Site						
GC-E			X			
HMC-S			X			
HickHCrTSD-East			X			Hickory Hollow Creek where it exits under the east side of Tatum Salt dome road

Sampling conducted in April

Constituent Sampling Breakdown

Site	Salmon				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	28	11			
Field Measurements					
Alkalinity					
Dissolved Oxygen	X				
Redox Potential	X				
pH	X	X			
Specific Conductance	X	X			
Turbidity	X				
Temperature	X	X			
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Antimony					
Arsenic	Selected wells only	Selected locations only	0.0001	SW-846 6020	LMM-02
Barium	Selected wells only	Selected locations only	0.1	SW-846 6010	LMM-01
Beryllium					
Cadmium					
Calcium					
Chromium	Selected wells only	Selected locations only	0.002	SW-846 6010	LMM-01
Gamma Spec	Selected wells only	Selected locations only	10 pCi/L	Gamma Spectrometry	GAM-A-001
Gross alpha/Gross beta	Selected wells only	Selected locations only	2/4	Gas proportional counter	GPC-A-001
Iron					
Lead	Selected wells only	Selected locations only	0.002	SW-846 6020	LMM-02
Magnesium					
Manganese					
Mercury					
Molybdenum					
Nickel					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Selenium					
Silver					
Sodium					
Sulfate					
Tritium	X	X	400 pCi/L	Liquid Scintillation	LSC-A-001
Tritium, enriched	25% of the samples	25% of the samples	10 pCi/L	Liquid Scintillation	LMR-15
Uranium					
Vanadium					
VOCs	Selected wells only		0.001	SW-846 8260, Low Level	LMV-05
Zinc					
Total No. of Analytes	9	8			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Sherwood, Washington

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring 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	Groundwater	Surface Water	Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Approx. No. Samples/yr	3	0			
Field Measurements					
Alkalinity					
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Calcium					
Chloride	X		0.5	SW-846 9056	MIS-A-039
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate	X		0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	X		10	SM2540 C	WCH-A-033
Total Organic Carbon					
Uranium					
Vanadium					
Zinc					
Total No. of Analytes	3	0			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

SHP-2015-01

Effective Date: 10/31/2014
Expiration Date: 10/31/2017

Program Directive

Initiated By: Sam Campbell

Directive Subject: Filtration of Surface Water Samples

Directive and Associated Task Changes: All surface water samples at the Shiprock site will be collected without filtering regardless of sample turbidity. An additional filtered sample will be collected at all sample locations on the San Juan River.

Organization(s) Affected: Environmental Monitoring Operations, Projects/Programs

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, current version).

Justification: Surface water results are used to evaluate potential ecological and human risk, which requires that samples are collected without filtering. In addition, Tribal stakeholders have requested collection of unfiltered samples.

Review and Concurrence:

David E. Miller
2014.10.20 12:52:17 -06'00'

David Miller, Site Lead

Linda S. Tegelman
2014.10.20 11:20:44 -06'00'

Linda Tegelman, Quality and Performance Assurance

Manager Approval:

Sam Campbell
Sam Campbell
2014.10.20 10:50:05 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File ADM 130.10

Sampling Frequencies for Locations at Shiprock, New Mexico

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
FLOODPLAIN - SHP01						
608		X				Low flow
610		X				
611		X				
612		X				
614		X				Low flow
615		X				Low flow
617					X	Data logger only
618		X				Low flow
619		X				Low flow
622		X				
623		X				
625		X				
626		X				
628		X				
630		X				
734		X				Low flow
735		X				Low flow
736		X				Low flow; data logger
766		X				
768		X				
773		X				
775		X				
779		X				
782R		X				
783R		X				
792		X				
793		X				
797		X				Low flow
798		X				
850		X				Low flow
853		X				
854		X				Data logger
855		X				
856		X				
857		X				Data logger
862					X	WLs only
863					X	WLs only
1000					X	WLs only
1001					X	WLs only
1008		X				Data logger
1009		X				
1062					X	WLs only
1089		X				U, SO4, N as NO3 only at vault
1104		X				U, SO4, N as NO3 only at vault
1105		X				
1109		X				Trench 2; U, SO4, N as NO3 only at vault
1110		X				Trench 1; U, SO4, N as NO3 only at vault
1111		X				Well point; U, SO4, N as NO3 only. Purge 1 casing vol then sample

Sampling Frequencies for Locations at Shiprock, New Mexico

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
FLOODPLAIN - SHP01						
1112		X				Well point; U, SO4, N as NO3 only. Purge 1 casing vol then sample
1113		X				Well point; U, SO4, N as NO3 only. Purge 1 casing vol then sample
1114		X				Well point; U, SO4, N as NO3 only. Purge 1 casing vol then sample
1115		X				Well point; U, SO4, N as NO3 only. Purge 1 casing vol then sample
1117		X				Well point; U, SO4, N as NO3 only. Purge 1 casing vol then sample
1128		X				
1132		X				
1134		X				
1135		X				
1136		X				
1137		X				
1138		X				
1139		X				
1140		X				
1141		X				
1142		X				
1143		X				
TERRACE - SHP02						
600		X				
602		X				Data logger
603		X				
604		X				Data logger
648				Odd year		Measure flow rate semiannually; sample biennially; next in 2013
725		X				Data logger
726		X				
727		X				
728		X				Data logger
730		X				Data logger
731		X				Data logger
800					X	WLs only
801					X	WLs only
802					X	WLs only
803					X	WLs only
812		X				
813		X				Data logger
814		X				
815		X				
816		X				
817		X				Low flow
818		X				Ext. well; U, SO4, N as NO3 only at vault
819		X				Data logger
820		X				
821		X				
822		X				
823		X				

Sampling Frequencies for Locations at Shiprock, New Mexico

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
TERRACE - SHP02						
824		X				
825		X				
826		X				Data logger
827		X				Data logger
828		X				Data logger
829		X				
830		X				Data logger
832		X				
833		X				
835		X				Low flow; data logger
836		X				Low flow; data logger
837		X				Data logger
838		X				Low flow
841		X				Low flow; data logger
843		X				Data logger
844		X				
848		X				Data logger
1002		X				
1003		X				
1004		X				
1007		X				
1011		X				
1048		X				
1049		X				
1057		X				
1058		X				
1059		X				
1060		X				
1067					X	WL only; Bob Lee Wash
1068		X				Bob Lee Wash
1069		X				Bob Lee Wash; data logger
1070		X				Ext. well; U, SO4, N as NO3 only at vault
1071		X				Ext. well; U, SO4, N as NO3 only at vault
1073		X				Data logger
1074		X				
1078		X				Ext. well; U, SO4, N as NO3 only at vault
1079		X				Low flow
1087		X				SUMP-Bob Lee Wash
1088		X				SUMP-Many Devils Wash
1091		X				Ext. well; U, SO4, N as NO3 only at vault
1092		X				Ext. well; U, SO4, N as NO3 only at vault
1093R		X				Ext. well; U, SO4, N as NO3 only at vault
1095		X				Ext. well; U, SO4, N as NO3 only at vault
1096		X				Ext. well; U, SO4, N as NO3 only at vault
1120		X				
1122		X				
MW1		X				
DM7		X				

Sampling Frequencies for Locations at Shiprock, New Mexico

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Surface Locations						
FLOODPLAIN - SHP01						
501		X				East of disposal cell
655		X				Drainage channel
897		X				Just below mouth of Many Devils Wash
899		X				
940		X				Just NE of 1004, San Juan River
956		X				San Juan River at intake
965		X				San Juan River about 1500' below dist. Channel
967		X				San Juan River upgradient
1118		X				Seep sump (423/426) U, SO4, N as NO3 only at vault
1203		X				East of disposal cell
1205		X				San Juan River E of well 853
TERRACE - SHP02						
662		X				Lower Bob Lee Wash
885					X	Upper Bob Lee Wash; water level
889		X				Many Devils Wash
949		X				
1215		X				
1218		X				
1219		X				
1220		X				
1221		X				

Sampling conducted in March and September

NOTE: All San Juan River locations will have both filtered and unfiltered samples collected

Constituent Sampling Breakdown

Site	Shiprock				
Analyte	Groundwater	Surface Water	Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Approx. No. Samples/yr	256	38			
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)	X	X	0.1	EPA 350.1	WCH-A-005
Calcium	X	X	5	SW-846 6010	LMM-01
Chloride	X	X	0.5	SW-846 9056	MIS-A-039
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium	X	X	5	SW-846 6010	LMM-01
Manganese	X	X	0.005	SW-846 6010	LMM-01
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	0.05	EPA 353.1	WCH-A-022
Potassium	X	X	1	SW-846 6010	LMM-01
Radium-226					
Radium-228					
Selenium	X	X	0.0001	SW-846 6020	LMM-02
Silica					
Sodium	X	X	1	SW-846 6010	LMM-01
Strontium	X	X	0.2	SW-846 6010	LMM-01
Sulfate	X	X	0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	12	12			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Shirley Basin South, Wyoming

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
100-SC			X			
101-SC			X			
102-SC			X			
110-DC			X			
112-DC			X			
113-DC			X			
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 June

Constituent Sampling Breakdown

Site	**Shirley Basin South**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	14	0			
Field Measurements					
Alkalinity					
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Cadmium	X		0.001	SW-846 6020	LMM-02
Calcium					
Chloride	X		0.5	SW-846 9056	MIS-A-039
Chromium	X		0.005	SW-846 6010	LMM-01
Gross Alpha					
Gross Beta					
Iron					
Lead	X		0.002	SW-846 6020	LMM-02
Magnesium					
Manganese					
Molybdenum					
Nickel	X		0.02	SW-846 6010	LMM-01
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X		0.05	EPA 353.1	WCH-A-022
Potassium					
Radium-226	X		1 pCi/L	Gas Proportional Counter	GPC-A-018
Radium-228	X		1 pCi/L	Gas Proportional Counter	GPC-A-020
Selenium	X		0.0001	SW-846 6020	LMM-02
Silica					
Sodium					
Strontium					
Sulfate	X		0.5	SW-846 9056	MIS-A-044
Sulfide					
Thorium-230	X		1 pCi/L	Alpha Specrtrometry	ASP-A-008
Total Dissolved Solids	X		10	SM2540 C	WCH-A-033
Total Organic Carbon					
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	13	0			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

SHL-2015-01

Effective Date: 11/30/2014
Expiration Date: 11/30/2017

Program Directive

Initiated By: Sam Campbell

Directive Subject: Miscellaneous Sampling Activities

Directive and Associated Task Changes:

1. Samples will be collected from wells HC-2d, HC-4, HC-5, HC-7, HC-8, MV-1, MV-2, MV-3, MV-4, and MV-5 using the dedicated high-flow submersible pumps after the minimum purge volume has been removed, and thereafter field parameters have stabilized (i.e. pH within 0.2 units and conductivity/temperature within 10% over final 3 readings and turbidity less than 10 NTUs). A least three field parameter measurements will be recorded a minimum of every 50 gallons after the minimum purge volume is removed. The minimum purge volume is the volume of water contained in the pump riser-pipe plus the total volume of the water column in the well. Table 1 below provides the calculated minimum purge volumes for each well.

2. Samples will be collected from the screen interval of wells HC-1, HC-3, and HC-6 using a depth-specific bailer.

Organization(s) Affected: Environmental Monitoring Operations, Projects and Programs.

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (SAP) (LMS/PRO/S04351, current version).

Justification: The current dedicated pump configuration is designed for high-flow sampling, and the SAP does not address high-flow sampling. Wells listed in item 2 above do not have a pump installed, so a depth-specific bailer is currently the only option for a sampling device because of the depth to water in these wells. Utilization of the specific purging and sampling methods will continue because it’s consistent with the sample collection process historically used at the site.

Table 1. Well Purge Volume Calculations

Well ID	Interval Description	Depth Interval (ft)	Length (ft)	Inside Diameter (in)	Conversion Factor (gal/ft)	Well Casing Volume (gal)
HC-2d	Pump riser pipe above water	0 – 1,050	1,050	1.25	0.064	67
	Water column in well	1,050 – 1,836	786	8.25	2.780	2,185
					HC-2d Total Minimum Purge Volume (gallons)	**2,252**
HC-4	Pump riser pipe above water	0 - 1013	1,013	1.25	0.064	65
	Water column in well	1,013 – 1,294	281	8.25	2.780	781
					HC-4 Total Minimum Purge Volume (gallons)	**846**
HC-5	Pump riser pipe above water	0 - 1367	1,367	1.25	0.064	87
	Water column in well	1,367 – 3,561	2,194	5	1.020	2,238
					HC-5 Total Minimum Purge Volume (gallons)	**2,325**
HC-7	Pump riser pipe above water	0 - 975	975	1.25	0.064	62
	Water column in well	975 – 1,225	250	5	1.020	255
					HC-7 Total Minimum Purge Volume (gallons)	**317**
HC-8	Pump riser pipe above water	0 – 1,369	1,369	1.25	0.064	88
	Water column in well	1,369 – 2,441	1,072	5	1.020	1093
					HC-8 Total Minimum Purge Volume (gallons)	**1,181**
MV-1	Pump riser pipe above water	0 - 997	997	1.25	0.064	64
	Water column in well	997 – 1,750	753	5	1.020	768
					MV-1 Total Minimum Purge Volume (gallons)	**832**
MV-2	Pump riser pipe above water	0 – 1,006	1,006	1.25	0.064	64
	Water column in well	1,006 – 2,011	1,005	5	1.020	1,025
					MV-2 Total Minimum Purge Volume (gallons)	**1,089**
MV-3	Pump riser pipe above water	0 - 983	983	1.25	0.064	63
	Water column in well	983 – 1,658	675	5	1.020	689
					MV-3 Total Minimum Purge Volume (gallons)	**752**
MV-4	Pump riser pipe above water	0 – 1,080	1,080	1.25	0.064	69
	Water column in well	1,080 – 1,560	480	5	1.020	490
					MV-4 Total Minimum Purge Volume (gallons)	**559**
MV-5	Pump riser pipe above water	0 – 1,050	1,050	1.25	0.064	67
	Water column in well	1,050 – 1,505	455	5	1.020	464
					MV-5 Total Minimum Purge Volume (gallons)	**531**

Review and Concurrence:

Rick Hutton

Digitally signed by Rick Hutton
DN: c=us, o=u.s. government, ou=department of energy, ou=Energy IT Services, ou=Legacy Management, ou=People, cn=Rick Hutton
Date: 2014.12.08 14:47:31 -07'00'

Rick Hutton, Nevada Off-Sites Project Manager

Richard C. Findlay

Rick C. Findlay
2014.12.03 08:56:59 -07'00'

Rick Findlay, Project Technical Lead

Millie J. Birrenbach
2014.12.03 10:44:06
-07'00'

Millie Birrenbach, Quality and Performance Assurance

Manager Approval:

Sam Campbell

Sam Campbell
2014.11.24 16:11:40
-07'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File ADM 130.10

Sampling Frequencies for Locations at Shoal, Nevada

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
H-2					X	Download transducers
H-3					X	Download transducers
HC-1			X			Download transducers
HC-2			X			Download transducers
HC-3			X			Download transducers
HC-4			X			Download transducers
HC-5			X			Download transducers
HC-6			X			Download transducers
HC-7			X			Download transducers
HC-8			X			Download transducers
MV-1			X			Download transducers
MV-2			X			Download transducers
MV-3			X			Download transducers
Piezometers						
MV-1PZ					X	Download transducers
MV-2PZ					X	Download transducers
MV-3PZ					X	Download transducers

Sampling conducted in May

Constituent Sampling Breakdown

Site	Shoal Site				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	11				
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)					
Bromide					
Calcium					
Carbon-14					
Chloride					
Chromium					
Gamma Spec					
Gross Alpha	X		2 pCi/L	EPA 900.0	GPC-A-001
Gross Beta					
Iodine-129					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Tritium	X		400 pCi/L	Liquid Scintillation	LSC-A-001
Tritium, enriched					
Uranium-234, -235, -238	X		1 pCi/L	Alpha Spectrometry	ASP-A-024
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	4	0			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Slick Rock, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
WEST						
317			X			
318A			X			
319			X			
320			X			
339			X			
340			X			
508			X			
510			X			
684			X			
EAST						
300			X			
303			X			
305			X			
307			X			
309			X			
310			X			
311			X			
312			X			
Surface Locations						
WEST						
347			X			
349			X			
693			X			
694			X			
EAST						
692			X			
696			X			
700			X			

Sampling conducted in September

Constituent Sampling Breakdown

Site	**Slick Rock**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
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)					
Calcium					
Chloride					
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese	0318A, 0320, 0339, 0340, 0508, 0510, 0684	0347, 0349, 0693, 0694	0.005	SW-846 6010	LMM-01
Molybdenum	0317, 0318A, 0320, 0339, 0340, 0508, 0510, 0684	0347, 0349, 0693, 0694	0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	0318A, 0320, 0339, 0340, 0508, 0510, 0684	0347, 0349, 0693, 0694	0.05	EPA 353.1	WCH-A-022
Potassium					
Radium-226	0319		1 pCi/L	Gas Proportional Counte	GPC-A-018
Radium-228	0319		1 pCi/L	Gas Proportional Counte	GPC-A-020
Selenium	0305, 0307, 0317, 0318A, 0319, 0320, 0339, 0340, 0508, 0510, 0684	0347, 0349, 0693, 0694	0.0001	SW-846 6020	LMM-02
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Uranium	0303, 0305, 0307, 0309, 0310, 0311, 0312, 0318A, 0320, 0339, 0340, 0508, 0510, 0684	X	0.0001	SW-846 6020	LMM-02
Vanadium					
VOCs (BETX)	0319 only		0.005	SW-846 8260	VOA-A-009
Zinc					
Total No. of Analytes	8	5			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

TUB-2015-01

Effective Date: 10/31/2014
Expiration Date: 10/31/2017

Program Directive

Initiated By: Sam Campbell

Directive Subject: Sampling of the Tuba City Evaporation Pond

Directive and Associated Task Changes: Samples will be collected from the evaporation pond using the following protocol:

- DO NOT cross the radiological control boundary when sampling.
- Collect samples through dedicated tubing installed in the pond and secured to a post that forms the boundary of the radiological control area.
- Use a peristaltic pump and pump water from the pond and through a 0.45 micron disposable filter installed *before* the peristaltic pump, which is different from the normal configuration where the filter is placed after the peristaltic pump.
- Filtration is required regardless of pond turbidity in order to control solids pumped from the pond, therefore turbidity measurements will not be made.
    - After completion of sampling, place the filter in a sealable plastic bag and store in the site radioactive materials area.
- Return excess water pumped while taking field measurements to the pond by directing the discharge from the flow-cell down the pond liner.

Organization(s) Affected: Environmental Monitoring Operations, Projects/Programs

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, current version).

Justification: This protocol is necessary because the evaporation pond is designated as a radiological area and the solids in the pond are the primary radiological concern. This directive provides a direction to sample water from the pond (not a radiological concern) while managing the solids (radiological concern) that may potentially be removed from the pond.

Review and Concurrence:

Scott C. Smith
Digitally signed by Scott C. Smith
Date: 2014.10.23 14:32:15 -06'00'

Scott Smith, Site Lead

Linda S. Tegelman
2014.10.20 11:22:28 -06'00'

Linda Tegelman, Quality and Performance Assurance

Anthony Martinez

Digitally signed by Anthony Martinez
DN: c=us, o=u.s. government, ou=department of energy,
ou=Energy IT Services, ou=Legacy Management, ou=People,
cn=Anthony Martinez
Date: 2014.10.23 13:35:13 -06'00'

Anthony Martinez, Health and Safety – Radiological Control Technician

Manager Approval:

Sam Campbell

Sam Campbell
2014.10.20 10:53:22 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File ADM 130.10

Sampling Frequencies for Locations at Tuba City, Arizona

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring 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
286		X				
287		X				
288		X				
289		X				
290		X				
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

Sampling Frequencies for Locations at Tuba City, Arizona

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
910			X			August
911			X			August
912			X			August
913			X			August
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

Sampling Frequencies for Locations at Tuba City, Arizona

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
1117			X			August
1118			X			August
1119			X			August
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
NMW-1A		X				
NMW-2A		X				
NMW-3A		X				
NMW-4A		X				
NMW-5		X				
NMW-6S		X				
NMW-7D		X				
NMW-8S		X				
NMW-9D		X				
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
1573			X			West pipe Shonto Well - August
Treatment System Locations						
1202		X				
1205		X				Treatment system distillate; verify location with system operators
1206		X				

Semi-annual sampling conducted in February and August; Annual sampling conducted in August.

Constituent Sampling Breakdown

Site	**Tuba City**				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	143	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		0.1	EPA 350.1	WCH-A-005
Arsenic	X	X	0.0001	SW-846 6020	LMM-02
Calcium	X	X	5	SW-846 6010	LMM-01
Chloride	X	X	0.5	SW-846 9056	WCH-A-039
Chromium					
Gross Alpha					
Gross Beta					
Iron	X	X	0.05	SW-846 6020	LMM-02
Lead					
Magnesium	X	X	5	SW-846 6010	LMM-01
Manganese	X	X	0.005	SW-846 6010	LMM-01
Molybdenum	X	X	0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	0.05	EPA 353.1	WCH-A-022
Potassium	X	X	1	SW-846 6010	LMM-01
Radium-226					
Radium-228					
Selenium	X	X	0.0001	SW-846 6020	LMM-02
Silica	X		0.2	SW-846 6010	LMM-01
Sodium	X	X	1	SW-846 6010	LMM-01
Strontium					
Sulfate	X	X	0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	X	X	10	SM2540 C	WCH-A-033
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	16	14			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

WEL-2015-01

Effective Date: 10/1/2014
Expiration Date: 10/1/2017

Program Directive

Initiated By: Sam Campbell

Directive Subject: Sampling Activities

Directive and Associated Task Changes:

1. Purging and sampling at RMW wells will be accomplished using a high-flow method rather than a low-flow method. Samples will be collected from wells RMW-1, RMW-2, RMW-3, and RMW-4 with dedicated submersible pumps after one well casing volume has been purged and field parameters have stabilized (i.e., pH within 0.2 unit and specific conductance within 10% over final three readings and turbidity less than 10 NTU for the last reading).

2. Filtration of samples will be accomplished as follows: Samples collected for dissolved iron analysis at the 1000 series wells will be filtered at the time of collection through a 0.45 µm pore-size filter. All other sample collection will be conducted without filtration regardless of sample turbidity.

Organization(s) Affected: Environmental Monitoring Operations, Projects/Programs.

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, current version).

Justification:

1. The sampling method for the RMW wells is consistent with historical sampling events. The current dedicated pump configuration is designed for high-flow sampling and does not allow for low-flow sampling.

2. Modification of filtration criterion is needed to be consistent with the *Long-Term Surveillance and Maintenance Plan for the U. S. Department of Energy Weldon Spring, Missouri, Site* (LMS/WEL/S00790) and data quality objectives at the site.

Review and Concurrence:

John R. Thompson
Digitally signed by John R. Thompson
Date: 2014.09.30 14:39:33 -05'00'

Randy Thompson, Site Operations Manager

Rex Hodges

Rex Hodges, Site Hydrologist

Catherine M. Payne
Catherine M. Payne
2014.09.30 16:01:24 -04'00'

Katie Payne, Quality and Performance Assurance

Manager Approval:

Sam Campbell
Sam Campbell
2014.09.29 13:26:16 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
Record File ADM 130.10

WEL-2014-01

Effective Date: 06/09/2014
Expiration Date: 06/09/2017

Program Directive

Initiated By: Sam Campbell

Directive Subject: Weldon Spring, Missouri, Site Purge Water Disposition

Directive and Associated Task Changes: Purge water generated at the Weldon Spring Site during sampling of monitoring wells will be dispositioned according to the attached Table 1.

Organization(s) Affected: Environmental Monitoring Operations, Weldon Spring

Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites*, LMS/PRO/S04351 (current version).

Background: Monitoring wells are sampled at the Weldon Spring site using the micropurge method. This method produces relatively small amounts of purge water. The wells are classified as Type 1 or Type 2 based on the concentrations of contaminants of concern (uranium, nitroaromatics and volatiles) in the groundwater. Type 1 monitoring wells at the Weldon Spring site are defined as locations that have concentrations of contaminants of concern in the groundwater equal to or less than levels identified in Table 2. Purge water from Type 1 wells can be directly discharged onto the ground near the monitoring well. Type 2 monitoring wells are defined are locations that have concentrations of contaminants of concern above the levels identified in Table 2 where the purge water cannot be discharged onto the ground, but must be containerized and dispositioned following the methods specified in *Leachate Collection and Removal System Operating Plan* (LMS/WEL/S08030, current version). Table 2 provides criteria for classification of Type 1 and 2 purge water based on concentrations of contaminants of concern at the Weldon Spring site.

Justification: A historical review of the analytical data was performed in January 2014 of the current list of monitoring wells being sampled at Weldon Spring. The review was used to determine which wells were classed as Type 1 and which as Type 2. This analysis, review and determination was performed by the Weldon Spring site hydrologist and approved by the Weldon Spring site environmental compliance representative.

Based upon this review and approval, the purge water monitoring well locations identified on Table 1 as Type 2 must be collected and dispositioned following the methods specified in *Leachate Collection and Removal System Operating Plan* (LMS/WEL/S08030, current version). Groundwater from monitoring wells classified as Type 2 contains organic and/or uranium concentrations that require pre-treatment prior to final disposal to the Metropolitan St. Louis Sewer District (MSD) in accordance with MSD agreement letters with DOE.

Groundwater from monitoring wells classified as Type 1 on Table 1 have low contaminant concentrations and purge water may be discharged to the ground in the vicinity of the well.

Review and Concurrence:

John R. Thompson

Digitally signed by John R. Thompson
Date: 2014.06.23
11:30:43 -05'00'

Randy Thompson, Site Operations Lead

Katie Payne

Katie Payne, Quality and Performance Assurance

Yvonne Deyo, Site Manager

Terri R Uhlmeyer

Terri R. Uhlmeyer
2014.06.26 08:04:06
-05'00'

Terri Uhlmeyer, Compliance Lead

Manager Approval:

Sam Campbell

Sam Campbell
2014.06.30 15:23:10 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:
rc-grand.junction (ADM 130.10)
Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites

Table 1. List of Wells Currently at Weldon Spring (2014)

Quarry	Site	Vicinity
Type 2 Locations (Collect purge water from these wells for pretreatment and disposition to MSD)		
1004	2012	4001 (Army)
1005	2013	4006 (Army)
1006	2014	4013 (MDC)
1007	2033	4015 (MDC)
1008	2046	4029 (Army)
1013	2049	4031 (Army)
1014	2050	4036 (Army)
1015	2051	4040 (Army)
1016	2052	4043 (Army)
1027	2053	
1032	2054	
1048	2055	
1051	3024	
1052	3029	
	3030	
	3034	
	3037	
	3039	
	3040	
Type 1 Locations (Purge water from these wells may be disposed on the ground)		
1002	2001	4007 (Army)
1009	2002	4011 (Army)
1012	2003	4014 (MDC)
1017	2005	4020 (MDC)
1018	2006	4022 (MDC)
1019	2017	4023 (MDC)
1021	2021	4026 (MDC)
1028	2022	4027 (Army)
1030	2023	4028 (Army)
1031	2032	4020 (MDC)
1044	2034	4032 (Army)
1045	2035	4033 (MDC)
1046	2036	4037 (Army)
1047	2037	4038 (Army
1049	2038	4039 (MDC)
1050	2039	4041 (MDC)
RMW-1	2040	4042 (Army)
RMW-2	2047	MWD-2 (Army)
RMW-3	2056	MWS-1 (Army)
RMW-4	3003	MWS-2 (Army)
	3006	MWS-4 (Army)
	3023	
	3025	
	3026	
	3027	
	3028	
	3038	

MDC = Missouri Department of Conservation

Table 2. Criteria for Determining Wastewater Types at Weldon Spring

Contaminant of Concern	Type 1 (No pretreatment)	Type 2 (Pretreatment required)
Uranium	≤ 100 pCi/L	> 100 pCi/L
Trinitrotoluene	≤ 200 µg/L	> 200 µg/L
2,4-Dinitrotoluene	≤ 17 µg/L	> 17 µg/L
2,6-Dinitrotoluene	≤ 0.68 µg/l	> 0.68 µg/L
Nitrobenzene	≤ 36 µg/L	> 36 µg/L
1,3-Dinitrobenzene	≤ 36 µg/L	> 36 µg/L
1,3,5-Trinitrobenzene	≤ 36 µg/L	> 36 µg/L
Trichloroethylene	≤ 300 µg/L	> 300 µg/L
Dichloroethylene	≤ 600 µg/L	> 600 µg/L
Tetrachloroethylene	≤ 500 µg/L	> 500 µg/L

Sampling Frequencies for Locations at Weldon Spring, Missouri

Location ID	Bi-Monthly	Quarterly	Semiannually	Annually	Not Sampled	Notes
Quarry Monitoring 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-1027		X				
MW-1028		X				
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 Monitoring 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	Bi-Monthly	Quarterly	Semiannually	Annually	Not Sampled	Notes
Chemical Plant Monitoring Wells						
MW-2032				X		Disposal Cell Monitoring Well
MW-2033					X	Water level only
MW-2034					X	Water level only
MW-2035				X		
MW-2036					X	Water level only
MW-2037					X	Water level only
MW-2038			X			
MW-2039					X	Water level only
MW-2040			X			
MW-2046			X			Disposal Cell Monitoring Well
MW-2047			X			Disposal Cell Monitoring Well
MW-2049					X	Water level only
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-2056				X		
MW-3003			X			
MW-3006			X			U - bimonthly
MW-3023					X	Water level only
MW-3024	X					U - bimonthly
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					U - bimonthly
MW-3031			X			U - semiannual
MW-3034			X			
MW-3037			X			
MW-3038					X	Water level only
MW-3039			X			
MW-3040	X					U - bimonthly
MW-4001					X	Water level only
MW-4006					X	Water level only
MW-4007				X		U - bimonthly
MW-4011					X	Water level only
MW-4013			X			
MW-4014				X		
MW-4015				X		
MW-4020					X	Water level only
MW-4022				X		
MW-4023				X		
MW-4026			X			
MW-4027					X	Water level only
MW-4028					X	Water level only

Sampling Frequencies for Locations at Weldon Spring, Missouri

Location ID	Bi-Monthly	Quarterly	Semiannually	Annually	Not Sampled	Notes
Chemical Plant Monitoring Wells						
MW-4029			X			
MW-4030					X	Water level only
MW-4031			X			
MW-4032					X	Water level only
MW-4033					X	Water level only
MW-4036			X			U - bimonthly
MW-4037					X	Water level only
MW-4038					X	Water level only
MW-4039			X			
MW-4040	X					U - bimonthly
MW-4041			X			U - bimonthly
MW-4042			X			U - bimonthly
MW-4043	X					U - bimonthly
MWD-2	X		X			U - bimonthly
MWS-1			X			U - bimonthly
MWS-2	X					U - bimonthly
MWS-4			X			U - bimonthly
Springs						
SP-5303		X				
SP-5304		X				
SP-6201	X					U - bimonthly
SP-6301		X				U - bimonthly
SP-6303		X		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	X		X			Sampling dependant on leachate volume/hauling
LW-DC12	X					Sampling dependant on leachate volume/hauling

Constituent Sampling Breakdown

Site	Weldon Spring				
Analyte	Groundwater	Surface Water	Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Approx. No. Samples/yr	231	22			
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	108			HACH	
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Antimony					
Arsenic	16		0.0001	SW-846 6020	LMM-02
Barium	16		0.1	SW-846 6010	LMM-01
Boron					
Beryllium					
Bromide					
Cadmium					
Calcium					
Chloride	2		0.5	SW-846 9056	MIS-A-039
Chromium	16		0.002	SW-846 6010	LMM-01
Cobalt	2		0.05	SW-846 6010	LMM-01
Chemical Oxygen Demand	4		5	EPA 410.4	WCH-A-010
Copper	2		0.025	SW-846 6010	LMM-01
Fluoride	2		0.5	SW-846 9056	MIS-A-040
Gamma Spec					
Gross Alpha	2		2 pCi/L	EPA 900.0	GPC-A-001
Gross Beta					
Iron	112		0.05	SW-846 6010	LMM-01
Lead	16		0.002	SW-846 6020	LMM-02
Lead-210					
Magnesium					
Manganese	14		0.005	SW-846 6010	LMM-01
Mercury	2		0.0001	SW-846 7470	LMM-01
Molybdenum					
Nickel	16		0.02	SW-846 6010	LMM-01
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	45		0.05	EPA 353.1	WCH-A-022
Nitroaromatics	87		0.00003	SW-846 8330	LMN-02
PAHs	16		0.005	SW-846 8310	LMS-02
PCBs	16		0.00005	SW-846 8082	PEP-A-006
Phosphate					
Polonium-210					
Potassium					
Radium-226	16		1 pCi/L	Gas Proportional Counter	GPC-A-018
Radium-228	16		1 pCi/L	Gas Proportional Counter	GPC-A-020
Selenium	16		0.0001	SW-846 6020	LMM-02
Silica					
Silver	2		0.001	SW-846 6020	LMM-02
Sodium					
Strontium					
Sulfate	106	16	0.5	SW-846 9056	MIS-A-044
Sulfide					
Thallium	14		0.004	SW-846 6020	LMM-02
Thorium, isotopic	14		1 pCi/L	Alpha Spectrometry	ASP-A-008
Tin					
Total Dissolved Solids	2		10	SM2540 C	WCH-A-033
Total Suspended Solids	2		5	SM2540 D	WCH-A-034
Total Organic Carbon	2		1	SM5310 B, C, D	WCH-A-025
Tritium					
Uranium-234, -238					
Uranium	227	23	0.0001	SW-846 6020	LMM-02
Vanadium					
VOCs	24		0.005	SW-846 8260	VOA-A-009
Zinc	2		0.02	SW-846 6010	LMM-01
Total No. of Analytes	31	2			

Note: All analyte samples are considered unfiltered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.