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

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for
U.S. Department of Energy Office of Legacy Management Sites**

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Appendixes

Appendix A Site-Specific Information and Program Directives

Ambrosia Lake, New Mexico	Monticello, Utah
Amchitka, Alaska	Monument Valley, Arizona
Bear Creek, Wyoming	Mound, Ohio
Bluewater, New Mexico	Naturita, Colorado
Burrell, Pennsylvania	Parkersburg, West Virginia
Canonsburg, Pennsylvania	Pinellas Site, Florida
Central Nevada Test Area, Nevada	Rifle, Colorado
Colonie, New York	Rio Blanco, Colorado
Durango, Colorado	Riverton, Wyoming
Falls City, Texas	Rocky Flats, Colorado
Gasbuggy, New Mexico	Rulison, Colorado
Gnome-Coach, New Mexico	Salmon, Mississippi
Grand Junction Disposal Site, Colorado	Sherwood, Washington
Grand Junction Office Site, Colorado	Shiprock, New Mexico
Grand Junction Processing Site, Colorado	Shirley Basin South, Wyoming
Green River, Utah	Shoal, Nevada
Gunnison, Colorado	Slick Rock, Colorado
Hallam, Nebraska	Tuba City, Arizona
L-Bar, New Mexico	Weldon Spring, Missouri
LEHR, California	
Lakeview, Oregon	

Appendix B Desk Instructions

- B-1 Environmental Quality Information System (EQuIS) Version 6.5
Data Gathering Engine (EDGE) Desk Instructions for Generic Sites
- B-2 Compressed Gas Operations
- B-3 Desk Instructions for Using the Trailer-Mounted 20-Kilowatt Olympian
Generator

Appendix C Job Safety Analysis

Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain of Custody
DO	dissolved oxygen
DOE	U.S. Department of Energy
EDD	Electronic Data Deliverable
EDGE	EQuIS data gathering engine
EQuIS	Environmental Quality Information System
EPA	U.S. Environmental Protection Agency
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
mV	millivolt(s)
NTU	nephelometric turbidity unit
ORP	oxidation-reduction potential
PCB	polychlorinated biphenyl
PDF	Portable Document Format
pH	potential hydrogen
QC	quality control
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
SPM	sample planning module
VOC	volatile organic compound

Forms Referenced in This Manual

Forms are accessible at: LM Intranet home page > **Library** > **LMS Forms and Worksheets**.

<i>Landowner/Stakeholder Notification Form</i>	LMS 1013
<i>Prejob Brief/Safety Meeting Attendance Record</i>	LMS 1554

Terminology

Chain of Custody (COC) form: A form used to document sample custody and receipt. It typically contains information such as sample collection dates and time, the sample analyses required, sample preservation, filtration status, and traceability.

co-sample (n.): A sample that was collected at the same location and time as a sample that was collected by or for another group or agency. The analytes, bottles, and preservatives are not necessarily the same and no samples are split. Example usage: "Co-samples were collected at location MW01 with XYZ, Inc. personnel."

co-sample (v.): To collect a sample at the same location and time as a sample that was collected by or for another group or agency. The analytes, bottles, and preservatives are not necessarily the same and no samples are split. Example usage: "Location MW01 was co-sampled with XYZ, Inc. personnel."

composite Sample: A combination of multiple individual aliquots taken at pre-selected times or locations to represent the integrated composition of the media being sampled.

custody: To maintain a sample in sight, immediate possession, locked or sealed under one's personal control, or stored in a secure location. 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 may be obtained from a vendor or may be manufactured in the field by using paper strips and clear plastic tape. The custody seal will bear the signature of the person affixing the seal and the date that the seal was affixed.

duplicate sample: More than one sample collected from the same source location but placed in separate containers. It may also be called a field duplicate. Duplicate water samples will be collected by filling containers for the original sample (all aliquots) followed by containers for the duplicate sample. Duplicate samples are used to assess precision in the sampling and analytical process.

Equipment Blank: A sample collected from the rinsate water after the decontamination of nondedicated equipment that was used to collect field samples. Equipment blanks provide a check for cross-contamination of samples from ineffective equipment decontamination.

field blank: A sample that is prepared in the field to evaluate the potential for contamination of a field sample by site contaminants from a source not associated with the sample collected (for example air-borne dust or organic vapors). Field blanks are typically collected only when contamination from field (ambient) conditions is suspected.

filtered sample: A sample that has been passed through a filter with a pore size of 0.45 micrometer (μm). A filtered sample collected for metals analyses is also referred to as "dissolved." See also the definition of "Screened Sample."

holding time: The analyte-specific amount of time allowed between sample collection and laboratory extraction and/or analysis. If samples are extracted/analyzed within the prescribed holding time, then temporal changes to analyte concentrations are considered minimal.

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.

screened sample: A sample that has been passed through a filter with a pore size greater than 0.45 μm . See also the definition of “Filtered Sample.”

split sample: A sample that has been subdivided into two or more parts, each representative of the original sample. A split sample has been taken from a homogenized source: a larger sample was collected from a single location and mixed to ensure representativeness prior to containerizing. (Split samples should not be taken for volatile organics samples.) Split samples should be collected when samples from one location are to be sent to multiple laboratories for the same analysis. Split samples may be used to compare the performance of the laboratories.

trip blank: A volatile organic compound (VOC) sample that is prepared using organic-free water and taken to the field by the sampling team. Trip blanks are prepared before any sampling event where water samples are collected for VOC analysis. Trip blanks are stored and shipped with the VOC field samples collected during the event. Trip blanks are used to document contamination of VOC samples attributable to shipping and field handling procedures.

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1.0 Introduction

This sampling and analysis plan (SAP) specifies U.S. Department of Energy (DOE) Office of Legacy Management (LM) standard operating procedures (SOPs) used in environmental monitoring activities and will be implemented at most sites managed by LM (exceptions are the Fernald Preserve and Mound sites). This document provides detailed procedures for the field sampling teams so that samples are collected in a consistent and technically defensible manner. Site-specific monitoring plans (e.g., long-term surveillance and maintenance plans, groundwater compliance action plans, and environmental monitoring plans) document background information and establish the basis and rationale for sampling and monitoring activities. Information from these plans will be included in site-specific sections to this plan (Appendix A), which identify sample locations, sample frequencies, types of samples, field measurements, and associated analytes for each site. Additionally, within each site-specific section, program directives may be included to establish and justify additional site-specific requirements or to modify requirements in this plan. A flowchart detailing required tasks needed to accomplish routine sampling is displayed in Figure 1.

ASTM International (ASTM) procedures form the technical basis and provide general guidance for the development of sampling protocols specified in this SAP, which include ASTM D4750 – 87 *Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)* (ASTM 2001), ASTM D4448 – 01 *Standard Guide for Sampling Ground-Water Monitoring Wells* (ASTM 2013), and ASTM D5088 – 15a *Standard Practice for Decontamination of Field Equipment Used at Waste Sites* (ASTM 2015). Procedures for monitoring other environmental media such as air, soil/sediment, biota or natural gas can be found in program directives in Appendix A or in site-specific documents.

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

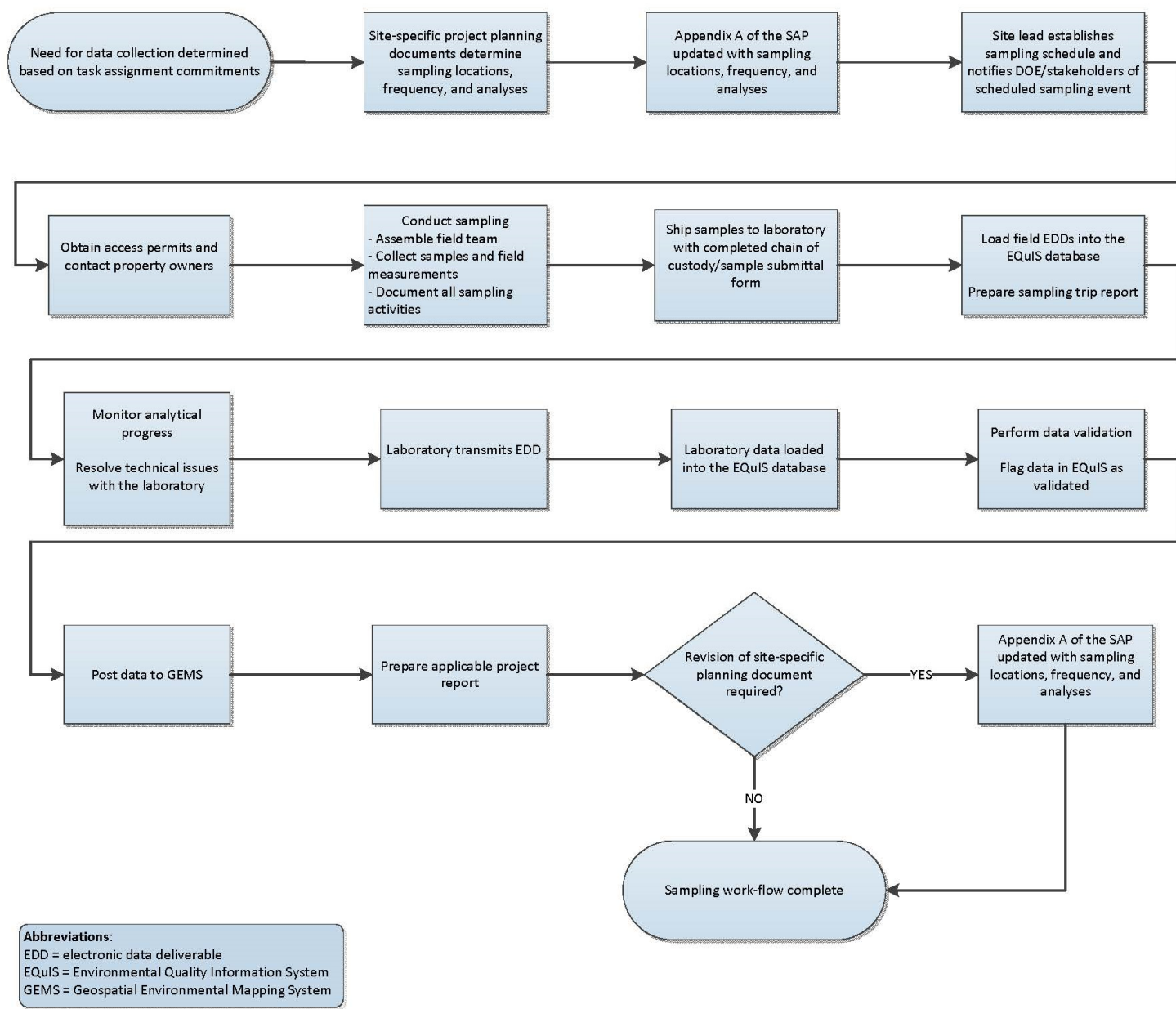


Figure 1. Sampling Flowchart

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, surveying, downloading dataloggers, repairing or replacing pumps, replacing signs, or repairing fences.
- Capture changes to sampling locations and/or required analyses.
- Sign off on the Plan-of-the-Week to authorize the work.

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 Property Management 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. Administrative support personnel will notify landowners via phone or email of the upcoming sampling event and document the notification on the *Landowner/Stakeholder Notification Form* (LMS 1013). 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.
- Preparation of field electronic data deliverables (EDDs) and loading on the field computer.
- Obtaining sampling documentation, including sampling lists, pre-printed labels, chain of custody forms, signed job safety analyses (JSA), and safety data 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 Low-Flow Sampling

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 shown in Table 1.

Table 1. Well Classifications

Classification	Properties/Use
Category I	Wells that can maintain a stable water level at a 100 mL/min ^a flow rate.
Category II	<ul style="list-style-type: none">Wells that cannot maintain a stable water level at a 100 mL/min flowrate and have initial water level above the top of the screened interval.OR wells that cannot maintain a stable water level at a 100 mL/min flowrate and have a dedicated pump/tubing installed.
Category III	<ul style="list-style-type: none">Wells that cannot maintain a stable water level at a 100 mL/min flowrate and have an initial water level within the screened interval.AND, no pump/dedicated tubing is installed.
Category IV	Domestic and flowing wells.

Note:

^a mL/min = milliliters per minute.

The well classification may vary between sampling events. For example, a well that produces more than 100 milliliters per minute (mL/min) (Category I) may begin to produce less than 100 mL/min as, over time, the screen becomes obstructed, and the Category II sampling protocol is required. Conversely, a well that produces less than 100 mL/min (Category II) may produce more than 100 mL/min during higher groundwater levels or after well redevelopment, and the Category I protocol can be applied.

Category I Protocol

Category I wells will be purged and sampled using a low-flow method developed using guidance described in ASTM D4448-01 *Standard Guide for Sampling Ground-Water Monitoring Wells* (ASTM 2007). 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 screened interval, 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.

Depth to water will be measured with an electric water-level meter immediately before purging (see Section 3.1.1.4). The average flow rate during the purging process must not exceed 500 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 a 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% 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). Criteria for purging a Category I well are summarized in Table 2.

All field measurements and sampling documentation will be recorded in the EQuIS (Environmental Quality Information System) data gathering engine (EDGE) software application. EDGE has numerous quality control checks built into the application including an alert to the sampler when stability criteria have been attained. Desk instructions for the operation of EDGE are found in Appendix B.

Table 2. 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."
	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.

Notes:

^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 for descriptions of qualifiers based on sampling protocol.

^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 specified in Table 2.

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.



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. An alternate method of sampling a Category II or Category III well will be specified and justified in a program directive and included in Appendix A.

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 (note that the “Constituent Sampling Breakdown” tables for most sites in Appendix A direct that all domestic well samples are to be collected unfiltered, regardless of turbidity.) 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).

3.1.1.2 High-Flow Sampling

Some wells require purging and sampling at flow rates above 500 mL/min using high-flow techniques. These wells may be very deep, and the large purge volumes are removed using high-flow dedicated submersible pumps. In other cases, high-flow techniques are necessary when the sampling intake cannot be installed in the screened interval and casing volumes must be purged from an intake point near the top of the water column. Wells constructed with continuous multichannel tubing also require a high-flow purging and sampling protocol because the small channels do not allow application of low-flow sampling protocols with the sample tubing in the screened interval and verification of a stable water level. Situations that require high-flow techniques are very specific, so no protocols are established in this plan for high-flow purging and sampling. If high-flow sampling is necessary, then purging requirements including minimum purge volume, field parameter stability, and frequency of field parameter readings will be specified in a program directive.

3.1.1.3 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 industry guidance (ASTM 2007). 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 sampling equipment is used.

Samples will be filtered as specified in Table 3. For most inorganic analyses, samples will be filtered if sample turbidity is greater than or equal to 10 NTUs; no sample filtration is required if turbidity is less than 10 NTUs. Alternate sample filtration or sample screening protocol will be specified and justified in a program directive. Samples requiring filtration will be passed through filter with a 0.45 micrometer (μm) pore size, and samples requiring cooling will be stored in a cooler with ice (wet-ice or re-usable ice packs) immediately after they have been collected. Ice will be maintained within the cooler at all times and will be checked and then documented in EDGE at each location sampled. For samples preserved with an acid or a base, the pH of selected samples will be checked by pouring a small amount of preserved sample over pH paper to establish the volume of preservative required and to verify that the pH criterion has been met. Only commercially supplied and certified solutions will be used for sample preservation. Sample container and preservation requirements are shown in Table 3.

Table 3. Water Sample Collection Guidelines

Analytical Parameter ^a	Container Type/Size	Filtration	Preservation	Holding Time
Metals				
Numerous metals including U	HDPE/500 mL	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Organics				
Herbicides	Amber glass/1 L ^d	Never filter	Cool 0 °C to 6 °C	7 days
Nitroaromatics	Amber glass/1 L ^d (2)	Never filter	Cool 0 °C to 6 °C	7 days
PAHs	Amber glass/1 L ^d (2)	Never filter	Cool 0 °C to 6 °C	14 days
PCBs	Amber glass/1 L ^d (2)	Never filter	Cool 0 °C to 6 °C	1 year
Pesticides	Amber glass/1 L ^d	Never filter	Cool 0 °C to 6 °C	7 days
SemiVOCs	Amber glass/1 L ^d	Never filter	Cool 0 °C to 6 °C	7 days
VOCs	Amber glass/3 x 40mL w/Teflon-lined septa	Never filter	Cool 0 °C to 6 °C, HCl pH < 2, no headspace	14 days
Radiological				
Am-241	HDPE/1 L ^c	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Gamma spectrometry	HDPE/1 L ^c	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Gross alpha, gross beta	HDPE/1 L ^c	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Ni-63	HDPE/1 L ^c	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Np-237	HDPE/1 L ^c	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Pb-210	HDPE/1 L ^c	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Po-210	HDPE/1 L ^c	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Pu-238, Pu-239, Pu-240	HDPE/1 L ^c	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Ra-226	HDPE/ 2 x 1 L ^c	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Ra-228	HDPE/ 2 x 1 L ^c	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Rn-222	Glass/3 x 40 mL	Never filter	Cool 0° C to 6 °C, no headspace	Not established
Tc-99	HDPE/1 L	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Th-230	HDPE/1 L	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Tritium	HDPE/1 L ^c	Never filter	No preservative	6 months
U-234, U-238	HDPE/1 L	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months

Table 3. Water Sample Collection Guidelines (continued)

Analytical Parameter ^a	Container Type/Size	Filtration	Preservation	Holding Time
General Water Quality				
Alkalinity	HDPE/500 mL ^c	Filter if >10 NTUs ^b	Cool 0 °C to 6 °C	14 days
Ammonia	HDPE/125 mL	Filter if >10 NTUs ^b	H ₂ SO ₄ pH < 2, cool 0 °C to 6 °C	28 days
Anions (Br, Cl, F, SO ₄ , SiO ₂)	HDPE/125 mL	Filter if >10 NTUs ^b	Cool 0 °C to 6 °C (Cooling required for SO ₄ only)	28 days
Chemical oxygen demand	HDPE/125 mL	Never filter	H ₂ SO ₄ pH < 2, cool 0 °C to 6 °C	28 days
Cyanide	HDPE/1 L	Filter if >10 NTUs ^b	NaOH pH > 12, 0.6 g ascorbic acid if Cl ₂ present, cool 0 °C to 6 °C	14 days
Hardness	HDPE/125 mL	Filter if >10 NTUs ^b	HNO ₃ pH < 2	6 months
Nitrate + nitrite as Nitrogen	HDPE/125 mL	Filter if >10 NTUs ^b	H ₂ SO ₄ pH < 2, cool 0 °C to 6 °C	28 days
Phosphate	HDPE/125 mL	Filter if >10 NTUs ^b	H ₂ SO ₄ pH < 2, cool 0 °C to 6 °C	28 days
Sulfide	HDPE/1 L ^c	Filter if >10 NTUs ^b	NaOH pH > 9, 2 mL of 2N zinc acetate, cool 0 °C to 6 °C, no headspace	7 days
Total dissolved solids	HDPE/125 mL	Filter if >10 NTUs ^b	Cool 0 °C to 6 °C	7 days
Total organic carbon	HDPE/125 mL	Never filter	H ₂ SO ₄ pH < 2, cool 0 °C to 6 °C	28 days
Total suspended solids	HDPE/1 L	Never filter	Cool 0 °C to 6 °C	7 days
TPH	Amber glass/1 L ^d	Never filter	Cool 0 °C to 6 °C	14 days

Notes:

^a This table incorporates the majority of analyses conducted for LM projects. See Appendix A for site-specific analyses.

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

^c Collection of sample volume in duplicate for every 20 samples collected is required for laboratory quality control.

^d Collection of sample volume in triplicate for every 20 samples collected is required for laboratory quality control.

Abbreviations:

Am = americium, Br = bromide, °C = degrees Celsius, Cl = chloride, F = fluoride, H₂SO₄ = sulfuric acid, HCl = hydrochloric acid, HNO₃ = nitric acid, L = liter, N = Normal, NaOH = sodium hydroxide, Ni = nickel, Np = neptunium, PAHs = polycyclic aromatic hydrocarbons, Pb = lead, PCBs = polychlorinated biphenyls, Po = polonium, Pu = plutonium, Ra = radium, Rn = Radon, SiO₂ = silica, SO₄ = sulfate, Tc = technetium, Th = thorium, TPH = total petroleum hydrocarbons, U = uranium

Water samples collected for volatile organic compound (VOC) analyses have specific sample collection considerations and requirements. Care should be taken when collecting samples for VOC analyses to avoid non-sample-related contamination sources such as sunscreen, insect repellent, and engine exhaust. Water samples for VOC analyses are collected in 40-milliliter (mL) vials (which may be pre-acidified) fitted with Teflon-lined septum caps. The vials should be completely filled to prevent volatilization, and caution should be exercised when filling a vial to avoid turbulence, which could also produce volatilization. The sample should be carefully poured down the side of the vial to minimize turbulence. Care should be taken not to overflow the vial and flush out the acid preservative, if present. The vial should be filled completely so that surface tension holds the water in a convex meniscus above the top of the vial. The cap is then applied and some overflow is lost, but the air space in the vial is eliminated. After capping,

turn the vial over and tap it to check for bubbles. If a bubble or bubbles are present, a new vial should be obtained and the sample re-collected.

In addition to field samples, other types of samples may be collected such as quality control samples (duplicates, equipment blanks, trip blanks, and field blanks), which are described in Section 5.1. Other types of samples may include split samples, co-samples, and composite samples. See the Terminology section for definitions.

3.1.1.4 Groundwater Levels

Groundwater levels will be measured using an electric water-level meter. The water-level meter consists of a metallic probe, a graduated tape, and an audible alarm that sounds when the probe contacts conductive groundwater. Groundwater levels will be measured by slowly lowering the probe until it contacts the groundwater, and the audible alarm is heard. The measurement should be repeated several times to ensure the audible alarm sounds at the same depth each time. Read and record the depth to groundwater to the nearest 0.01 foot (ft) directly off the graduated tape where it meets the top of the well casing as the alarm sounds. The groundwater-level reading will be made at the mark on the well casing where the elevation survey was conducted. If there is no mark on the casing, then the reading should be made on the north side of the casing, and, if there is no mark and the casing is not level, then the water level reading should be made at the low-point on the casing.

Obtaining repeatable groundwater-level measurements at a well can be problematic in some cases. Rising or dropping water levels in a well, deviated wells, groundwater with high specific conductance, presence of light non-aqueous phase liquids, and dedicated pump infrastructure can all interfere with obtaining a repeatable groundwater level. Options to obtain repeatability include cleaning the water level probe, adjusting the sensitivity of the water level meter, and allowing for more time to obtain repeatability of the measurement. If a water level is not repeatable, then do not record the measurement and document the suspected reason for the lack of repeatability.

Groundwater levels collected prior to sampling a well will be recorded on the groundwater form (GW) in EDGE. If groundwater-level measurements are required on wells that are not sampled, then groundwater-level measurements will be recorded on the “Water Level” form or the “Water Level Table Form” in EDGE. Recording groundwater-level information in EDGE in the field is preferable because it provides a well-specific quality control (QC) check of the water level. If a water level entry in EDGE turns red (reading out of range), then the water level should be rechecked. Desk instructions for the use of EDGE are provided in Appendix B. In some cases (e.g., a computer malfunctions, computer is unavailable), use of EDGE may not be practical, so paper forms will be used instead, and groundwater levels will be entered into the EDGE Water Level Table Form at a later time.

Dataloggers may be installed in some wells to provide a continuous record of water levels. Operation, maintenance, calibration, and downloading of dataloggers will be conducted according to manufacturer’s instructions and the EDGE desk instructions in Appendix B.

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 program directive in Appendix A. Generally, 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 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.
- Navigation to surface water locations will be accomplished using the sample location map so that samples from subsequent sampling events may be collected from approximately the same location. Any departure from collecting a sample at the normal location must be documented in the field notes.
- For new surface water locations, sample location data will be collected using a GPS device and downloaded into the EQuIS database.

Samples will be filtered as specified in Table 3. For most inorganic analyses, sample will be filtered if sample turbidity is greater than or equal to 10 NTUs; no sample filtration is required if turbidity is less than 10 NTUs. Alternate sample filtration or sample screening protocol will be specified and justified in a program directive. Samples requiring filtration will be passed through a filter with a 0.45 μm pore size, and samples requiring cooling will be stored in a cooler with ice (wet-ice or reusable ice packs) immediately after they have been collected. Ice will be maintained within the cooler at all times and will be checked and then documented in EDGE at each location sampled. For samples preserved with an acid or a base, the pH of selected samples will be checked by pouring a small amount of preserved sample over pH paper to establish the volume of preservative required and to verify that the pH criterion has been met. Only commercially supplied and certified solutions will be used for sample preservation. Sample container and preservation requirements are shown in Table 3.

In addition to field samples, other types of samples may be collected such as quality control samples (duplicates, equipment blanks, trip blanks, and field blanks), which are described in

Section 5.1. Other types of samples may include split samples, co-samples, and composite samples. See the Terminology section for definitions.

3.1.3 Sample Identification and Handling

Each sample will be assigned a unique sample number generated by the EQuIS sample planning module (SPM), and a location number corresponding to each well or surface-water 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 EDGE. Sample labels will be generated through a customized SPM plug-in with most of the information pre-printed on the label. Additional information required on the label during sampling typically includes sample date and time, sampler's initials, and filtration status. Sample bottles will be labeled before or immediately after sample collection.

To safeguard the cleanliness of sample bottles and promote sample integrity, the following sample handling protocols will be implemented. Sample bottles used for water sampling will be pre-cleaned to guidelines established by the U.S. Environmental Protection Agency (EPA) in *Specification and Guidance for Contaminant-Free Sample Containers* (EPA 1992). During transport to, from, and in the field, empty bottles will be stored with lids attached in the original, unopened shipping box, in a clean plastic tub with a lid, or in sealed plastic bags to protect against road dust. During most sampling activities, a graded approach to sample handling will be used. Samplers will put on a pair of new, disposable gloves when handling sample bottles. The new gloves will be worn through the bottle handling sequence at each location, which includes removing bottles from initial storage, sample collection and filtration, sample labeling, sample preservation, and placing them in final storage (sealed plastic bags or cooler). Care should be taken to minimize touching of other items during the sample handling process. If samples are to be collected by EPA method 1631 (EPA 1996a) for low-level mercury analysis (EPA 2002), then the "clean hands/ dirty hands" sampling protocol specified by EPA must be implemented because of the extremely low detection limit (0.5 nanogram/L) and potential for detecting cross contamination in the sample.

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. Custody seals will be placed on each cooler 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. Coolers, 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 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. Sufficient time for the laboratory to complete extraction and analysis is for samples to arrive with at least half of the holding time remaining.

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 coordinator will retain carrier and shipping receipts as long as they have value associated with the laboratory sample-receiving activities. A chain-of-custody form will accompany samples sent or transported to an analytical laboratory. Chain-of-custody records document all transfers of sample possession and show that the samples were in constant custody between collection and analysis. 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.

3.1.4 Field Measurements and Calibration

3.1.4.1 Field Measurements

Field measurements are useful for assessing general water quality, assessing geochemical conditions, and indicating when purging of a groundwater monitoring well is complete. Field measurements such as alkalinity, chlorine, ferrous iron, dissolved oxygen, oxidation-reduction potential (ORP), 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 Category I wells. Field measurements for each site are specified in Appendix A. Terminology associated with typical field measurements collected during water sampling activities are listed below, and the minimum specifications for field instrumentation and test kits used to make field measurements are listed in Table 4 (HACH 2007-2015; YSI 2008).

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.

Open Container: When referring to field measurements, making a measurement in an open container of water that was removed from the original environment, such as in a bucket. This water is exposed to ambient air.

Oxidation-Reduction Potential: Also referred to as ORP or redox 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. NOTE that redox potential is sometimes expressed as Eh, which is not equivalent to ORP. ORP and Eh are similar, in that both quantify the potential of the medium to transfer electrons; however, Eh is defined as a voltage reading versus the standard hydrogen electrode, while ORP is a much less specific term in which the

measurement can be made relative to any reference electrode. Eh may be determined by adding an offset voltage to the ORP reading.

pH: The negative logarithm to the base 10 of the hydrogen ion activity in moles per liter: $\text{pH} = -\log [\text{H}^+]$. 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: Also referred to as conductivity, electrical conductivity, or specific electrical conductance. Conductivity is the ability of water to conduct an electrical current. Units are typically measured in $\mu\text{S}/\text{cm}$ or $\mu\text{mho}/\text{cm}$, which are equivalent. 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 nephelometric 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.

Table 4. Minimum Specifications for Field Measurements and Tests

Measurement	Calibration	Range	Accuracy	Resolution	Comments
Chlorine	Not required	0.02 to 2 mg/L	0.02 mg/L	0.01 mg/L	Total chlorine, colorimetric method
Dissolved oxygen	1-point	0 to 20 mg/L	$\pm 2\%$ of reading or ± 0.2 mg/L	0.01 mg/L	Rapid pulse or similar technology required that does not require flow across the probe. Output in mg/L and % air saturation
Atmospheric pressure	Not required	500 to 800 mm Hg	± 3 mm Hg	0.1 mm Hg	When combined with dissolved oxygen instrumentation
Ferrous iron	Not required	0.02 to 3.00 mg/L	± 0.02 mg/L	0.01 mg/L	Colorimetric method
ORP	1-point	-999 to 999 mV	± 20 mV	0.1 mV	
pH	3-point	0 to 14 s.u.	± 0.2 s.u.	0.02 s.u.	
Specific conductance	1-point	0 to 100,000 $\mu\text{mho}/\text{cm}$	1 % of reading	1 $\mu\text{mho}/\text{cm}$	
Temperature	Not required	-5 to 45 °C	± 0.15 °C	0.1 °C	

Table 4. Minimum Specifications for Field Measurements and Tests (continued)

Measurement	Calibration	Range	Accuracy	Resolution	Comments
Total alkalinity	Not required	10 to 4,000 mg/L as CaCO ₃	± 1% for digital titrator	1 mg/L	Digital titration method
Turbidity	3-point	0 to 1,000 NTUs	2% of reading in 0 to 500 NTU range, 3% of reading in 500 to	0.01 NTU	

3.1.4.2 Instrument Calibration

Field instruments must be calibrated before a sampling event begins. For occupied sites that sample continually 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 5. 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 5. 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
	1-point check with pH 4, 7, or 10 buffer	Daily and at end of sampling event	± 0.2 pH s.u.
Specific conductance	1-point calibration	Prior to start of sampling event	NA
	1-point operational check	Daily and at end of sampling event	± 10% 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% 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	3 or 4-point calibration	Every 3 months	NA
	3-point operational check	Daily and at end of sampling event	± 10% of standard
Temperature	Operational check	Prior to start of sampling event	± 1.5 °C compared to NIST-traceable thermometer

Abbreviations:

NA = Not applicable.

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 $\mu\text{mhos/cm}$).
- 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.

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.

All field measurements and calibration/operational check information will be recorded on paper or electronic forms.

Documentation of field measurements will include:

- Date and time of measurement
- Value of the measurement and units
- Instrumentation/test kits used
- Name of the person conducting the field measurement

- Date and time of the associated operational check
- If measurements were collected in a flow cell (air exclusion), in situ, or in an open container

Documentation of calibration/operational check information will include:

- 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

3.1.5 Sampling Equipment

3.1.5.1 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, titrator, turbidity meter, pumps, generator, compressor, control box, all-terrain vehicle, winch, motor vehicle, dataloggers, field computer, and hand tools. 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.

Some equipment requires additional instruction because of higher level hazards associated with the operation of the equipment. Examples of this type of equipment include compressed gas cylinders to drive bladder pumps and a 20 kilowatt generator for large electric submersible pumps; desk instructions for use of this equipment are found in Appendix B.

3.1.5.2 Equipment Decontamination

The level of equipment decontamination will depend on the type and use of the equipment. In order to apply an appropriate level of decontamination, equipment associated with sampling activities was divided into two major types—sample contacting equipment and non-sample contacting equipment. Non-sample contacting equipment is further divided into subtypes to delineate the level of decontamination. Sample contacting and non-sample contacting equipment are described in ASTM D5088-02 *Standard Practice for Decontamination of Field Equipment Used at Waste Sites* (ASTM 2008) as follows:

Sample contacting equipment—equipment that comes in direct contact with the sample or portion of sample that will undergo chemical analyses or physical testing.

Non-sample contacting equipment—related equipment associated with the sampling effort, but that does not directly contact the sample.

Equipment decontamination will be conducted according to the requirements in Table 6. Between sample locations, decontaminated sample-contacting equipment will be stored in protective containers or plastic bags to maintain cleanliness.

Table 6. Decontamination Protocol for Non-Dedicated Equipment

Sample Contacting Equipment	Non-Sample Contacting Equipment ^a		
	Downhole Measurement Equipment	Downhole Maintenance Equipment	Purge-water Contacting Equipment
Tubing Bailers and dippers Test kits Pumps Containers	Borehole cameras Water-level indicators Water-quality sondes/probes Pressure transducers Cables, cords, and attachments	Surge blocks Surge rods Screen brushes Geoprobe rods and tools Smeal cable and tools	Flow-cell Tubing Water-quality sondes/probes Buckets and containers Turbidity cell
Decontamination Level 1	Decontamination Level 2	Decontamination Level 3	Decontamination Level 4

Note:

^a A more rigorous decontamination protocol may be required on a site-specific basis depending on the magnitude and type of contaminants or site requirements. Alternate decontamination protocol will be specified in a Program Directive.

Decontamination Level 1: Rinse all sample contacting surfaces with a diluted-detergent solution followed by an analyte-free-water (e.g. deionized or distilled water) rinse. Wipe or rinse with analyte-free water all non-sample contacting surfaces until visibly clean (no solids or discoloration). If non-dedicated sampling equipment is used to collect samples for organic analyses, then an additional rinse with an organic desorbing agent (e.g., isopropanol) may be required (based on project-specific requirements) followed by a final analyte-free-water rinse. If samples are collected through this equipment, then equipment blank collection is required. Although this decontamination protocol is applied to test kits, collection of equipment blanks is not required with use of test kits.

Decontamination Level 2: Rinse all water-contacting surfaces with a diluted detergent solution followed by an analyte-free-water rinse or wipe all water contacting surfaces with a lint-free tissue saturated with diluted detergent followed by a lint-free tissue saturated with analyte-free water. Use of this type equipment does not require collection of equipment blanks.

Decontamination Level 3: Rinse all equipment surfaces with control water (water of known quality) until visibly clean. Ensure equipment is wiped or air-dried prior to using at the next location. Use of this type equipment does not require collection of equipment blanks.

Decontamination Level 4: Rinse water-contacting surfaces with water if the equipment is not visibly clean. Wipe non-water contacting surfaces if the equipment is not visibly clean. Use of this equipment does not require collection of equipment blanks.

3.1.6 Investigation-Derived Waste

Purge water generated during groundwater sampling activities, including excess sample water, will be managed as specified in Table 7. Excess calibration standards, excess test-kit solutions, and excess treated 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 treated 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 requires project-specific planning and procedures depending upon project goals and data quality objectives. 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 section in Appendix A or in a site-specific document.

3.3 Soil and Sediment

Soil and sediment sampling require project-specific planning and procedures depending upon project goals and data quality objectives. 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 section in Appendix A or in a site-specific document.

3.4 Ecological

Ecological monitoring requires project-specific planning and procedures depending upon project goals and data quality objectives. 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 section in Appendix A or in a site-specific document.

Table 7. Purge Water Disposition at LM Sites

Category	Site	Applicable Documents	Disposition	Comments
Uranium Mill Tailings Radiation Control Act, Title I	Ambrosia Lake	<i>Management Plan for Field-Generated Investigation Derived Waste at UMTRCA Sites (LMS/PLN/S04352)</i>	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			
Uranium Mill Tailings Radiation Control Act, Title II	Bluewater	<i>Management Plan for Field-Generated Investigation Derived Waste at UMTRCA Sites</i>	Disperse on ground	Keep purge ^a water from entering surface water
	Gas Hills East			
	Gas Hills North			
	L-Bar			
	Sherwood			
	Shirley Basin South			
	Split Rock			
Decontamination & Decommissioning Sites	Grand Junction	Notice to file	Disperse on ground	
	Hallam			

Table 7. Purge Water Disposition at LM Sites (continued)

Category	Site	Applicable Documents	Disposition	Comments
Offsites Project	Central Nevada Test Area	<i>Fluid Management Plan Central Nevada Test Area Corrective Action Unit 443</i> (DOE 2009), and notice to file	Purge water from well UC-1-P-2SR may require special handling; a notice to file will be issued by Environmental Compliance with instructions on handling the purge water prior to sampling this well. Disperse purge water from all other wells on 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	Notice to file	Disperse on ground	
	Rulison	Notice to file	Disperse on ground	
	Salmon	Notice to file	Purge water from some wells may require special handling; a notice to file will be issued by the Environmental Compliance team before each sampling event with detailed instructions on purge water management. Disperse purge water from all other wells on ground.	
	Shoal	<i>Fluid Management Plan Subsurface Corrective Action Unit 447, Shoal, Nevada, Site</i> , (DOE 2011)	Disperse on ground	
Comprehensive Environmental Response, Compensation, and Liability Act	Monticello	<i>Monticello Mill Tailings Site Operable Unit III Post-Record of Decision Monitoring Plan</i> (DOE 2004)	Disperse on ground at all wells except permeable reactive barrier wells. Dispose of purge water in Pond 4.	
	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: <i>Guidelines for the Disposition of Purge, Decontamination, and Excess Sample Water</i> (Appendix A)	Dispose of in applicable onsite treatment system	
	Pinellas	SAP	Dispose in storage tank onsite	
	Weldon Spring	SAP Program Directive	Type I wells—disperse on ground Type II wells—dispose of at Leachate Collection and Removal System	

Table 7. Purge Water Disposition at LM Sites (continued)

Category	Site	Applicable Documents	Disposition	Comments
Other	Parkersburg	<i>Long-Term Surveillance Plan for the Parkersburg, West Virginia, Disposal Site</i> (DOE 2014)	Disperse on ground	Groundwater meets state and federal groundwater and drinking water standards, respectively.

Note:

^a Purge water includes purge water, decontamination water, and excess sample water.

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4.0 Analytical Program

Analytical services are procured from commercial laboratories via a Statement of Work for Laboratory Analytical Services (SOW) as specified in the *Sample Management Plan* (LMS/PLN/S15849). A comprehensive list of analytes, along with the required analytical methods and required detection limits, is provided in Attachment A of the SOW. The analytical methods used for groundwater and surface water analyses as specified in Attachment A are typically from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA 1996b) or *Methods for Chemical Analysis of Water and Wastes* (EPA 1983).

Commercial laboratories provide these analytical services in accordance with the *Department of Defense (DoD) and Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* (DoD and DOE 2017) to ensure that data are of known, documented quality. The QSM provides specific technical requirements, clarifies DOE requirements, and conforms to DOE Order 414.1D, *Quality Assurance*. The QSM is based on Volume 1 of The National Environmental Laboratory Accreditation Conference (NELAC) Institute (TNI) Standards (September 2009), which incorporates International Organization for Standards (ISO)/International Electrotechnical Commission (IEC) 17025:2005(E), General requirements for the competence of testing and calibration laboratories. The QSM provides a framework for performing, controlling, documenting, and reporting laboratory analyses. Analytical data will be validated according to *Environmental Data Validation Procedure* (LMS/PRO/S15870).

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5.0 Quality Assurance

The *Quality Assurance Manual* (LMS/POL/S04320) establishes the quality assurance program and requirements for achieving quality for all work performed including environmental sampling and monitoring programs. The *Quality Assurance Manual* (LMS/POL/S04320) defines the procedural direction for implementing the requirements of the *Quality Assurance Program Description* including requirements necessary for planning, implementing, documenting, training, and reviewing the activities, equipment, and records resulting from using this SAP. Additional quality assurance requirements and guidance for LM Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites are provided in the *Legacy Management CERCLA Sites Quality Assurance Project Plan* (DOE 2006).

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, trip blanks and field 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. When required, the frequency of duplicate samples for other matrices will be specified in a site-specific program directive located in the appropriate section in Appendix A.

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 analyte-free water (rinsate) used to decontaminate nondedicated sampling equipment. When required, the collection and frequency of equipment blanks for other matrices or filter blanks (air) will be specified in a site-specific program directive in Appendix A.

5.1.3 Trip Blanks

Trip blanks will be prepared using analyte-free water 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 VOC analyses is required. Trip blanks subsequently will be handled as all other water samples collected for analysis of VOCs. Each cooler in which VOC samples are stored or shipped will have an accompanying trip blank, which will be analyzed for VOCs only.

5.1.4 Field Blanks

Field blanks will be collected on as-needed basis to assess impacts from adverse ambient conditions. Examples of situations that may necessitate the collection of a field blank include windy conditions that create visible wind-born particulate or collection of samples for VOC analyses in an area of heavy vehicle traffic. Field blanks will be prepared in the field during adverse conditions at a sampling location where impacts are most likely. Field blanks will be prepared using analyte-free water and analyzed for the same constituents as the environmental samples.

5.1.5 Inspection and Maintenance of Monitoring Wells

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). Programmatic guidance and SOPs for monitoring well inspection and maintenance are found in the *Inspection and Maintenance of Groundwater Monitoring and Extraction Wells* (LMS/PRO/S18459).

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 EQulS database. The “Q” flag will be displayed in the data validation column of the 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 based on sampling technique 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 documentation of data validation activities and preparation of data validation reports are detailed in the *Environmental Data Validation Procedure*.

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). The WS300 course involves:

- Required reading of this SAP, and a required read for significant updates.
- Review and sign-off of the applicable Job Safety Analysis (JSA).
- Review of Safety Data Sheets for all chemicals used.

- Review of manufacturer's instructions for all equipment used.
- Demonstrated proficiency of following on-the-job training components:
 - 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).
 - Measurement of water levels in wells.
 - Well purging and groundwater sampling protocol.
 - Surface water sample collection.
 - Operation of the EDGE data collection software.
 - Sample labeling, preservation, and chain of custody.
 - Decontamination of sampling equipment.
 - Collection of QC samples.
 - Shipping of samples.

Training conforming to the requirements of the *Training Policies and Procedures Manual* (LMS/POL/S15034) will be conducted by an experienced sampler with a minimum of 10 years of experience. 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 SOPs 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 or audited commercial laboratories that:
 - Conform to Quality Systems for Analytical Services requirements.
 - Are accredited or 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.

5.5 Program Directives

Program directives are used to document, justify, and authorize interim or site-specific changes to this SAP. The procedures and format used for preparing program directives are found in Section 7.0, “Program Directives,” within the *Document Management Manual* (LMS/POL/S09818). Program directives that affect changes to this SAP 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 Appendix A. Guidelines, tracking logs, directive templates, and PDF files of approved directives are managed by Document Management.

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 and is used to communicate and document field activities and site issues. The format and content of the Trip Report may vary depending on the media sampled, site conditions, and site-specific requirements. Items 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.
- EQUIS Task Code number.
- Well inspection summary.
- References to the sampling procedure used and any applicable Program Directives.
- Additional instructions from Site Lead.
- Field variances (variance from sampling procedures).
- Equipment problems.
- Pump/tubing installation details.
- Stakeholder/Regulatory issues.
- Site disturbances.
- Access issues.
- Corrective actions required/taken
- Incident Reports initiated.

An example of a Trip Report is shown in Figure 2.

memo



To: Fred Smith, Navarro
From: Samantha Tigar, Navarro
Date: November 21, 2017
CC: Tim Bartlett, Navarro
Steve Donivan, Navarro
Janice McDonald, Navarro
EDD Delivery
Records
File: MNT 0045.20(A)
Re: Monthly Area of Attainment Sampling Trip Report

Site: Monticello, Utah, Disposal Site.

Date of Event: November 14 and 15, 2017.

Team Members: Gretchen Baer and Samantha Tigar, Navarro

Number of Locations Sampled: Samples were collected from 20 of 22 monitoring wells, 8 extraction wells, 1 surface water, and the transfer tank.

Locations Not Sampled/Reason: Monitoring wells MW-01 and MW-05 were dry.

Location Specific Information: Location specific information is shown in Table 1.

Table 1. Location Specific Information

Location IDs	Comments
MW-01, MW-05	Monitoring wells were dry.
MW-18	Category I monitoring well did not meet turbidity criterion; filtered according to the SAP.
MW-20	Partial metals bottle collected before well ran dry.
OR-02, OR-03, OR-05, OR-06	Extraction wells were running and initial water levels could not be obtained.

Quality Control Sample Cross Reference: A summary of the quality control samples collected is shown in Table 2.

Table 2. Quality Control Sample Summary

False ID	Sample ID	True ID	Sample Type	Associated Matrix
2690	MNT01-04.1711005-017	MW-19	Duplicate	Groundwater
2692	MNT01-04.1711005-029	MW-07	Duplicate	Groundwater

Task Code Assigned: Samples were assigned to task MNT01-04.1711005. Field data sheets can be found in [\\crow\sms\MNT01-04.1711005\FieldData](#).

Figure 2. Trip Report Example

Sample Shipment: Samples were shipped from Grand Junction, Colorado, to GEL Laboratories in Charleston, South Carolina, via FedEx priority overnight on November 16, 2017.

Water Level Measurements: Water levels were measured in all sampled wells and in extraction wells that were not running.

Well Inspection Summary: No issues were identified.

Sampling Method: Samples were collected according to the *Sampling and Analysis Plan (SAP) for the U. S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, continually updated).

Field Variance: Category I turbidity criterion could not be met at monitoring well MW-18 and the sample was filtered.

Equipment: All equipment functioned properly.

Stakeholder/Regulatory/DOE: None.

Institutional Controls:

Fences, Gates, and Locks: All gates were left closed and secured.

Signs: No issues were observed.

Trespassing/Site Disturbances: None observed.

Disposal Cell/Drainage Structure Integrity: N/A.

Safety Issues: None.

Access Issues: None.

General Information: Nothing to note.

Immediate Actions Taken: None.

Future Actions Required or Suggested: Nothing to note.

Figure 2. Trip Report Example (continued)

5.6.2 Field Information and Data

The EDGE data collection software was designed to capture all information needed to document water sampling activities. EDGE data will be used at each water sampling location to record and document sample collection and identification, water level measurements, purge stability, field measurement data, sampling equipment used, field test-kit results, chain of custody information, and sampling personnel (Appendix B). EDGE will also be used to document instrument calibration and operational checks, daily safety meetings, well inspection and maintenance, and well redevelopment. If EDGE cannot be used in the field, then the appropriate hard-copy form (e.g., water sampling field data sheet) will be completed, and information will be transferred to the applicable EDGE form in the office. Desk instructions for the use of EDGE are found in Appendix B.

Deviations from the procedures specified in this plan will be documented as a field variance comment in EDGE and included in the sampling trip report.

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 EDGE.
- Chain-of-Custody forms.
- Sampling trip reports.
- Laboratory analytical data reports.
- Field and laboratory data validation summary reports.
- 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).

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6.0 Safety and Health

Sampling activities will be conducted according to the safety and health requirements and procedures specified in the *LMS Safety and Health Program* (LMS/POL/S20043). 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 safety and health 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 in the EDGE data collection software or on the *Prejob Brief/Safety Meeting Attendance Record* (LMS 1554) 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 safety and health documents, such as an additional JSA, Radiological Work Permit, or Confined-Space Evaluation.

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7.0 References

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Sample Management Plan, LMS/PLN/S15849, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

Training Policies and Procedures Manual, LMS/POL/S15034, continually updated, prepared by Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

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Appendix A

Site-Specific Information and Program Directives

Current Index of Site-Specific Program Directives as of July 2019

Directive No.	Effective Date	Expiration Date	Initiated By	Subject
BLU-2017-01	4/14/2017	04/14/2020	Gretchen Baer	Groundwater Sampling
CNT-2019-01	4/15/2019	4/15/2022	Sam Campbell	High-Flow Sampling
CLN-2019-01	4/01/2019	4/01/2022	Sam Campbell	Groundwater Monitoring Activities, Colonie, New York, Site
DUP-2017-01	04/14/2017	04/14/2020	Sam Campbell	Sampling of Monitoring Well 0879
MNT-2018-01	07/16/2018	07/18/2021	Sam Campbell	Montezuma Creek Field Investigation
MNT-2018-03	10/13/2018	10/13/2021	Sam Campbell	Surface-Water Discharge-Measurement Protocol
MON-2019-01	11/30/2018	11/30/2021	Sam Campbell	Sampling of Livestock Wells
PIN-2017-01	9/01/2017	09/01/2020	Sam Campbell	Groundwater Sampling Procedures
PIN-2018-02	08/10/2018	08/10/2021	Sam Campbell	Sampling of Monitoring Wells Affected by Soybean-Oil Injections
RBL-2018-01	12/01/2017	12/01/2020	Sam Campbell	Natural Gas and Produced-Water Sampling at a Natural Gas Production Well
RFS-2019-01	11/5/2018	11/5/2021	Sam Campbell	Miscellaneous Sampling Activities
RFS-2018-01	12/01/2017	12/01/2020	Sam Campbell	Processing Composite Surface Water Samples
RFS-2018-02	12/01/2017	12/01/2020	Sam Campbell	Disposition of Excess Water
RUL-2018-01	12/01/2017	12/01/2020	Sam Campbell	Natural Gas Sampling and Produced-Water Sampling at a Natural Gas Production Well
RVT-2019-01	11/1/2018	11/1/2021	Sam Campbell	Sampling of CMT Wells
SAL-2017-01	04/14/2017	04/14/2020	Sam Campbell	High-Flow Sampling
SHP-2018-01	12/01/2017	12/01/2020	Sam Campbell	Filtration of Surface Water Samples
SHP-2018-02	12/05/2017	12/05/2020	Sam Campbell	Sampling of the Shiprock Evaporation Pond
SHP-2018-03	07/06/2018	07/06/2021	Joe Lobato	Sampling of the Shiprock Evaporation Pond
SHL-2018-01	06/08/2018	06/08/2021	Sam Campbell	Miscellaneous Sampling Activities
TUB-2018-01	12/01/2017	12/01/2020	Sam Campbell	Sampling of the Tuba City Evaporation Pond
WEL-2017-01	10/01/2017	10/01/2020	Sam Campbell	Purge Water Disposition at the Weldon Spring, Missouri, Site
WEL-2017-02	10/01/2017	10/01/2020	Sam Campbell	Sampling Activities

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<p align="center">Sampling Frequencies for Locations at Ambrosia Lake, New Mexico</p>
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Location ID	Quarterly	Semiannually	Annually	Triennially	Not Sampled	Notes
Monitoring Wells						
409				X		Usually dry; sample if water is present; next in 11/2022
675				X		Next in 11/2022
678				X		Next in 11/2022

Sampling conducted in November

Constituent Sampling Breakdown

Site	Ambrosia Lake		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	2	0			
Field Measurements					
Total Alkalinity					
Dissolved Oxygen	X				
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	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	SM2320 B	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 (NO ₃ +NO ₂)-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	EPA 900.0	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
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.

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 $\sim\frac{1}{4}$ 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, <u>estimated</u>)	190	180	150
Water Column Height (ft)	92	178	125
One Casing Volume (gallons [gal])	279	225	510
Three Casing Volumes (gal)	837	674	1530
$\frac{1}{4}$ Casing Volume (gal)	70	56	127

Organization(s) Affected: Environmental Monitoring Operations, Projects and 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.

Contractor to U.S. Department of Energy Office of Legacy Management

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:



Dick Johnson, Site Lead

Richard K. Johnson
2017.04.12 14:40:20 -06'00'



Linda Tegelman, Quality and Performance Assurance

LINDA TEGELMAN (Affiliate)
2017.04.12 10:23:20 -06'00'

Manager Approval:



Sam Campbell, Environmental Monitoring Operations

SAM CAMPBELL (Affiliate)
2017.04.12 14:30:39 -06'00'

<p align="center">Sampling Frequencies for Locations at Bluewater, New Mexico</p>
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Location ID	Quarterly	Semiannually	Annually	Triennially	Not Sampled	Notes
Monitoring Wells						
E(M)		X				
Y2(M)		X				
F(M)		X				
T(M)		X				
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				
Private Wells						
HMC-951		X				

Sampling conducted in May and November.

Constituent Sampling Breakdown

Site	Bluewater		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	40	0			
Field Measurements					
Total Alkalinity	X				
Dissolved Oxygen	X				
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Arsenic	X		0.0001	SW-846 6020	LMM-02
Bicarbonate	X		10	SM2320 B	WCH-A-003
Calcium	X		5	SW-846 6010	LMM-01
Carbonate	X		10	SM2320 B	WCH-A-004
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					
Potassium	X		1	SW-846 6010	LMM-01
Radium-226				EPA 900.0	
Radium-228					
Selenium	X		0.0001	SW-846 6020	LMM-02
Silica	X		0.1	SW-846 6010	LMM-01
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					
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	15	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.

<p align="center">Sampling Frequencies for Locations at Burrell, Pennsylvania</p>
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Location ID	Quarterly	Semiannually	Annually	Biennially	Every 5 Years	Notes
Monitoring Wells						
420					X	Next in October 2020
422					X	Next in October 2020
423					X	Next in October 2020
424					X	Next in October 2020
520					X	Next in October 2020
522					X	Next in October 2020
523					X	Next in October 2020
524					X	Next in October 2020
Surface Locations						
611					X	SEEP on cell; next in 10/20
612					X	SEEP on cell; next in 10/20

Sampling conducted in October
Based on LTSP dated April 2000

Constituent Sampling Breakdown

Site	Burrell		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/every 5 years	8	2			
Field Measurements					
Total Alkalinity	X	X			
Dissolved Oxygen	X	X			
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Static Water Level	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	SM2320 B	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				EPA 900.0	
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
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	14	14			

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.

<p align="center">Sampling Frequencies for Locations at Canonsburg, Pennsylvania</p>

Location ID	Quarterly	Semiannually	Annually	Every 5 Years	Not Sampled	Notes
Monitoring Wells						
0406A				X		Next in 10/2023
0412				X		Next in 10/2023
0413				X		Next in 10/2023
0414B				X		Next in 10/2023
0424				X		Next in 10/2023
Surface Locations						
0602				X		Next in 10/2023

Sampling conducted in October
Based on LTSP dated March 2013

Constituent Sampling Breakdown

Site	Canonsburg		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/every 5 years	5	1			
Field Measurements					
Total Alkalinity	X	X			
Dissolved Oxygen	X	X			
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Static Water Level	X				
Turbidity	X	X			
Temperature	X	X			
Laboratory Measurements					
Aluminum					
Ammonia as N (NH ₃ -N)					
Calcium					
Chloride					
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO ₃ +NO ₂)-N					
Potassium					
Radium-226					
Radium-228				EPA 900.0	
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	1	1			

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.



CNT-2019-01

Effective Date: 04/15/2019
Expiration Date: 04/15/2022

Program Directive

Initiated By: Sam Campbell

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. The calculated minimum purge volumes that are shown in the table below 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 75, 60, and 60 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.



Contractor to the U.S. Department of Energy Office of Legacy Management

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:

KENNETH
KARP (Affiliate)

Digitally signed by
KENNETH KARP (Affiliate)
Date: 2019.04.08 16:03:07
-06'00'

Ken Karp, Nevada Offsites Project Manager

Rick C. Findlay
2019.04.08 10:40:24 -06'00'

Rick Findlay, Site Lead

MILDRED BIRRENBACH
(Affiliate)
2019.04.08 12:32:32 -06'00'

Millie Birrenbach, Quality and Performance Assurance

Manager Approval:

SAM CAMPBELL (Affiliate)
2019.04.09 20:32:14 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

**Table 1 - Sampling Frequencies for Locations at
Central Nevada Test Area, Nevada**

Location ID	Quarterly	Semiannually	Annually	Variable	Not Sampled	Notes
Monitoring Wells						
MV-1				X		Bladder pump; next in 7/2026
MV-2				X		Bladder pump; next in 7/2026
MV-3				X		Bladder pump; next in 7/2026
MV-4				X		Bladder pump; next in 7/2023
MV-5				X		Bladder pump; next in 7/2023
MV-6				X		Bladder pump; next in 7/2023
HTH-1RC				X		Bladder pump; next in 7/2026
UC-1-P-1SRC				X		Bladder pump; next in 7/2023
UC-1-P-2SR				X		Bladder pump; next in 7/2023
Piezometers						
MV-1UPZ				X		Depth discrete bailer; next in 7/2026
MV-1LPZ					X	
MV-2UPZ					X	
MV-2LPZ					X	
MV-3UPZ					X	
MV-3LPZ					X	
MV-4PZ				X		Depth discrete bailer; next in 2026
MV-5PZ					X	
HTH-1UPZ					X	
HTH-1LPZ					X	

Note: Well UC-1-P-2SR will be sampled using a depth discrete bailer (sample depths 780 ft, 1200 ft, 1591 ft and 2192 ft)

**Table 2 - Analytical Suite for Sample Locations
at Central Nevada Test Area, Nevada**

Analyte	Measurement by Location Type		Laboratory Requirements			Laboratory	
	Groundwater	Surface Water	Required Detection Limit	Analytical Method	Line Item Code	ALS	University of Arizona
Approx. No. Samples/yr	14	0					
Field Measurements							
Alkalinity	X						
Dissolved Oxygen	X						
Redox Potential	X						
pH	X						
Specific Conductance	X						
Static Water Level	X						
Turbidity	X						
Temperature	X						
Laboratory Measurements							
Aluminum							
Ammonia as N (NH3-N)							
Bromide							
Calcium							
Carbon 14 (inorganic)	X		NA	AMS	LMR-18		X
Chloride							
Chromium							
Gamma Spec							
Gross Alpha							
Gross Beta							
Iodine-129	X		NA	AMS	LMR-17		X
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	3	0					

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.



CLN-2019-01

Effective Date: 04/01/2019
Expiration Date: 04/01/2022

Program Directive

Initiated By: Sam Campbell

Directive Subject: Groundwater Monitoring Activities, Colonie, New York, Site

Directive and Associated Task Changes: Groundwater monitoring activities, including monitoring well redevelopment and groundwater monitoring, will be conducted to reflect New York State Department of Environmental Conservation (NYSDEC) requirements. Specific instructions to implement these requirements and to supplement requirements in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* are as follows:

- Monitoring wells will be redeveloped according to the *Inspection and Maintenance of Groundwater Monitoring and Extraction Wells* (LMS/PRO/S18459).
- Sample analyses will be conducted by a laboratory that is accredited pursuant to the New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) for the category of parameters analyzed.

Process knowledge and historic analytical data indicate that the waste groundwater will contain dissolved concentrations of trichloroethylene (TCE), tetrachloroethylene (PCE), cis-1,2-dichloroethylene (cDCE), vinyl chloride (VC), and uranium. Therefore, investigation derived waste (IDW) groundwater from well redevelopment and from sampling will be containerized and temporarily stored on site pending laboratory analysis. Estimates of the volume of IDW groundwater that will be generated are 350 gallons (50 gallons per well) during well redevelopment and less than 20 gallons (less than 3 gallons per well) for each groundwater sampling event. Drum and storage specifications include:

- IDW groundwater will be stored in clean, closed-head, steel or high density polyethylene (HDPE) 55-gallon drums meant for liquids. IDW groundwater from multiple monitoring wells can be combined into the same drum.
- All drums (both 55-gallon and 85-gallon overpack) must be visually inspected prior to use to ensure that they do not show signs of damage (holes, rust spots, bulges, that lids close securely, etc.).
- The maximum fill level on a 55-gallon drum will be limited to approximately 5 inches below the top of the drum to ensure that overfilling does not occur.
- Each 55-gallon drum that contains liquid must be stored in an 85-gallon overpack drum which will serve as secondary containment. The overpack drum may be made of steel or plastic.
- Each overpack drum that contains liquid will be labeled as “Waste Groundwater Generated by DOE” and the site name, accumulation date, and LM contact information will be included on the label.

- All drums (both those containing liquid and empty drums) must be maintained in a closed condition with lids tightly left in place.
 - The 85-gallon overpack drums will be placed on wooden pallets to inhibit corrosion.
 - The stored drum pallets will be co-located on Colonie site property.
 - All unused drums that remain on site will be labeled as “Empty.”
- An initial waste characterization will be conducted on the IDW groundwater to determine the applicable requirements that will direct the proper disposition of the water. The initial waste characterization analyses can be used to guide disposition of the IDW groundwater in subsequent sampling events.

To characterize the IDW groundwater:

- A composite grab sample will be collected by grabbing equal volume aliquots from each full 55-gallon drum using a COLIWASA drum sampler. Use of the COLIWASA will provide the full liquid profile from within the drum for inclusion in the sample. Collection of any sediment from the bottom of the drum will be avoided to the extent possible.
- The aliquots will be combined into one container and the individual sample bottles (as specified in Table 1) will be filled for analyses. The analytical requirements are also specified in Table 1. Note that none of the samples are field filtered.
- Return any remaining IDW groundwater from the container to a 55-gallon drum.

Table 1: Characterization Analyses of Waste Groundwater

Analyses	Analytical Method	Sample Requirements
RCRA list volatile organic compounds (VOCs)	EPA 8260	3 40-mL glass w/PTFE-lined lids, HCl pH < 2, cool 4° C
RCRA list semiVOCs	EPA 8270	2 1-L amber glass w/PTFE-lined lids, cool 4° C
RCRA list metals and uranium	EPA 6020	500 mL HDPE, HNO ₃ pH <2

- Once the IDW groundwater analytical results have been received and evaluated, a waste-type determination will be made and the proper management and disposition option will be determined. This determination will be made by the LMS site lead and LMS Environmental Compliance personnel. In general:
 - The analytical results will be used to verify that the IDW groundwater does not meet the definition of a Resource Conservation and Recovery Act (RCRA) Toxicity Characteristic (TC) hazardous waste as defined in Title 6 New York Codes, Rules, and Regulations (NYCRR) Part 371.3e. If the IDW meets the definition of a TC hazardous waste, it will be managed in accordance with all applicable hazardous waste generator requirements in 6 NYCRR Part 372, which address accumulation, shipping, treatment, and disposal requirements.



- If the IDW groundwater is not a hazardous waste, and contaminant concentrations are below NYSDEC limits, then it is eligible to be released onto an unpaved surface onsite.

Should discharge to the ground surface be allowable, care must be taken to ensure that the IDW groundwater infiltrates the ground surface before it leaves the site and that the water is not allowed to run into a storm drain or surface water.

- IDW groundwater that is non-hazardous but is ineligible for release to an unpaved surface because a NYSDEC limit is exceeded will be transported offsite for treatment by a qualified water treatment facility.

Organization(s) Affected: Environmental Monitoring Operations, Projects and Programs, and Environmental Compliance.

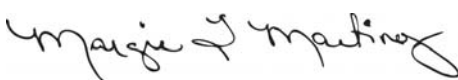
Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites (SAP) (LMS/PRO/S04351-current version).*

Justification: Sampling activities must reflect NYSDEC requirements. Management and disposition of groundwater IDW for the Colonie site are not specified in the SAP, and, therefore are detailed in this program directive.


Review and Concurrence:


Digitally signed by Carl M. Young
Date: 2019.03.11 14:37:10 -04'00'

Carl Young, PG, Site Lead


Margie L. Martinez
2019.03.11 12:30:57 -06'00'

Margie Martinez, Quality and Performance Assurance


ANN HOUSKA (Affiliate)
2019.03.11 14:08:41 -06'00'

Ann Houska, Environmental Compliance

Manager Approval:


SAM CAMPBELL (Affiliate)
2019.03.11 15:17:39 -06'00'

Sam Campbell, Manager – Environmental Monitoring Operations

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DUP-2017-01

Effective Date: 04/14/2017
Expiration Date: 04/14/2020

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, Programs and Projects.


Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/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:

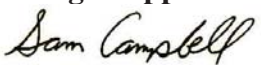

David E. Miller
2017.04.13 08:51:29 -06'00'

David Miller, Site Lead


LINDA TEGELMAN (Affiliate)
2017.04.12 10:23:59 -06'00'

Linda Tegelman, Quality and Performance Assurance

Manager Approval:


SAM CAMPBELL (Affiliate)
2017.04.12 14:34:10 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

**Sampling Frequencies for Locations at
Durango, Colorado**

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
<i>DUR01 Mill Tailings</i>						
612			X			
617			X			
630			X			
631			X			Download datalogger
633			X			Download datalogger
634			X			
635			X			
859					X	Download datalogger
863			X			Download datalogger
<i>DUR02 Raffinate Pond</i>						
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
<i>DUR03 Bodo Canyon</i>						
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						
<i>DUR01 Mill Tailings</i>						
584			X			
586			X			
652			X			RIVER
691			X			RIVER
<i>DUR02 Raffinate Pond</i>						
588			X			

<p style="text-align: center;">Sampling Frequencies for Locations at Durango, Colorado</p>

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
654			X			RIVER
678			X			RIVER; replaced 0656

Sampling conducted annually in June.

Constituent Sampling Breakdown

Site	Durango		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	20	7			
Field Measurements					
Total Alkalinity	X	X			
Dissolved Oxygen					
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Static Water Level	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	SM2320 B	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 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.

1 pCi/L

<p align="center">Sampling Frequencies for Locations at Falls City, Texas</p>
--

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
709			X			
858			X			
862			X			
880			X			
886			X			Collect split samples with Conoco
891			X			Collect duplicate from this well
906			X			
908			X			
916			X			
921			X			
924			X			
963			X			

Annual sampling conducted in February
Based on LTSP dated March 2008

Constituent Sampling Breakdown

Site	Falls City		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	12	0			
Field Measurements					
Total Alkalinity					
Dissolved Oxygen	X				
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH ₃ -N)					
Calcium					
Chloride					
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO ₃ +NO ₂)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	1	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.

<p align="center">Sampling Frequencies for Locations at Gasbuggy, New Mexico</p>

Location ID	Quarterly	Semiannually	Annually	Every 5 Years	Not Sampled	Notes
Natural Gas Wells						
Valencia Canyon No. 37 API 30-039-21647				X		Next in 6/2024
Indian A No. 2 API 30-039-07525				X		Next in 6/2024
Schalk 29-4 No. 7 API 30-039-21620				X		Next in 6/2024

Water sampling conducted every 5 years

Constituent Sampling Breakdown

Site	Gasbuggy			
Analyte	Natural Gas Wells Produced Water	Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Approx. No. Samples/every 5 years	3			
<i>Laboratory Measurements</i>				
Aluminum				
Ammonia as N (NH ₃ -N)				
Calcium				
Chloride				
Chromium				
Gamma Spec				
Iron				
Lead				
Magnesium				
Manganese				
Molybdenum				
Nickel				
Nickel-63				
Nitrate + Nitrite as N (NO ₃ +NO ₂)-N				
Potassium				
Radium-226				
Radium-228				
Selenium				
Silica				
Sodium				
Strontium				
Total Dissolved Solids				
Total Organic Carbon				
Tritium	X	400 pCi/L	Liquid Scintillation	LSC-A-001
Uranium				
Zinc				
Total No. of Analytes	1			

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.

<p align="center">Sampling Frequencies for Locations at Gnome-Coach, New Mexico</p>
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Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
USGS-1			X			Electric pump
USGS-4			X			Bladder pump
USGS-8			X			Bladder pump

Annual sampling conducted in February

Constituent Sampling Breakdown

Site	Gnome-Coach		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	3	0			
Field Measurements					
Total Alkalinity	X				
Dissolved Oxygen	X				
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	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 Organic Carbon					
Tritium	X		400 pCi/L	Liquid Scintillation	LSC-A-001
Enriched Tritium					
Uranium					
Vanadium					
Zinc					
Total No. of Analytes	3	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.

<p align="center">Sampling Frequencies for Locations at Grand Junction Disposal Site, Colorado</p>

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 Site		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	3	0			
Field Measurements					
Total Alkalinity	X				
Dissolved Oxygen	Every 5 years; next in 2020				
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Calcium	Every 5 years; next in 2020		5	SW-846 6010	LMM-01
Chloride	Every 5 years; next in 2020		0.5	SM2320 B	WCH-A-039
Chromium					
Gross Alpha	Every 5 years; next in 2020		2 pCi/L	Gas Proportional Counter	GPC-A-001
Gross Beta	Every 5 years; next in 2020		4 pCi/L	Gas Proportional Counter	GPC-A-001
Iron	Every 5 years; next in 2020		0.1	SW-846 6020	LMM-01
Lead					
Magnesium	Every 5 years; next in 2020		5	SW-846 6010	LMM-01
Manganese	Every 5 years; next in 2020		0.005	SW-846 6010	LMM-01
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	Every 5 years; next in 2020		1	SW-846 6010	LMM-01
Radium-226	Every 5 years; next in 2020		1 pCi/L	Gas Proportional Counter	GPC-A-018
Radium-228	Every 5 years; next in 2020		1 pCi/L	Gas Proportional Counter	GPC-A-020
Selenium	X		0.0001	SW-846 6020	LMM-02
Silica	Every 5 years; next in 2020		0.1	SW-846 6010	LMM-01
Sodium	Every 5 years; next in 2020		1	SW-846 6010	LMM-01
Strontium	Every 5 years; next in 2020		0.2	SW-846 6010	LMM-01
Sulfate	X		0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	X		10	SM2540 C	WCH-A-033
Total Organic Carbon	Every 5 years; next in 2020		1	SM5310 B	WCH-A-025
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium	X		0.0003	SW-846 6020	LMM-02
Zinc					
Total No. of Analytes	22	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.

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<p align="center">Sampling Frequencies for Locations at Grand Junction Site, Colorado</p>
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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 Site		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	7	6			
Field Measurements					
Total Alkalinity	X	X			
Dissolved Oxygen					
Redox Potential					
pH	X	X			
Specific Conductance	X	X			
Static Water Level	X				
Turbidity	X	X			
Temperature	X	X			
Laboratory Measurements					
Aluminum					
Ammonia as N (NH ₃ -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 (NO ₃ +NO ₂)-N					
Potassium					
Radium-226					
Radium-228				EPA 900.0	
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					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	5	4			

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.

<p align="center">Sampling Frequencies for Locations at Grand Junction Processing Site, Colorado</p>

Location ID	Quarterly	Semiannually	Annually	Every 5 Years	Not Sampled	Notes
Monitoring Wells						
590				X		Download data logger; next sampling in 1/2021
748				X		Next sampling in 1/2021
1001				X		Download data logger; next sampling in 1/2021
1014				X		In the Bike Path of the Parkway; Safety Hazard; Traffic Control will be provided;next sampling in 1/2021
Surface Locations						
2015				X		Next sampling in 1/2021
2016				X		Next sampling in 1/2021

Sampling conducted in January

Constituent Sampling Breakdown

Site	Grand Junction Processing Site		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/every 5 years	4	2			
Field Measurements					
Total Alkalinity	X	X			
Dissolved Oxygen	X	X			
Redox Potential	X	X			
pH	X	X			
Static Water Level	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	X	X	5	SW-846 6010	LMM-01
Chloride	X	X	0.5	SM2320 B	WCH-A-039
Chromium					
Gross Alpha					
Gross Beta					
Iron	X	X	0.1	SW-846 6020	LMM-01
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				EPA 900.0	
Selenium	X	X	0.0001	SW-846 6020	LMM-02
Silica	X	X	0.1	SW-846 6010	LMM-01
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	X	X	10	SM2540 C	WCH-A-033
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	17	17			

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.

<p align="center">Sampling Frequencies for Locations at Green River, Utah</p>
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Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
171			X			
173			X			
176			X			
179			X			
180			X			
181			X			
182			X			
183			X			
184			X			
185			X			
188			X			
189			X			
192			X			
194			X			
582			X			
588			X			
707			X			
813			X			
817			X			
Surface Locations						
801			X			
846			X			
847			X			

Annual sampling conducted in June

Constituent Sampling Breakdown

Site	Green River		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	19	3			
Field Measurements					
Total Alkalinity	X	X			
Dissolved Oxygen	X	X			
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Static Water Level	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	0.1	SW-846 6010	LMM-01
Silica					
Sodium					
Strontium					
Sulfate	X	X	0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	6	6			

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
Gunnison, Colorado**

Location ID	Quarterly	Semiannually	Annually	Every 5 years	Not Sampled	Notes
Monitoring Wells						
GUN01						
002			X			
005			X			
006			X			Data logger
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		BKGD; next in 2021
630					X	WLs ONLY; next in 2021
634					X	WLs ONLY; next in 2021
663					X	WLs ONLY; next in 2021
709					X	WLs ONLY; next in 2021
710					X	WLs ONLY; next in 2021
712					X	WLs ONLY; next in 2021
714					X	WLs ONLY; next in 2021
715					X	WLs ONLY; next in 2021
716				X		BKGD; next in 2021
720				X		POC; next in 2021
721				X		POC; next in 2021
722				X		POC; next in 2021
723				X		POC; next in 2021
724				X		POC; next in 2021
725				X		POC; next in 2021

<p align="center">Sampling Frequencies for Locations at Gunnison, Colorado</p>

Location ID	Quarterly	Semiannually	Annually	Every 5 years	Not Sampled	Notes
Surface Locations						
GUN01						
248			X			
250			X			
251			X			
777			X			
780			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

Site	Gunnison			Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater		Surface Water			
Approx. No. Samples/yr	33 (41 every 5th year)		6			
Field Measurements	GUN01	GUN08	GUN01			
Total Alkalinity						
Dissolved Oxygen						
Redox Potential	X	X	X			
pH	X	X	X			
Specific Conductance	X	X	X			
Static Water Level	X					
Turbidity	X	X	X			
Temperature	X	X	X			
Laboratory Measurements	GUN01	GUN08	GUN01			
Aluminum						
Ammonia as N (NH ₃ -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 (NO ₃ +NO ₂)-N						
Potassium		X		1	SW-846 6010	LMM-01
Radium-226						
Radium-228				EPA 900.0		
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
Uranium	X	X	X	0.0001	SW-846 6020	LMM-02
Vanadium						
Zinc						
Total No. of Analytes	2	10	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.

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<p align="center">Sampling Frequencies for Locations at Hallam, Nebraska</p>

Location ID	Quarterly	Semiannually	Annually	Every 5 Years	Not Sampled	Notes
Monitoring Wells						
1A				X		Next in 6/2021
1B				X		Next in 6/2021
2A				X		Next in 6/2021
2B				X		Next in 6/2021
2B2				X		Next in 6/2021
2C2				X		Next in 6/2021
3A				X		Next in 6/2021
3B				X		Next in 6/2021
4A				X		Next in 6/2021
4B				X		Next in 6/2021
4C				X		Next in 6/2021
5A				X		Next in 6/2021
5B				X		Next in 6/2021
6A					X	Water level; micropurge if possible
6B					X	Water level; micropurge if possible
7B				X		Next in 6/2021
7C				X		Next in 6/2021
8B				X		Next in 6/2021
8C				X		Next in 6/2021

Sampling conducted in June
Based on LTSP dated June 2008

Constituent Sampling Breakdown

Site	Hallam		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	17	0			
Field Measurements					
Total Alkalinity	X				
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH ₃ -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 (NO ₃ +NO ₂)-N					
Potassium					
Radium-226				EPA 900.0	
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Organic Carbon					
Tritium	X		400 pCi/L	Liquid Scintillation	GPC-A-001
Uranium					
Vanadium					
Zinc					
Total No. of Analytes	5	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.

<p align="center">Sampling Frequencies for Locations at L-BAR, New Mexico</p>
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Location ID	Quarterly	Semiannually	Annually	Triennially	Not Sampled	Notes
Monitoring Wells						
1A				X		Next sampling November 2022
17B				X		Next sampling November 2022
29A				X		Next sampling November 2022
61				X		Next sampling November 2022
62				X		Next sampling November 2022
63				X		Next sampling November 2022
69				X		Next sampling November 2022
72				X		Next sampling November 2022
81				X		Next sampling November 2022
100				X		Next sampling November 2022
Moquino - Old				X		Next sampling November 2022; Water users backup well.*
Moquino - New				X		Next sampling November 2022; Water users backup 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		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/every 3 years	12	0			
Field Measurements					
Total Alkalinity					
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	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	EPA 900.0	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.

<p align="center">Sampling Frequencies for Locations at Lakeview, Oregon</p>

Location ID	Quarterly	Semiannually	Annually	Biennially	Every 5 years	Notes
Monitoring Wells						
<i>LKV01 - Processing Site</i>						
503				Even year		Next sampling in 5/2020
505				Even year		Next sampling in 5/2020
509				Even year		Next sampling in 5/2020
540				Even year		Next sampling in 5/2020
<i>LKV02 - Disposal Site</i>						
515					X	Every 5 years; next in 5/2024
602					X	Every 5 years; next in 5/2024
603					X	Every 5 years; next in 5/2024
604					X	Every 5 years; next in 5/2024
605					X	Every 5 years; next in 5/2024
606					X	Every 5 years; next in 5/2024
607					X	Every 5 years; next in 5/2024
608					X	Every 5 years; next in 5/2024
609					X	Every 5 years; next in 5/2024
Private Wells						
<i>LKV01 - Processing Site</i>						
543				Even year		Next sampling in 5/2020

Sampling conducted in May.

Constituent Sampling Breakdown

Site	Lakeview		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater				
Approx. No. Samples/yr	9 every 5 yrs; 5 every 2 yrs				
Field Measurements					
Total Alkalinity	X				
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	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				EPA 900.0	
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		0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	13	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.

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MNT-2018-01

Effective Date: 07/16/2018
Expiration Date: 07/16/2021

Program Directive

Initiated By: Sam Campbell

Directive Subject: Montezuma Creek Field Investigation

Directive and Associated Task Changes: Field activities will be conducted according to the attached work plan and the *Sampling and Analysis Plan for the U. S. Department of Energy Office of Legacy Management Sites*. All sampling protocols specified in the sampling and analysis plan (with the exception of filtration) will be implemented including sample labeling, preservation, and handling, chain of custody, calibration and operational checks of field equipment, collection of quality control samples, and use of a DOE-CAP accredited/audited laboratory. Water samples collected from surface-water locations will be filtered (except for exempted analytical parameters) regardless of turbidity.

Organization(s) Affected: Monticello site personnel, Groundwater Modeling and Geochemistry, and Environmental Monitoring Operations.

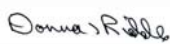
Affected Documents: *Sampling and Analysis Plan for the U. S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351)

Justification: The SAP (Section 3.3) requires additional site-specific information for projects that include soil-sample collection. The attached work plan provides the additional detail needed for collection of soil samples. All surface water samples will be filtered to provide consistent sample collection and simplify interpretation of results.

Review and Concurrence:


FREDERICK SMITH
(Affiliate)
2018.07.16 09:18:05 -06'00'

Fred Smith, Site Lead


DONNA RIDDLE
(Affiliate)
2018.07.17 07:28:55
-06'00'

Donna Riddle, Quality and Performance Assurance


Ron Kent, Site Hydrologist

Manager Approval:


SAM CAMPBELL (Affiliate)
2018.07.16 07:36:21 -06'00'

Sam Campbell, Manager Environmental Monitoring Operations

1.0 Purpose and Scope

This work plan describes the scope of work associated with the proposed geochemical field sampling program. This plan identifies locations where water and soil samples will be collected for use: 1) to characterize reaches of stream that are gaining and losing water to groundwater; and 2) characterize solid phase uranium in the streambed sediments. Results of the investigation will be used to configure and calibrate the groundwater flow model currently in development. In addition, the surface water and soil geochemistry will be used to constrain the transport model that is also under development.

2.0 Stream Characterization: Field Sampling Plan

During a dry year, such as this year, Montezuma Creek is dry in reaches where the stream is losing (contributing water to groundwater) and is wet in reaches where it is gaining (receiving groundwater). By recording locations along the stream that are visually wet, an approximation of gaining and losing reaches of the creek can be identified. Additionally, collecting water quality samples from wet sections of the creek provides information on the quality of groundwater entering the creek. Comparing the water quality results during a dry year with historic water quality data collected during wet years will help characterize the dilution capacity of the creek. Sediment samples collected from the creek bottom will help characterize the solid phase distribution of contaminants within the creek sediments and allow for better predictions of future creek contaminant concentrations.

2.1 Determining Inflow and Outflow of Montezuma Creek

Two samplers will walk downstream along Montezuma Creek (beginning on the eastern side of Highway 191 to the SW00-04 sampling location, red line on Figure 1) with a handheld GPS. Samplers will record the GPS location, streambed elevation, and water level elevation every 100 feet along the creek. Where there is no water present in the stream, only the streambed elevation will be recorded with the note “dry”. For wet stream reaches, the samplers will record the location, streambed height, water level, width of the creek, and YSI measurements (pH, temperature, specific conductance, oxidation-reduction potential, dissolved oxygen) at the beginning, middle, and end of pooled water.

2.2 Water Quality Samples

After walking the stream and recording locations and elevations of pooled water, creek water samples will be collected at locations having a change in specific conductivity measurements (a higher specific conductance is indicative of contaminated groundwater entering the stream and a lower specific conductance is indicative of Burro Canyon Formation groundwater). It is anticipated that approximately 20 water samples will be collected from the pooled water sections of the creek. Three additional wetland water samples will be collected (Wetland 1, 2, and 3), if water is present.

At each creek water sampling location, water samples and field measurements will be collected, handled, and managed according to the *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (SAP). Sample bottle and preservation requirements are listed in Table 1. Water samples will be collected using a syringe or a peristaltic pump (if high turbidity would overwhelm a syringe filter) and will be filtered in the field using a 0.45µm filter regardless of turbidity. Alkalinity of each water sample will be measured in the field using a HACH kit.

Creek water samples will be analyzed by a Department of Energy Consolidate Audit Program (DOECAP)-approved contract lab for uranium, vanadium, arsenic, selenium, molybdenum, manganese, iron, chloride, sulfate, nitrate, and major cations (calcium, magnesium, potassium, and sodium), plus dissolved organic carbon (Table 1). At a minimum, each creek water sample will be referenced by a sample ID and GPS determined coordinates of the sample location. Sample IDs range from 1101 to 1130 and will be assigned to a specific location at the time of sampling.

2. Soil Sampling of Montezuma Creek and Wetlands

Uranium and other contaminants can sorb to sediments and have the potential to release into the stream and groundwater at a later date. The location, streambed elevation, and general description of the collected sample will be recorded. Soil samples will be labeled, managed, and shipped according to the SAP.

Soil samples from the creek bed (if dry) or bank (if running water) will be collected at select locations using either a shovel or hand auger at depths up to 1 foot ±3 inches below the creek bed. Trenches will be dug with a shovel to a depth no more than 8 inches and no wider than the shovel. The hand auger will

be no larger than 3 inches in diameter. Soil samples will be collected adjacent to the creek water sampling locations at the creek bank, and completed going downstream to upstream after water samples have been collected. Additionally, soil samples will be collected in the dry portions of the creek bed at locations where sediment has accumulated (approximately 10 additional sample locations). Preference will be given to locations having increased organic or fine grained material because these materials tend to concentrate uranium.

As with the creek water samples, soil samples will also be collected from the three wetlands using either a shovel or hand auger at depth up to 1 foot below the bottom of the wetlands. Preference again will be given to locations having increased organic or fine grained material because these materials tend to concentrate uranium.

Soil samples will be placed in a stainless steel pan and homogenized after collection. Samples will then be transferred to a wide-mouth 250mL polyethylene jar that will be sent to an DOECAP-approved laboratory and analyzed for uranium, vanadium, arsenic, selenium, molybdenum, manganese, iron, sulfate, chloride, nitrate, and total organic and inorganic carbon content, as well as, major cations (calcium, sodium, potassium, magnesium) (Table 1). Information collected during soil sampling will include, at a minimum, the sample ID (ranging from 1001 to 1100), sample description (i.e., color, grain size, etc.), GPS determined coordinates of the sample location and the sample collection depth. Because of the limited depth of excavation, encountering radiologically contaminated soils is not anticipated; however, samples will be scanned after collection to ensure compliance with U. S. Department of Transportation regulations. It is anticipated that as many as 100 soil samples could be collected with approximately three samples with depth collected at each location.

3.0 Analytical Program

Soil and water samples collected will be analyzed for the constituents listed in Table 1 by a DOECAP-approved contract lab.

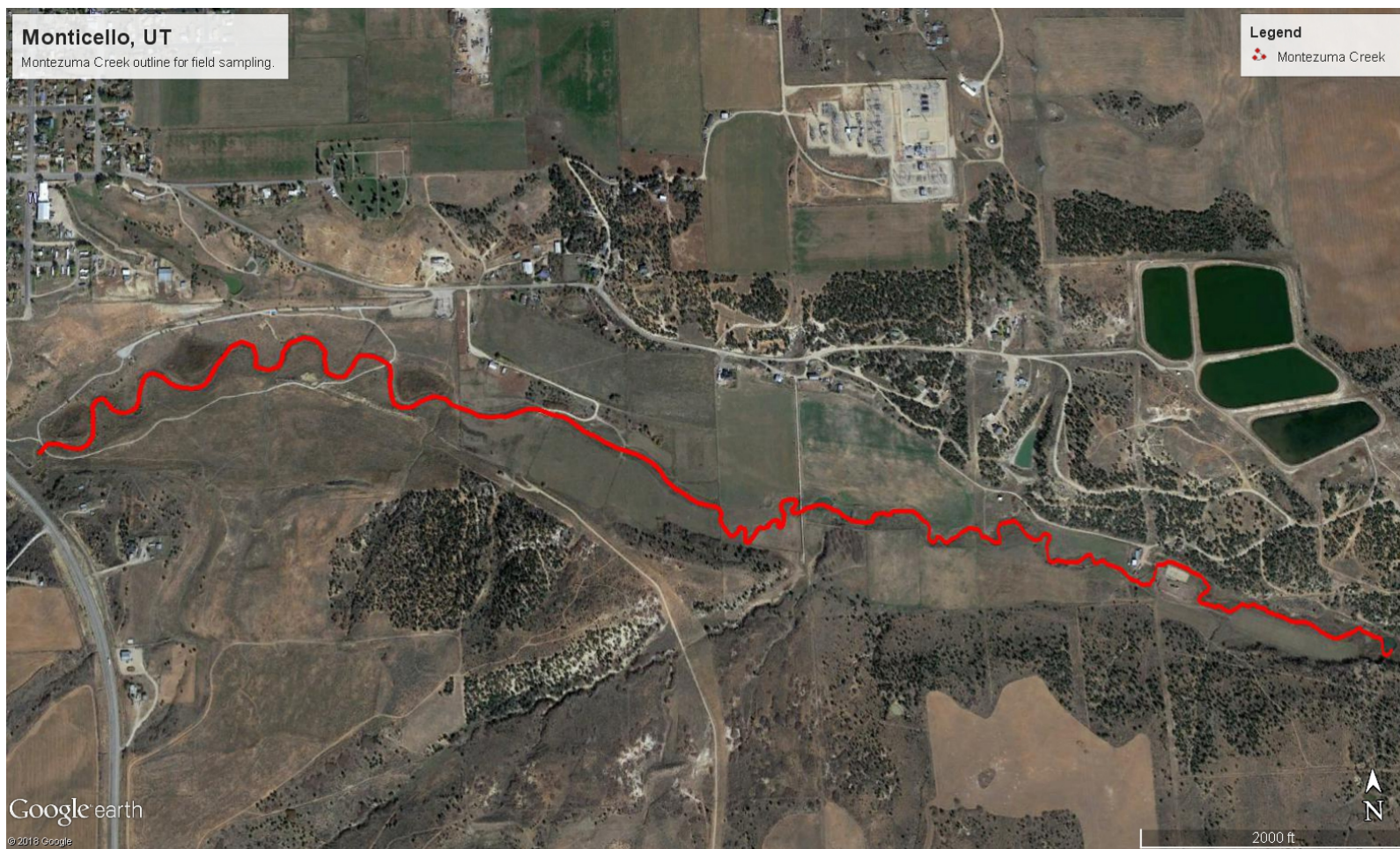


Figure 1: Montezuma Creek outline (Google Earth 2018)

Table 1: Analytical and Sample Collection Requirements.

Analytes	Bottle Size/Type	Preservation	Comments
Water Samples			
Major cations (calcium, potassium, magnesium, and sodium) and metals (arsenic, iron, manganese, molybdenum, selenium, vanadium and uranium)	500 mL HDPE	HNO ₃ pH < 2	All samples filtered through a 0.45 µm filter regardless of turbidity
Anions (chloride and sulfate)	125 mL HDPE	Cool 0° to 6° C	
Nitrate and dissolved organic carbon	250 mL HDPE	H ₂ SO ₄ pH < 2 Cool 0° to 6° C	
Alkalinity	NA	NA	Field test – HACH test kit
Soil Samples			
Major cations (calcium, potassium, magnesium, and sodium) and metals (arsenic, iron, manganese, molybdenum, selenium, vanadium and uranium), anions (chloride nitrate, and sulfate), total organic carbon, total inorganic carbon	250 mL HDPE wide mouth jar	Cool 0° to 6° C	Acid digestion on metals and water leach on anions



MNT-2018-03

Effective Date: 10/13/2018
Expiration Date: 10/13/2021

Program Directive

Initiated By: Sam Campbell

Directive Subject: Surface-Water Discharge-Measurement Protocol

Directive and Associated Task Changes: Stream discharge measurements in Montezuma Creek will be conducted according the following protocol.

Stream flow in Montezuma Creek will be determined according to the velocity-area method as described in ASTM D 3858-95 *Standard Test Method for Open-Channel Flow Measurement of Water by Velocity-Area Method*. The velocity-area method consists of measuring the representative current velocity in each of multiple cross-sections traversing the width of the flow channel. Total discharge at a given location is the sum of the area-velocity products of the individual cross-sections.

Field personnel will follow manufacturer instructions for instrument operation. Flow measurement by the open-channel method may employ instruments such as rotating element, magnetic induction, or sonic technology.

Method accuracy is improved where stream flow is measured in a channel with uniform flow and well-defined edges and that is without submerged obstructions (rocks and vegetation), turbulence, eddying, stagnant sections, and rough stream bed.

Flow measurement results will be documented in a field log book and will be accompanied by field observations such as weather conditions, water diversions, flow in tributary streams, and bank seepage. Discharge measurements will also be summarized in the Trip Report.

Organization(s) Affected: Environmental Monitoring Operations, Groundwater Modeling and Geochemistry

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites (SAP) (LMS/PRO/S04351[current version])*

Justification: Stream discharge measurement activities are not included in the SAP; therefore, a Program Directive is needed to specify required protocols. The protocols listed above are consistent with former planning documents (Post-ROD Monitoring Plan) and will provide a method for measuring stream discharge that is consistent with past practices.



Contractor to the U.S. Department of Energy Office of Legacy Management

Review and Concurrence:

FREDERICK SMITH
(Affiliate)

Digitally signed by FREDERICK SMITH (Affiliate)
DN: c=US, o=U.S. Government, ou=Department of
Energy, 0.9.2342.19200300.100.1.1=89001003230480,
cn=FREDERICK SMITH (Affiliate)
Date: 2018.09.25 16:38:24 -06'00'

Fred Smith, Site Lead

RONALD KENT (Affiliate)
2018.09.25 16:13:52
-06'00'

Ron Kent, Site Hydrologist

DONNA RIDDLE (Affiliate)
2018.09.25 15:13:32 -06'00'

Donna Riddle, Quality and Performance Assurance

Manager Approval:

SAM CAMPBELL (Affiliate)
2018.09.26 07:06:36 -06'00'

Sam Campbell, Manager Environmental Monitoring Operations

<p align="center">Sampling Frequencies for Locations at Monticello, Utah</p>

Location ID	~1-million Gallons	Semiannually ^a	Annually ^b	Every 5 Years	Not Sampled	Notes
North Off-Site Wells						
31NE93-205				X ^c		Water Level (WL) Semiannually; next sample in October 2021
95-07				X ^c		WL Semiannually; next sample in October 2021
Former Mill Site Wells						
93-01			X			WL Semiannually
MW00-01		X				
MW00-02					X	WL Semiannually
MW00-03					X	WL Semiannually
T00-01			X			WL Semiannually
T00-02					X	WL Semiannually
T00-03					X	WL Semiannually
T00-04			X			WL Semiannually
T00-05					X	WL Semiannually
T00-06					X	WL Semiannually
T00-07					X	WL Semiannually
T01-01		X				
T01-02		X				
T01-04		X				
T01-05		X				
T01-06					X	WL Semiannually
T01-07		X				
T01-08					X	WL Semiannually
T01-09					X	WL Semiannually
T01-10					X	WL Semiannually
T01-12		X				
T01-13			X			WL Semiannually
T01-18			X			WL Semiannually
T01-19		X				
T01-20			X			WL Semiannually
T01-23			X			WL Semiannually
T01-24					X	WL Semiannually
T01-25			X			WL Semiannually
T01-26					X	WL Semiannually
T01-27					X	WL Semiannually
T01-28					X	WL Semiannually
T01-35		X				
Downgradient Wells						
82-08		X				
83-70			X			WL Semiannually
88-85		X				Datalogger
92-07		X				

<p align="center">Sampling Frequencies for Locations at Monticello, Utah</p>

Location ID	~1-million Gallons	Semiannually ^a	Annually ^b	Every 5 Years	Not Sampled	Notes
Downgradient Wells						
92-08		X				
92-09		X				
92-10			X			WL Semiannually
92-11		X				
92-12					X	WL Semiannually
95-01			X			WL Semiannually
95-02					X	WL Semiannually
95-03			X			WL Semiannually
95-04					X	WL Semiannually
95-06				X ^c		WL Semiannually
95-08					X	WL Semiannually
0200		X				
0202		X				
MW00-06		X				
MW00-07			X			WL Semiannually
P92-02					X	WL Semiannually
P92-06		X				
PW-10		X				
PW-14					X	WL Semiannually
PW-16					X	WL Semiannually
PW99-16					X	WL Semiannually
PW-17		X				
PW-18					X	WL Semiannually
PW-20					X	WL Semiannually
PW-22					X	WL Semiannually
PW-23					X	WL Semiannually
PW-28		X				
PRB Wells						
R1-M1					X	WL Semiannually
R1-M2					X	WL Semiannually
R1-M3		X				
R1-M4		X				
R1-M5					X	WL Semiannually
R1-M6					X	WL Semiannually
R2-M1					X	WL Semiannually
R2-M2					X	WL Semiannually
R2-M3					X	WL Semiannually
R2-M4					X	WL Semiannually
R2-M5					X	WL Semiannually
R2-M6					X	WL Semiannually
R2-M7					X	WL Semiannually
R2-M8					X	WL Semiannually

<p align="center">Sampling Frequencies for Locations at Monticello, Utah</p>

Location ID	~1-million Gallons	Semiannually ^a	Annually ^b	Every 5 Years	Not Sampled	Notes
PRB Wells						
R2-M9					X	WL Semiannually
R2-M10					X	WL Semiannually
R3-M1					X	WL Semiannually
R3-M2		X				
R3-M3		X				
R3-M4					X	WL Semiannually
R4-M1					X	WL Semiannually
R4-M2					X	WL Semiannually
R4-M3		X				
R4-M4					X	WL Semiannually
R4-M5					X	WL Semiannually
R4-M6		X				
R4-M7					X	WL Semiannually
R4-M8					X	WL Semiannually
R5-M1					X	WL Semiannually
R5-M2					X	WL Semiannually
R5-M3					X	WL Semiannually
R5-M4					X	WL Semiannually
R5-M5					X	WL Semiannually
R5-M6					X	WL Semiannually
R5-M7					X	WL Semiannually
R5-M8					X	WL Semiannually
R5-M9					X	WL Semiannually
R5-M10					X	WL Semiannually
R6-M1					X	WL Semiannually
R6-M2					X	WL Semiannually
R6-M3		X				
R6-M4		X				
R6-M5					X	WL Semiannually
R6-M6					X	WL Semiannually
R7-M1					X	WL Semiannually
R7-M2					X	WL Semiannually
R8-M1					X	WL Semiannually
R9-M1					X	WL Semiannually
R10-M1		X				
R11-M1					X	WL Semiannually
T1-D					X	WL Semiannually
T1-S					X	WL Semiannually
T2-D					X	WL Semiannually
T2-S					X	WL Semiannually
T3-D					X	WL Semiannually
T3-S					X	WL Semiannually

<p align="center">Sampling Frequencies for Locations at Monticello, Utah</p>

Location ID	~1-million Gallons	Semiannually ^a	Annually ^b	Every 5 Years	Not Sampled	Notes
PRB Wells						
T4-D					X	WL Semiannually
T4-S					X	WL Semiannually
T5-D					X	WL Semiannually
T5-S					X	WL Semiannually
T6-D					X	WL Semiannually
T6-S					X	WL Semiannually
T7-D					X	WL Semiannually
TW-01					X	WL Semiannually
TW-02					X	WL Semiannually
TW-03					X	WL Semiannually
TW-04					X	WL Semiannually
TW-05					X	WL Semiannually
TW-06					X	WL Semiannually
TW-07					X	WL Semiannually
TW-08					X	WL Semiannually
TW-09					X	WL Semiannually
TW-10					X	WL Semiannually
TW-11					X	WL Semiannually
TW-12					X	WL Semiannually
TW-13					X	WL Semiannually
TW-14					X	WL Semiannually
Former Mill Site 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 Semiannually at each SW location)						
SW00-01		X				
SW00-02		X				
SW01-01		X				
SW01-02		X				
SW01-03		X				
Sorenson		X				
SW00-04		X				
SW92-08		X				
SW92-09		X				
SW94-01		X				

<p align="center">Sampling Frequencies for Locations at Monticello, Utah</p>

Location ID	~1-million Gallons	Semiannually ^a	Annually ^b	Every 5 Years	Not Sampled	Notes
Area of Attainment Wells						
MW-01	X					
MW-03	X					
MW-04	X					
MW-05	X					
MW-06	X					
MW-07	X					
MW-08	X					
MW-09	X					
MW-10	X					
MW-11	X					
MW-12	X					
MW-13	X					
MW-14	X					
MW-15	X					
MW-16	X					
MW-17	X					
MW-18	X					
MW-19	X					
MW-20	X					
MW-21	X					
MW-22	X					
MW-23	X					
OR-01	X					
OR-02	X					
OR-03	X					
OR-04	X					
OR-05	X					
OR-06	X					
OR-07	X					
OR-08	X					
Transfer Tank Out	X					

^aSemiannual sampling occurs in April and October

^bAnnual sampling occurs in October

^c5-year sample frequency next in October 2021.

Constituent Sampling Breakdown

Site	Monticello				Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	PRB Wells	Surface Water	Seeps and Wetlands			
Approx. No. Samples/Yr	57	18	20	14			
Field Measurements							
Total Alkalinity	X	X	X	X			
Dissolved Oxygen	X	X	X	X			
Redox Potential	X	X	X	X			
pH	X	X	X	X			
Specific Conductance	X	X	X	X			
Static Water Level	X	X					
Turbidity	X	X	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 353.2	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
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	SM160.1	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			



MON-2019-01

Effective Date: 11/30/2018
Expiration Date: 11/30/2021

Program Directive

Initiated By: Sam Campbell

Directive Subject: Sampling of Livestock Wells

Directive and Associated Task Changes: Sampling of livestock wells 0780 and 0782 will be accomplished using a high flow, high-volume purge method as described below:

1. Purging will be accomplished with the sample intake at the top of the water column.
2. One casing volume will be removed prior to taking field measurements.
3. After one casing volume is removed, sampling can commence after Category I purge stability criteria are met. Stability parameters will be measured approximately every $\frac{1}{4}$ casing volume.
4. If the turbidity criterion cannot be met after five casing volumes have been purged, then sampling may commence without turbidity stability; however, samples will be filtered if the turbidity criterion is not met.

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 SAP only addresses low-flow sampling. The low-flow sampling technique is not feasible for these wells because of the following factors: unknown well construction, lack of well-head security, large well diameters, and a large volume of stagnant water in the well. A high-volume purge to remove the stagnant water in these wells is necessary to mitigate these factors and to obtain representative samples.

Review and Concurrence:

Digitally signed by Cecylia M. Wentz
Date: 2018.11.29 16:38:02 -07'00'

Cecylia Wentz, Site Lead

LINDA TEGELMAN
(Affiliate)

2018.11.30 07:30:10

Linda Tegelman, Quality and Performance Assurance

Manager Approval:

SAM CAMPBELL (Affiliate)
2018.11.29 16:28:40 -07'00'

Sam Campbell, Manager – Environmental Monitoring Operations

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**Sampling Frequencies for Locations at
Monument Valley, Arizona**

Location	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
400			X			
402			X			
602			X			
603			X			
604			X			
605			X			
606			X			Duplicate sample location.
611			X			
612			X			
613			X			
618			X			
619			X			
625			X			Will need portable pump to sample
648			X			
650			X			Duplicate sample location.
651			X			
652			X			
653			X			
655			X			
656			X			
657			X			
661			X			
662			X			Duplicate sample location.
663			X			
664			X			
668			X			
669			X			
700			X			
711			X			
715			X			
719			X			
727			X			
733			X			
734			X			
735			X			
738			X			
739			X			
740			X			
743			X			
760			X			
761			X			
762			X			

<p align="center">Sampling Frequencies for Locations at Monument Valley, Arizona</p>

Location	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
764			X			
765			X			
766			X			
Monitoring Wells						
767			X			
768			X			
770			X			
771			X			
772			X			
774			X			
775			X			
776			X			
780			X			Livestock well; need portable pump to sample
782			X			Old public well; need portable pump to sample
785			X			
786			X			
795			X			
796			X			
797			X			
798			X			
799			X			
900			X			Stockpile De Chelly Well, need portable pump to sample
Surface Locations						
623			X			Frog pond
781			X			Spring

Sampling conducted in December

Constituent Sampling Breakdown

Site	Monument Valley		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	63	2			
Field Measurements					
Total Alkalinity	X	X			
Dissolved Oxygen	X	X			
Iron ²⁺	X	X			
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Static Water Level	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					
Calcium	X	X	5	SW-846 6010	LMM-01
Chloride	X	X	0.5	SW-846 9056	MIS-A_039
Chromium					
Total 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					
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	0.05	EPA 353.1	WCH-A-022
O18/O16 in Sulfate					
Potassium	X	X	1	SW-846 6010	LMM-01
Selenium					
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					
S-34/S-32 in Sulfate					
Dissolved Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
U-234, -238	785, 786, 795, 796, 797, 798, and 799 only		1 pCi/L	Alpha Spectrometry	ASP-A-024
Vanadium	X	X	0.0003	SW-846 6020	LMM-02
Zinc					
Total No. of Analytes	14	13			

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. **Uranium Isotopes will only be completed on 7 groundwater samples (Locations 0785 – 0799)**

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<p align="center">Sampling Frequencies for Locations at Naturita, Colorado</p>

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				
Surface Locations						
531		X				
533		X				
SM2		X				
SM4		X				

Sampling conducted in May and October

Constituent Sampling Breakdown

Site	Naturita		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	8	4			
Field Measurements					
Total Alkalinity	X	X			
Dissolved Oxygen					
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Static Water Level	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	X	0531 only	5	SW-846 6010	LMM-01
Chloride	X	0531 only	0.5	SM2320 B	WCH-A-039
Chromium					
Dissolved Organic Carbon	X	0531 only	1	SM5310B	WCH-A-024
Gross Beta					
Iron	X	0531 only	0.05	SW-846 6020	LMM-02
Lead					
Magnesium	X	0531 only	5	SW-846 6010	LMM-01
Manganese	X	0531 only	0.005	SW-846 6010	LMM-01
Molybdenum	X	0531 only	0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X	0531 only	0.05	EPA 353.1	WCH-A-022
Oxygen Isotopes	X	0531 only	NA	Mass Spectrometry	LMW-10
Potassium	X	0531 only	1	SW-846 6010	LMM-01
Radium-226					
Radium-228					
Selenium	X	0531 only	0.0001	SW-846 6020	LMM-02
Silica					
Sodium	X	0531 only	1	SW-846 6010	LMM-01
Strontium					
Sulfate	X	0531 only	0.5	SW-846 9056	MIS-A-044
Sulfur Isotopes	X	0531 only	NA	Mass Spectrometry	LMW-10
Total Dissolved Solids	X	X	10	SM2540 C	WCH-A-033
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Uranium Isotopes	X	0531 only	0.1 pCi/L	Alpha Spectrometry	LMR-02
Vanadium	X	X	0.0003	SW-846 6020	LMM-02
Zinc					
Total No. of Analytes	19	19			

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.

<p align="center">Sampling Frequencies for Locations at Parkersburg, West Virginia</p>

Location ID	Quarterly	Semiannually	Annually	Every 10 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 10/23
MW-6				X		Next sampling 10/23

Sampling conducted in October

Based on LTSP dated September 2014

Constituent Sampling Breakdown

Site	Parkersburg		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Ground Water	Surface Water			
Approx. No. Samples/every 10 years	2	0			
Field Measurements					
Total Alkalinity					
Dissolved Oxygen	X				
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Alkalinity, total as CaCO ₃	X		10	SM2320 B	WCH-A-002
Ammonia as N (NH ₃ -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
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
Nickel	X		0.02	SW-846 6010	LMM-01
Nickel-63					
Nitrate + Nitrite as N (NO ₃ +NO ₂)-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
Zirconium	X		0.001	SW-846 6010	LMM-02
Total No. of Analytes	26	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.

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-2017-01

Effective Date: 09/01/2017
Expiration Date: 09/01/2020

Program Directive

Initiated By: Sam Campbell

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, Projects and Programs.

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
CABALLERO (Affiliate)
Date: 2017.08.30 08:29:57
-04'00'

Julian Caballero, Site Hydrologist



Digitally signed by JOSEPH
DANIEL (Affiliate)
Date: 2017.08.30 10:25:46 -04'00'

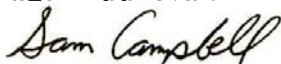
Joe Daniel, Site Lead



MILDRED BIRRENBACH
(Affiliate)
2017.08.30 07:24:46 -06'00'

Millie Birrenbach, Quality and Performance
Assurance

Manager Approval:



SAM CAMPBELL (Affiliate)
2017.08.30 07:35:38 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

Micropurge Sampling¹

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 pump/tubing/flow cell volume 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 one casing volume 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	$\pm 5\%$ of reading ^{a,c}
Turbidity	≤ 20 NTUs ^{a,b}
Dissolved oxygen	$\leq 20\%$ 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.

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	$\pm 5\%$ of reading ^{a,c}
Turbidity	≤ 20 NTUs ^{a,b}
Dissolved Oxygen	$\leq 20\%$ 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 CCV—start of each day and end of sampling event	1-point check ± 0.2 pH units	<p>If the CCV does not meet criteria Repeat the CCV.</p> <p>If still out of range recalibrate and read new ICV.</p> <p>J-flag data as estimated between last successful CCV and failed CCV.</p>
Specific Conductance [FT 1200]	1-point calibration ($\sim 1,000$ $\mu\text{mhos}/\text{cm}^b$) at start of sampling event	ICV—immediately after calibration CCV—start of each day and end of sampling event	2-point check (~ 100 and $\sim 10,000$ $\mu\text{mhos}/\text{cm}$) to bracket the expected sample range $\pm 5\%$ 1-point check ($\sim 10,000$ $\mu\text{mhos}/\text{cm}$) $\pm 5\%$	
Temperature [FT 1400]	No calibration required	ICV—start of sampling event CCV—end of sampling event	± 0.5 °C from corrected NIST thermometer reading at three temperatures in the expected sample range	
Dissolved Oxygen [FT 1500]	Calibrate in water-saturated air at beginning of sampling event and every membrane change-out	ICV—immediately after calibration CCV—start of each day and end of sampling event	± 0.3 mg/L of theoretical DO in water-saturated air	
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 $\pm 10\%$ 10 to 40 NTU $\pm 8\%$ 41 to 100 NTU $\pm 6.5\%$ >100 NTU $\pm 5\%$	
		CCV—start of each day and end of sampling event. Use either primary or secondary (Gelex) standard.	3-point check: 0 to 10 NTU $\pm 10\%$ 10 to 40 NTU $\pm 8\%$ 41 to 100 NTU $\pm 6.5\%$ >100 NTU $\pm 5\%$	
Oxidation-Reduction Potential	One-point calibration at start of sampling event	ICV—immediately after calibration CCV—start of each day and end of sampling event	1-point check $\pm 10\%$	

^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 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 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 FDACS 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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PIN-2018-02

Effective Date: 8/10/2018
Expiration Date: 8/10/2021

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 Pinellas site have impacted groundwater chemistry, numerous monitoring wells 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. Completion of the purging process will be determined by meeting turbidity, water level, and purge-volume criteria only for impacted wells.

Numerous wells across the Pinellas site and off site, including all the wells at the 4.5 Acre Site, have been impacted by the soybean-oil injections that occurred in October/November of 2014, February 2015, November 2015, and October 2016 through March 2017. Some wells may have minor impacts and will be sampled using normal Pinellas (i.e. State of Florida) protocols; however, severely impacted wells will be sampled using the criteria listed above, noted on the field data sheets, and included in the Trip Report. Water that has been severely 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.

Organization(s) Affected: Environmental Monitoring Operations, Programs and Projects, and Pinellas site personnel.

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.

Contractor to U.S. Department of Energy Office of Legacy Management

Review and Concurrence:



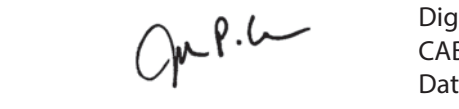
Digitally signed by JOSEPH
DANIEL (Affiliate)
Date: 2018.08.08 13:32:31 -04'00'

Joe Daniel, Pinellas Site Lead



MILDRED BIRRENBACH
(Affiliate)
2018.08.08 11:47:20 -06'00'

Millie Birrenbach, Quality and Performance Assurance



Digitally signed by JULIAN
CABALLERO (Affiliate)
Date: 2018.08.08 13:25:46 -04'00'

Julian Caballero, Site Hydrogeologist

Manager Approval:



SAM CAMPBELL (Affiliate)
2018.08.08 13:28:31 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

Electronic Distribution:

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

**Sampling Frequencies for Locations at
Rifle, Colorado**

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
New Rifle						
CW06		X				
CW09		X				
CW12		X				
CW19		X				
CW21		X				
CW22		X				
CW23		X				
CW25		X				
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
219		X				
590		X				Data logger; downgradient
609		X				
620		X				Far downgradient
635		X				Downgradient
658		X				
659		X				Onsite
664		X				Onsite
669		X				Onsite
670		X				Onsite
680		X				
683		X				
684		X				
687		X				
688		X				
689		X				
690		X				
852		X				
855		X				Onsite
862		X				
863		X				
864		X				
Old Rifle						
292A		X				Background well
304		X				Onsite
305		X				Onsite
309		X				Onsite
310		X				Data logger; onsite
654		X				
655		X				Data logger; onsite
656		X				Onsite
658		X				Background well
742-1		X				

<p align="center">Sampling Frequencies for Locations at Rifle, Colorado</p>
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Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
742-2		X				
742-3		X				
744-1		X				
744-2		X				
744-3		X				
745		X				
746		X				
747		X				
Surface Locations						
<i>New Rifle</i>						
320		X				Wetland Pond
322		X				Colorado River
323		X				Gravel pit pond
324		X				Colorado River downgradient
326		X				Colorado River
452		X				Wetland Pond
453		X				Wetland Pond
575		X				Gravel pit pond
<i>Old Rifle</i>						
294		X				River, upstream
395		X				Seep, upgradient
396		X				River
398		X				Ditch, onsite
741		X				River
Disposal Cell						
<i>RFL08-Disposal Cell Effluent</i>						
MW02			X			July
MW03			X			July

Semi-annual sampling conducted in June and November

Constituent Sampling Breakdown

Site	Rifle					Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater		Surface Water					
Approx. No. Samples/yr	51		26					
Field Measurements								
Total Alkalinity	X		X					
Dissolved Oxygen	X		X (disposal site only)					
Redox Potential	X		X					
pH	X		X					
Specific Conductance	X		X					
Static Water Level	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	X	X		0.0001	SW-846 6020	LMM-02
Calcium	X	X	X	X	X	5	SW-846 6010	LMM-01
Chloride	X	X	X	X	X	0.5	SW-846 9056	MIS-A_039
Chromium								
Gross Alpha								
Gross Beta								
Iron					X			
Lead								
Magnesium	X	X	X	X	X	5	SW-846 6010	LMM-01
Manganese					X			
Molybdenum		X		X		0.003	SW-846 6020	LMM-02
Nickel								
Nickel-63								
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	X	X	X	0.05	EPA 353.1	WCH-A-022
Potassium	X	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	X	1	SW-846 6010	LMM-01
Strontium								
Sulfate	X	X	X	X	X	0.5	SW-846 9056	MIS-A-044
Sulfide								
Total Organic Carbon					X	1	SM5310 B	WCH-A-025
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	11	13	11	13	12			

*RFN = New Rifle; *RFO = Old Rifle; *RFL = Disposal Cell

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.

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RBL-2018-01

Effective Date: 12/1/2017
Expiration Date: 12/1/2020

Program Directive

Initiated By: Sam Campbell

Directive Subject: Natural Gas and Produced-Water 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 procedure.

Collection of a produced water sample at the wellhead of a producing natural gas well will be conducted according to this sampling and analysis plan with one exception. Because significant amounts of petroleum hydrocarbons may be present in the sample, special handling is required. After collection of the sample, the sample will be allowed to sit for a time to determine if a free hydrocarbon layer develops on top of the water sample. If a hydrocarbon layer develops, the layer will be pumped or decanted off the top of the water sample, and the hydrocarbon fraction will be given to the company representative for on-site disposal.

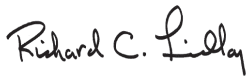
Collection of natural gas and produced water samples at the wellhead of a producing natural gas well have addition safety concerns and precautions that are detailed in the attached procedure.

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, and collection of produced water from a natural gas well has special sample handling and safety precautions. This Program Directive will be used to guide sample collection for both media.

Review and Concurrence:


 2017.11.15
08:22:22 -07'00'

Rick Findlay, Site Lead

 MILDRED BIRRENBACH
(Affiliate)
2017.11.14 16:22:38
-07'00'

Millie Birrenbach, Quality and Performance Assurance

Manager Approval:

 SAM CAMPBELL (Affiliate)
2017.11.15 07:25:36
-07'00'

Sam Campbell, Environmental Monitoring Operations Manager

<p align="center">Sampling Frequencies for Locations at Rio Blanco, Colorado</p>

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		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	4				
Field Measurements					
Total Alkalinity	X				
Dissolved Oxygen	X				
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	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					
Sulfate					
Sulfide					
Total Organic Carbon					
Tritium	X		400 pCi/L	Liquid Scintillation	LSC-A-001
Tritium, enriched	25% of the samples		10 pCi/L	Liquid Scintillation	LMR-15
Uranium					
Vanadium					
Zinc					
Total No. of Analytes	3	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.

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RVT-2019-01

Effective Date: 11/01/2018
Expiration Date: 11/01/2021

Program Directive

Initiated By: Sam Campbell

Directive Subject: Sampling of CMT Wells

Directive and Associated Task Changes: CMT wells will be sampled using Category I protocol with the following exceptions:

1. Purging will be accomplished with the sample-tubing intake at the top of the water column.
2. A stable water level will be verified using the following method. Begin pumping with the tubing above the water column. Slowly lower the tubing into the water. As bubbles appear in the tubing, continue to slowly lower the tubing. When a steady stream of water in the tubing is obtained (no bubbles), then the well yield is equal to the pump rate indicating water level stabilization.
3. Three casing volumes will be removed prior to taking field measurements.

Organization(s) Affected: Environmental Monitoring Operations

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 small diameter of CMT wells does not allow for the standard low-flow sampling specified in the SAP; therefore, modification of protocol is required.

Review and Concurrence:

LINDA TEGELMAN (Affiliate)
2018.11.01 11:35:38 -06'00'

Linda Tegelman, Quality and Performance Assurance

Manager Approval:

SAM CAMPBELL (Affiliate)
2018.11.01 11:22:27 -06'00'

Sam Campbell, Manager – Environmental Monitoring Operations

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<p align="center">Sampling Frequencies for Locations at Riverton, Wyoming</p>
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Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
101					X	WL only; data logger
110					X	WL only
111					X	WL only
700					X	WL only
702					X	
705			X			
707			X			Data logger
709					X	WL only
710			X			Data logger
716			X			
717			X			
718			X			
719			X			
720			X			
721			X			
722R			X			Data logger
723			X			
724					X	WL only; data logger
725					X	WL only
726					X	WL only
727			X			
728					X	WL only
729			X			Data logger
730			X			
732			X			
733					X	WL only
734					X	WL only
736					X	WL only
784			X			
788			X			
789			X			Data logger
824			X			Data logger
826			X			Data logger

<p align="center">Sampling Frequencies for Locations at Riverton, Wyoming</p>
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Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Multilevel Monitoring Wells						
852-1			X			
852-2			X			
852-3			X			
852-4			X			
853-1			X			
853-2			X			
Multilevel Monitoring Wells						
853-3			X			
853-4			X			
854-1			X			
854-2			X			
854-3			X			
854-4			X			
855-1			X			
855-2			X			
855-3			X			
855-4			X			Data logger
856-1			X			
856-2			X			
856-3			X			
856-4			X			Data logger
857-1			X			
857-2			X			
857-3			X			
857-4			X			Data logger
858-1			X			
858-2			X			
858-3			X			
858-4			X			
859-1			X			
859-2			X			
859-3			X			
859-4			X			
860-1			X			
860-2			X			
860-3			X			
860-4			X			

<p align="center">Sampling Frequencies for Locations at Riverton, Wyoming</p>
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Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Surface Locations						
747			X			
749			X			
794			X			
796			X			
810			X			Gravel pit
811			X			Little Wind River
812			X			Little Wind River
822			X			
823			X			
879			X			
Domestic Wells						
405			X			921 Rendezvous Road
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
876			X			160 Goes in Lodge Road
878			X			250 Goes in Lodge Road
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	

Annual groundwater and surface water sampling conducted in August.

Constituent Sampling Breakdown

Site	Riverton				Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water	Domestic Wells	AWSS			
Approx. No. Samples/yr	56	9	9	0			
Field Measurements							
Total Alkalinity	X	X	X				
Dissolved Oxygen							
Redox Potential							
Total Chlorine							
pH	X	X	X				
Specific Conductance	X	X	X				
Static Water Level	X						
Turbidity	X	X	X				
Temperature	X	X	X				
Laboratory Measurements							
Aluminum							
Ammonia as N (NH3-N)							
Calcium							
Chloride							
Chromium							
Gross Alpha							
Gross Beta							
Iron							
Lead							
Magnesium							
Manganese	X	X	X		0.005	SW-846 6010	LMM-01
Molybdenum	X	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	X	X	X		0.5	SW-846 9056	MIS-A-044
Sulfide							
Total Organic Carbon							
Uranium	X	X	X		0.0001	SW-846 6020	LMM-02
Vanadium							
Zinc							
Total No. of Analytes	4	4	4	0			

RFS-2018-02

Effective Date: 12/1/2017
Expiration Date: 12/1/2020

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 be 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: Since site closure in 2005, excess water has been discharged to the onsite groundwater treatment systems. In 2015-2016, the treatment systems were reconfigured, necessitating new guidelines for the disposition of excess water in these systems.

Review and Concurrence:



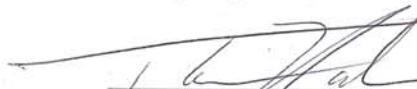
Linda Kaiser, Rocky Flats Site Lead



George Squibb, Surface Water Lead



John Boylan, Groundwater Lead



Theresa Nash, Quality and Performance Assurance

Manager Approval:



SAM CAMPBELL (Affiliate)
2017.11.30 16:06:43 -07'00'

Sam Campbell, Environmental Monitoring Operations Manager

1. This guidance applies to all groundwater and surface water sampling locations on the Rocky Flats Site (RFS) in existence as of the effective date of this directive, as well as locations that may be identified in the future, *EXCEPT* where directed otherwise by the RFS Environmental Compliance (EC) lead. These locations include groundwater and surface routine monitoring locations sampled in accordance with the *Rocky Flats Legacy Management Agreement* (RFLMA), the *Surface Water Configuration Adaptive Management Plan* (AMP), and locations installed or sampled for project-specific objectives (e.g., piezometers at the Original Landfill).
2. The disposition of decontamination, purge, and excess sample water will generally be carried out by the field personnel involved in the water-generating activity (e.g., sampling, well development). Field personnel are encouraged to contact the RFS EC lead with any questions or concerns regarding onsite water disposition or any other aspect of this directive.
3. Table 1 presents a summary of the guidance for the onsite disposal of decontamination, purge, and excess sample water at the RFS.

Table 1. Disposition of water from groundwater and surface water field activities

Location	Water Type	Disposition	Basis
Groundwater			
All groundwater locations (e.g., wells, piezometers)	Decontamination Water	Pour onto the ground ^a	Contaminant concentrations in decontamination water would be less than applicable surface water standards.
All groundwater locations	Purge Water	Pour into appropriate onsite treatment system based on location of well (see Figure 1)	Contaminants may be present in concentrations greater than applicable surface water standards.
All groundwater locations	Excess Sample Water (pH= 6-8)		
Surface water			
All surface water locations	Decontamination Water	Pour onto the ground ^a or pour into Solar Ponds Plume Treatment System (if mixed with excess sample water)	Contaminant concentrations in decontamination water would be less than applicable surface water standards.
All surface water locations	Excess Sample Water (pH= 6-8)	Pour into Solar Ponds Plume Treatment System	Contaminants may be present in concentrations greater than applicable surface water standards.

^a Pour onto the ground in a location that is downgradient of the well or on the ground near the surface water location, and in a manner that minimizes erosion and avoids direct discharge to surface water.

4. Definitions

- a. *Decontamination water* is defined as water generated from cleaning or rinsing reusable sampling implements (e.g., tubing, bowls) that may have come into contact with RFS contaminants. Decontamination water may contain non-hazardous cleaning solutions or detergents (e.g. Liquinox).
- b. *Excess sample water* is defined as the portion of a groundwater sample or surface water sample that is to be discarded (e.g., water that is left over once all samples have been collected).
- c. *Free product* is defined as a non-aqueous phase liquid (e.g., liquid not dissolved in water) that can be denser than water (e.g., trichloroethene) or lighter than water (e.g., oil).
- d. *Purge water* is defined as groundwater that is produced from a well or piezometer during construction, development, redevelopment, testing, and/or sampling.

5. Groundwater

- a. Decontamination water from groundwater locations may be poured on the ground in an area immediately downgradient of the sampling location. This shall be conducted in a manner that prevents erosion and runoff to surface water.
- b. Under no circumstances may decontamination water be poured directly into surface water or down a well/piezometer. If the volume of decontamination water is large or if alternate disposition is preferred, contact the RFS EC lead for further guidance.
- c. Purge water and excess groundwater sample water shall be disposed on the RFS based on the location of the well at which it was produced. *For the purpose of this directive only*, the Central Operable Unit has been separated into three areas (Figure 1), each of which contains an onsite groundwater treatment system (Solar Ponds Plume Treatment System, East Trenches Plume Treatment System, and Present Landfill Treatment System). Purge water from groundwater wells located within each area illustrated on the figure shall be disposed in the treatment system within that area.
- d. It is recognized that not all purge water produced at the RFS contains contaminants in excess of RFLMA surface water quality standards. However, disposing of all purge water in an onsite treatment system is a conservative approach to ensure that groundwater with contaminant concentrations greater than the RFLMA surface water quality standards is treated prior to reaching surface water.
- e. The physical location at each treatment system where purge water is to be disposed will be selected by the RFS Groundwater Lead and may be based on ease of access, safety and health concerns, prevention of treatment system fouling (e.g., due to high solids content in purge water), and/or other relevant considerations.

6. Surface Water

- a. Excess sample water from surface water monitoring locations that has been preserved and has a pH less than 6 or greater than 8 shall be neutralized prior to being disposed of at the RFS. Neutralization of this water shall be accomplished by adding a neutralizing agent (e.g., sodium bicarbonate for acid neutralization) to the water and mixing thoroughly. All neutralizing agents shall be approved for use in the neutralization process by the RFS EC lead prior to use. The pH of the neutralized water must be measured with an instrument or test strip to confirm that the pH is between 6 – 8 prior to disposal. Neutralization activities shall be completed in accordance with all applicable safety and health requirements (e.g., wearing proper personal protective equipment).
- b. All excess sample water from surface water monitoring locations shall be disposed of in the Solar Ponds Plume Treatment System, regardless of the surface water monitoring location where it was collected.
- c. Decontamination water from surface water locations may be poured to the ground in the immediate area of the sampling location or may be disposed of in the SPPTS. If poured on the ground, care shall be taken to prevent erosion.
- d. Under no circumstances may decontamination water be poured directly into surface water at the RFS (e.g., pond, Walnut Creek). If the volume of decontamination water is large or if alternate disposition is preferred, contact the RFS EC lead for further guidance.

7. New Locations and Locations Not Previously Sampled

- a. Water generated at a new location (new well, piezometer, surface water monitoring point) or at a location not previously sampled, will be disposed at the same treatment system and in the same manner as water from other, pre-existing locations in the same area (Figure 1). The only exceptions are (1) the water contains immiscible liquids or otherwise presents anomalous characteristics, or (2) the RFS EC lead instructs otherwise. In either of these cases, the field staff shall consult the RFS EC lead for direction on appropriate disposition.
- b. If consultation with the EC lead is necessary to determine the disposition of excess water associated with new well/piezometer installation or locations not previously sampled, any water generated at these locations shall be stored and properly marked and labeled until direction from the RFS EC lead is received.

8. Off-normal Conditions

- a. Field personnel shall contact the RFS EC lead if they observe atypical conditions in water produced at the RFS. Such conditions may include the presence of free product or other immiscible liquid (as evidenced by the separation of phases in the container), an oily sheen, or an unusual odor.

- b. In cases where there are visible phases within the container, the expected course of action will be to separate the non-aqueous phase portion into another container and ship offsite for appropriate treatment and/or disposal. However, the RFS EC lead will provide direction if a different action should be taken.

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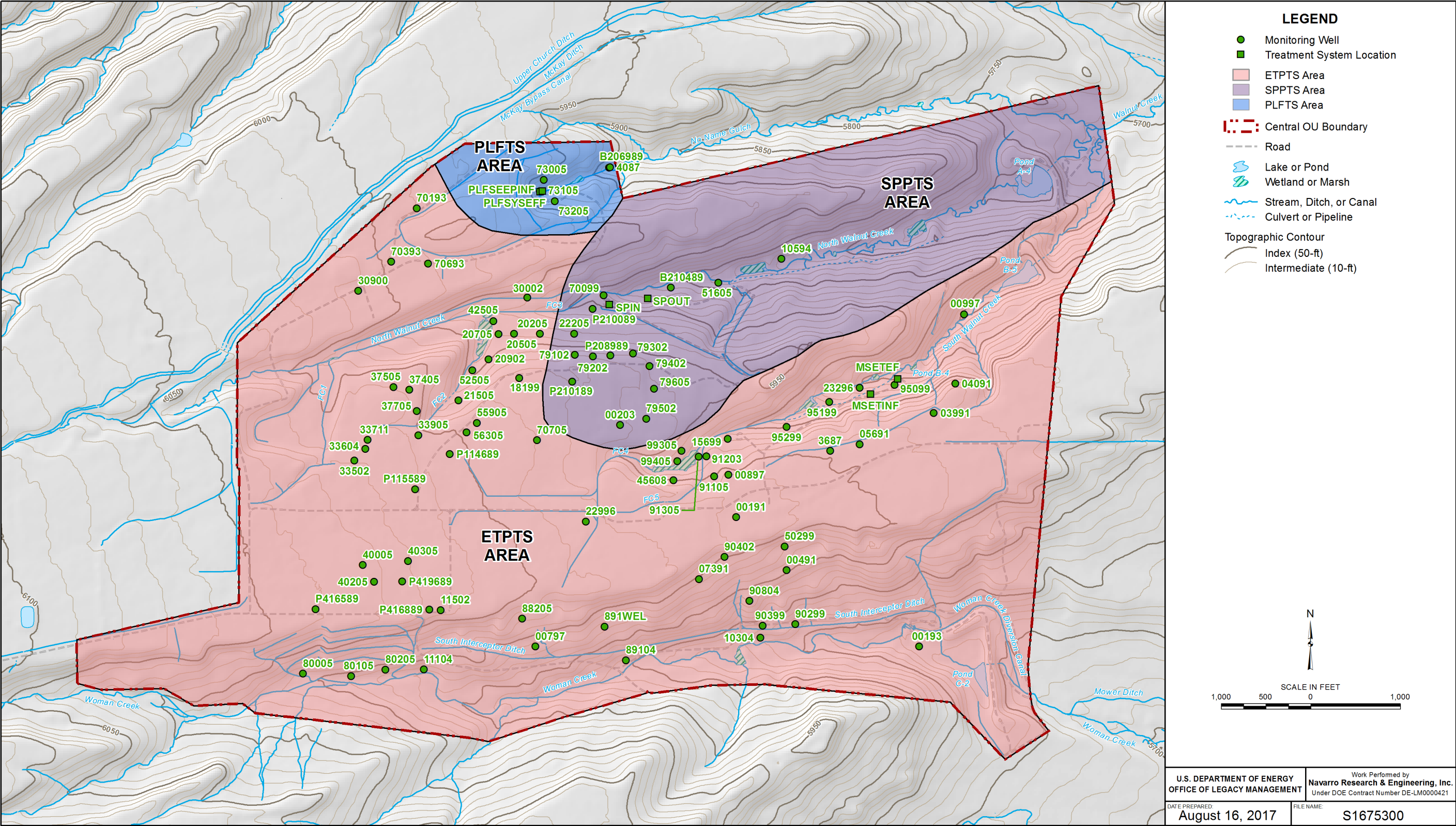


Figure 1. RFS Groundwater Treatment System Areas

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<p align="center">Sampling Frequencies for Locations at Rocky Flats, Colorado</p>
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Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
Refer to the Rocky Flats Legacy Management Agreement, Attachment 2, Table 2, "Water Monitoring Locations and Sampling Criteria"						
Surface Locations						
Refer to the Rocky Flats Legacy Management Agreement, Attachment 2, Table 2, "Water Monitoring Locations and Sampling Criteria"						

Constituent Sampling Breakdown

Site	Rocky Flats			
Analyte	Groundwater	Surface Water		
Approx. No. Samples/year	130 in odd-numbered years; 172 in even-numbered years	Varies		
Field Measurements				
Total Alkalinity	X			
Dissolved Oxygen				
Redox Potential				
pH	X			
Specific Conductance	X			
Turbidity	X			
Temperature	X			
Ferrous Iron				
Laboratory Measurements		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Refer to the Rocky Flats Legacy Management Agreement, Attachment 2, Table1, "Surface Water Standards" and Table 2, "Water Monitoring Locations and Sampling Criteria" for location-specific requirements				

RUL-2018-01

Effective Date: 12/1/2017
Expiration Date: 12/1/2020

Program Directive

Initiated By: Sam Campbell

Directive Subject: Natural Gas and Produced-Water 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 procedure.

Collection of a produced water sample at the wellhead of a producing natural gas well will be conducted according to this sampling and analysis plan with one exception. Because significant amounts of petroleum hydrocarbons may be present in the sample, special handling is required. After collection of the sample, the sample will be allowed to sit for a time to determine if a free hydrocarbon layer develops on top of the water sample. If a hydrocarbon layer develops, the layer will be pumped or decanted off the top of the water sample, and the hydrocarbon fraction will be given to the company representative for on-site disposal.

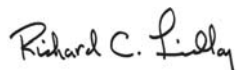
Collection of natural gas and produced water samples at the wellhead of a producing natural gas well have addition safety concerns and precautions that are detailed in the attached procedure.

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, and collection of produced water from a natural gas well has special sample handling and safety precautions. This Program Directive will be used to guide sample collection for both media.

Review and Concurrence:

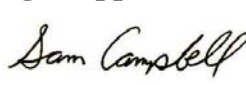
 2017.11.15 08:19:27 -07'00'

Rick Findlay, Site Lead

 MILDRED BIRRENBACH
(Affiliate)
2017.11.14 16:23:17 -07'00'

Millie Birrenbach, Quality and Performance Assurance

Manager Approval:

 SAM CAMPBELL (Affiliate)
2017.11.15 07:27:01
-07'00'

Sam Campbell, Environmental Monitoring Operations Manager

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	<ol style="list-style-type: none"> 1) Slippage and loss of control due to steep grades and wet road conditions 2) Vehicle accidents 3) Driving hazards caused by well field operator activities 	<ol style="list-style-type: none"> 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) 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) 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	<ol style="list-style-type: none"> 1) Slips, trips, falls 2) Head, eye, or foot injury, burns 3) Injury to hands 4) Inclement weather and lightning strikes 5) Biological hazards—snakes, insects, and bears 6) Explosion caused by spark or fire in the work area 7) Explosive atmosphere within work area 	<ol style="list-style-type: none"> 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) 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) 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) 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) 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) 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) 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	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
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.

<p align="center">Sampling Frequencies for Locations at Rulison, Colorado</p>
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Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
Off-Site						
CER Test Well			X			
Daniel Gardner			X			
Kevin Whelan			X			
Morrisania Ranch			X			
Patrick McCarty			X			
Tim Jacobs Ranch New			X			
On-Site						
Cary Weldon House W			X			
Wesley Kent House W			X			
Surface Locations						
On-Site						
Spring 300 Yrd N SGZ			X			
Spring 500 ft E SGZ			X			
Off-Site						
Battlement Creek			X			
City Springs			X			
Potter Ranch			X			

Sampling conducted in May

<p align="center">Sampling Frequencies for Locations at Rulison, Colorado</p>
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Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Gas and Produced Water Wells						
BM 26-22B						05-045-16086
BM 26-22C						05-045-16087
BM 26-22D						05-045-16074
BM 26-33B			X			05-045-15743
BM 26-33C			X			05-045-15742
BM 26-33D			X			05-045-15739
BM 26-34A			X			05-045-15744
BM 26-34B			X			05-045-15745
BM 26-34C			X			05-045-15741
BM 26-34D			X			05-045-15748
BM 35-32A						05-045-10919
BM 36-13			X			05-045-10840
BM 36-13A						If available
BM 36-13B						05-045-15469
BM 36-13C						If available

Sampling based on amount of gas produced

Constituent Sampling Breakdown

Site	Rulison		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Gas	Produced Water			
Approx. No. Samples/yr		8			
Field Measurements					
Total Alkalinity					
Dissolved Oxygen					
Redox Potential					
pH					
Specific Conductance					
Turbidity					
Temperature					
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Calcium					
Chloride					
Chromium					
Gamma Spec					
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					
Tritium		X	400 pCi/L	Liquid Scintillation	LSC-A-001
Tritium, enriched					
Uranium					
Vanadium					
Zinc					
Total No. of Analytes	0	1			

analytes does not include field parameters.

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.

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Effective Date: 04/14/2017
Expiration Date: 04/14/2020

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 1070 gallons and 1049 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	1768	2 3/8	0.23	407
	Fiberglass casing	1770–1777.2	6.7	7	2	13 x 3
	PVC well screen and sump	1777.2–2098	320.8	4	0.65	208 x 3
Total Volume						1070
SA5-5-4	Pump drop-pipe	0–1768	1768	2 3/8	0.23	407
	Fiberglass casing	1770.5–1778.3	7.8	7	2	16 x 3
	PVC well screen and sump	1778.3–2083	304.7	4	0.65	198 x 3
Total Volume						1049

Organization(s) Affected: Projects and 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.

Contractor to U.S. Department of Energy Office of Legacy Management


Review and Concurrence:

 David Traub
2017.04.13 08:00:00
-06'00'

David Traub, Site Lead


 Rex A. Hodges
2017.04.13 07:49:36
-06'00'

Rex Hodges, Site Hydrologist

 MILDRED BIRRENBACH
(Affiliate)
2017.04.13 05:50:01 -06'00'

Millie Birrenbach, Quality and Performance Assurance

Manager Approval:

 SAM CAMPBELL (Affiliate)
2017.04.13 07:36:43 -06'00'

Sam Campbell, Environmental Monitoring Operations, Manager

<p align="center">Sampling Frequencies for Locations at Salmon, Mississippi</p>
--

Location ID	Quarterly	Semiannually	18 Months	Every 5 years	Not Sampled	Notes
Monitoring Wells						
On-Site						
Shallow Sources						
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		
SA1-8-L				X		
SA1-12-H				X		
SA1-12-L				X		
SA2-1-L				X		
SA2-2-L				X		
SA2-4-L				X		
SA2-6-H				X		
SA2-6-L				X		
SA3-4-H				X		
SA3-4-L				X		
HMH-5R				X		
HMH-16R				X		
HM-S				X		
HM-L				X		
HM-L2				X		
SA4-5-L				X		
Test Cavity						
HM-1				X		
HM-2A				X		
HM-2B				X		
HM-3				X		
E-7				X		
Aquifer 5						
SA5-4-4				X		
SA5-5-4				X		
Other						
SA1-11-3				X		
SA3-11-3				X		
Monitoring Wells						
Off-Site						
Bx.Cty WI #370007-04				X		
Well North Lumberton				X		
Purvis Cty Supply WL				X		
Surface Locations						

<p align="center">Sampling Frequencies for Locations at Salmon, Mississippi</p>
--

Location ID	Quarterly	Semiannually	18 Months	Every 5 years	Not Sampled	Notes
On-Site						
Shallow Sources						
HALFMOON CREEK				X		
HALFMOONCR KOVERFLOW				X		
Pond west of GZ				X		
Half Moon Ck Exit				X		
Other						
REECo Pit (A)				X		
REECo Pit (B)				X		
REECo Pit (C)				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

Constituent Sampling Breakdown

Site	Salmon				
Analyte	Groundwater	Surface Water	Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Approx. No. Samples/Every 5 years	35	10			
Field Measurements					
Total Alkalinity					
Dissolved Oxygen	X				
Redox Potential	X				
pH	X	X			
Specific Conductance	X	X			
Static Water Level	X				
Turbidity	X				
Temperature	X	X			
Laboratory Measurements					
Alkalinity-Carb	X	X	10	SM2320 B	WCH-A-004
Alkalinity-Bicarb	X	X	10	SM2320 B	WCH-A-003
Antimony					
Arsenic					
Barium					
Beryllium					
Cadmium					
Calcium	X	X	5	SW-846 6010	LMM-01
Chloride	X	X	0.5	SW-846 9056	WCH-A-039
Chromium					
Iron					
Lead					
Magnesium	X	X	5	SW-846 6010	LMM-01
Manganese					
Mercury					
Molybdenum					
Nickel					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium	X	X	1	SW-846 6010	LMM-01
Selenium					
Silver					
Sodium	X	X	1	SW-846 6010	LMM-01
Sulfate	X	X	0.5	SW-846 9056	MIS-A-044
Tritium	Selected wells only	Selected locations only	400 pCi/L	Liquid Scintillation	LSC-A-001
Tritium, enriched	Selected wells only	Selected locations only	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	11	10			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

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<p align="center">Sampling Frequencies for Locations at Sherwood, Washington</p>

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		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	3	0			
Field Measurements					
Total Alkalinity					
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	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
Uranium					
Vanadium					
Zinc					
Total No. of Analytes	3	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.

SHP-2018-01

Effective Date: 12/1/2017
Expiration Date: 12/1/2020

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 (SAP) (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
2017.11.13 15:05:54 -07'00'
David Miller, Site Lead


LINDA TEGELMAN (Affiliate)
2017.11.13 14:05:26 -07'00'
Linda Tegelman, Quality and Performance Assurance

Manager Approval:


SAM CAMPBELL (Affiliate)
2017.11.13 14:36:39 -07'00'
Sam Campbell, Environmental Monitoring Operations Manager

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SHP-2018-02

Effective Date: 12/5/2017
Expiration Date: 12/5/2020

Program Directive

Initiated By: Sam Campbell

Directive Subject: Sampling of the Shiprock Evaporation Pond


Directive and Associated Task Changes: Sampling sediment and water from the Shiprock evaporation pond will be conducted according to the enclosed instructions. Sampling will be conducted in phases and sampling details modified as data from each phase are analyzed. An additional set of instructions will be added to this directive for each phase of sampling.


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: Sampling to characterize sediment and water from the Shiprock evaporation pond is necessary to make decisions for the eventual removal of the pond. Procedures for sampling sediment are not directly addressed in the SAP and require a Program Directive or site-specific work plan to provide the needed detail. Water samples collected under this Program Directive will be new locations with special sampling considerations. This Program Directive will be used to guide sample collection for both media.

Review and Concurrence:


David E. Miller
2017.12.05
10:51:52 -07'00'
David Miller, Site Lead


LINDA TEGELMAN (Affiliate)
2017.12.05 08:39:17 -07'00'
Linda Tegelman, Quality and Performance Assurance

Manager Approval:


SAM CAMPBELL (Affiliate)
2017.12.05 07:54:49 -07'00'
Sam Campbell, Environmental Monitoring Operations Manager

Shiprock Evaporation Pond Sample Collection Phase I

Sediment and Surface-Water Sample Collection: Sediment and surface-water sampling at the Shiprock evaporation pond will be conducted from a small rowboat kept at the Shiprock site.

General

- Conduct work in accordance to the safety controls specified in the *Sampling of the Shiprock Evaporation Pond* and the *Environmental Monitoring Operations at LM Sites* JSAs.
- Use the small rowboat to traverse the pond to the approximate sample locations.
- Collect sediment and surface-water samples at the approximate locations shown in Figure 1.
- Record GPS coordinates at the actual location of each sample.
- Collect samples in the containers specified in Table 1, and analyze samples for the constituents specified in Table 1.
- Do not collect a field duplicate because the objective of this sampling event is to obtain initial screening information; therefore, field quality-control samples are not required.

Sediment Samples

- Measure and document the thickness of sediment at each sediment sampling location.
- Collect sediment samples by pushing, or tapping with a rubber mallet as needed, a 2-inch diameter Geoprobe sample sleeve into the sediment. If necessary, affix the sleeves to an extension rod in order to effectively reach the bottom of the sediment.
- Transfer sediment samples from the Geoprobe sample sleeve to a stainless steel pan and homogenize the sample prior to the final transfer to a 1-liter HDPE bottle.

Surface Water Samples

- Record the following field measurements at each surface water location: pH, specific conductance, temperature, turbidity, and total alkalinity.
- Prior to surface water sample collection, measure specific conductance at one-foot increments starting at the top of the sediment to investigate the potential existence of a concentration gradient. If a gradient is observed, collect samples from the point in the water column with the highest measured specific conductance. If no gradient is observed, collect samples by dipping the bottles at the surface.
- Filter metals samples regardless of turbidity EXCEPT FOR the iron and selenium aliquot, which will be collected without filtering regardless of turbidity (Table 1).

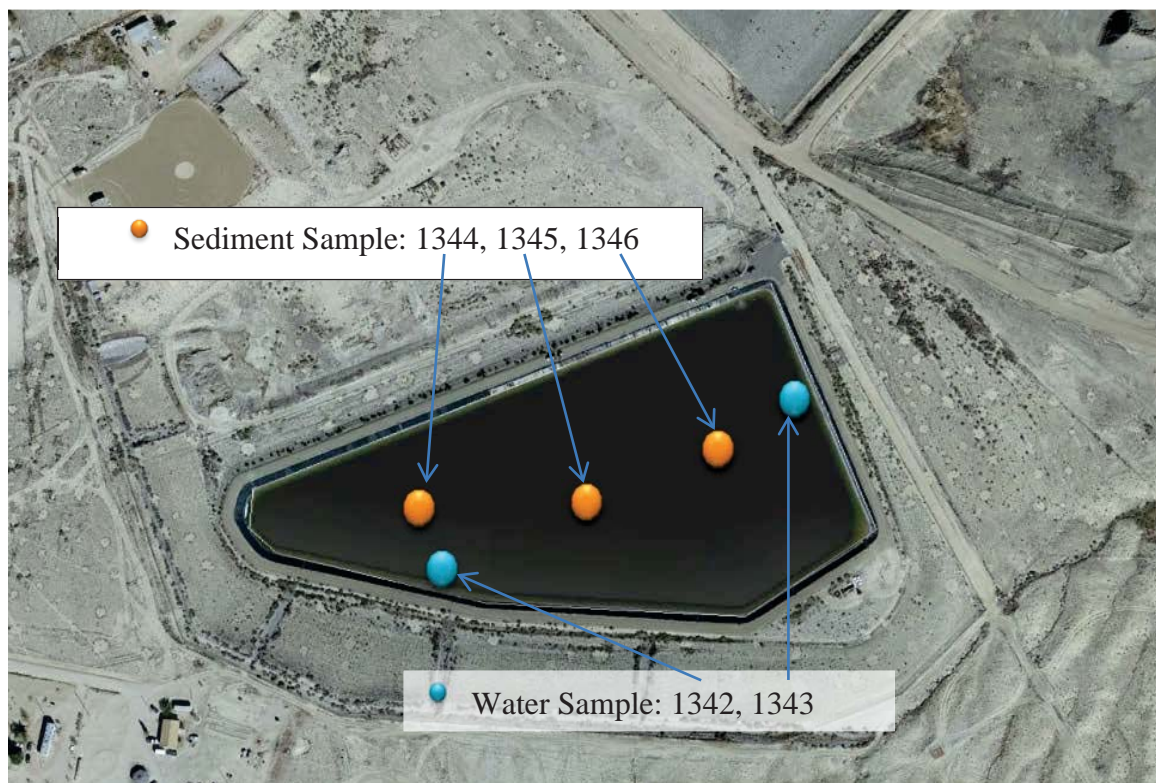


Figure 1. Evaporation Pond Sediment and Surface-Water Approximate Sampling Locations

Table 1. Containers, Preservation, and Analytical Requirements

Location	Container, Preservation, and Analytes
Surface Water	
1342	<p>1 - 500 mL HDPE: Total metals (no filtration): Fe, Se <i>Preservative: HNO₃</i></p> <p>1 - 500 mL HDPE: Dissolved metals (filtered): Al, B, Be, Ca, Fe, Mg, Hg, K, Si, SiO₂, Na, Sr, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Ag, Tl, U, Zn <i>Preservative: HNO₃</i></p> <p>1 - 1L HDPE: Thorium isotopes water <i>Preservative: HNO₃</i></p>
1343	<p>1 - 1L HDPE: Uranium isotopes water <i>Preservative: HNO₃</i></p> <p>3 - 40 mL Glass: Methanol <i>Preservative: 4 °C</i></p> <p>1 - 500 mL HDPE: TDS, TSS, Cl, F, SO₄ <i>Preservative: 4 °C</i></p> <p>1 - 500 mL HDPE: Hardness, NO₂+NO₃-N, Ammonia-N <i>Preservative: 4 °C, H₂SO₄</i></p>
Sediment	
1344	<p>1 - 1L HDPE: As, Ba, Cd, Pb, Se, U, Cl, Solids, Cyanide, Solids, Ra-226, Cs-137, K-40, Th-232, Sulfate, Solids, Thorium Isotopes, Solid, Uranium Isotopes, Ca, Mg, Mn, Hg, K, Na, Sr, Zn <i>Preservative: None</i></p>
1345	
1346	

SHP-2018-03

Effective Date: 7/6/2018
Expiration Date: 7/6/2021

Program Directive

Initiated By: Joe Lobato

Directive Subject: Sampling of the Shiprock Evaporation Pond


Directive and Associated Task Changes: Sampling sediment and water from the Shiprock evaporation pond will be conducted according to the enclosed instructions. Sampling will be conducted in phases and sampling details modified as data from each phase are analyzed. An additional or modified set of instructions will be detailed in a new directive for each phase of sampling. This directive covers Phase II of the Shiprock pond sampling. The objective of this phase is to collect sediment samples for characterization by Energy Fuels and to collect water samples to assess the effects of evaporation on water quality in the pond.


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: Sampling to characterize sediment and water from the Shiprock evaporation pond is necessary to make decisions for the eventual removal of the pond. Procedures for sampling sediment are not directly addressed in the SAP and require a Program Directive or site-specific work plan to provide the needed detail. Water samples collected under this Program Directive will be new locations with special sampling considerations. This Program Directive will be used to guide sample collection for both media.

Review and Concurrence:


David E. Miller
2018.07.05 11:25:15 -06'00'
David Miller, Site Lead


LINDA TEGELMAN (Affiliate)
2018.07.03 15:20:06 -06'00'
Linda Tegelman, Quality and Performance Assurance

Manager Approval:


SAM CAMPBELL (Affiliate)
2018.07.03 12:37:39 -06'00'
Sam Campbell, Environmental Monitoring Operations Manager

Shiprock Evaporation Pond Sample Collection Phase II

Sediment and Surface-Water Sample Collection: Surface-water sampling at the Shiprock evaporation pond will be conducted from shore. Sediment sampling will be conducted from the shore at four locations and from the middle of the pond at two locations (Figure 1). Sediment samples collected from the middle of the pond will be accessed using a small rowboat kept at the Shiprock site, or they will be accessed by foot if the water level is too shallow to support boat operations.

General

- Conduct work in accordance to the safety controls specified in the Sampling of the Shiprock Evaporation Pond and the Environmental Monitoring Operations at LM Sites JSAs.
- Use the small rowboat to traverse the pond to the approximate sediment sample locations or walk to the locations if the water is too shallow for the boat.
- Collect sediment and surface-water samples at the approximate locations shown in Figure 1.
- Record GPS coordinates at the actual location of each sample.
- Collect samples in the containers specified in Table 1, and analyze samples for the constituents specified in Table 1.
- A field-duplicate sample will be collected at a water sample location only. Field duplicates are not required at sediment sample locations.

Surface Water Samples

- Water sample locations 1342, 1343 will be taken from shore.
- Record the following field measurements at each surface water location: pH, specific conductance, temperature, turbidity, and total alkalinity.

Sediment Samples

- For sediment sample locations 1344, 1345, and 1346 use a shovel to collect the sample just below the water surface near the shore. Use caution to ensure the liner is not damaged.
- At location 1347 collect a sample of dry material on top of the liner.
- For sediment sample locations 1348 and 1349 collect sediment samples by pushing or tapping with a rubber mallet, as needed, a 2-inch diameter Geoprobe sample sleeve into the sediment.
- Transfer all sediment aliquots at a location to a stainless steel pan and homogenize the sample prior to the final transfer to three 1-liter HDPE bottle.

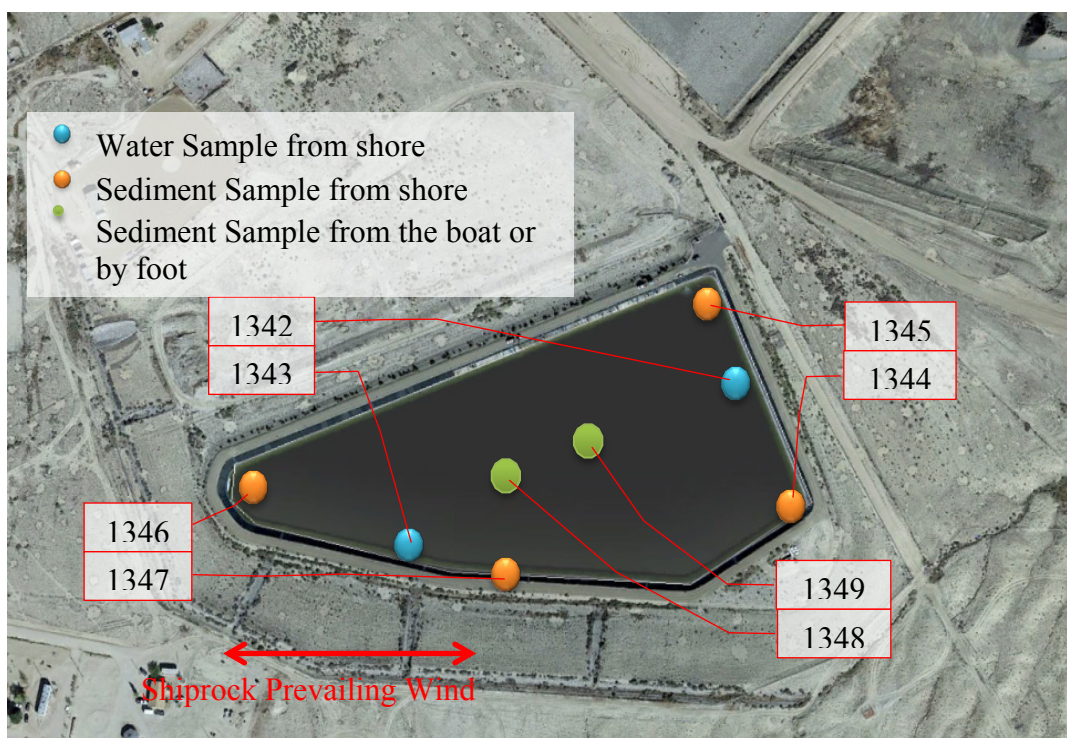


Figure 1. Evaporation Pond Sediment and Surface-Water Approximate Sampling Locations

Table 1. Containers, Preservation, and Analytical Requirements

Location	Container, Preservation, and Analytes
Surface Water	
1342	1 - 500 mL HDPE: Metals: Al, B, Be, Ca, Fe, Mg, Hg, K, Se, Si, SiO ₂ , Na, Sr, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Ag, Tl, U, Zn Preservative: HNO ₃
1343	
1343	
1343	1 - 500 mL HDPE: TDS, TSS, Cl, F, SO ₄ Preservative: 4 °C
1343	1 - 500 mL HDPE: Hardness, NO ₂ +NO ₃ -N, Ammonia-N Preservative: 4 °C, H ₂ SO ₄
Sediment	
1344	3 @ 1L HDPE: All sediment samples will be transferred to Energy Fuels Preservative: None
1345	
1346	
1347	
1348	
1349	

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**Sampling Frequencies for Locations at
Shiprock, New Mexico**

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
FLOODPLAIN - SHP01						
608		X				
610		X				
611		X				
612		X				
614		X				
615		X				
617					X	Data logger only
618		X				
619		X				
622		X				
623		X				
625		X				
626		X				
628		X				
630		X				
734		X				
735		X				
736		X				Data logger
766		X				
768		X				
773		X				
775		X				
779		X				
782R		X				
783R		X				
792		X				
793		X				
797		X				
798		X				
850		X				
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				
1104		X				
1105		X				
1109		X				
1110		X				
1111		X				

**Sampling Frequencies for Locations at
Shiprock, New Mexico**

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
FLOODPLAIN - SHP01						
1112		X				
1113		X				
1114		X				
1115		X				
1117		X				
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 3/2021
725		X				Data logger
726		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
813		X				Data logger
814		X				
815		X				
816		X				
817		X				
818		X				
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				Data logger
836		X				Data logger
837		X				Data logger
838		X				
841		X				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				
1071		X				
1073		X				Data logger
1074		X				
1078		X				
1079		X				
1087		X				SUMP-Bob Lee Wash
1088		X				SUMP-Many Devils Wash
1091		X				
1092		X				
1093R		X				
1095		X				
1096		X				
1120		X				
1122		X				
MW1		X				
DM7		X				

<p align="center">Sampling Frequencies for Locations at Shiprock, New Mexico</p>

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
898					X	San Juan River upgradient
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 (425/426)
1203		X				East of disposal cell
1205		X				San Juan River E of well 853
TERRACE - SHP02						
662		X				Lower Bob Lee Wash
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		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	256	38			
Field Measurements					
Total Alkalinity	X	X			
Iron ²⁺	X	X			
Dissolved Oxygen	X	X			
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Static Water Level	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	X	X	0.1	SW-846 6020	LMM-01
Lead					
Magnesium	X	X	5	SW-846 6010	LMM-01
Manganese	X	X	0.005	SW-846 6010	LMM-01
Molybdenum					
Nickel					
Nickel-63					
Nitrogen isotopes	Selected wells only	Selected locations only	NA	Mass Spectrometry	LMV-12
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	0.05	EPA 353.1	WCH-A-022
Oxygen isotopes	Selected wells only	Selected locations only	NA	Mass Spectrometry	LMV-10
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					
Sulfur isotopes	Selected wells only	Selected locations only	NA	Mass Spectrometry	LMV-10
Tritium	Selected wells only	Selected locations only	400 pCi/L	Liquid Scintillation	LSC-A-001
Uranium isotopes	Selected wells only	Selected locations only	0.1 pCi/L	Alpha Spectrometry	LMR-02
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	18	18			

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.

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<p align="center">Sampling Frequencies for Locations at Shirley Basin South, Wyoming</p>

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 or July

Constituent Sampling Breakdown

Site	Shirley Basin South		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	14	0			
Field Measurements					
Total Alkalinity	X				
Dissolved Oxygen	X				
Redox Potential	X				
pH	X				
Specific Conductance	X				
Static Water Level	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH ₃ -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 (NO ₃ +NO ₂)-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 Spectrometry	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 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.

SHL-2018-01

Effective Date: 06/08/2018
Expiration Date: 06/08/2021

Program Directive

Initiated By: Sam Campbell

Directive Subject: Miscellaneous Sampling Activities

Directive and Associated Task Changes:

- Samples will be collected from wells HC-2d, HC-4, HC-5, HC-7, HC-8, MV-1, MV-2, MV-3, MV-4, MV-5, and HS-1 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). Measuring and recording of field parameters will commence when the minimum purge volume has been removed, and measurements will continue a minimum of every 10 minutes until field parameters have stabilized. 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.
- Samples will be collected from the screen interval of wells HC-1, HC-3, and HC-6 using a depth-specific bailer. This sampling technique will be considered a “low-flow” sampling technique; therefore, results from this well will be qualified with an “F” flag during the data validation process. Well classification using this sampling technique will be identified as “Other” in the EDGE data collection software; therefore, qualification of results with a “Q” flag is not required (only results from Category II and III wells are qualified with a “Q” flag) when 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. Additional direction is needed for well classification and data validation qualifiers when using a depth-specific bailer because it is not specifically addressed in the SAP.

Contractor to U.S. Department of Energy Office of Legacy Management

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	5	1.020	802
HC-2d Total Minimum Purge Volume (gallons)						869
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
HS-1	Pump riser pipe above water	0 – 315	315	4	0.652	205
	Water column in well (upper)	315 – 500	185	10.25	4.29	794
	Water column in well (lower)	500 – 700	200	8.25	2.78	556
HS-1 Total Minimum Purge Volume (gallons)						1,555

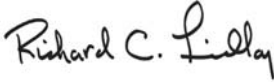
Contractor to U.S. Department of Energy Office of Legacy Management

Review and Concurrence:

KENNETH KARP (Affiliate)

2018.06.05 15:24:51 -06'00'

Ken Karp, Task Assignment Manager

 2018.06.05
07:54:16 -06'00'

Rick Findlay, Project Technical Lead

 MILDRED BIRRENBACH
(Affiliate)
2018.06.05 13:39:32 -06'00'

Millie Birrenbach, Quality and Performance Assurance

Manager Approval:

 SAM CAMPBELL (Affiliate)
2018.06.05 14:09:25 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

**Table 1. Sampling Frequencies for
Locations at Shoal, Nevada**

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Onsite Monitoring Wells						
HC-1			X			Depth specific bailer
HC-2d			X			Electric pump
HC-3			X			Depth specific bailer
HC-4			X			Electric pump
HC-5			X			Electric pump
HC-6			X			Depth specific bailer
HC-7			X			Electric pump
HC-8			X			Electric pump
MV-1			X			Electric pump
MV-2			X			Electric pump
MV-3			X			Electric pump
MV-4			X			Electric pump
MV-5			X			Electric pump
Piezometers						
MV-1PZ					X	Water levels only
MV-2PZ					X	Water levels only
MV-3PZ					X	Water levels only
MV-4PZ					X	Water levels only
MV-5PZ					X	Water levels only
Offsite Monitoring Wells						
H-2					X	Water levels only
H-3					X	Water levels only
HS-1					X	

Note: Well HS-1 is a water supply well used by Ranchers for cattle

**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			
672			X			Domestic well
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		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	14	7			
Field Measurements					
Total Alkalinity	X	X			
Dissolved Oxygen					
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Static Water Level	X				
Turbidity	X	X			
Temperature	X	X			
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Magnesium					
Manganese	0300, 0318A, 0320, 0339, 0340, 0508, 0510, 0684, 0672	0347, 0349, 0693, 0694	0.005	SW-846 6010	LMM-01
Molybdenum	0300, 0317, 0318A, 0320, 0339, 0340, 0508, 0510, 0684, 0672	0347, 0349, 0693, 0694	0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	0300, 0318A, 0320, 0339, 0340, 0508, 0510, 0684	0347, 0349, 0693, 0694	0.05	EPA 353.1	WCH-A-022
Potassium					
Radium-226	0300, 0319		1 pCi/L	Gas Proportional Counter	GPC-A-018
Radium-228	0300, 0319		1 pCi/L	Gas Proportional Counter	GPC-A-020
Selenium	0300, 0305, 0307, 0317, 0318A, 0319, 0320, 0339, 0340, 0508, 0510, 0684, 0672	0347, 0349, 0693, 0694	0.0001	SW-846 6020	LMM-02
Sulfate					
Uranium	0300, 0303, 0305, 0307, 0309, 0310, 0311, 0312, 0318A, 0320, 0339, 0340, 0508, 0510, 0684, 0672	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 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.

TUB-2018-01

Effective Date: 12/1/2017
Expiration Date: 12/1/2020

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 used filter in a sealable plastic bag and store in the site radioactive materials area.
 - After handling the used filter, place the nitrile gloves that must be worn during the pond sampling 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.

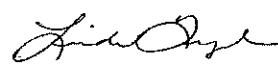
Organization(s) Affected: Environmental Monitoring Operations, Projects/Programs

Affected Documents: *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites (SAP) (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:


Peter R. Lemke
2017.11.16 08:37:24
-07'00'
Peter Lemke, Site Lead


LINDA TEGELMAN (Affiliate)
2017.11.13 14:06:36 -07'00'
Linda Tegelman, Quality and Performance Assurance

 11/21/17
Bill Cary, Safety and Health

Manager Approval:

 SAM CAMPBELL (Affiliate)
2017.11.13 14:38:38 -07'00'

Sam Campbell, Environmental Monitoring Operations Manager

<p align="center">Sampling Frequencies for Locations at Tuba City, Arizona</p>

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

<p align="center">Sampling Frequencies for Locations at Tuba City, Arizona</p>

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
Monitoring Wells						
695			X			August
901			X			August
902			X			
903			X			August
904			X			August
906		X				DATA LOGGER
908		X				DATA LOGGER
909		X				DATA LOGGER
910			X			August
911			X			August
912			X			August
913			X			August
914			X			August
915			X			August
916			X			August
917			X			August
918			X			August
919			X			August
920			X			August
921			X			August
929		X				
930		X				
932		X				
934		X				DATA LOGGER
935		*				Converted to extraction well
936		*				DATA LOGGER
938		*				Converted to extraction well
940		X				DATA LOGGER
941		X				DATA LOGGER
942		*				DATA LOGGER
943			X			DATA LOGGER; August
945			X			August
946			X			DATA LOGGER; August
947			X			August
948					X	Water level only
968					X	Water level only
1003		X				
1004		X				
1005					X	Water level only
1006		X				
1007		X				

**Sampling Frequencies for Locations at
Tuba City, Arizona**

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
Monitoring Wells						
1008					X	Water level only
1101		X				
1102		X				
1103		X				
1104		*				
1105		X				
1106		*				
1107		*				
1108		X				
1109		*				
1110		X				
1111		*				
1112		*				
1113		*				
1114		*				
1115		*				
1116		*				
1117		*				
1118		*				
1119		*				
1120		X				
1121		X				
1122		*				
1123		*				
1124		X				
1125		*				
1126		*				
1127		*				
1128		*				
1129		*				
1130		*				
1131		*				
1402		X				
1403		X				
1404		X				
1405		X				
1406		X				
Monitoring Wells						
1407		X				
1408		X				
1409		X				
1410		X				
1411		X				
1412		X				
1413		X				
1414		X				
1418		X				
1420					X	
1421					X	
1422					X	
1423					X	
1424		X				
NMW-1A		X				
NMW-2A					X	
NMW-3A					X	
NMW-4A					X	
NMW-6S		X				
NMW-7D		X				
NMW-8S		X				
NMW-9D		X				

<p align="center">Sampling Frequencies for Locations at Tuba City, Arizona</p>

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
Surface Locations						
759			X			August; Moenkopi wash-downgradient
778			X			August; Moenkopi wash-at Jimmy Spring
1568			X			Cattle trough near 1573 & 1574
1569		X				Evap pond - North
1570		X				Evap pond - South
Treatment System Locations						
1202					X	
1205					X	
1206					X	

Semi-annual sampling conducted in February and August; Annual sampling conducted in August.

Sample only active extraction wells. Coordinate with operators to confirm operating wells.

Treatment system monitoring done independently by operators on as-needed basis.

* Extraction well; sample if extraction system is operating.

Constituent Sampling Breakdown

Site	Tuba City		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	143	9			
Field Measurements					
Total Alkalinity	X	X			
Dissolved Oxygen	X				
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Static Water Level	X				
Turbidity	X				
Temperature	X	X			
Laboratory Measurements					
Aluminum					
Ammonia as N (NH ₃ -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 (NO ₃ +NO ₂)-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	X		0.2	SW-846 6010	LMM-01
Sulfate	X	X	0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	X	X	10	SM2540 C	WCH-A-033
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium	X		0.0003	SW-846 6020	IMM-02
Zinc					
Total No. of Analytes	18	14			

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.

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WEL-2017-01

Effective Date: 10/01/2017
Expiration Date: 10/01/2020

Program Directive

Initiated By: Sam Campbell

Directive Subject: Purge Water Disposition at the Weldon Spring, Missouri, Site

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).

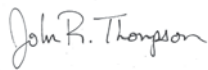
Justification: Background: Monitoring wells are sampled at the Weldon Spring site using the micropurge method. This method produces relatively small amounts of purge water. The wells are classified as Type 1 or Type 2 based on the concentrations of contaminants of concern (uranium, nitroaromatics and 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 as 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 May 2017 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.

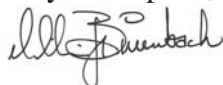
Groundwater from monitoring wells classified as Type 1 on Table 1 have low contaminant concentrations and purge water may be discharged to the ground in the vicinity of the well.

Review and Concurrence:



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Thompson
Date: 2017.10.16 07:41:22 -05'00'

Randy Thompson, Site Operations Lead



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Millie Birrenbach, Quality and Performance
Assurance



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15:02:12 -05'00'

Yvonne Deyo, Site Lead



TERRI UHLMAYER (Affiliate)
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Terri Uhlmeier, Compliance Lead

Manager Approval:



SAM CAMPBELL (Affiliate)
2017.09.21 09:59:14 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

Contractor to U.S. Department of Energy Office of Legacy Management

Table 1. List of Wells Currently at Weldon Spring (2017)

Quarry	Site	Vicinity
Type 2 Locations (Collect purge water from these wells for pretreatment and disposition to MSD)		
1004	2006	4001 (Army)
1005	2012	4006 (Army)
1006	2013	4013 (MDC)
1007	2033	4015 (MDC)
1008	2046	4029 (Army)
1013	2049	4031 (Army)
1014	2050	4036 (Army)
1015	2053	4040 (Army)
1016	2055	4043 (Army)
1027	3003	
1032	3024	
1048	3029	
1051	3030	
1052	3034	
	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	2014	4022 (MDC)
1019	2017	4023 (MDC)
1021	2021	4026 (MDC)
1028	2022	4027 (Army)
1030	2023	4028 (Army)
1031	2032	4030 (Army)
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	2051	MWS-1 (Army)
RMW-4	2052	MWS-2 (Army)
	2054	MWS-3 (Army)
	2056	MWS-4 (Army)
	3006	MWS-21 (Army)
	3023	
	3025	
	3026	
	3027	
	3028	
	3037	
3038		

MDC = Missouri Department of Conservation

Contractor to U.S. Department of Energy Office of Legacy Management

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

WEL-2017-02

Effective Date: 10/01/2017
Expiration Date: 10/01/2020

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, Weldon Spring

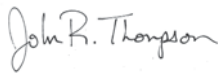
Affected Documents: *Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, current version).

Justification:

1. The high-flow sampling method for the RMW wells is consistent with historical protocols. 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.

Contractor to U.S. Department of Energy Office of Legacy Management

Review and Concurrence:



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Thompson
Date: 2017.09.20 14:16:12 -05'00'



Rex A. Hodges
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Randy Thompson, Site Operations Lead

Rex Hodges, Site Hydrologist



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Millie Birrenbach, Quality and Performance
Assurance

Manager Approval:



SAM CAMPBELL (Affiliate)
2017.10.11 14:42:51 -06'00'

Sam Campbell, Environmental Monitoring Operations Manager

**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	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	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				
MW-2002		X				
MW-2003		X				
MW-2005		X				
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	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	X		
MW-3003		X				
MW-3006		X		X		
MW-3023					X	Water level only
MW-3024		X				
MW-3025					X	Water level only
MW-3026		X		X		
MW-3027					X	Water level only
MW-3028					X	Water level only
MW-3029					X	Water level only
MW-3030		X	X			
MW-3031					X	Water level only
MW-3034			X			
MW-3037			X	X		
MW-3038					X	Water level only
MW-3039			X			
MW-3040		X		X		
MW-4001					X	Water level only
MW-4006					X	Water level only
MW-4007		X		X		
MW-4011			X			
MW-4013			X	X		
MW-4014			X	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		X		
MW-4037					X	Water level only
MW-4038					X	Water level only
MW-4039			X			
MW-4040		X		X		
MW-4041		X		X		
MW-4042		X				
MW-4043		X				
MWD-2		X				
MWS-1		X		X		
MWS-2		X				
MWS-4			X	X		
Springs						
SP-5303		X				
SP-5304		X				
SP-6201		X				
SP-6301		X	X			
SP-6303		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	X	X			Sampling dependant on leachate volume/hauling

<p align="center">Sampling Frequencies for Locations at Weldon Spring, Missouri</p>
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Location ID	Bi-Monthly	Quarterly	Semiannually	Annually	Not Sampled	Notes
MW-4027					X	Water level only
MW-4028					X	Water level only
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		X		
MW-4037					X	Water level only
MW-4038					X	Water level only
MW-4039			X			
MW-4040		X		X		
MW-4041		X		X		
MW-4042		X				
MW-4043		X				
MWD-2		X				
MWS-1		X		X		
MWS-2		X				
MWS-4			X	X		
Springs						
SP-5303		X				
SP-5304		X				
SP-6201		X				
SP-6301		X	X			
SP-6303		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	X	X			Sampling dependant on leachate volume/hauling

Constituent Sampling Breakdown

Site	Weldon Spring		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	265	23			
Field Measurements					
Total Alkalinity					
Dissolved Oxygen	X	X			
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Static Water Level	X				
Turbidity	X	X			
Temperature	X	X			
Ferrous Iron	108			HACH	
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Antimony					
Arsenic	24		0.0001	SW-846 6020	LMM-02
Barium	16		0.1	SW-846 6020	LMM-02
Boron					
Beryllium					
Bromide					
Cadmium					
Calcium					
Chloride	2		0.5	EPA 302	MIS-A-045
Chromium	16		0.002	SW-846 6020	LMM-02
Cobalt	2		0.05	SW-846 6020	LMM-02
Chemical Oxygen Demand	4		5	EPA 410.4	WCH-A-010
Copper	2		0.025	SW-846 6020	LMM-01
Fluoride	2		0.5	EPA 300	MIS-A-045
Gamma Spec					
Gross Alpha	2		2 pCi/L	EPA 900.0	GPC-A-001
Gross Beta					
Iron	104		0.05	SW-846 6010	LMM-01
Lead	16		0.002	SW-846 6020	LMM-02
Lead-210					
Magnesium					
Manganese	16		0.005	SW-846 6020	LMM-02
Mercury	2		0.0001	SW-846 7470A	LMM-01
Molybdenum					
Nickel	16		0.02	SW-846 6020	LMM-02
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	108		0.05	EPA 353.2	WCH-A-022
Nitroaromatics	83		0.00003	SW-846 8330 MOD	LMN-03
PAHs	14		0.005	SW-846 8310	LMS-02
PCBs	14		0.00005	SW-846 8082	PEP-A-006
Phosphate					
Polonium-210					
Potassium					
Radium-226	16		1 pCi/L	EPA 903.1 mod	GPC-A-018
Radium-228	16		1 pCi/L	EPA 904 mod	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	102	16	0.5	EPA 300	MIS-A-045
Sulfide					
Thallium	14		0.004	SW-846 6020	LMM-02
Thorium, isotopic	14		1 pCi/L	EML HASL 300 mod	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	237	23	0.0001	SW-846 6020	LMM-02
Vanadium					
VOCs	29		0.005	SW-846 8260B	LMV-06
Zinc	2		0.02	SW-846 6020	LMM-02
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.

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Appendix B

Desk Instructions

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Appendix B-1

Environmental Quality Information System (EQuIS) Version 6.5 Data Gathering Engine (EDGE) Desk Instructions for Generic Sites

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1.0 Introduction

The Earthsoft Inc. Environmental Quality Information System (EQuIS) Data Gathering Engine (EDGE) is a set of integrated tools for the collection of field data. After a scheduled task has been defined using Sample Planning Module (SPM), EDGE uses the electronic data deliverable (EDD) file created for the task in SPM. Field personnel enter field data into the EDD using EDGE forms. After the sampling task has been completed in the field, EDGE may be used to generate a chain-of-custody (COC) form and PDF files of the field forms.

1.1 Purpose

The purpose of these desk instructions is to:

- Provide guidance to personnel who have had some training and experience with EDGE.
- Provide guidance for collecting field data associated with instrument calibrations; groundwater (GW), surface water (SW), solid, and biota samples; water-level measurements; well maintenance and inspection; and well redevelopment at generic Office of Legacy Management sites.
- Describe the management of EDGE data files.

2.0 File Management Summary

The following folder locations, naming conventions, and maintenance steps are recommended:

- **C:\EDGE**—After extracting the EDGE zip file, store the files here. A desktop shortcut should be made to the Start_EDGE.exe file. Obsolete versions of EDGE should be deleted from field computers so the desktop shortcut points to the current version.
- **C:\EDGE_EDD** (field computers)—Store the working field EDD files here. This path is set in **Options > Working Folders > EDD EDGE Folder**. When the user selects **Open EDD** in EDGE, he or she will be automatically directed to this location.
- **C:\EDGE_Backup** (field computers)—Store the EDD files created during auto backup here. This path is set in **Options > EDD Backup**. It is recommended to set **Auto Save Interval** (in minutes) to 15.
- Periodically, files that are no longer needed in **C:\EDGE_EDD** and **C:\EDGE_Backup** should be deleted.
- **C:\EDGE\EDGE\COC Template**—COC templates are stored here. The computer owner should ensure that only the most recent versions of the COC templates files are stored here. The most recent versions of the COC template files are found here:
\\crow\sms\Earthsoft\Edge\COC Template.
- **C:\EDGE\EDGE\Formats\EDGE**—Reference values files (RVFs) are stored here. The computer owner should ensure that the most recent versions of the RVFs are stored here. The most recent RVFs may be obtained from Environmental and Spatial Data Management.

- Task folder—Task folders are created in SPM and found in \\crow\sms. The naming convention should be the scheduled task ID, for example: TUB01-01.1708001. A task folder contains all files and subfolders related to a scheduled task. The files and subfolders related to EDGE are as follows:
 - EDD working file—A field EDD created in SPM for each scheduled task. This file is stored in the SPM_Originals subfolder. It may then be copied into the C:\EDGE_EDD\ folder of a field computer. The naming convention should be “scheduled task ID_EDGE_EDD.xlsx” or “scheduled task ID_EDGE_EDD.xls” (e.g., TUB01-01.1708001_EDGE_EDD.xlsx).
 - Completed field EDD file—The completed field EDD, renamed using the name or initials of a field sampler who collected the data. It is copied from the field computer or from the Field_EDDs_To_Be_Loaded folder and stored in the subfolder called CompletedFieldEDD. The naming convention should be the sampler’s name and the scheduled task ID: Sampler_Scheduled Task ID_EDGE_EDD.xlsx or Sampler_Scheduled Task ID_EDGE_EDD.xls (e.g., JDOE_TUB01-01.1708001_EDGE_EDD.xlsx).
 - Submitted field EDD file—The version of the field EDD that was submitted (uploaded) to the database. It is stored in the subfolder called SubmittedFieldEDD. The naming convention should be “EditToLoad_Sampler_Scheduled Task ID_EDGE_EDD.xlsx” or “EditToLoad_Sampler_Scheduled Task ID_EDGE_EDD.xls” (e.g., EditToLoad_JDOE_TUB01-01.1708001_EDGE_EDD.xlsx).
 - PDF files of the field forms created by EDGE—These will be stored in the RECORDS\FieldData subfolder. These files will be managed as records.
 - COC file—A COC file that is created in EDGE. The naming convention should be “Scheduled Task ID-COC.xlsx” or “Scheduled Task ID-COC.xls” (e.g., TUB01-01.1708001-COC.xlsx).
- Completed field EDD files may be saved in \\crow\sms\Field_EDDs_To_Be_Loaded. Environmental and Spatial Data Management personnel monitor this folder and will save a copy of the completed field EDD to the CompletedFieldEDD subfolder in the task folder; after that, they begin the process of submitting (uploading) the field data to the database. The copy of the EDD that is submitted will be stored in the subfolder called SubmittedFieldEDD.
- Datalogger files—Datalogger (transducer) files are found in \\crow\sms\TRANSDUCERS. The files are organized in subfolders by site, then by date. For example, the datalogger files downloaded at Rocky Flats in February 2018 are found in \\crow\sms\TRANSDUCERS\RFS01\2018-02.
- When a field EDD is opened in EDGE, an empty folder with the same name as the field EDD is automatically created. This folder can be deleted or ignored.

3.0 Launch EDGE and Open a Field EDD

- [1] Open EDGE with the Start_EDGE.exe shortcut.



It may take a moment for EDGE to launch. Do not double-click the Start_EDGE.exe icon more than once unless multiple instances of the application are needed.

- [2] The main application screen is the primary EDGE user interface (Figure 1). Most of the user interaction will take place on this screen. It contains the following components:
- [a] Application menu ribbon—If the Application menu ribbon is minimized, click on the **Home** tab to open the ribbon. Double-clicking will lock the ribbon open.
 - [b] Task Chooser—To select a task, click on the task in the **Task Chooser**.
 - [c] Location Chooser/Filter—Location selection is done in the Location Chooser/Filter control in the **Chooser** tab.
 - [d] Data tabs—Tabs can be repositioned, and EDGE will persist with the same ordering the next time it is run. Visible data tabs can be selected with **Show/Hide** tabs (select the globe icon in the top left corner).
 - [e] Intelligent Bar—Displays messages as well as information about the data tab currently selected. The Intelligent Bar is visible or not visible based on the setting in the Application Options.
 - [f] Status Bar—Displays basic information to the user about currently used Facility (facility code), Opened Format file name, Current RVF, and EDD file name.

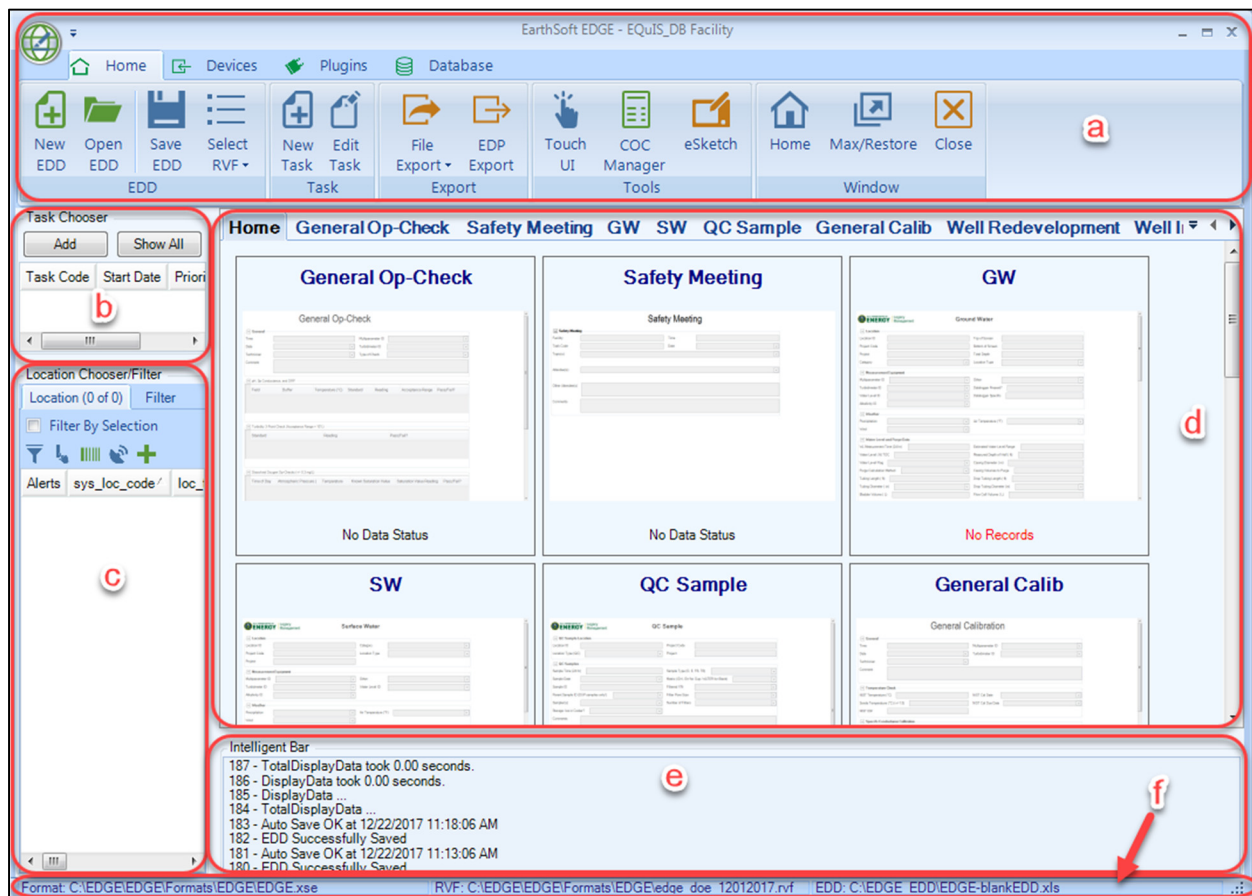


Figure 1. EDGE User Interface

- [3] There are four ways to open an EDD:
- [a] Click the **Open EDD** button on the **Home** tab.
 - [b] Click the **Load** button on the **Form** tab.
 - [c] Click the **globe** icon and select **Open EDD**.
 - [d] Click the **globe** icon and select the desired EDD from the list of recently opened EDDs (if available).

4.0 Entering Data into the Field Data Forms

- [1] Select the tab for the desired form. If applicable, select the appropriate location in the **Location Chooser/Filter** pane.
- [2] Click the **New** button on the **Form** tab. If the **New** button is clicked in error, click the **Delete** button on the **Form** tab to delete the current record.
- [3] Enter all field data following the sampling plan and any site-specific requirements.

5.0 Connecting to a Sonde in the Groundwater and Surface Water Forms

- [1] In the **Field Results** toolbar, select **YSI 6920**.
- [2] Select **COM1**.
- [3] Click the **Connect** button.



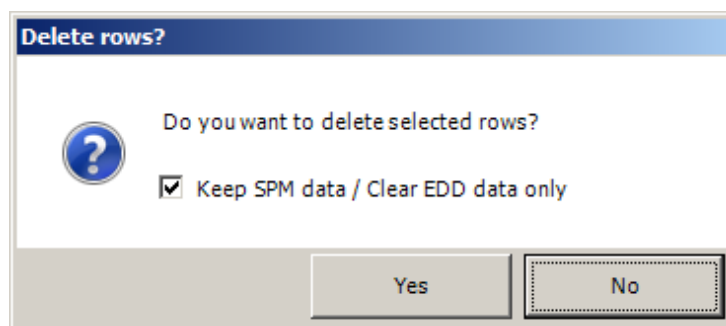
Note

*If a Communication Timeout window appears, click **Retry**. If the Communication Timeout window appears again, click **Cancel** and troubleshoot the cable connections and sonde batteries.*

- [4] Click the **Run** button.
- [5] Click the **Discrete Sample** button.
- [6] Change sample interval if desired (an interval of 4, 8, or 12 seconds is recommended), then click **Enter**.
- [7] Select **Start Sampling**.
- [8] To import data:
 - [a] Switch to **Received Data** tab.
 - [b] Select a row of data to import.
 - [c] Click the **Import** button.
 - [d] Select **Hide** to view the form. The collection of sonde data will continue in the background. Select **YSI 6920** again to view the sonde data, if desired.
 - [e] Select **Disconnect** and **Close**, or just select **Close** when finished at the location.

6.0 Items on the Field Results Toolbar in the Groundwater and Surface Water Forms

- [1] **Add**—Adds a row if the user is manually entering the field measurements.
- [2] **Remove**—Deletes the selected row of data. When **Remove** is selected, the following window will appear. In most cases, leave the box selected and click **Yes**.



- [3] Refresh—Recalculates the grid. For example, if the user changes a volume or time, **Refresh** updates the flow rate calculation. **Refresh** also updates the purge criteria color alerts. (Be patient: It takes a while for the grid to refresh after selecting **Refresh**.)
- [4] Unlock—After changes are made to the analyte columns displayed, clicking **Unlock** will toggle to **Lock**. Then click **Lock** to toggle back to **Unlock**. This will ensure that these same columns are displayed for this form for all locations.
- [5] Autofit—Autofits the displayed columns. One click will autofit to header length, a second click will expand the autofit to the maximum width of the Field Results section.
- [6] Analytes—Used to change the analyte columns shown. In the GW form, users typically select **Field and Purge Data**.
- [7] Show—Used to choose additional rows or columns. Options are **Date** column (not usually used but necessary if the user is entering data after the current date), **Location** column (not recommended), **Equipment** row (not recommended), **Unit** row (highly recommended), **Group Name** row (not recommended).
- [8] YSI 6920—Used to access the sonde-connection application.

It is easy to accidentally rearrange the rows and columns in the Field Results and Field Results Extra sections.



- *If a column header is clicked, the rows will be sorted by the values in that column. To fix it, click the **Time** column header to re-sort the rows by time, in ascending order.*
- *If the small pin icon in a column header is clicked, that column is pinned to the left. Click the **small pin** icon again to unpin the column and drag it back to where it should be.*
- *It is easy to accidentally drag the columns.*
- *Any changes made to the column positions in a particular type of form will affect all forms of that type.*

7.0 Entering Information into the Lab COC & Analysis Sections in the Groundwater, Surface Water, Quality Control Sample and Solid Forms

- [1] The **Current COC:** field should have autopopulated. If there is more than one COC associated with the current location, select the correct COC from the drop-down list in this field.
- [2] Select the bottles that were collected using the check boxes.
- [3] In the **Filtered** column, indicate for each bottle whether the sample was field-filtered. Choose **Field** or **None** from the drop-down menu.

8.0 Entering Alkalinity Test Kit Results in the Groundwater and Surface Water Forms

When the volume used (Alk_Vol) and the titrator reading (Titrator) are entered, the alkalinity value (Alk) is calculated.

9.0 Quality Control Sample Form

Remember to select (or correct) **Sample Type**. (This field may be autopopulated if the sample type was specified in the EDD by SPM.) The usual choices are: **D** for duplicate, **E** for equipment blank, **TB** for trip blank, and **FB** for field blank. If the quality control (QC) sample is a duplicate, select the **Parent Sample ID** from the drop-down list in that field.



Note

The only locations available in the drop-down list will be those that have had either a GW or SW form created.

Enter a **Parent Sample** *only* for duplicates. Leave the field blank for all other QC sample types.

10.0 Water Level Form and WaterLevelTableForm

Water-level measurements may be entered into either the Water Level form or the WaterLevelTableForm. The Water Level Flag options are **B** for below top of pump, **D** for dry, **E** to indicate questionable elevation, **F** for flowing well, and **I** for inaccessible.



Note

A water-level value that is outside the estimated range will cause the Depth to Water field to highlight in red as a warning.

In the **Dip/Elevation** field (if showing), enter **dip** for a normal depth to water measurement when the measurement point is *above* the water. Enter **elevation** when the measurement point is *below* the water (an unusual situation).

11.0 Datalogger Form

- [1] Load the datalogger EDD (transducer EDD)
 - [a] Click the **Open EDD** button on the **Home** tab.
 - [b] Click on the relevant transducer EDD: Facility_Code-TR-yymm-#. For example *RFS01-TR-1804-3*.



Caution! This EDD is different than the EDD used for sampling. The EDD used here is a transducer EDD to be used with the Datalogger form. “TR” in the EDD file name is an abbreviation for transducer; knowing this will help the user select the correct EDD.

- [2] Tab to the Datalogger form and highlight the appropriate location listed in the Location Chooser/Filter.
- [3] Click the **New** button on the **Form** tab.
- [4] Connect to the transducer to download the data and read the device water level and time.
 - [a] Connect the datalogger system (cable quick disconnect) to the laptop computer and launch the appropriate software. Follow the steps required to set up and run the datalogger. A Logging Setup Wizard will prompt you through the configuration of a datalogger, 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.
 - [b] Retrieve the transducer data: Using the same software program, the data can be extracted. Data can be viewed electronically via a report or graph and then stored automatically as a file in the computer. Disconnect once data are downloaded and form is completed.
 - [c] Save the transducer data files to the appropriate Transducer Raw data subfolder in [\\crow\sms\TRANSDUCERS](#). For example, the transducer data files downloaded at Rocky Flats in February 2018 are saved in [\\crow\sms\TRANSDUCERS\RFS01\2018-02\Transducer Raw data](#).
- [5] Enter all the relevant information on the Datalogger form.
- [6] Click the **Save** button on the **Form** Tab.
- [7] Repeat steps above and continue to the next location and retrieve logger data until all location transducers have been downloaded
- [8] Save the EDD. Use the **Save As** option to rename the EDD to Facility_Code-TR-yy-mm-#. *For Example RFS01-TR-1804-3_FIELD EDD.*
- [9] Save the EDD to the appropriate Completed Field EDDs subfolder in [\\crow\sms\TRANSDUCERS](#). For example, the EDD file for data downloaded at Rocky Flats in February 2018 is saved in [\\crow\sms\TRANSDUCERS\RFS01\2018-02\Completed Field EDDs](#).

12.0 Well Redevelopment Form

Use the Well Redevelopment Form to document a well redevelopment. At a minimum, the following information should be entered:

- Technician’s name
- The correct date in a row in the Well Redevelopment Data section

The user can enter brushing and surging activities, turbidity measurements, volumes purged, notes, and water-quality measurements for before and after well redevelopment.

13.0 Well Inspection and Maintenance Forms

The user can choose the Well Inspection and Maintenance Form, Well Inspection Form, or Well Maintenance Form, whichever is most relevant. For example, if the user is only performing inspections, the Well Inspection Form may be desired, as the maintenance sections are not included. Any section in any of the three forms may be left blank.

14.0 EZEDD Table (for onsite laboratory data)

- [1] Make sure the EZEDD and LDE tabs are displayed and open the appropriate EDD.
- [2] Select the **EZEDD** tab.
- [3] If the error message “A COC has not been created for this task” is displayed, click **OK** and select the **Field Samples** tab. Enter the COC information following these steps:
 - [a] Deselect the **Filter by Selection** box in the **Location Chooser** to display all locations at once.
 - [b] The **View** menu in the toolbar lets the user switch between a list or grid view of the data.
 - [c] Enter the sample dates as provided by the samplers.
 - [d] Check the **Filter by Selection** box in the **Location Chooser** to display one location at a time.
 - [e] Using the **Location Chooser**, select each location and select the box for each bottle in the **COC** tab as appropriate.
 - [f] Save the EDD. Use the **Save As** option to rename or change the location of the EDD, if desired.
 - [g] Reopen the EDD in EDGE.
- [4] In the EZEDD table, enter the laboratory results and any other pertinent data, including sample date, sample time, result_value, result_unit (usually milligrams per liter), lab_qualifiers, parent_sample_code, dilution_factor, method_detection_limit, analysis_date. (The Result_Type_Code “TRG” means target analyte.) Header names that are in red indicate required fields.



The headers for each row (in list view) or column (in grid view) can be dragged to make data entry more convenient.

- [5] After all data entry is complete, save the EDD.
- [6] Upload the EDD to the database.

15.0 Creating a Chain-of-Custody Form

- [1] With the **Home** tab selected, click the **COC Manager** button.
- [2] Make sure the Current COC and Template fields are correct.
- [3] Enter the shipping date.
- [4] Save the EDD.
- [5] Generate an Excel version of the COC by clicking the **COC** button, then selecting **Export**.
- [6] Save the Excel file in the Task Folder and print the desired worksheets.

16.0 Generating PDF Versions of the Field Data Forms

- [1] Open the EDD in EDGE and look at the GW and SW forms to ensure that all purge data (Field Results section) and all field analysis (Field Results Extra section) columns are displayed and are autofitted correctly.
- [2] Select the **globe** icon on the top left corner of the screen, then select the **Options** button to access form printing options. Set the **Form Printing** option “Make control black white” to **True**. Set **Print Quality** to **High** to improve the PDF file resolution.
- [3] Create PDFs using **File Export > Export Forms**.
- [4] In the Task folder, save the PDFs to the RECORDS\FieldData subfolder.

17.0 Adding an Unplanned Location to a Task

If a sampler in the field needs to add a location to an existing task:

- [1] In the **Location Chooser/Filter** pane, click the small green “+” icon.
- [2] A message box will open, prompting the user to enter the location (sys_loc_code). Enter the location exactly as it appears in the database. Take care to enter any leading zeros, hyphens, or other special characters. Then click the **Create** button.
- [3] Note that the added location will now appear on the list of locations in the Location Chooser/Filter pane.

17.1 Entering Data into a Form for an Unplanned Location

Enter field data into the desired GW, SW, or QC sample form as it would be entered for a planned location, with these additional steps:

- [1] In the **Location Type** field in the **Location** section, select the location type from the drop-down menu. The entry will be **SL** for a surface location, **WL** for a well, and **QC** for field QC samples.
- [2] In the **Sample** section, enter a value in the **Sample ID** field. Choose a unique value. For example, if the sample IDs previously assigned to the task range from

MNT01-4.1706001-001 to MNT01-4.1706001-016, a unique value would be MNT01-4.1706001-017.

- [3] In the **Sample** section, select a value in the **Sample Type** field from the drop-down menu. The entry will be **F** for field sample, **D** for duplicate, **E** for equipment blank, **FB** for field blank, or **TB** for trip blank.
- [4] In the **Lab COC & Analysis** section, bottles are not selectable. Click **COC Manager** to add bottles for the unplanned location to the **COC**. Click **Add Unscheduled**. Select the location in the **Samples** pane, then select the desired method-analyte groups (MAGs) in the **SPM Groups** pane. Click **Assign Analysis**, then click **Finish**. On the **Containers** tab, set the preservation and filtration. After generating the COC, check it carefully.

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Appendix B-2

Compressed Gas Operations

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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.

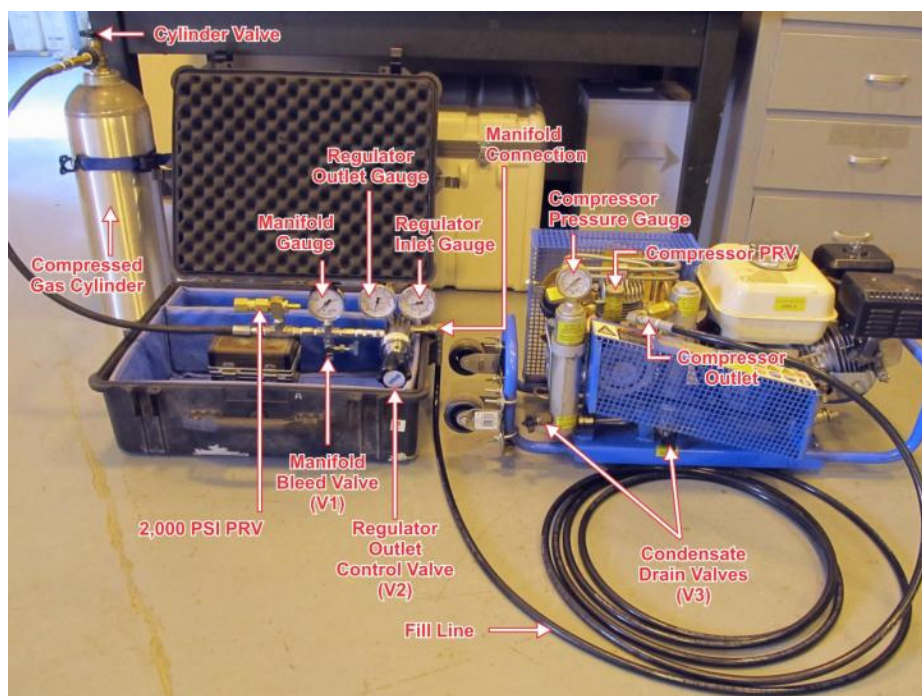


Figure 1. Cylinder Filling System

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 Safety and Health 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).



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:



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.



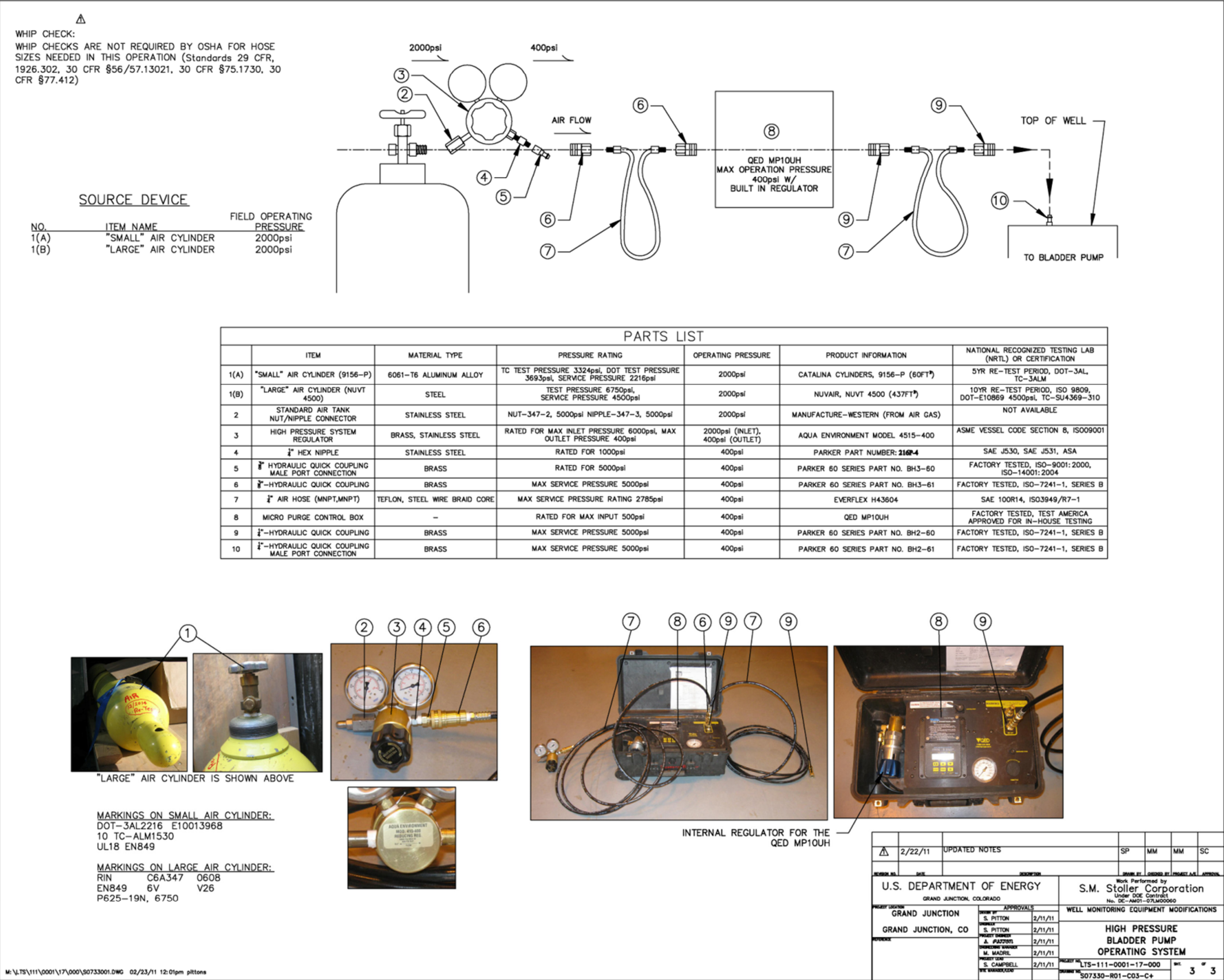
- *Do not stand in front of the condensate drain valve to drain accumulated condensate.*
- *Wear leather gloves to drain accumulated condensate.*
- *Wear safety glasses to drain accumulated condensate.*

- [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.



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Appendix B-3

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.



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



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.



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.



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

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Contractor to the U.S. Department of Energy Office of Legacy Management

Job Safety Analysis (JSA)

Descriptive title: Environmental Monitoring Operations at LM Sites

JSA Number: LMS-150319-001

General LMS ☒ or **Specific site:** Numerous LM Sites

Issuance date: 5/22/2019

Expiration date: 5/22/2020

Work Scope

1.	Work involves routine water and soil sampling, water level measurements, surveying, pressure transducer downloads, and minor maintenance. Routine water and soil sampling tasks include collection, preservation, and shipping of samples, and collection of field measurements, including water levels and water-quality measurements. Routine minor 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 a UTV.
2.	Work will be conducted at most LM sites.
3.	Work will be conducted outside during all seasons of the year.
4.	The following equipment may be used: UTVs, compressors, generators, compressed gas cylinders, hand tools, paint sprayers, truck-mounted winches, weed eaters, batteries, sample pumps, concrete mixers, and sampling and surveying equipment. When performing the procedure-based activities of Geoprobe drilling, Smeal Rig operation, or Welding and Cutting, this JSA will be used to cover general safety hazards not addressed in the referenced procedures.
5.	Work will be performed by Contractor personnel.

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	<ul style="list-style-type: none">• 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.• Conduct physiological monitoring when temperatures exceed 80° F in accordance with the <i>Heat Stress Evaluation and Monitoring Procedure</i> (LMS/POL/S15935).• Monitor weather conditions of air temperature and wind speed every 4



Contractor to the U.S. Department of Energy Office of Legacy Management

Job Safety Analysis (JSA)

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	<p>hours when temperatures are less than 30° F in accordance with the <i>Cold Stress Procedure</i> (LMS/PRO/S16014).</p> <ul style="list-style-type: none"> Working in temperatures less than 0° F air temperature must be approved by Safety and Health. Wear adequate clothing for weather conditions. Drink sufficient fluids—approximately 8 ounces every hour of active work.
	Medical Emergency	<ul style="list-style-type: none"> At least one person in the group shall have current first aid and CPR training. Carry a first aid kit that meets LMS requirements. Some form of external communication should be available for use such as a cell phone or satellite phone. 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 phone or radio. For minor maintenance activities requiring no power equipment or groundwater level measurement tasks, when performed at locations with phone coverage and where no other hazards are present, workers may be paired by communication between the site and the office via phone.
	Slips, trips, and falls over uneven terrain and equipment	<ul style="list-style-type: none"> Be aware of uneven terrain and avoid or 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 boots that provide ankle support. Follow designated routes and trails when possible. When crossing rock-armored features, be prepared for the potential for the rock to move; concentrate on each step and do not carry items that obscure vision.



Contractor to the U.S. Department of Energy Office of Legacy Management

Job Safety Analysis (JSA)

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	Falls to a lower level	<ul style="list-style-type: none"> 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.
	Hunting activities	<ul style="list-style-type: none"> Wear high-visibility clothing or vests when conducting field work in an area with hunting activities. Notify or alert hunters that you are working in the area (if possible). Consider suspending work when gunfire is near.
	Inclement weather (wind, lightning, tornados)	<ul style="list-style-type: none"> In accordance with <i>LMS Health and Safety Plan</i> (LMS/POL/S20043), evaluate the need to seek shelter if thunder is audible. 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 up-gradient of the site.
	Roaming or aggressive domestic or wild animals	<ul style="list-style-type: none"> Workers shall visually assess the work area when they arrive to look for the presence of animals.



Contractor to the U.S. Department of Energy Office of Legacy Management

Job Safety Analysis (JSA)

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	<ul style="list-style-type: none"> • 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 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 read and comply with all manufacturer instructions.
Working near a public roadway	Vehicle striking people or equipment	<ul style="list-style-type: none"> • 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 that meet ANSI/ISEA-107 2010 at all times. • No work will be performed near a public roadway before sunrise or after sunset, or when visibility is low.
Operating a vehicle	Vehicle accidents	<ul style="list-style-type: none"> • Inspect vehicle prior to use and understand how to use the vehicle functions before operating. Complete LMS form 1056 <i>Daily Motor Vehicle Inspection</i> prior to use. • Do not use any two-way communication device while operating a vehicle. • Do not operate a vehicle while fatigued. Alternate driving duties with a partner to prevent driving while fatigued. • Do not work/drive more than 15 hours per day. • Do not exceed 70 total consecutive work hours per week and have at a minimum an 8-hour break between work periods. • Do not attempt to cross moving water that is more than 6 inches deep.



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Job Safety Analysis (JSA)

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)
Towing a trailer	Trailer incidents and accidents	<ul style="list-style-type: none"> • In accordance with <i>Trailer Towing and Cargo Loading</i> (LMS/PRO/S17069), complete a 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	<ul style="list-style-type: none"> • Wear ANSI Z87.1 approved safety glasses. • Do not allow vehicles to touch. • Ensure both vehicles' electrical systems are the same voltage. • Follow this sequence when jump starting a vehicle: <ol style="list-style-type: none"> 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	<ul style="list-style-type: none"> • Watch for rough road conditions including rocks, brush, and well heads. <ul style="list-style-type: none"> ◦ Use high-clearance four-wheel drive vehicle when necessary. ◦ Use a spotter when backing into obscure or tight areas. ◦ 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 a UTV or walk to the work location. • Recover stuck vehicles in accordance with the <i>Vehicle Recovery Procedure</i> (LMS/PRO/S11542).



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Job Safety Analysis (JSA)

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	Grass fires	<ul style="list-style-type: none"> • 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 a UTV or walk to the sample location. • 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 residue 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.
	Inadvertently destroying threatened/endangered species or their habitat, disturbing wetlands, disturbing cultural or archaeological artifacts	<ul style="list-style-type: none"> • 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.
	Injury from use of a winch	<ul style="list-style-type: none"> • Wear 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. • Secure the cable and engage the drum clutch when in transport.



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Job Safety Analysis (JSA)

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	Injury from use of a winch	<ul style="list-style-type: none"> Conduct winching operations in accordance with the <i>Vehicle Recovery Procedure</i> (LMS/PRO/S11542) and manufacturer's instructions.
Driving off-road—UTVs	Rollovers, cuts, abrasions, scratches, head and bodily injury	<ul style="list-style-type: none"> Operators and passengers must wear a DOT-approved safety helmet. Trailer must be attached to the tow vehicle when loading and unloading UTVs. Wear gloves while operating UTV. Inspect UTV prior to operating. Operators must complete UTV safe operations training courses. Drive at speeds recommended by manufacturer for safe operation on flat even ground. Reduce speeds when other conditions are encountered. Report any spills of fuel or chemicals to the EC POC. Operators and passengers of UTVs must use the seat belts and cab nets, if present.
	Potential exposure to dust and silica generated by traveling on unpaved areas.	<ul style="list-style-type: none"> Travel at speeds that minimize dust generation. When possible, avoid following directly behind another UTV to reduce exposure to airborne dust and silica generated from first UTV. Allow enough time between subsequent UTVs to allow for dust to visibly clear before following another UTV. Rotate personnel traveling in first UTV to reduce exposure from following other UTVs.
Crossing wire fences	Cuts to hand or body	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Keep hands and fingers out of pinch points and crush areas. Wear gloves to protect hands from cuts, abrasions, and blisters as necessary.



Contractor to the U.S. Department of Energy Office of Legacy Management

Job Safety Analysis (JSA)

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	Insect bites and irritating plants	<ul style="list-style-type: none"> • 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 wash affected areas with soap and water as soon as reasonable. Check body for ticks when activities are completed. • Do not reach into dark or obscured places without wearing gloves.
	Snakes and animals	<ul style="list-style-type: none"> • Do not attempt to capture or handle snakes or animals. • Maintain a safe distance from snakes or animals. • Look for snakes and animals when placing hands and feet in areas with thick vegetation or into well vaults. • Wear snake chaps in areas with a high-density of poisonous snakes.
	Injury or death from Permit-Required Confined-Space Entry (posted as "Permit-Required Confined Space")	<ul style="list-style-type: none"> • In accordance with <i>Confined Space Entry</i> (LMS/PRO/S16015): <ul style="list-style-type: none"> ○ Prior to entering ANY confined space, notify Safety and Health ○ Check out multi-gas meter, monitor space prior to entry, fill out <i>Safety and Health Re-Classification for Permit to Non-Permit Confined Space</i> (LMS form 1824) and transmit completed forms to Safety and Health • Contact Safety and Health for guidance.
	Reclassification from Permit to Non-Permit-Required Confined-Space Entry (posted as "Permit Required Confined Space")	<ul style="list-style-type: none"> • Prior to entering ANY confined space, notify Safety and Health and follow these steps: <ol style="list-style-type: none"> 1. Check out multi-gas meter from Safety and Health prior to fieldwork. 2. Open and secure the lid to prevent inadvertent closure. 3. Vent the space for a minimum of 5 minutes. 4. Test the atmosphere at the top, middle, and bottom of the space using a multi-gas meter. Complete <i>Re-classification from Permit to Non-Permit Confined Space</i> (LMS form 1824). 5. If the atmosphere is safe, as determined by the multi-gas meter



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Job Safety Analysis (JSA)

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	Reclassification from Permit to Non-Permit-Required Confined-Space Entry (posted as "Permit Required Confined Space")	<p>readings and completion of form 2171, the confined space can be entered. The entrant must possess and continue to use the gas monitor while in the confined space.</p> <p>6. Return completed forms to Safety and Health.</p> <ul style="list-style-type: none"> Be aware that a non-permit required confined space may become permit-required due to the introduction of items such 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 Safety and Health Manual, Standard 7.5, "Confined-Space Entry."
	Eye injury from working in vegetation	<ul style="list-style-type: none"> Wear ANSI Z87.1 approved safety glasses when working in vegetated areas.
	Radiological	<ul style="list-style-type: none"> Contact Safety and Health during the planning phase to determine if a Radiological Work Permit is required when 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.
	Hantavirus	<ul style="list-style-type: none"> 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 Safety and Health for guidance. .
	Falls from ladders	<ul style="list-style-type: none"> Inspect ladders prior to use and complete Ladder Inspection Form (LMS 1047) prior to each use in accordance with <i>Ladder Safety</i> (LMS/PRO/S16031). Be aware of personnel working below and on side of ladder. Use the



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Job Safety Analysis (JSA)

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	Falls from ladders	<p>three-point climbing guidelines while ascending or descending the ladder.</p> <ul style="list-style-type: none"> Place the ladder on firm footing and/or extend the ladder a proper distance above the upper resting surface. Ensure the base is placed 1 foot away from the structure for every 4 feet of the ladder's height. Use only ladders that are rated for the weight and the work situation.
Sample collection and preservation	Radiological	<ul style="list-style-type: none"> Use nitrile gloves when collecting and preserving samples and conducting field tests. Contact Safety and Health 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.
	Chemical exposure and spills	<ul style="list-style-type: none"> Review Safety Data Sheets (SDSs). Use nitrile gloves and ANSI Z87.1 approved safety glasses with side shields when dispensing sample preservatives (acids and bases) or using calibrations solutions and field test reagents. Ensure at a minimum that two 32-ounce bottles of eyewash solution are on hand during any use of chemicals in the field. 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.
Operation of bladder pumps using compressed air	Unexpected pressure releases from gas cylinders, compressors, and pneumatic equipment	<ul style="list-style-type: none"> Only individuals trained in the safe use of compressed air cylinders may use them. Compressed air cylinders shall be secured (either vertical or horizontal) with the regulator removed and protective cap in place during transport on public roads. Regulators can remain attached to air cylinder on a



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Job Safety Analysis (JSA)

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)
Operation of bladder pumps using compressed air	Unexpected pressure releases from gas cylinders, compressors, and pneumatic equipment	<p>controlled site (from well to well).</p> <ul style="list-style-type: none"> • Use a properly rated regulator for the control of air 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 <i>Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites</i> (LMS/PRO/S04351). • Never put any part of your body in front of the system pressure-discharge. • Wear ANSI Z87.1 approved safety glasses.
General field work	Drowning	<ul style="list-style-type: none"> • 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. • Use the buddy system and wear a life vest when working within 5 feet of water where a drowning hazard exists.
	Back injury	<ul style="list-style-type: none"> • 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.



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Job Safety Analysis (JSA)

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)
General field work	Noise exposure	<ul style="list-style-type: none"> In accordance with <i>Hearing Conservation Program</i> (LMS/PRO/S16027): <ul style="list-style-type: none"> Reduce noise exposure by placing generators and compressors away from work areas by using an extension cord or extra air hose. In general, always wear hearing protection if the noise levels prevent a normal conversation between 2 people standing 3 feet apart. Based on noise surveys performed on LMS generators, only the Honda 3500 requires the use of hearing protection, and only when working within 20 feet of it. Hearing protection is not required when starting the generator.
	Electric shock from generators and electrical equipment	<ul style="list-style-type: none"> In accordance with the <i>Electrical Safety Program</i> (LMS/PRO/S16017): <ul style="list-style-type: none"> 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 electrically powered equipment. 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 a Penetration Permit has been completed. If use of equipment that is not compatible with GFCIs is required (e. g. pump controllers), then ensure that: <ul style="list-style-type: none"> There is no precipitation during use. The ground around the generator and cords is dry. Discharge from the pump is directed away from electrical equipment. Dry leather gloves are used when handling electrical equipment and connections. Cords are inspected and found with no deficiencies.
	Injury from flying particles, pinch points, and cuts from power tools	<ul style="list-style-type: none"> Inspect all power tools prior to use; remove from service and tag those that are unserviceable.



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Job Safety Analysis (JSA)

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)
General field work	Injury from flying particles, pinch points, and cuts from power tools	<ul style="list-style-type: none"> • Wear ANSI Z87.1 approved safety glasses with side shields when potential exists for flying particles. • Wear a face shield, ANSI Z87.1 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 cut-resistant 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.
	Fires/explosions from refueling	<ul style="list-style-type: none"> • Vehicles and equipment shall not be fueled with the engine running. • Allow equipment to cool prior to fueling. • 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) and spring-closing (self-closing) lids. • Ensure that at least one fire extinguisher, minimum of 10 pound ABC, 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. • Keep equipment surface clean and free of fuel or other liquid build up. • 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.
	Chemical exposure, explosion, electric burn from 12-volt battery charging	<ul style="list-style-type: none"> • 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



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Job Safety Analysis (JSA)

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)
General field work	Chemical exposure, explosion, electric burn from 12-volt battery charging	<p>AC power supply.</p> <ul style="list-style-type: none"> • Charge battery with caps in place. • Connect positive cable to positive terminal first and negative cable to negative 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 nearby. • Ensure good ventilation to area. • Provide secondary containment for battery during charging, and have a spill kit available.
	Overhead hazards	<ul style="list-style-type: none"> • 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.
	Asphyxiation from gas-powered equipment	<ul style="list-style-type: none"> • 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.
Well maintenance activities	Chemical exposure from prepping and painting well casing	<ul style="list-style-type: none"> • When scraping rust or paint from well casing, wear ANSI Z87.1 approved safety glasses with side shields. • When painting, review SDSs prior to use. • When painting with a brush, wear nitrile gloves and ANSI Z87.1 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.



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Job Safety Analysis (JSA)

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)
Well maintenance activities	Fire from paint spray	<ul style="list-style-type: none"> Keep the spray gun at least 25 feet away from the generator while in use.
	Chemical exposure from concrete or bentonite	<ul style="list-style-type: none"> Review SDSs prior to use. Wear nitrile gloves and ANSI Z87.1 approved safety glasses with side shields. Notify Safety and Health prior to activity and comply with requirements of the <i>Silica Exposure Control Plan</i> (LMS/PRO/S16043). Minimize generation of dust by pouring slowly. Stand upwind. Rinse concrete dust or cement off skin surfaces as soon as possible.
	Rotational hazard and pinch points from a concrete mixer	<ul style="list-style-type: none"> 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.
Managing purge water and investigation derived waste	Improper/illegal management	<ul style="list-style-type: none"> Refer to the <i>Sampling and Analysis Plan for U. S. Department of Energy Office of Legacy Management Sites</i> (Table 5) 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.
	Environmental releases	<ul style="list-style-type: none"> Contact the EC and Safety and Health 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 of the Navajo Nation may be uninformed of site activity occurring	<ul style="list-style-type: none"> Work activities at the Shiprock site shall be performed according to the controls specified in the <i>Shiprock Remediation System Operations, and Routine Maintenance and Inspections JSA</i>.



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Job Safety Analysis (JSA)

JSA Review/Approval

Sam Campbell

Line Supervisor (Print Name)

Scott Ficklin

Safety and Health Representative (Print Name)

Darlene DePinho

Environmental Compliance Representative (Print Name)

Subcontractor/Worker Representative (Print Name)

Sam Campbell SAM CAMPBELL (Affiliate)
2019.05.29 14:22:18 -06'00'

Signature
Digitally signed by SCOTT
FICKLIN (Affiliate)
Date: 2019.05.22 13:32:38 -06'00'

SCOTT FICKLIN
(Affiliate)

Darlene M DePinho DARLENE DEPINHO (Affiliate)
2019.05.29 14:09:32 -06'00'

Signature Date

Signature Date



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Job Safety Analysis (JSA)

I have reviewed, understand the hazards present at the worksite, and will comply with the Integrated Work Planning and Control document to perform work, as acknowledged by my signature below. I understand the JSA does not authorize work.

Print Name	Signature	Company	Date



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Job Safety Analysis (JSA)

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

ESH Representative (Print Name)

Signature

Date

Line Supervisor (Print Name)

Signature

Date

Worker or Subcontractor Representative (Print Name)

Signature

Date



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Job Safety Analysis (JSA)

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

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Provide Feedback and Improvement Suggestions (ISMS Core Function #5)

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