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Environmental Program Directorate

Standard Operating Procedure

For **SPRING AND SURFACE WATER SAMPLING**

APPROVAL SIGNATURES:

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1. PURPOSE AND SCOPE

This standard operating procedure (SOP) describes the responsibilities and process for collecting, documenting, and submitting samples from surface water (base flow and snowmelt) and springs collected as required by the Interim Facility-Wide Groundwater Monitoring Plan. This procedure applies to all Los Alamos National Laboratory (LANL), Environmental Programs (EP) Directorate personnel and contractor personnel authorized to collect surface water and spring samples.

2. BACKGROUND AND PRECAUTIONS

2.1 Background

This procedure has been developed to be consistent with the requirements of the Compliance Order on Consent (March 1, 2005), hereafter referred to as the Consent Order. Field personnel collecting samples under this procedure are effectively in compliance with the requirements of the Consent Order by following the actions specified within this procedure.

Field personnel are not responsible for reviewing and understanding the Consent Order but are responsible for collecting samples in accordance with this procedure. The LANL Groundwater Technical Leader overseeing these sampling activities is responsible for ensuring the requirements of the Consent Order are met, and technical best practice requirements are properly incorporated in this procedure.

2.2 Precautions

- If any issues arise in the field that would cause a variation on the sample collection as described in this SOP, the field team leader (FTL) shall contact the Groundwater Technical Leader, if possible, to resolve these issues before continuing with sampling.
- If unusual conditions occur at the sampling site or during the sampling that might affect the sampling results, the FTL shall discuss such conditions with the Groundwater Technical Leader.
- Project personnel using this procedure should become familiar with the contents of the following documents to properly implement this SOP:
  - RRES-ES-FIELD, General Field Safety for All Employees
  - EP-ERSS-SOP-5056, Sample Containers and Preservation
  - EP-ERSS-SOP-5057, Handling, Packaging, and Transporting Field Samples
  - ENV-DO-203, Field Water Quality Analysis
  - EP-ERSS-SOP-5061, Field Decontamination of Equipment
  - USGS Water Supply Paper 2175, *Measurement and Computation of Stream Flow*: Volume 1, Chapter 8, Measurement of Discharge by Miscellaneous Methods
  - USGS Water Supply Paper 2175, *Measurement and Computation of Stream Flow*: Volume 2, Chapter 10, Computation of Discharge

3. EQUIPMENT AND TOOLS

The Equipment and Supplies Checklist for Sampling is included as Attachment 1.

4. STEP BY STEP PROCESS DESCRIPTION

4.1	**Pre-Sampling Instructions**	
Field Team Leader	1.	Review sampling plans and analytical requirements.
	2.	Discuss any issues related to sample collection or the sampling plan with the requestor.
	3.	Initiate required analytical request and chain-of-custody forms.
	4.	Ensure that equipment is calibrated in accordance with ENV-DO-203, Field Water Quality Analysis.
	5.	Obtain historical notes from previous sampling events regarding site location and sampling conditions.
	6.	Obtain a global positioning system (GPS) unit and upload sample site coordinates, if they exist. [Note: Some field locations, such as TA-15 and TA-16, do not permit usage of a GPS.]
4.2	**Sample Site Location and Selection – Spring Sampling**	
Field Team Member	1.	Sampling site should be marked with a stake, or flagging if appropriate. • Consider taking extra stakes to the field in case a replacement is needed. • Remove stakes from sampling sites when the stations are moved or sampling at the location is discontinued. [NOTE: Locations for spring sampling stations along the Rio Grande (such as Rio Grande at Pajarito) may not be marked because the location is too close to the stream bed to retain a stake.]
	2.	Locate the spring at the site.
	3.	Determine where or whether the spring should be sampled in accordance with the guidance provided in Attachment 4.

4.3 Sample Site Location and Selection – Surface Water Sampling

Field Team Member	1.	Locate the surface water sampling site, which is normally identified by a stake with the station name. • NOTE: Stakes may not be present at some surface water sampling sites because of possible public access or vandalism, the physical location (e.g., near a road), or the short-term nature of the sampling campaign. Take extra stakes to the field in case a replacement is needed. • Remove stakes from sampling sites when the stations are moved or sampling at the location is discontinued.
	2.	Collect base flow and snowmelt samples from running water. [NOTE: In some cases, a project may require sampling pooled or ponded water. Contact Groundwater Technical Lead for clarification, preferably before a site is sampled.] • Consult with the Groundwater Technical Lead if there are any questions regarding where and how samples are to be collected. • When snow and/or ice is present, determine if there is running water by removing the snow and breaking through the ice, if it is reasonable to do so.
	3.	Collect samples far enough upstream of a confluence so that the samples are not influenced by water from another stream.

4.4 Sample Collection for Spring and Surface Water Sampling

Field Team Member	1.	[NOTE: The order of operations for sampling and associated activities is dependent on conditions at the site. It is the FTL's responsibility to determine what the most appropriate order of operations will be. The integrity of the sample water is the most important consideration. The following order is an example, but may not be the most appropriate for a given site] Collect the samples in accordance with the sampling plan, according to the following guidance: • If the discharge is deep enough to get a sample free of nearby surface contaminants, the sample may be directly collected by dipping the collection bottle into the water. • Otherwise, collect the sample by using a peristaltic pump with new polyetheylene tubing. • Collect volatile organic samples by decanting from a glass bottle. • If a filtered sample is required, use a 0.45 mm filter in conjunction with polyethylene tubing and a peristaltic pump • Wear nitrile gloves to collect the sample.
	2.	Measure water quality parameters (ph, SC, DO, Temp, Turb) with appropriate meters.

	3.	Complete the required fields on the Spring/Surface Water Sampling Field Data Sheet (Attachment 2).
	4.	Photograph the site, recording the time, orientation, subject and photographer. If appropriate, take an upstream and downstream photograph as well.
	5.	Where both field conditions and flow conditions allow, make a discharge flow measurement using the following guidance: • For most springs, use a wide-mouth bottle of known volume to capture discharge from the spring and record the time required to fill the bottle. If all the spring discharge cannot be captured in the bottle, then a best estimate will be made by the sample team leader to gage how much water is flowing around the bottle mouth. If multiple flows are present, then each individual flow should be measured if possible, and added to obtain a total flow. Flows should be reported in gallons per minute. • For a surface water site next to an established gaging station, record the gage height water level, to the nearest 0.01 ft. Following sample collection and gage height documentation, the sample team leader will retrieve discharge rates corresponding to the specific gaging station from Storm Water personnel located in TA-64, building 64. • If a gaging station is not present, use either a Parshall flume (following the guidance in Attachment 3) or a flow velocity – channel volume calculation, as appropriate. Flow Velocity – Channel Volume Equation *Channel Width (ft) * Channel Depth (ft) * Flow Velocity (ft/s) = Volume (cfs)* • For further details, consult USGS Water Supply Paper 2175, *Measurement and Computation of Stream Flow*: Volume 1, Chapter 8, Measurement of Discharge by Miscellaneous Methods as well as USGS Water Supply Paper 2175, *Measurement and Computation of Stream Flow*: Volume 2, Chapter 10, Computation of Discharge • When quantitative measurements are not possible, make a qualitative description of flow including an estimate of discharge. • It is the FTL's responsibility to decide upon which discharge measurement technique is most appropriate, according to the site's unique conditions.
Field Team Member (Continued)	6.	Decontaminate all analytical instruments (YSI multi-meter, etc.) using deionized water.
	7.	Preserve samples as specified on the Analytical Request forms. [NOTE: Refer to EP-ERSS-SOP-5056 Sample Containers and Preservation for guidance.]
	8.	Apply chain-of-custody tape.
	9.	Store the samples in a cooler with blue ice or equivalent and transfer to the Sample Management Office. [NOTE: Refer to EP-ERSS-SOP-5057, Handling, Packaging, and Transporting Field Samples, for further guidance.]

4.5	**Sample Completion and Site Restoration**	
Field Team Member	1.	Restore the site to its pre-sampling condition.
Field Team Member (Continued)	2.	Replace any site location stakes, if needed. • Remove stakes from sampling sites when the stations are moved or sampling at the location is discontinued. [NOTE: Ground penetrations of greater than 12 inches on LANL property will require an excavation permit.]
	3.	Dispose of any waste materials in accordance with the sample plan or work plan. • Contact the responsible Waste Coordinator if further guidance is required.
	4.	Decontaminate the sampling equipment utilized by rinsing with deionized water and wiping dry with a paper towel.
4.6	**Records Management**	
Field Team Leader	1.	Maintain and submit the following records and/or documents generated as a result of this procedure to the Records Processing Facility according to EP-DIR-SOP-4004, Records Transmittal and Retrieval Process: • Sample Collection Log / Field Chain-of-Custody • Spring/Surface Water Sampling Field Data Sheet (Attachment 2) • Field notes or other field documentation

5. DEFINITIONS

Confluence – A flowing together of two or more streams.

Groundwater – Subsurface water in the saturated zone from which wells and springs are supplied.

Field Team Leader – Member of the sampling team who is responsible for the overall coordination, planning, and performance of the sampling.

Field Team Member – Personnel trained to this procedure and authorized to conduct the work prescribed in this procedure.

Spring – A place where groundwater flows from the ground onto the surface.

Stagnant Water – Surface water where there is no detectable flow either upstream or downstream.

Stream Flow – To aid in water quality interpretations, stream flow is divided into three types or matrices. Each of the three flow types might be collected at a single location within a time span of as little as a week, depending upon weather conditions. At times, the flow may represent a combination of the several of these components. This procedure discusses sampling for the first two of the three types listed below:

- *Base flow* – Persistent stream flow but not necessarily perennial water. This stream flow is present for periods of weeks or longer. The water source may be effluent discharge or shallow groundwater that discharges into canyons.
- *Snowmelt* – Flowing water that is present as a result of melting snow. This type of water often may be present for a week or more and in some years may not be present at all.
- *Storm runoff* – Flowing water that is present in response to rainfall. These flow events are generally very short lived, with flows lasting from less than an hour to several days.

Surface Water – Water on the earth's surface including ponds, lakes, and streams.

6. PROCESS FLOW CHART

Not applicable.

7. ATTACHMENTS

Attachment 1 Equipment and Supplies Checklist for Sampling

Attachment 2 Spring/Surface Water Sampling Field Data Sheet

Attachment 3 Use of Parshall Flume

Attachment 4 Spring Sampling and Approach Consideration Guidelines

8. REVISION HISTORY

Revision No. *(Enter current revision number, beginning with Rev.0)*	Effective Date *(DCC inserts effective date for revision)*	Description of Changes *(List specific changes made since the previous revision)*	Type of Change *(Technical [T] or Editorial [E])*
0	7/05	New document. Supersedes RRES-WQH-SOP-047.1 and ER SOP 6.13.	T
1	3/06	Removed specific references to ENV-WQH and ENV-ECR procedures. Incorporated ECR QA review comments.	T
0	10/30/08	New procedure. Supersedes ENV-DO-204, R1.	E
1	9/23/2010	SOP 5224 updated with primarily editorial changes. Revision incorporates use of GPS technology to locate springs, and proper photo documentation of springs. Spring/Surface Water Sampling Sheet updated.	T/E

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ATTACHMENT 1

SOP-5224-1

Equipment and Supplies Checklist for Sampling

Records Use Only

- ☐ Chain-of-Custody Forms and Tape
- ☐ Spring/Surface Water Sampling Field Data Sheet
- ☐ GPS Unit (if permitted)
- ☐ Peristaltic Pump, New Polyethylene Tubing, and Required Power Source (Batteries)
- ☐ 0.45 mm Filters
- ☐ Measuring Equipment (YSI multi-meter and Turbidimeter)
- ☐ Sample Containers, Properly Labeled and Protected for Transport
- ☐ Ball-Point Pens (Indelible Dark Ink) and Felt Tip Markers (Indelible Dark Ink)
- ☐ Nitrile Gloves (Disposable)
- ☐ Kimwipes or Other Disposable Wipes
- ☐ Deionized Water
- ☐ Ziplock Bag for Contact Waste
- ☐ Preservatives, Safety Glasses and Eyewash
- ☐ pH Indicator Paper (1 – 14) and Disposable Droppers
- ☐ Coolers with Blue Ice (or Equivalent)
- ☐ Camera
- ☐ Stakes
- ☐ Radio, Cell Phone, Pager
- ☐ First Aid Kit
- ☐ Graduated wide-mouthed plastic cylinder
- ☐ Tape Measure and Stop Watch
- ☐ Parshall Flume
- ☐ Backpacks
- ☐ Shovel (if snow or ice is present)

SOP-5224-2

Spring/Surface Water Sampling Field Data Sheet

Records Use Only

Los Alamos NATIONAL LABORATORY EST.1943

Site name:	**Date:**	**Onsite time:**	
Objective:		**Weather:**	
Sampling crew:			
Two-minute safety drill:			
Meters calibrated at (location) _____ **by** (whom) _____ **at** (time) _____			
YSI Meter number:	**Turbidimeter serial number:**		
Sample Retrieval	**Date:**	**Time:**	**Method:**
Sample Event ID:	**Sample ID Numbers:**		

FIELD PARAMETERS		
pH (su):	Sp. Cond. (µS/cm):	Turbidity (NTU):
Temperature (°C):	DO (mg/L):	Q (gpm):
Explanation of Q method, including calculations:		

Note: To convert cfs to gpm, multiply cfs by 448.83

SITE DESCRIPTION (circle all that apply)						
Media type:	Spring				Baseflow (persistent flow)	
Sample location:	Bank		Wading		Station Gage: at / above / below	
	Midstream natural feature		Other (specify):			
Description of Sampling Site:	Pool	Riffle	Eddy	Diffuse	Other	
	Written description:					
Substrate:	Bedrock	Concrete	Cobble	Gravel	Sand	Mud
Stage Conditions:	Stable: normal / low / high		Falling	Rising	Other (specify):	
Hydraulic Event:	Routine	Snowmelt	Flood	Drought	Other (specify):	
Stream Color:	Brown	Clear	Green	Blue	Gray	Other (specify):
Description of flow:	Turbulent	Laminar	Recirculating	Stagnant	Other	
	Written description:					

Photos and GPS				
GPS point #1:	Name:	Coordinates:		Units:
GPS point #2:	Name:	Coordinates:		Units:
Photo #1:	Description:	Facing:	Time:	Taken by:
Photo #2:	Description:	Facing:	Time:	Taken by:
Photo #3:	Description:	Facing:	Time:	Taken by:
Other notes:				

Offsite time:	**Relinquish samples at SMO**, care of _____ at (time) _____
Objectives met?	

ATTACHMENT 3

SOP-5224-3

Use of Parshall Flume

Records Use Only

Los Alamos NATIONAL LABORATORY EST.1943

1. Storm Water personnel maintain a Parshall flume in TA-64, South Bay. Contact Storm Water personnel for more detailed instructions. See Table 3-1 for capacity of flume
2. Install the flume in the flow channel, with the floor of the inlet converging channel set in a level position. This can be determined using a level bubble or carpenter's level. Soil or streambed material is then packed around the flume to prevent leakage under and around it.
3. The flume should be installed so as to minimize the submergence ratio, which is defined as the ratio between the downstream head to the upstream head, allowing for "free-flow" conditions. For Parshall flumes in the size ranges used at LANL, the submergence ratio shall not exceed 0.6.

   [NOTE: If this cannot be achieved refer to U.S. Geological Survey Water Supply Paper 2175, Measurement and Computation of Stream Flow: Volume 2, Chapter 10 Computation of Discharge, page 317 and Figures 158 and 159 for application of submergence correction factors.]
4. After the flume is installed, allow the water to pool upstream of the flume. No gage-height readings should be recorded until the pool has risen to a stable level.
5. After stabilization, gage-height readings should be taken at half-minute intervals for approximately three minutes. Calculate the mean value of the readings taken to determine the gage height.
6. Utilize the calibration data for the specific Parshall flume, if available, or use Table 3-2 to obtain the discharge flow rate.
7. After completion of the flow measurement, remove the flume.

Table 3-1
Capacities of Parshall Flumes

Size (Throat Width, inches)	Free Flow Capacity (ft^3/s)	
	Min	Max
6	0.05	3.9
9	0.09	8.9
12	0.11	16.1
24	0.42	33.1

Table 3-2
Discharge Rates for Parshall Flumes for Free-Flow Conditions

Gage Height (ft)	Flume Size (inches)			
	6	9	12	24
0.1	0.05	0.09	0.11	
0.2	0.16	0.26	0.35	0.66
0.3	0.31	0.49	0.64	1.24
0.4	0.48	0.76	0.99	1.93
0.5	0.69	1.06	1.39	2.73
0.6	0.92	1.40	1.84	3.62
0.7	1.17	1.78	2.33	4.60
0.8	1.45	2.18	2.85	5.66
0.9	1.74	2.61	3.41	6.80
1.0	2.06	3.07	4.00	8.00
1.1	2.40	3.55		
1.2	2.76	4.06	5.28	10.6
1.3	3.12	4.59		
1.4	3.51	5.14	6.68	13.5
1.5		5.71		
1.6		6.31	8.18	16.6
1.7		6.92		
1.8		7.54	9.79	19.9
1.9		8.20		
2.0			11.5	23.4
2.2			13.3	27.2
2.4			15.2	31.1

[NOTE: The values in the table above should be used as a guide or preliminary ratings for flumes built in the field. The field installations should be field calibrated to give the most accurate measurements due to structural differences that may be present between the actual flume and the model.]

ATTACHMENT 4

SOP-5224-4

Spring Sampling Approach and Consideration Guidelines

Records Use Only

Sampling Site Characteristic	Approach	Considerations
Spring with clearly established sampling locations	Sample at established locations	None
Spring with multiple discharge points and high flow rate	Select a sampling location at a point of discharge that will provide a representative sample, usually the strongest flow discharge point.	Ensure that the sampling location is not contaminated by surface materials or nearby surface water
Spring with multiple discharge points and low flow rate	Select a location near the discharge point where the water is at its deepest and where a low turbidity sample can be collected	Ensure that the sampling location is not contaminated by surface materials of nearby surface water.
Spring with low flow that issues along another water source (e.g., Rio Grande or a baseflow)	Select a sampling location that is NOT influenced by the other water source Typically, this means a relatively strong flow is present at least 1 foot above the level of the other water source.	Ensure the sampling location is not contaminated by nearby surface water. If it is not possible to collect a sample from the spring that is not mixed with another source, do not collect the sample
Spring is underneath snow and / or ice	If running water is found beneath snow/ice, proceed with sampling. If discharge is frozen solid, sampling is not possible.	Bring shovel to uncover spring. Take care not to sample melting snow or ice.