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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 Facility-Wide Monitoring Project 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 unexpected issues arise in the field that cause a significant variation on the sample collection protocol, the field team leader (FTL) shall contact the requestor 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 requestor.
- 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
  - EP-ERSS-SOP-5085, Chain-of-Custody for Analytical Data Record Packages
  - 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.
4.2	**Sample Site Location and Selection – Spring Sampling**	
Field Team Leader	1.	Prior to going to the field, obtain required maps or a global positioning (GPS) unit programmed with the coordinates of the spring to be sampled.
Field Team Member	2.	Mark locations for sampling stations in the field with stakes. • 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. [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.]
	3.	Locate the spring at the site.
	4.	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.	Ensure that stakes are present at surface water sampling sites, which are normally identified by stakes with labels identifying 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.] • Consult with the requester if there are any questions regarding where and how samples are to be collected.
	3.	Collect samples far enough upstream of a confluence so that the samples are not influenced by water from another stream.
	4.	Document, on the Spring/Surface Water Sampling Field Data Sheet (Attachment 2), the flow conditions for each stream and the distance upstream from the confluence at which the sample was collected.

4.4 Sample Collection

Field Team Member	1.	Where both field conditions and flow conditions allow, make a discharge flow measurement using the following guidance: • For a spring sample, use a 1-quart wide-mouth polyethylene bottle to capture water discharging 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 gauge how much water is flowing around the bottle mouth. The sample team leader will then convert the 1-quart fill time, and estimated pass-by flow, in necessary, to a gallon/minute discharge rate.. • For a surface water sample collected next to an established gauging station, record the gauge height water level, to the nearest 0.01 ft. Following sample collection and gauge height documentation, the sample team leader will need to retrieve discharge rates corresponding to the specific gauging station from Storm Water personnel located in TA-64, building 64. Where surface water sample sites are located away from established gauging stations, but can be driven to, and water level permits, use a current meter or a Parshall flume to measure stream discharge, following the guidance in Attachment 3, as appropriate. For a surface water sampling site located in a back-country area, the sample team leader will estimate the depth and width of the channel. The flow velocity will then be estimated by measuring the time required for a floatable object to travel a given reach of stream. A discharge estimate can be determined by multiplying the width (ft) X depth (ft) X velocity (ft/second)
	2.	When quantitative measurements are not possible, make a qualitative description of flow including an estimate of discharge. • Take photographs to aid in documenting the qualitative description.
	3.	Decontaminate all analytical instruments (pH meters, etc.) using deionized water before taking the first sample and between samples.

Field Team Member (Continued)	4.	Collect the samples in accordance with the sampling plan, according to the following guidance: • Use pre-cleaned, new polyethylene bottles or other transfer device (e.g., a Peristaltic pump and clean transfer tubing). • For spring samples, use a peristaltic pump with new tubing to collect the samples. If the water stream 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. • For surface water samples collected from the bank of a stream, collect the water sample either by using a peristaltic pump with new tubing, or by dipping the collection bottle into the water. • Collect organic samples using a glass bottle. • Refer to EP-ERSS-SOP-5056 for the required size bottles and preservatives for proper analytical results. • If a filtered sample is required, use a 0.45 mm filter and refer to EP-ERSS-SOP-5056 for further instructions. • Wear nitrile gloves to collect the sample.
	5.	Obtain the required field parameters for the spring or surface water samples and document on the Spring/Surface Water Sampling Field Data Sheet (Attachment 2).
	6.	Preserve samples as specified on the Analytical Request forms. [NOTE: Refer to EP-ERSS-SOP-5056 for guidance.]
	7.	Apply chain-of-custody tape. [NOTE: Refer to ENV-WQH-QP-029, Creating and Maintaining Chain-of-Custody, for further guidance.]
	8.	Complete the required data fields on the Spring/Surface Water Sampling Field Data Sheet (Attachment 2).
	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: • Analytical Request Forms and 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

Using a CRYPTOCard, click here to record "self-study" training to this procedure.

If you do not possess a CRYPTOCard or encounter problems, contact the EP training specialist.

ATTACHMENT 1

SOP-5224-1

Equipment and Supplies Checklist for Sampling

Records Use Only

- ☐ Analytical Request Form
- ☐ Chain-of-Custody Forms and Tape
- ☐ GPS Unit (if sample location is unknown)
- ☐ Peristaltic Pump, Associated Tubing, and Required Power Source (Batteries)
- ☐ 0.45 mm Filters
- ☐ Measuring Equipment (pH, Temperature, Specific Conductance, Dissolved Oxygen, and Turbidity)
- ☐ Sample Containers, Properly Labeled
- ☐ Ball-Point Pens (Indelible Dark Ink)
- ☐ Felt Tip Markers (Indelible Dark Ink)
- ☐ pH Indicator Paper (1 – 14) and Disposable Droppers
- ☐ Nitrile Gloves (Disposable)
- ☐ Kimwipes or Other Disposable Wipes
- ☐ Deionized Water
- ☐ Safety Glasses
- ☐ Eyewash
- ☐ Clipboards
- ☐ Trash Bags
- ☐ Preservatives
- ☐ Coolers with Blue Ice (or Equivalent)
- ☐ Camera
- ☐ Stakes
- ☐ Radio, Cell Phone, Pager
- ☐ First Aid Kit

ATTACHMENT 2

SOP-5224-2

Spring/Surface Water Sampling Field Data Sheet

Records Use Only

Los Alamos NATIONAL LABORATORY EST.1943

Location:

Sample Retrieval	**Time:**	**Date:**

Analytical Request Record No.:

Sampled By:

FIELD PARAMETERS	
pH:	Temperature:
Specific Conductance:	DO:
Turbidity:	Other (specify):
Discharge (units and method of measurement):	

STREAMS (circle all that apply)						
Location:	Wading	Bank	Station Gage: at / above / below			
	Bridge: upstream / downstream		Side Bridge _____ ft/mile		Boat	Ice
	Other (specify):					
Sampling Site:	Pool	Riffle	Open	Braided	Backwater	
	Sampler Type:					
Bottom:	Bedrock	Rock	Cobble	Gravel	Sand	Mud
	Concrete					
Stage Conditions:	Not determined		Stable: normal / low / high			
	Falling	Rising	Rising	Peak	Other (specify):	
Hydraulic Event:	Routine Sampling		Regular Flow			
	Snowmelt	Flood	Drought	Spill		
	Ice Cover: Thickness _____ inches		Other (specify):			
Stream Color:	Brown	Clear	Green	Blue	Gray	
	Other (specify):					
Stream Mixing/Flow Type: Turbulent/Laminar/Stagnant	Excellent	Good	Fair	Poor		

SPRINGS (circle all that apply)						
Sampling Site:	Pool	Riffle	Braided	Backwater		
Bottom:	Bedrock	Rock	Cobble	Gravel	Sand	Mud
Stage Conditions:	Not determined		Stable: normal / low / high			
Stream Color(s):	Brown	Clear	Green	Blue	Gray	
	Other (specify):					
Spring Water Mixing and sample location distance from source.	Excellent	Good	Fair	Poor		

Other Observations: _____

ATTACHMENT 3

SOP-5224-3

Use of Parshall Flume

Records Use Only

1. When using a Parshall flume to determine discharge flow values for a surface water stream or spring, select the proper size flume for the expected flow conditions.

   [NOTE: Refer to Table 3-1 for free flow capacities of the size ranges of Parshall flumes used at the laboratory.]

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 resin 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 clear discharge points and large flow of water	Select a sampling location at a point of discharge that will provide a representative sample	Ensure that the sampling location is not contaminated by surface materials or nearby surface water
Spring with low flow that issues along another water source (e.g., Rio Grande)	Select a sampling location that is NOT influenced by the other water source	Ensure the sampling location is not contaminated by nearby surface water. Typically, this means a relatively strong flow is present at least 1 foot above the level of the other water source. 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 with low flow rate that discharges over a large area but water in not more than 1 inch deep	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.