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Los Alamos NATIONAL LABORATORY EST. 1943

Environmental Program Directorate

Standard Operating Procedure

For **GROUNDWATER SAMPLING USING WESTBAY® MP SYSTEM**

APPROVAL SIGNATURES:

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1. PURPOSE AND SCOPE

This procedure describes field procedures for groundwater sampling using Westbay® systems. This procedure applies to all personnel who conduct groundwater sampling with Westbay® systems.

This standard operating procedure (SOP) 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 will be 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 Los Alamos National Laboratory (LANL) Facility-wide Monitoring Project Leader overseeing these sampling activities is responsible for ensuring the requirements of the Consent Order and technical best practice requirements, are properly incorporated in this procedure.

2. BACKGROUND AND PRECAUTIONS

2.1 Background

The Westbay® MP System is a modular multilevel groundwater-monitoring device that uses a single closed-access tube with valved ports. The valved ports are used to provide access to several different screens of a monitoring well through an inner well (MP) casing. The modular design permits as many monitoring zones to be established as desired during well completion. This system allows for sampling without purging the zone under normal aquifer conditions and takes samples at an in-situ pressure.

The Westbay® MP System consists of plastic casing components, which are permanently installed inside the monitoring well casing, portable pressure measurement and sampling probes, and specialized tools. The Westbay® sampling probe and sample containers are constructed of stainless steel.

2.2 Precautions

Actions specified within this procedure, unless preceded with "should" or "may," are to be considered mandatory (i.e., "shall," "must").

Decontaminate all equipment that will be placed inside the well in accordance with the provisions of EP-ERSS-SOP-5061, Field Decontamination of Drilling and Sampling Equipment.

Prior to sampling, ensure that there is a process for disposing of purged water and a Notice of Intent (NOI) for disposal of the purge water is in place.

3. EQUIPMENT AND TOOLS

See Attachment 1, Equipment and Supplies Checklist for Sampling Using the Westbay® MP System.

4. STEP BY STEP PROCESS DESCRIPTION

4.1 Prerequisites and Initial Conditions

Field Team Member	1.	Print out the applicable Analytical Request/Chain of Custody form(s) from the Sample Management Office (SMO) database (reference EP-ERSS-SOP-5110, Creating and Maintaining Chain-of-Custody) prior to leaving for field.

2. Review the sampling plan for the current sampling activity to ensure samples are collected as specified and identify any sample collection or site issues.

3. Determine waste requirements by reading the waste characterization strategy form (WSCF) and contacting the Waste Coordinator for information and instructions on containerization or other waste handling measures for contact waste, purge water, and decontamination water. Samplers will use the appropriate waste disposal path for all other generated wastes and record accordingly in the field log.

4. Notify the LANL Water Stewardship Program (LWSP) shift operations manager (SOM) of planned work activities to be placed on the LWSP plan of the day (POD). Ensure work activities are conducted on an approved POD for the appropriate facility in which work will be performed before any field or lab activities begins.

5. Notify the appropriate facility personnel before working in restricted areas in order to be put on the plan of the week/plan of the day for that location.

6. Assemble the equipment needed for sampling event using Attachment 1, Equipment and Supplies Checklist for Sampling the Westbay® MP System, as a reference. Obtain a copy of the completed MP Casing Log with the Depths of Key Items Table for the well to be sampled (available on LANL server).

7. Verify field instruments to be used for water quality readings are calibrated in accordance with EP-ERSS-SOP-5103, Field Water Quality Analysis.

8. Mobilize Westbay® trailer to the site and level the trailer in accordance with the field trailer owner's manual contained in trailer.

9. At least one person on the sampling team must be Westbay® certified or be trained by a Westbay® certified person and able to demonstrate proficiency in conducting sampling with the Westbay® system.

4.2 Calibration and Performance Checks of Westbay® Sampler Probes

Field Team Member	1.	Verify the sampler probe is calibrated. If the probe has not been factory calibrated or performance checked in the previous 12 months, or if the sample probe transducer readings are questionable, perform a performance check as described in step 2. [NOTE: A sampler probe may be considered properly calibrated as long as the probe returns values that are within pre-determined measurement precision specifications: • The measurement precision of a Westbay MOSDAX sampler probe is 0.1% of the pressure rating • How long a sampler probe will maintain calibration depends on the amount of regular use the probe has experienced, whether or not the probe was exposed to environmental extremes, and how the probe was handled during use, transportation, and storage. Sampler probe calibration is performed only by the manufacturer. Sampler probes should be returned to the manufacturer once a year for factory calibration or the calibration period can be extended to 2 years or more if on-site calibration performance checks are conducted on a regular basis.]
	2.	Conduct a calibration performance check on the Westbay® MP System sampler probe, by bench checking barometric pressure measurements of each sampler probe by comparing probe barometric pressure measurements with a local meteorological station. This check must be done at the Technical Area 64 (TA-64), building 64, compound, using meteorological data from the TA-06 meteorological (Met) station, to get an accurate result. Other locations must be evaluated prior to use.
	3.	Record the performance check location, date, time in mountain standard time, and the sampler probe barometric measurement in pounds per square inch absolute (psia) on Attachment 3, Westbay® Pressure QA/QC Check Record.
	4.	Obtain the Met station atmospheric pressure data for the 15-minute interval closest to the time the probe reading was taken. [NOTE: The barometric pressure recorded at TA-6 on 15-minute intervals can be found on the LANL weather web page, http://www.weather.lanl.gov/].
	5.	Record the following information on the Westbay® Pressure QA/QC Check Record (Attachment 3) • Met Station • Time of Met station barometric reading in Mountain Standard Time (MST) • Barometric pressure at Met station (millibars [mb]).
	6.	Convert pressure in millibars to pounds per square inch (psi) by multiplying the pressure in mb by 0.01450 psi/mb.
Field Team Member	7.	Add 0.026 psi to the Met station value calculated in step 5 to compensate for the elevation difference of the TA-64 building and the TA-06 Met station.

(continued)	8.	Determine the error tolerance of the sampler probe by multiplying the pressure rating of the probe (psi) by 0.1%, and record the error tolerance on the Westbay® Pressure QA/QC Check Record (Attachment 3).
	9.	Determine the acceptable range of barometric pressure measurements by adding/subtracting the error tolerance determined in Step 3 to/from the atmospheric pressure obtained from the Met station and record on the Westbay® Pressure QA/QC Check Record (Attachment 3).
	10.	Compare the Barometric Pressure Reading measured by the sample probe with the acceptable range and verify that measurements are within the acceptable range and write Yes or No in the Passed field on the Westbay® Pressure QA/QC Check Record (Attachment 3) followed by the users initials.
	11.	If barometric pressure measurement by the sample probe is not within the acceptable range, recheck the pressure measurements. If the measurement is still not within the acceptable range, return sampler probe to manufacturer for calibration and/or repair.

4.3 Performing Sampler Probe Maintenance

Field Team Member	1.	Perform routine maintenance by performing the following steps on the sampler probe as specified in MOSDAX Owners Manual each time a probe is used at a well site.
	2.	Check/lubricate O-rings, and change if necessary.
	3.	Check cables.
	4.	Perform surface check of probe arm and shoe functions.
	5.	Unscrew the cable head on the sample winch cable and check the cable connection to the epoxyed nut for rust or other damage at the first sampling event of the month or the watershed. Rehead the cable if damage is found before use. Record any maintenance performed in the field logbook.

4.4 Sampling Operations

Field Team Member	1.	If not already connected, setup sampler winch and connect cables in accordance with the MOSDAX Sampler Probe Manual and the Mount Sopris Manual. [NOTE: Reference the MOSDAX Manual throughout this section for further detail and instruction, if needed.]
	2.	Setup mast and well head equipment.
Field Team Member	3.	Rinse sample bottles and sample probe with de-ionized (DI) water. Collect equipment rinsate blank sample if required by sampling and analysis plan (SAP).

(continued)	4.	Attach sampler probe and stainless steel sample bottles to winch cable. [NOTE: Always have a spotter outside trailer to help winch operator when raising sample string to ensure sample string is not raised within 3 inch (in.) below the mast wheel.]
	5.	Perform surface function tests and document on Attachment 4, Groundwater Sampling Field Data Sheet.
	6.	Land sampler probe on well head apparatus.
	7.	Evacuate air from stainless-steel sample bottles with the vacuum pump to 2–4 psi and document the final vacuum pressure in Zone Pressure, Column (O) on the Groundwater Sampling Field Data Sheet (Attachment 4).
	8.	Using the MP Casing Log and Depths of Key Items Table as reference, lower the sample probe to the desired port. If the digital counter is not functional, use the Collar Detect Command and count the magnetic collars to locate the desired port.
	9.	If quality assurance (QA) pressure checks of any ports other than those to be sampled are required, perform the QA checks for each zone on the first run of sampling for that zone. Do not open ports of any zones other than the one to be sampled without decontaminating the sample probe before the sample is collected.
	10.	Land sampler probe at desired port of zone to be sampled. Document the location of sampler probe by referencing the measurement port in column (A), and the pressure inside the MP casing (Pi) in Column (m) of the Groundwater Sampling Field Data Sheet (Attachment 4). Landing the sampler probe can be accomplished using the winch or by hand in accordance with the MOSDAX Sampler Probe Manual.
	11.	Attach the sampler probe to the monitoring port by pressing the “Shoe Out” function key on the MOSDAX Controller.
	12.	Record the zone pressure (Po) in Column (O) on the Groundwater Sampling Field Data Sheet (Attachment 4).
	13.	Collect the water sample by pressing the “Valve Open” function key on the MOSDAX Controller. Record the time the valve was opened in Column (Q) of the Groundwater Sampling Field Data Sheet (Attachment 4) and in the Water Quality Sampling Record (Attachment 2).
	14.	When pressure stabilizes, record the Po with the valve open in Column (R) on the Groundwater Sampling Field Data Sheet (Attachment 4).
	15.	Close the sampling valve by pressing the “Close Valve” function key on the MOSDAX Controller.
Field Team Member (continued)	16.	Retract the shoe by pressing the “Shoe In” function key on the MOSDAX controller.
	17.	Record the Pi in Column (U) on the Groundwater Sampling Field Data Sheet (Attachment 4). Compare Pi value with the pre-sampling value recorded in step 10.

	18.	Slowly raise the sampler probe and stainless steel bottle(s) until they are no longer landed and retract the landing arm by pressing the “Arm In” function key on the MOSDAX controller.
	19.	Remove the sampler probe and stainless steel sample bottles from the well casing. [NOTE: Always have a spotter outside trailer to help winch operator when raising sample string to ensure sample string is not raised within 3 in. below the mast wheel.]
	20.	When pressure in the sample bottles is greater than 80 psi, vent excess pressure from the bottle string by removing the poly end-cap on the bottom bottle and opening the vent valve with a pair of pliers. Vent water into a sample container, but do not used vented water for volatile or semivolatile samples.
	21.	Shut the vent valve when the sample bottles are depressurized and, using a pair of pliers, close the valve located on the pigtail between the bottles.
	22.	Disconnect sample bottles from sample probe.
	23.	Transfer water to sample containers and parameter bottles directly from the stainless-steel sample bottles, being careful not have the sample bottles touch the sample and parameter containers or have sample water contaminate the sampler’s nitrile gloves.
	24.	Record the volume of sample retrieved in the Water Quality Sampling Record, field logbook, and Groundwater Sampling Field Data Sheet (Attachment 4), and provide pertinent information about the sampling run in the comment field, Column (V).
	25.	Collect water samples in the order of priority as stated in the sampling and analysis plan, or as otherwise directed. Refer to EP-ERSS-SOP-5103 for specific guidance for the samples to be obtained. The preferred collection order for some of the more common groundwater analytes is as follows: • Volatile Organics (VOAs or VOCs) and total organic halogens (TOX) • Dissolved gases and total organic carbon (TOC) • Semivolatile organics (SMVs or SVOCs) • Metals and cyanide • Major water-quality cations and anions • Radionuclides
Field Team Member (continued)	26.	Perform field chemistry measurements or field parameters (turbidity, pH, temperature, electrical conductance, and dissolved oxygen) on each sample run. Record the information in the field logbook and Water Quality Sampling Record for Westbay® Wells (Attachment 2) and any other information as needed. Reference EP-ERSS-SOP-5103.
	27.	Discard water used for field parameter measurements upon completion according to NOI. DO NOT use for analytical sample.

	28.	Preserve the samples with the appropriate preservatives as identified on the chain of custody. Refer to EP-ERSS-SOP-5AAA, Sample Containers and Preservation, for specific guidance.
	29.	Seal the lid of every sample container with a custody seal (i.e., custody tape) to ensure that samples are not tampered with.
	30.	Complete the chain of custody form for each sample set collected. Handle, package, and transport samples in accordance with EP-ERSS-SOP-5057, Handling, Packaging, and Transporting Field Samples.
	31.	Repeat Steps 6–29, as needed, to collect the appropriate volume of water for sampling as required.
	32.	When sampling has been completed at a port, decontaminate all sampling equipment by performing the following steps: • Prepare a decon solution of 1% by volume of Liquinox® in DI water (37.9 milliliters [mL] of Liquinox® /gallon [gal] of water). Label the bottle of decon solution as “Liquinox, 1% by volume.” • To decon the sample probe, make sure the valve is open. Using a wash bottle, squirt decon solution through the pigtail end and observe streaming from face seal for several seconds. Rinse in the same fashion using another wash bottle with DI water. Allow to drain and repeat rinse at least two times. Rinse the outside of the probe briefly. If unsure that the probe is adequately rinsed, collect rinsate and measure conductivity. It should be the same as the conductivity of DI water. • To decon the Westbay sample bottles, remove pigtails, open valves, and decon the pigtails in the fashion as the sampling probe in the above step. Add about 2 ounces (oz) of decon solution to one end of sampling bottle, and slosh back and forth several times while rotating the bottle. Drain. Rinse by adding about 5 oz of DI, slosh, and drain. Repeat rinse at least four times. Rinse outside of bottles briefly including threaded ends.

4.5 System Disassembly/Breakdown

Field Team Member	1.	Take down the Westbay® mast if sample event is complete. [NOTE: The mast may remain standing at the well overnight if the well casing can be locked.]
Field Team Member (continued)	2.	Secure sample trailer and field equipment.
	3.	Lock well casing.

4.6 Records Management		
Field Team Leader	1.	Maintains and submits the following records and/or documents generated to the Records Processing Facility according to EP-DIR-SOP-4004, Records Transmittal and Retrieval Process: • Water Quality Sampling Record for Westbay® Wells (pages 1 & 2) (Attachment 2) • Westbay® Pressure QA/QC Check Record (Attachment 3) • Groundwater Sampling Field Data Sheet (Attachment 4) • Field Logbook • Other Significant Information

5. DEFINITIONS

Electrical conductivity (EC) – A measure or the ease with which an electric current flows through a substance. When measured in water, it is dependent upon the presence of dissolved ions and temperature. It is the reciprocal of the resistance in ohms (Ω) between the opposite faces of a 1 centimeter (cm) cube of water at a specific temperature. Because R has units of ohm meters (Ω cm), EC has units of (Ω cm)-1, called siemens (S). Most natural waters have low conductivities, so EC is generally measured in microseimens per centimeter (µS/cm).

Groundwater – Water that collects or flows beneath the Earth's surface, filling the porous spaces in soil, sediment, and rocks. Groundwater originates from rain and from melting snow and ice and is the source of water for aquifers, springs, and wells.

Hydrogen-ion activity (pH) – The effective negative log10 of hydrogen ion activity. A measure of how acidic or basic a solution is (numerically equal to 7 for neutral solutions, increasingly basic above and acidic below that value).

Personal protective equipment (PPE) – Clothing worn by workers to minimize the potential for contamination to skin or personal clothing is referred to as anticontamination clothing, or anti-Cs. The degree of protective clothing required depends on the work area and nature of the job.

Piezometric elevation – The elevation to which the water at a specific point in an aquifer will rise; the water elevation calculated from pressure data.

Pi – Pressure inside the Westbay® casing. Pi measured above the DI water column in the Westbay® casing is equal to atmospheric pressure at a given port elevation; calculated piezometric elevation will approximate the elevation of the port. Pi measured below the DI water level inside the Westbay® casing will be the pressure head of the DI water column; calculated piezometric elevation will be that of the elevation of the top of the DI water column.

Po – Pressure in the formation outside the Westbay® casing at a specific monitoring port. Po of “dry” monitoring ports will approximate Pi at that port if the port is above the DI water column. Po of “wet” monitoring ports should not normally equal the Pi of the port. Review past field notes if they exist. Calculated piezometric elevation represents the piezometric water level at the location of the monitoring port.

Specific conductance – The electrical conductance that would occur between the faces of a 1 cm cube of water at 25 degrees Celsius (°C). Since EC is temperature sensitive, it is commonly corrected to its equivalent value at 25°C for data comparison. Some equipment makes this conversion automatically, in which case the readings should be noted as “at 25°C.” Otherwise, the water temperature at the time of reading should always be recorded along with the conductivity measurement so that the measurement can later be corrected to 25°C.

Turbidity – Refers to inorganic solids and organic matter suspended in water. Turbidity, in nephelometric turbidity units (NTUs), is measured as the intensity of light scattered by the suspended particulates in a water sample relative to a standard reference suspension.

Volatile organic compounds (VOCs) – A class of chemical compounds, predominantly hydrocarbons and halogenated hydrocarbons, with low molecular weights and low boiling points that are insoluble or slightly soluble in water.

Dissolved oxygen – The amount of oxygen dissolved in water in parts per million (ppm) by weight or in milligrams per liter (mg/L).

6. PROCESS FLOW CHART

Flow chart is to be included at a later date.

7. ATTACHMENTS

Attachment 1 Equipment and Supplies Checklist for Sampling the Westbay® MP System
Attachment 2 Water Quality Sampling Record for Westbay® Wells
Attachment 3 Westbay® Pressure QA/QC Check Record
Attachment 4 Groundwater Sampling Field Data Sheet

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	10/03	New document.	T
1	7/04	Added procedural steps.	T
2	8/04	Level 2 Resumption walkdown changes: Conduct sampling steps 1, 2, 5, and 20; HCP hazard mitigations	T
3	12/05	Added procedural steps and general editing; made recommended changes as a result of 7/05 procedural walk down; removed HCP attachment; added requirements for spotter for winch operation.	T
0	10/29/08	Additional details added and technical clarifications made. Equipment decontamination process added.	T

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

If you do not have a crypto card with A-level Access, contact creichelt@lanl.gov for instructions on credit

ATTACHMENT 1: EQUIPMENT AND SUPPLIES CHECKLIST FOR SAMPLING USING THE WESTBAY® MP SYSTEM

SOP-5225-1

Equipment and Supplies Checklist for Sampling Using the Westbay® MP System

Records Use Only

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- ☐ Sampling trailer with winch and generator
- ☐ Chain-of-custody forms
- ☐ Sample labels
- ☐ Custody Seals
- ☐ Sample collection log forms
- ☐ Personnel Protection Equipment (e.g. leather gloves, safety glasses)
- ☐ MOSDAX Sampler Probe
- ☐ MOSDAX Handheld Controller
- ☐ Four (4) non-vented sample containers
- ☐ Tool kit and replacement parts
- ☐ GeoPump and tubing
- ☐ Field Logbook
- ☐ Nitrile gloves
- ☐ Kimwipes
- ☐ Deionized water
- ☐ Alconox
- ☐ Paper towels
- ☐ Eyewash
- ☐ Well key (Med-1)
- ☐ Ball point pen (permanent dark ink; Rite in the Rain brand or equivalent)
- ☐ Felt tip permanent marker
- ☐ Monitoring Equipment (conductivity, pH, temperature, dissolved oxygen, turbidity)
- ☐ Large zip lock bag for contact waste
- ☐ Regular plastic/garbage bag for non-contact waste

Example

- ☐ Trip blanks (if required)
- ☐ Preservatives
- ☐ Roll up table
- ☐ Coolers with blue ice
- ☐ Filters (0.45 µ and silver), if required
- ☐ Small container for field parameter container
- ☐ Vacuum pump
- ☐ Tubing and attachments for Vacuum pump
- ☐ Well Specific Attachments
- ☐ Electrical cables w/GFCI
- ☐ pH papers, batteries, squirt bottles
- ☐ Monopod and wheel attachments including safety cones
- ☐ Radio, cell phone, pager
- ☐ Material Safety Data Sheets (MSDS)
- ☐ MODAX Manuals and Mount Sopris Manuals
- ☐ Westbay® Completion Log w/ Depth of Key items table
- ☐ First aid kit
- ☐ Fire extinguisher

Example

ATTACHMENT 2: WATER QUALITY SAMPLING RECORD FOR WESTBAY® WELLS

SOP-5225-2

Water Quality Sampling Record for Westbay® Wells

Records Use Only

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Water Quality Sampling Record for Westbay® Wells

Date: _____ Page 1 of 2

Project: _____

Field Team Member Signature: _____

(Print name and title, then sign)

WATER SAMPLED

Well Number: _____ Sample Type: _____

Zone Number: _____

Depth: _____

Sampling Period: Start_____ Complete: _____

SAMPLE INFORMATION

Sample Probe: _____

Filter Size: _____

Thermometer ID: _____

EC Meter ID: _____

pH Meter ID: _____

Dissolved O_2 Meter ID: _____

Turbidity Kit ID: _____

Alkalinity Kit ID: _____

Example

SAMPLE TYPES

F – Field	EQB – Equipment Blank
FD – Filed Duplicate	PEB – Performance Blank
FTB – Field Trip Blank	FB – Field Bank

Water Quality Sampling Record for Westbay® Wells

Date: _____ Page 2 of 2

Project: _____ Well Number: _____

Zone number: _____

Depth: _____

Signature: _____

Time	Run No	Volume Retrieved (liters)	Parameter Measurements							Comments
			pH	EC (µS/cm)	Temp (^{0}C)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Pressure of Zone (psi)	Other	

Example

SUBMITTAL INFORMATION

Sample ID(s): Date Submitted to SMO

_____

_____

_____

ATTACHMENT 3: WESTBAY® PRESSURE QA/QC CHECK RECORD

SOP-5225-3

Westbay® Pressure QA/QC Check Record

Records Use Only

Los Alamos NATIONAL LABORATORY EST.1943

Westbay® Pressure QA/QC Check Record

Check Record for Serial Number _____

PSI Gauge _____

Date	Met Station	Time of Met Station Barometric Reading (MST)	Barometric Pressure at met Station (mb)	Barometric pressure at Met Station (psi) (1mb=0.0145 psi)	Add 0.026 psi to Met Station Value for TA-64 Check Location	Time of Probe Reading (MST)	Probe Barometric Reading (psi)	Acceptable Range (psi)	Passed

Example

ATTACHMENT 4: GROUNDWATER SAMPLING FIELD DATA SHEET

SOP-5225-4

Groundwater Sampling Field Data Sheet

Records Use Only

Project: _____
Monitoring Well No.: _____
Sampling Zone(s): _____
Sampling Probe No.: _____

Date: _____
Start Time: _____
Technicians: _____
_____

(A) Zone No	(B) Run No.	(C) Surf. Press.	Surface Function Tests								(L) Position Sampler	Sample Collection Checks									(V) Comments (volume retrieved)
			(D) Shoe Out	(E) Close Valve	(F) Check Vacuum	(G) Open Valve	(H) Evacuate Container	(I) Close Valve	(J) Shoe In	(K) Arm In		(M) Press In MP	(N) Shoe Out	(O) Zone Press	(P) Open Valve	(Q) Time of Valve Open	(R) Zone Press	(S) Close Valve	(T) Shoe In	(U) Press In MP	

Example

Additional Comments: (pH, Turbidity, S>C>, etc.