STANDARD OPERATING PROCEDURE FOR:

GROUNDWATER AND LEACHATE SAMPLING USING DIRECT-PUSH SYSTEMS

TVA-KIF-SOP-47

Prepared by
Environmental Standards, Inc.

for
Tennessee Valley Authority
Environment and Technology
Environmental Science and Resources

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1.0 PURPOSE

This standard operating procedure (SOP) describes the procedures for collecting groundwater samples using direct push systems. Specifically, this SOP presents the procedures to be used for the collection of groundwater and leachate samples using a Geoprobe® Screen Point Sampler or equivalent sampling system and a Waterloo Groundwater Profiler® or equivalent system.

2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned tasks shall be thoroughly evaluated prior to conducting field activities. The *Site-Wide Safety and Health Plan* (SWSHP) provides a description of potential hazards and associated safety and control measures.

Prior to intrusive subsurface activities greater than 6 inches deep, the appropriate utility notifications (that is, National 811 One Call) must be made and the dates of intrusive activities must be within the lawful dates provided by the One Call Center. The Field Team Leader verifies, to the extent practicable, that utilities have responded to the One Call request and have marked their respective utilities. If there is uncertainty associated with potentially unmarked utilities, the Field Team Leader suspends work until the issues can be resolved.

Field sampling equipment is decontaminated in accordance with the *Decontamination of Equipment* SOP (TVA-KIF-SOP-08) prior to use. Although sampling typically is conducted from least to most impacted, field logistics may necessitate other sample collection orders.

The following devices are generally used for direct push groundwater sampling:

- Geoprobe® or equivalent direct push system,
- Screen Point Sampler (or equivalent) complete with the screen insert (with plug and O-rings), screen liner, and expendable drive points,
- Waterloo Profiler tip (or equivalent),
- Peristaltic pump, small-diameter bailer, or other appropriate pump, and
- In-line electrical conductivity sensor.

3.0 PROCEDURES

The following sections describe the procedures for sampling groundwater using direct push systems. Any deviations from these procedures is approved by the Project Manager and Quality Assurance/Quality Control (QA/QC) Lead and fully documented. Field work cannot progress until deviations are approved or resolved.

3.1 Pre-Job Preparation

The Project Manager is responsible for overall implementation of this SOP and ensuring that the SOP complies with current regulations and standards. The Project Manager is also responsible for the following activities:

a. Obtain equipment necessary for completing the sampling activities (see Table 1 for an example checklist of groundwater and leachate sampling equipment and materials).

b. Verify methods to be used to transport materials and identify appropriate laboratories to perform analyses.

c. Obtain appropriate laboratory-supplied sample bottles both for the required sample analyses and the required quality control (QC) sample analyses. Confirm that the analytical laboratory has been contacted and is prepared to receive the samples.

d. If sampling is conducted on personal property, provide the Field Team Leader with the schedule for sampling and verify that site/sampling area access and legal right-of-entry have been obtained, where required.

e. Review the site-specific work control documents such as the *Quality Assurance Project Plan* (TVA-KIF-QAPP), *Sampling and Analysis Plan* (SAP), SWSHP, and appropriate SOPs to determine appropriate field protocols.

f. Obtain site maps of the sampling area(s). If the site maps do not have sampling locations already indicated, review sampling locations with the TVA Project Manager and mark maps appropriately. Identify location (that is, GPS coordinates) and staking requirements as applicable.

g. Instruct the field team that no project information is discussed with the public and questions are to be referred to the TVA Outreach Center.

h. Identify appropriate/secure temporary sample storage locations if necessary.

3.2 Field Preparation

The Field Team Leader introduces the field team to the property owner, if present, upon arrival at the site (if appropriate). After introductions, the following steps are performed.

a. Predetermine sampling locations referenced in project-specific documentation. Record the sampling locations with a GPS device and mark planned sampling locations in order to verify utility clearance prior to intrusive subsurface sampling deeper than 6 inches (usually conducted by Field Team Leader or a designee).

b. Verify that the appropriate utility clearance service has marked utilities at off-site sampling locations. Confirm with the Project Manager that clearance and right-

of-access permission have been obtained from the landowner(s) for off-site sample location access. Document clearance activities and utility markings in the field logbook and request sign-offs from the Project Manager.

c. Pre-identify any potential site access logistical issues. Note any slope stability, overhead obstruction, or other physical constraints that could hinder or preclude sample collection. Notify the Project Manager of any identified sample collection issues and provide recommendations for any relocation based on field observations.

d. Establish the decontamination area away from (and preferably upwind of) potentially contaminated areas where possible. Decontaminate non-disposable sampling equipment and downhole tools that may come in contact with the sample matrix prior to use in accordance with *Decontamination of Equipment* SOP (TVA-KIF-SOP-08).

e. Obtain potable and deionized (DI) water for decontamination. Record the water source in the field logbook. Obtain approval for using onsite water for decontamination from the Project Manager/Technical Lead prior to use.

3.3 Direct Push Well Purging

With many of the direct push sampling techniques, purging is either not practical or not possible; therefore, no purging is conducted. The sampling device is simply pushed or driven to the desired depth and opened, and the sample is collected and retrieved. As a result, some samples collected in this way may not be satisfactory or acceptable for certain analyses (that is, the technique may yield a turbid sample that is not appropriate for metals analyses).

3.4 Sampling

Direct push systems are hydraulically powered machines that use static and dynamic percussion force to advance small-diameter sampling tools for collection of soil and groundwater samples. Two common groundwater sampling methods for use with direct push equipment are the Screen Point Sampler method and the Groundwater Profiler method (discussed below).

3.4.1 Screen Point Sampler

The Geoprobe® Screen Point Sampler (or equivalent) is a direct push device consisting of a PVC or stainless-steel screen that is driven to depth within a sealed steel sheath and then deployed for the collection of groundwater samples. Upon deployment, up to 41 inches of screen can be exposed to the formation. Three types of screens are available for use with this system—stainless steel with 0.004-inch slot size (reusable); PVC with 0.010-inch slot size (reusable); and PVC with 0.010-inch slot size (expendable).

The following procedure is used for collecting groundwater samples using a Screen Point Sampler (or equivalent):

a. Disassemble and decontaminate the sampler in accordance with the *Decontamination of Equipment* SOP (TVA-KIF-SOP-08) prior to use.

b. Following decontamination, reassemble the sampler, making sure any damaged or missing O-rings are replaced.

c. Thread the sampler onto the leading end of a probe rod and begin advancing the probe rod to the desired sampling depth. Petroleum-based lubricants are **not** applied to the pipe threads to facilitate ease of connection.

d. Add additional probe rods as necessary. Keep track of the rod measurements and number of rods added as the sampler is advanced so that an accurate sampling depth can be achieved.

e. Verify total depth of boring by measuring depth of Screen Point Sampler with a small diameter water level meter.

f. Note in the field logbook the difficulty/ease with which the sampler is advanced, as well as other important subsurface probing/sampling characteristics.

g. Once the desired sampling depth has been reached, collect a groundwater sample utilizing one of several standard methods depending on the equipment being used. Two of the most prevalent methods are Disposable Screen and Check-Valve Assembly as described below.

3.4.1.1 Decontaminated/Disposable Screen

a. Once at the desired sampling depth, pull the sampler up a distance to which screen length is desired that will disengage the expendable tip and create an open borehole.

b. Verify depth of screen point sampling system with small diameter water level meter. If desired depth has not been obtained, a manual push of the screen (with the use of decontaminated inner push rods) into the borehole may be required, allowing groundwater to enter the sampler.

Note: Some sampling systems do not require this step because the outer sheath of the sampler can be retracted, leaving the screened portion of the sampler in place.

c. Collect water level measurement with small diameter water level meter and record in field logbook.

d. Collect a sediment-free groundwater sample using a decontaminated small-diameter bailer passed down the inside of the probe rods or a peristaltic or bladder

pump with new certified or decontaminated Silastic®, Teflon®, Tygon®, or equivalent tubing connected to the sampler screen.

Note: Filter the samples collected for dissolved-phase analytes using a 0.45-µm in-line filter, first (if applicable). Allow the water to purge through the filter for one to two minutes prior to sample collection.

Note: Peristaltic pump is not used for collection of volatile organic compound (VOC) samples.

e. Place the sediment-free groundwater sample in the appropriate laboratory-supplied certified-clean bottleware.

3.4.1.2 Check Valve Assembly

a. Once at the desired sampling depth, attach the check valve assembly (with check ball) to one end of Silastic®, Teflon®, Tygon®, or equivalent tubing.

b. Insert the check valve assembly down the casing until the assembly is immersed in groundwater.

c. Pump water through the tubing to the ground surface by oscillating the tubing up and down.

Note: Filter the samples collected for dissolved-phase analytes using a 0.45-µm in-line filter, first (if applicable). Allow the water to purge through the filter for one to two minutes prior to sample collection.

d. Containerize the groundwater sample in the appropriate laboratory-supplied certified clean bottleware.

When the last groundwater sample has been collected, borings are sealed and closed following the guidelines of the *Monitoring Well Closure* SOP (TVA-KIF-SOP-46) to prevent a possible pathway for contaminant migration.

3.4.2 Depth-Discrete Groundwater Sampler

The Waterloo Profiler and equivalent depth-discrete groundwater samplers are direct push groundwater sampling systems that are designed to collect depth-discrete groundwater samples in a single boring with one probe entry. The following procedure is used when collecting groundwater samples with this instrument.

a. Attach the Waterloo Profiler (or equivalent depth-discrete groundwater sampler) tip to the first section of clean, heavy-duty threaded steel pipe.

b. Advance the Waterloo Profiler (or equivalent depth-discrete groundwater sampler) by pushing, pounding, or vibrating the steel pipe into the ground using one of Precision Sampling Inc.'s custom-made sampling rigs. Add clean, sections

of pipe, as needed, until the tool reaches the desired sampling depth. Petroleum-based pipe joining materials is **not** used to lubricate the pipe connections.

c. Once the tool is positioned at the first sampling depth, collect the sample from the sampling line upstream of the pump. The groundwater sample is obtained by connecting a pump (type based on sampling depth) to the Teflon®, Silastic®, Tygon®, or equivalent tubing or stainless steel tubing that is attached to the inside of the Waterloo Profiler (or equivalent depth-discrete groundwater sampler) tip.

Note: Filter the samples collected for dissolved-phase analytes using a 0.45-µm in-line filter, first (if applicable). Allow the water to purge through the filter for one to two minutes prior to sample collection.

Note: At sites where groundwater is shallow (less than 25 feet below the ground surface), samples are collected using a peristaltic suction-lift pump (for non VOC analytes). Where groundwater occurs at a depth greater than 25 feet, a double-valve pump can be used.

d. Once the sample is collected, advance the Waterloo Profiler (or equivalent depth-discrete groundwater sampler) to the next sampling depth. In order to prevent the sampling ports from clogging as the sampler is advanced through the soil, small amounts of DI water are slowly pumped (typically less than 10 milliliters per minute) out of the tip. For injection pressures up to approximately 50 pounds per square inch (psi), the water is injected by reversing the flow on the peristaltic pump. When greater injection pressures are needed, an auxiliary high-pressure, low-flow pump is used.

Note: The pumps used in this process must be in good working order and maintained carefully according to the manufacturer specifications. It is possible that inadvertent introduction of a contaminant into the subsurface could occur if the pumps are not properly decontaminated/handled.

e. When the tool reaches the next groundwater sampling depth, reverse the flow direction on the peristaltic pump so that groundwater from the aquifer can again be extracted. Purging the system before groundwater sampling is required because of the previous pumping of DI water. Purging is complete when the electrical conductivity of the extracted groundwater (measured using an in-line sensor) increases and then stabilizes.

Note: The time and water volume for the groundwater conductivity to stabilize is variable and there is no "rule of thumb" that can be routinely applied regarding the amount of time or volume of water required to achieve this goal. Groundwater generated during this purging process is collected and disposed of

properly in accordance with *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12). Once the purging process is complete, groundwater is sampled.

f. When the last groundwater sample has been collected, seal and close borings following the guidelines of Section 3.4 of the *Monitoring Well Closure* SOP (TVA-KIF-SOP-46) to prevent a possible pathway for contaminant migration.

3.5 Sample Handling, Packing, and Shipping

Samples are marked, labeled, packaged, and shipped in accordance with the *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07).

3.6 Field Quality Control Samples

Field quality control (QC) samples may include trip blanks, equipment rinsate blanks, field duplicate samples, and matrix spike and matrix spike duplicate samples. A description of common field QC samples and the associated collection method are provided in the project-wide QAPP and the *Field Quality Control Sampling* SOP (TVA-KIF-SOP-11).

3.7 Field Logbook Documentation

Field logbooks to record daily activities, including sample collection and tracking information, are maintained by the Field Team Leader. Information is entered into the field logbook by the appropriate field team member using indelible ink. In addition to the minimum requirements discussed in the *Field Documentation* SOP (TVA-KIF-SOP-06), the field logbooks document those sampling characteristics specific to this SOP and as defined in the applicable project work control documents.

The Field Team Leader and/or designee reviews the field logbook entries on a weekly basis at a minimum (daily review is preferred) for completeness and accuracy and indicates this review by initialing the entries. The Field Team Leader is also responsible for the completion of required data collection forms.

3.8 Decontamination and Waste Management

Sampling equipment decontamination will be performed in a manner consistent with the *Decontamination of Equipment* SOP (TVA-KIF-SOP-08). Investigation-derived wastes produced during sampling or decontamination will be managed in accordance with *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12).

4.0 REFERENCES

- ASTM International. *Standard Guide for Direct Push Groundwater Sampling for Environmental Site Characterization,* D6001-05, 2005.
- Geoprobe Systems. *Dual Tube Groundwater Profiler Kit – Installation and Operation Instructions*. Instruction Bulletin No. 19275, November 2001.
- Tennessee Valley Authority (TVA). *Decontamination of Equipment SOP* (TVA-KIF-SOP-08), 2010.
- TVA. *Field Documentation* SOP (TVA-KIF-SOP-06), 2009.
- TVA. *Field Quality Control Sampling* SOP (TVA-KIF-SOP-11), 2009.
- TVA. *Groundwater Monitoring Well Abandonment* SOP (TVA-KIF-SOP-46), 2010.
- TVA. *Site-Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response* (SWSHP), 2010.
- TVA. *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12), 2010.
- TVA. *Quality Assurance Project Plan for the Tennessee Valley Authority Kingston Ash Recovery Project* (TVA-KIF-QAPP), December 18, 2009.
- TVA. *Sample Labeling, Packing, and Shipping SOP* (TVA-KIF-SOP-07), 2009.
- U. S. Environmental Protection Agency (EPA) Region 4. *Groundwater Sampling. Document # SESDPROC-301-R1.* November 1, 2007.

Table 1: Suggested Direct Push Groundwater and Leachate Sampling Equipment & Materials Checklist	
Item Description	**Check**
Health & Safety	
Nitrile gloves	
Hard hat	
Steel-toed boots	
Hearing protection	
Field first-aid kit	
Eyewash	
Safety glasses	
Barricades, cones, flashing lights, signs	
Respirator and cartridges (if necessary)	
Saranex™/Tyvek® suits and booties (if necessary)	
Paperwork	
Site-Wide Safety and Health Plan	
Sampling Analysis Plan/scope-of-work/project guidance documents	
Sample location map	
Grain-size Chart/Color Table	
Field logbook	
Chain-of-custody forms and custody seals	
Drum labels	
Marker for completing drum label	
Flags for marking well locations	
Equipment	
Peristaltic pump, small-diameter bailer, or other appropriate pump	
Screen Point Sampler (or equivalent) complete with the screen insert (with plug and O-rings), screen liner, and expendable drive points	
Waterloo Profiler tip (or equivalent)	
DI water	
Laboratory-supplied and certified-clean bottleware	
Portable GPS device	
Geoprobe® or equivalent direct push equipment	
Drums	
Digital camera	
Measuring tape/ruler	
Bucket	
Electrical conductivity sensor	

End of Procedure