STANDARD OPERATING PROCEDURES FOR GROUNDWATER MONITORING WELL INSTALLATION USING THE GEOPROBE®

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Revision Page

Date	Rev#	Summary of Changes	Sections
	1	**Initial Approval**	

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1.0 Scope & Application:

1.1 This Standard Operating Procedure (SOP) is applicable to the installation of permanent groundwater monitoring wells using the Geoprobe® machine.

1.2 A separate SOP applies to soil core sampling using the Geoprobe® machine.

2.0 Summary of Method:

2.1 The method employed utilizes a Geoprobe® machine (owned by EPA New England) to drive soil probing equipment into the subsurface so monitoring wells can be installed for groundwater sampling. The machine drives steel probe rods (with inner diameter openings) into the ground, which collectively serve as a protective casing through which well screens and risers are installed. The sampler uses the correct number of probe rods based on the desired well depth for a groundwater sampling event. Next, the sampler carefully inserts pre-connected PVC screens/risers, or another monitoring well device, into the inner opening of the probe rods, (ensuring the well riser will be sufficiently above ground when the well casing is removed). After retracting the probe rods and grouting the surrounding hole, the sampler may use the well for groundwater monitoring purposes.

3.0 Definitions:

3.1 Geoprobe®: The brand name of a hydraulically-powered machine which utilizes static force and percussion to drive small diameter sampling tools into the subsurface for the purpose of sample collection, such as groundwater. Also referred to as "direct push" machines, they rely on the compression of soil and rearrangement of soil particles, (rather than traditional drilling methods), for subsurface penetration of sampling tools.
(Note: The Geoprobe brand name is a registered trademark of Kejr, Inc., Salina, Kansas).

3.2 Probe Rod: Constructed of steel, they are used as outer casings through which PVC or other type of wells are installed. They are removed during the well installation process, once the well screen/risers have been positioned in the probe hole.

3.3 Grout: A binding material with low permeability, such as bentonite, used for sealing probe holes (such as surrounding a groundwater monitoring well). This prevents contamination of the subsurface and ensures groundwater sampling integrity.

3.4 Trip Blanks: A sample of the proper preservative from the laboratory, in the appropriate sample container, taken out to the field, and returned to the laboratory for analysis without being opened. Trip blanks are generally for volatile organic compounds, low level metals, and gasoline range hydrocarbon samples. Used to assess contamination introduced during sample transport.

3.5 Laboratory Quality Samples: Additional samples will be collected for the laboratory's quality control: matrix spike, matrix spike duplicate, laboratory duplicates, etc.

4.0 Health and Safety Warnings:

4.1 Prior to initiating any Geoprobe work in Massachusetts, Maine, New Hampshire, Rhode Island, or Vermont, EPA staff is required to notify the Dig Safe System, Inc. at the following number: 1-888-Dig-Safe (1-888-344-7233). Additional information is available on their website, http://www.digsafe.com/. In Connecticut, EPA staff is required to notify 'Call Before You Dig' (CBYD) at 1-800-922-4455 at least two days prior to the proposed work. Additional information is available on their website: http://www.occ.state.ct.us/Consumerinformation/cbyd.htm

4.2 Prior to using Geoprobe equipment on a site, scan the proposed probing area with EPA New England's hand-held metal detector device in advance, to avoid any metal or electrical interference which could damage the machine or cause injury to samplers.

4.3 When working with potentially hazardous materials or situations, follow EPA, OSHA, and specific health or safety procedures. Please refer to Section 6.0 - Personnel Qualifications, of this SOP for additional information.

4.4 All proper personal protection gear must be worn when operating the Geoprobe machine, including: eye protection (e.g. safety goggles), ear protection, hard hat, steel-toed work boots, and durable work gloves.

4.5 When handling the steel probe rods, the use of durable gloves (leather or canvas) is recommended due to small burrs on rods which could cause injury to unprotected skin.

4.6 At least two field personnel should collectively remove the Geoprobe machine from the trailer. This will help to control any sudden acceleration of the machine's wheels when moved down the inclined trailer ramp.

4.7 Samples which contain chemical hazards should be handled with suitable protection to skin, eyes, etc. and established decontamination procedures should be followed for both work and personal protection equipment clean-up.

5.0 Interferences:

5.1 Geoprobe equipment should not be operated during precipitation (e.g. rain, snow, hail), thunderstorms, and other unfavorable weather events.

5.2 During the well installation process a subsurface boulder(s) may impede the path of the probe rods in a desired well location. It is recommended that one first perform a test probe of 4' to 8' into the subsurface. Therefore, prior to driving in well casing rods, one can ensure the path is clear of interferences.

5.3 If groundwater monitoring wells must be installed on private property, EPA sampling staff must ensure permission for access is granted prior to initiating work.

6.0 Personnel Qualifications:

6.1 All field samplers working at Superfund sites are required to take a 40-hour OSHA health and safety training course, and a yearly 8-hour refresher course, prior to engaging in any field activities.

6.2 The field sampler should be properly trained by experienced staff before operating the Geoprobe machine.

6.3 All personnel shall be responsible for complying with all quality assurance/quality control requirements that pertain to their organizational/technical function.

7.0 Equipment and Supplies:

7.1 Geoprobe® Soil Probing Machine (owned by EPA New England)

7.2 Mobile dual circuit power unit, with electric start engine operating on unleaded gasoline.

7.3 Hand-held metal detector device.

7.4 Probe Rods - [Large]: diameter: 2.125", length: 48"; [Small]: diameter: 1"; length: 48"

7.5 Expendable Drive Point, and Expendable Point Holder (48").

7.6 Drive Cap and Puller Cap

7.7 Rod Grip Pull System with detachable handle, (for retracting probe rods).

7.8 Well screens - 5 ft. each, Well risers - 5 ft. each (PVC or other material); and PVC top caps, or other plastic type screws.

7.9 Sampling tubing (small diameter for low-flow groundwater pumping)

7.10 Tape measure, electrical/duct tape, cutting tools

7.11 Water level sounder

7.12 Geotech "Geopump 2" peristaltic or similar water pump; (car) battery power source.

7.13 Groundwater sampling containers

7.14 Sampling Preservative (if necessary)

7.15 Coolers with ice or laboratory-approved ice packs

7.16 Site logbook, custody seals, and chain of custody form

7.17 Cleaning brushes of assorted sizes, including: small nylon bristle (for scrubbing rod threads) and a long-handle brush (for cleaning rod interiors).

7.18 Soap for cleaning probing tools, (should be environmentally safe for on-site disposal).

7.19 EPA-approved plastic gasoline refill container

7.20 Decontamination equipment and reagents:
- Decon sprayers with attached pump: distilled water; (soapy) de-ionized water
- Decon transport sled
- Larger plastic bags (for storing contaminated work boots, gloves, etc.)
- Buckets, brushes

7.21 PID - Photo Ionization Detector/Analyzer

7.22 Miscellaneous: Zip lock plastic bags, plastic containers of tap water and distilled water, paper towels, permanent or waterproof pen/markers for labeling purposes.

8.0 Groundwater Monitoring Well Installation:

8.1. Identify the proposed location of the monitoring well. Perform a brief site survey, which includes using a metal detector to scan the proposed probe location for any metal obstacles or electrical hazards.

8.2 Determine the desired depth of the proposed monitoring well, and the corresponding number of probe rods which will be needed to meet the criteria.

8.3 Remove the Geoprobe machine and accompanying mobile power unit from the trailer, using caution when moving it down the ramp. Fill the gas tank if needed.

8.4 Move the Geoprobe machine into position over the proposed monitoring well location. After connecting the power cables, unfold the probe, and place in the proper probing position (see Owner's Manual for details).

8.5 Lay out all Geoprobe accessory equipment near the work site beforehand, such as probe rods, caps, etc. that will be used in the survey.

8.6 Perform an initial test probe*. Attach a 1" drive point to the threaded end of a point holder. Add a drive cap to the holder, and place under the probe hammer in the driving position (see Owner's Manual), and turn on the Geoprobe power source. Drive the point holder into the ground, until the drive cap is a few inches above the surface. Remove the drive cap, thread a 1" probe rod onto the holder, and drive once again. Thread successive rods in a similar manner until reaching desired well depth.

[*Note: Each Geoprobe operator must wear the required personal protection gear before operating the machine. Please refer to Health and Safety Warnings, Section 4.2, for details].

8.7 Remove the probe rods using the Rod Grip Puller, attaching a puller cap to the top probe rod, retracting upward with the machine, and detaching each successive rod.

8.8 Attach an 2.125" expendable drive point to the threaded end of a 2.125" point holder. Add a drive cap to the holder, and place under the probe hammer in the driving position. Drive the point holder into the ground, until the drive cap is a few inches above the surface. Remove the drive cap, and thread successive 2.125" probe rods in the same manner as described in step 8.6 above. Make sure that your probe rod assembly is straight as its being driven into the ground. After reaching the desired well depth, the well can now be installed.

8.9 For PVC Caps: Attach a cap to the end of a screen(s). Thread one or two 5 ft. risers to the top of screen assembly. With the assistance of a second person, firmly grasp and lower the assembly through the circular opening in the top probe rod, without releasing and dropping the assembly to the well bottom. Attach additional 5 ft. riser sections until the assembly reaches the bottom of the probe rods (the well bottom). [Note: at least one foot of riser should extend past the top probe rod above the ground surface].

8.10 To retract the probe rods surrounding the monitoring well, reposition the probe machine so the Rod Grip Puller can be attached to the lower portion of the top probe rod. One person should operate the Geoprobe machine while a second person grasps and firmly presses down on the PVC screen/riser assembly. Observe whether the risers stay in place or move up with the rods.

- If risers stay in place, stable formation conditions are present. Continue retracting and detaching each successive probe rod.
- If risers move up with the probe rods, the drive point is likely located in heavy sands. If they continue to rise, place a piece of spare PVC riser over the top of the well riser, and carefully hammer the assembly back into the ground as rods are retracted. (Do not hammer directly on the well riser; this could damage or contaminate the opening).

8.11 Create a sand barrier around the well screen by pouring special “well screen sand” into the opening around the well riser to the top of the well screen. (Note: some sand may already be present due to collapse of the natural formations). The sand forms a barrier which prevents the grout from penetrating into the screened portion of the well.

8.12 Next, grout the well. EPA-EIA uses medium-sized bentonite chips (such as Pure Gold™) which are poured on the top of the sand layer surrounding the riser. Sufficiently hydrate the bentonite by pouring tap water on top of it, which initiates the sealing process.

8.13 If not immediately sampling from the well, label the riser with permanent ink, add a surface cover (preferably water resistant) and secure cover with electrical/duct tape.

8.14 If necessary, thoroughly clean and scrub all Geoprobe equipment (probe rods, caps, etc.) with soap and water. Then complete a final rinse of equipment with distilled water. Be sure to wear thick rubber gloves while cleaning.

9.0 General Groundwater Sampling Procedure: (*Note*: for more detailed information, please refer to the separate Groundwater Sampling SOP)

9.1 Using a water level sounder with tape measure, determine the depth to the water table, and depth to the well bottom.

9.2 Measure out the correct length of small diameter tubing based on measured depths. At least 12" of additional tubing should protrude above the well riser. Lower the tubing into the well opening until it reaches the mid point of the well screen.

9.3 Purge at least three well volumes of water before sampling begins, using a water pumping device, such as a peristaltic pump.

9.4 Label appropriate sampling containers with sampling details and custody information**.**

9.5 To collect sample, hold the sample container in a slightly tilted position under the well tubing dispenser, and fill to desired amount.

9.6 Repeat step 9.6 until the appropriate number of samples is obtained.

9.7 After sampling is complete: disconnect the pump, remove the tubing from the well, label the well riser, and securely cover and tape the riser opening.

10.0 Handling, Preservation, and Storage:

10.1 After retrieving groundwater samples from the monitoring well, deliver to the assigned on-site preserver (if applicable). Label the sampling container(s) with sampling details and custody information

10.2 Preserve the sample with the appropriate preservative, (unless using approved pre-preserved sample vials).

10.3 Cap the containers, and use a custody seal if sample is for enforcement.

10.4 Load all samples into a cooler(s), ensuring that the bottles are in the ice but *not* totally immersed in water.

10.5 Record all pertinent data in the site logbook and on the field data sheet.

10.6 Complete the chain of custody form. Attach the custody seals to the cooler prior to delivering to the EPA regional laboratory.

10.7 Upon arriving at the EPA regional laboratory, contact assigned Chemistry staff to log in the samples. If after hours, place in the samples in the approved refrigerated storage area.

11.0 Data and Records Management:

11.1 All data and information is to follow the Field Data Management SOP.

11.2 The chain of custody form is signed over to the laboratory. A copy is kept with the sampling records.

11.3 The sampling data is to be stored at US EPA - NE, 11 Technology Dr, North Chelmsford, MA for at least 3 years.

12.0 Quality Control and Quality Assurance:

12.1 Representative samples are required. The sampler will evaluate the site specific conditions to assure the sample will be representative.

12.2 All sampling equipment must be decontaminated prior to use and after each discrete sample following the General Field Equipment - Cleaning, Preparation, and Decontamination SOP.

12.3 All field QC samples requirements in the SAP or QAPP must be followed. These may involve trip blanks, equipment blanks, field duplicates and the collection of extra samples for the laboratory's quality control.

13.0 Waste Management and Pollution Prevention:

13.1 During field sampling and analysis events there may be hazardous waste produced from the sample collection. The waste must be handled and disposed of in accordance with federal, state, and municipal regulations. Dispose of the hazardous waste produced at the site where the work was performed, if the operating site has proper disposal available. If there is no disposal that meets regulatory requirements, the waste must be transported back to EPA-NE and transferred to the hazardous waste manager for disposal. The sample volume should be minimized to reduce unnecessary waste.

14.0 References:

14.1 U.S. Environmental Protection Agency, (EPA) 1997. Expedited Site Assessment Tools For Underground Storage Tank Sites: A Guide for Regulators. (EPA 510-B-97-001). March, 1997.

14.2 Geoprobe Systems, 1997. 1998-99 Tools and Equipment Catalog

14.3 American Society for Testing and Materials (ASTM), 1992. ASTM D 5092 Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers: *1993 Annual Book of ASTM Standards, Vol. 0408.* Philadelphia, PA.