An Exelon Company

Appendix G

Project Operating Procedure 406: Groundwater Sampling via Temporary Wells

Groundwater Sampling via Temporary Wells – POP 406

Submitted:

Approved:

LIST OF ACRONYMS

C	Celsius
CFR	Code of Federal Regulations
DO	dissolved oxygen
GFI	ground fault interrupt
HASP	Health and Safety Plan
L/min	liters per minute
MS/MSD	matrix spike/matrix spike duplicate
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential
OSHA	Occupational Safety and Health Administration
PVC	poly vinyl chloride
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAP	Sampling and Analysis Plan
POP	Project Operating Procedure
TOC	top of well casing
U.S. EPA	United States Environmental Protection Agency

1.0 SCOPE & METHOD SUMMARY

This Project Operation Procedure (POP) describes the basic techniques and general considerations to be followed for the collection of groundwater samples from temporary monitoring wells. The procedures presented in this POP are taken from the United States Environmental Protection Agency (U.S. EPA) Science and Ecosystem Division's document *Groundwater Sampling* (U.S. EPA, 2007).

This POP describes the method for collecting valid and representative samples of groundwater from temporary monitoring wells. This POP is written such that consideration of different sampling equipment may be used in different instances for collecting representative groundwater samples. Groundwater sample collection generally involves purging the water that is non-representative of the formation water from a well prior to sample collection. Water quality indicator parameters are monitored until all parameters have stabilized for three successive readings. After the indicator parameters have stabilized, groundwater samples are then collected into the appropriate bottle or containers.

It is expected that the procedures outlined in this POP will be followed. Procedural modifications may be warranted depending on field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this POP will be noted in task-specific work plans or on Field Modification Forms as appropriate and will be approved in advance by the Task Manager. Deviations from the POP will be documented in the project records and in subsequent reports.

2.0 PERSONNEL QUALIFICATIONS

Groundwater sample collection is a relatively involved procedure requiring formal training and a variety of equipment. It is recommended that initial sampling of groundwater wells be supervised by more experienced personnel.

Field personnel must be health and safety certified as specified by the Occupational Safety and Health Administration (OSHA) (29 CFR 1910.120(e)(3)(i)) to work on sites where hazardous materials may be present.

It is the responsibility of the field sampling personnel to be familiar with the sampling procedures outlined within this POP, and with specific sampling, quality assurance, and health and safety requirements outlined in this *Sampling and Analysis Plan (SAP)*, the *Quality Assurance Project Plan (QAPP)*, and the *Health and Safety Plan (HASP)*. Field personnel are responsible for the proper use, maintenance, and decontamination of all equipment used for obtaining water level measurements, as well as proper documentation in the field logbook, field forms, or electronic documentation (as appropriate).

3.0 HEALTH AND SAFETY

Groundwater sampling may involve physical and/or chemical hazards associated with exposure to groundwater or materials in contact with groundwater. When groundwater sampling is performed, adequate health and safety measures must be taken to protect field personnel. These measures are addressed in the project HASP. All work will be conducted in accordance with the HASP.

4.0 INTERFERENCES

Potential interferences could result from cross-contamination between samples and sample locations. Minimization of cross-contamination will occur through the use of disposable or decontaminated sampling equipment at each location. Decontamination of sampling equipment is discussed in *POP 105 - Decontamination of Field Equipment*.

Potential interferences could result from the power source (e.g. generator). Minimization of contamination will occur through locating the power source a sufficient distance away from the well and sampling equipment and handling the power source with dedicated or disposable gloves.

5.0 EQUIPMENT & SUPPLIES

The following equipment list contains materials which may be needed in carrying out the procedures contained in this POP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

5.1 Well Construction Materials

Well construction materials are usually provided by the drilling subcontractor. The wells will be constructed from commercially available, flush-threaded, poly vinyl chloride (PVC) 1-foot long, 10 slot (0.010 inch) well screen and PVC riser pipe. Alternatively, tube wells may also be used. If field conditions require, sand pack and bentonite chips may also be used.

5.2 Other Required Materials

- Peristaltic pump;
- Field Instruments;
    - Individual or multi-parameter meter(s) to measure temperature, pH, specific conductance, dissolved oxygen (DO), oxidation reduction potential (ORP), and turbidity,
- Water level meter or oil-water interface probe;
- Tubing (Silicone and polyethylene (or as required));
- Sample Collection Records or Electronic Data Collector such as Trimble Yuma® or equivalent;
- Disposable nitrile gloves;
- Sample kit (i.e., bottles, labels, preservatives, cooler, ice);
- Filtration equipment (if necessary);
- Sample Chain of Custody forms (as required by *POP 102 – Chain of Custody Procedures*);
- Sample packaging and shipping supplies (as required by *POP 103 – Packaging and Shipment of Environmental Samples*);
- Waterproof marker or paint;
- Distilled or deionized water and dispenser bottles;
- Flow measurement cup or bucket;

- Buckets with lids;
- Power source (generator or 12-volt marine battery) and extension cords with ground fault interrupt (GFI) protection;
- Paper towels;
- Plastic sheeting;
- Trash bags;
- Ziploc-style bags;
- Equipment decontamination supplies (as required by *POP 105 – Decontamination of Field Equipment*);
- Health and safety supplies (as required by the HASP); and
- Field project logbook.

6.0 METHODS

6.1 Installation of Temporary Well

6.1.1 Borehole Preparation

Standard direct push methods should be used by the drilling subcontractor under the supervision of field personnel to achieve the desired target depths. A hand auger (or equivalent manual technique) may be used at shallow well locations not accessible by a drilling rig.

The typical diameter of the borehole will be a minimum of 2 inches to allow sufficient annular space for natural collapse of the subsurface materials around the screen.

If the borehole is installed using hand auger techniques, a bucket auger will be used to install the boring to the proposed depth. If the soil conditions do not allow the boring to remain open, a 4 – to 6-inch diameter casing may be driven to depth to keep soil from collapsing into the boring. The temporary well would be installed through the 4 – to 6-inch casing which would then be removed leaving the temporary well in place.

If field conditions require, sand pack may be placed around the screen and bentonite chips will extend from the top of the filter pack to ground surface to ensure the sample is being collected from the screened interval.

6.2 Water Level Measurement

Identify a consistent measuring point for all temporary wells. Generally, the measuring point is referenced from the top of the well casing (TOC) on the north side of the casing.

Water level measurements should be collected in accordance with *POP 403 – Water Level Measurements in a Monitoring Well* with the following modification. The temporary well TOC will be several inches to several feet above the ground surface. Upon the water level or interface probe signaling top of water in the temporary well grasp the level/probe tape between thumb and forefinger at the TOC measuring point. While maintaining a firm grip, drag the grasped section of level/probe tape straight down to the ground surface. This maneuver removes the above ground portion of the temporary well from the depth to groundwater measurement. With the grasped area of level/probe tape at ground surface, read the

measurement at the TOC. This measurement will be the depth to groundwater from ground surface.

Collect a depth to bottom of the temporary well in the same manner as the depth to groundwater was collected. The water level measurements should be entered on appropriate field documentation.

6.3 Instrument Calibration

Field instruments will be calibrated according to the requirements of the QAPP and manufacturer's specifications for each piece of equipment (e.g., *POP 502 - Water Quality Instrumentation*). Calibration records shall be recorded in the field logbook, appropriate field form, or electronic data collector.

6.4 Well Purging Methods and Procedures

6.4.1 Objectives

Prior to sample collection, purging must be performed for the temporary monitoring wells to remove fine grained materials from within the casing and immediate surrounding subsurface sediments and to remove a volume of groundwater in the subsurface directly affected by the installation process. Purging in this manner is to ensure that a representative groundwater sample is obtained.

All groundwater samples will be collected using low flow (low-stress) purging and sampling procedures. The low-flow method emphasizes the need to minimize water level drawdown and low groundwater pumping rates to collect samples with minimal alterations to groundwater chemistry.

For this project, a peristaltic pump with disposable tubing will be used. Purge water will be pumped directly into a bucket or containment vessel. The flow rate will be recorded on field documentation. A final purging rate will be selected that does not exceed 0.3 liters per minute (L/min).

Purge water will be pumped through a flow-through cell and the following parameters will be measured: pH, specific conductivity, temperature, DO, ORP, and turbidity. These parameters will be measured with a water quality meter, calibrated according to the manufacturer's

specifications (see *POP 502 - Water Quality Instrumentation*). Turbidity may also be measured separately with a nephelometer, also calibrated to the manufacturer's specifications. A round of parameter measurements will be recorded approximately 10 minutes after the flow-through cell is full, and then every 3 to 5 minutes thereafter, until parameter values have stabilized.

Purging is considered complete and sampling may begin when all parameter values have stabilized and turbidity is below 10 Nephelometric Turbidity Units (NTU). Stabilization is considered to be achieved when three consecutive readings, taken at 3- to 5-minute intervals, are within the following limits:

- Turbidity : less than 10 NTU or ± 10%
- DO : ± 10%
- Specific Conductance : ± 3%
- Temperature : ± 3% or less than 0.5 degrees C
- pH : ± 0.1 standard units
- ORP : ± 10 millivolts

Every effort will be made to lower the turbidity to less than 10 NTU before sampling. If the turbidity cannot be reduced to below 10 NTU, the pumping rate will be reduced for 10 minutes. If turbidity still cannot be reduced below 10 NTU, samples may be collected if all other parameters are stable and the turbidity is stable (i.e. not improving). The condition will be noted on the field documentation. During hot and cold weather sampling, short tubing lengths should be utilized to avoid temperature changes and freezing of the tubing – if the sample temperature does not stabilize as the water flows through tubing exposed to ambient temperatures, this should be noted in the field notes.

If after 30 minutes of purging, stabilization of parameters is not achieved, a sample will be collected and recorded in the field notes.

All purge water will be containerized and disposed per the project plan.

If a well purges dry, a groundwater sample will be collected when sufficient water has recharged the well. The condition will be noted on the field documentation.

6.5 Peristaltic Pumps

6.5.1 General

Well purging using pumps located at the ground surface can be performed with a peristaltic pump if the water level in the well is within approximately 20 feet of the top of the well.

Peristaltic pumps provide a low rate of flow typically in the range of 0.075-0.750 L/min. Peristaltic pumps are suitable for purging situations where disturbance of the water column must be kept minimal for particularly sensitive analyses.

6.5.2 Peristaltic Pump Procedure

Attach a new sample tube set-up to the peristaltic pump. Silicone tubing must be used through the pump head and must meet the pump head specifications. A second type of tubing (e.g., polyethylene) may be attached to the silicone tubing for use as the suction and discharge lines.

Measure the length of the suction line. Start the pump and slowly lower the suction line down the monitoring well until the end is located at the midpoint of the saturated screen. Direct the discharge into a graduated bucket. Adjust the pumping rate with the speed control knob so that a smooth flowing discharge is attained.

Measure the pumping rate by recording the time required to fill a flow measurement cup or bucket. The pumping shall be monitored to assure continuous discharge. If drawdown causes the discharge to stop, the suction line will be lowered very slowly further down into the well until pumping restarts.

6.6 Sample Collection Methods and Procedures

6.6.1 Objectives

Groundwater samples can be collected using similar methods employed for purging. In most cases during sampling, groundwater will be transferred to the appropriate containers directly from the discharge source. It is important that the tubing from the pump to the flow-through cell be disconnected prior to sample collection. During transfer, discharge tubing and other equipment shall not contact the inside of the sample containers.

Groundwater samples that may require filtration (as specified in the work plan), will be filtered in the field at the wellhead using a 0.45-micron, in-line filter.

Sample bottles shall be filled directly from the pump's discharge line (after tubing has been disconnected from the flow-through cell) and care shall be taken to keep the discharge tube from contacting the sample container.

6.7 Sample Handling and Preservation

- Cap and label the container with (at a minimum) the sample identifier, sampling date and time. Additional information such as preservation information and analytical tests may also be added to the sample label as appropriate.
- Place the sample containers into a cooler and maintain on ice.
- Complete sample chain of custody and other documentation per *POP 102 – Chain of Custody Procedures*.
- Package the samples for shipment to the laboratory per *POP 103 – Packaging and Shipment of Environmental Samples*.

6.8 Equipment Decontamination

All equipment that comes into contact with groundwater will be decontaminated in accordance with *POP 105 – Decontamination of Equipment* protocol before moving to the next location. Dedicated or disposable equipment will not be decontaminated.

7.0 DATA & RECORDS MANAGEMENT

Specific information regarding sample collection should be documented in several areas: the sample chain of custody record; sample collection record, field logbook, or electronic data collector; and sample labels or tags. Additional information regarding each form of documentation is presented in the following paragraphs.

7.1 Sample Chain of Custody Record

This standard form requires input of specific information regarding each collected sample for laboratory analytical purposes, as specified in POP 102 and 103.

7.2 Sample Collection Record or Electronic Data Collector

The sample collection record requires input of specific information regarding the collection of each individual sample including sample identification, water quality parameters, collection method, and containers/preservation requirements. An electronic data collector such as a Trimble Yuma® may be used in place of or in addition to the sample collection record.

7.3 Field Logbook

The logbook should be dedicated to the project and should be used by field personnel to maintain a general log of activities throughout the sampling program. The logbook should be used in support of, and/or in combination with, the sample collection record or electronic data collector. Documentation within the logbook should be thorough and sufficiently detailed to present a concise, descriptive history of the sample collection process.

7.4 Sample Labels

Sample labels shall be completed at the time each sample is collected and attached to each sample container. Sample labeling will be conducted per this SAP and the QAPP. Labels will include the information listed below.

- Client or project name/project number,
- Sample number or designation,
- Analysis type,

- Preservative ,
- Sample collection date,
- Sample collection time, and
- Sampler's name.

The records generated in this procedure will become part of the permanent record supporting the associated field work. All documentation will be retained in the project files following project completion.

8.0 QUALITY ASSURANCE & QUALITY CONTROL

Field personnel should follow specific quality assurance guidelines as outlined in the QAPP and/or this SAP.

Quality assurance requirements typically suggest the collection of a sufficient quantity of quality control (QC) samples such as field duplicate, equipment and/or field blanks and matrix spike/matrix spike duplicate (MS/MSD) samples. These requirements are outlined in the QAPP.

9.0 REFERENCES

POP 102 – Chain of Custody Procedures.

POP 103 – Packaging and Shipment of Environmental Samples.

POP 105 – Decontamination of Field Equipment.

POP 403 – Water Level Measurement in a Monitoring Well

POP 502 – Water Quality Instrumentation

United States Environmental Protection Agency*, Science and Ecosystem Division Groundwater Sampling* (U.S. EPA November 1, 2007).