

## **Ground Water Sampling Using a Bladder Pump**

### **FSOP 2.2.8 (August 31, 2016)**

## **Ohio EPA Division of Environmental Response and Revitalization**

### **1.0 Scope and Applicability**

- 1.1 A bladder pump consists of a flexible bladder inside a rigid housing with check valves at the top and bottom. Water enters the bladder through a check valve and is lifted (squeezed) to the surface through a discharge line when air or inert gas (e.g., carbon dioxide) pressure is applied through an air line to the space between the inside of the housing and the outside of the bladder. An air compressor or compressed air/gas tank and regulator cycle the pressure on and off, allowing water to continuously enter the bladder within the pump and be lifted to the ground surface. The bladder chamber does not allow the ground water sample to contact the compressed air or gas. The check valves prevent backwashing from the discharge line and bladder. Flow can be readily controlled and low flow rates of 100 ml/min or less are easy to maintain.
- 1.2 Depending on project data quality objectives (DQOs), Ohio EPA recommends the use of polyethylene or Teflon® bladders and Teflon®/stainless steel bladder housings. Pump discharge line tubing should be composed of polyethylene or Teflon®. Both bladders and discharge line tubing are disposable.
- 1.3 Bladder pumps minimize ground water sample agitation, aeration and turbidity, and are generally recognized as the best overall sampling device for both organic and inorganic constituents (U.S. EPA 1992). Bladder pumps are Ohio EPA's preferred ground water sampling device, especially for the low-flow sampling technique (FSOP 2.2.6, Low-Flow Ground Water Sampling).
- 1.4 Ohio EPA's bladder pump can be used to sample wells up to 200 feet deep and wells with inside diameters as small as 0.75 inches.
- 1.5 All ground water sampling techniques and associated procedures should be consistent with Ohio EPA's [Technical Guidance Manual \(TGM\) for Hydrogeologic Investigations and Ground Water Monitoring](#), specifically [Chapter 10, Ground Water Sampling](#). In addition, U.S. EPA 2002 (Yeskis and Zavala) provides ground water sampling guidance for RCRA and CERCLA sites. The site-specific work plan (SSWP) will provide project objectives and DQOs. In the event there appears to be inconsistency between the TGM and project objectives or DQOs, please contact the DERR SIFU supervisor and DERR site coordinator for clarification.

### **2.0 Definitions**

- 2.1 Cycles Per Minute (CPM): the number of times the process of filling and discharging the bladder occurs (cycles) over one minute
- 2.2 Discharge: the process of the bladder closing and discharging water when pressure is applied

- 2.3 Refill: the process of the bladder opening and refilling with water after the pressure is released

### **3.0 Health and Safety Considerations**

- 3.1 Always review the site-specific health and safety plan (HASP) for site-specific hazards before performing work.
- 3.2 Refer to FSOP 2.2.4, Ground Water Sampling (General Practices) for general ground water sampling and health and safety considerations.
- 3.3 When sampling with a bladder pump and using compressed nitrogen gas or carbon dioxide, properly secure compressed gas cylinders when transporting, using or storing them.
- 3.4 When carrying a 12-volt battery, lift the battery properly. Bend your hips and knees to squat down, grasp the battery, and while keeping it close to your body, straighten your legs to lift it. Do not lift the battery by bending forward, which may cause back injury.
- 3.5 Be careful when operating a 12-volt power supply under wet conditions, and if using a generator for power supply ensure that it is grounded to avoid electrical shock.
- 3.6 If using a generator for power supply, handle gasoline carefully. Always wear protective gloves when handling gasoline, and store gasoline containers outside of the work area.

### **4.0 Procedure Cautions**

- 4.1 Refer to FSOP 2.2.4, Ground Water Sampling (General Practices) for general ground water sampling procedure cautions.
- 4.2 If NAPL is encountered in a monitoring well, do not perform ground water sampling. Immediately notify the DERR-SIFU supervisor and DERR site coordinator.
- 4.3 Do not lower or lift the bladder pump inside a well using the discharge tubing. Instead, use a safety cord for lowering and lifting the pump. The cord should be composed of an inert material that will not affect ground water quality, and should be tied to the pump using a non-slip knot such as a bowline.
- 4.4 When using a bladder pump in a well containing high levels of turbidity or suspended solids, fine sediment may damage the bladder or cause the check valves to fail.

### **5.0 Personnel Qualifications**

Ohio EPA personnel working at sites that fall under the scope of OSHA's hazardous

waste operations and emergency response standard (29 CFR 1910.120) must meet the training requirements described in that standard.

## 6.0 Equipment and Supplies

- 6.1 Stainless steel bladder pump
- 6.2 Dual tubing (connected air line and discharge tubing)
- 6.3 Disposable bladders
- 6.4 Aluminum lock discs
- 6.5 Safety cord
- 6.6 Knife or tubing/cord cutters
- 6.5 Control box and regulator
- 6.6 Air compressor powered by 12-volt power supply and generator or compressed air/gas tanks
- 6.8 Other ground water sampling equipment and supplies as needed per FSOP 2.2.4, Ground Water Sampling (General Practices)

## 7.0 Procedures

- 7.1 Measure the well's static water level and total depth in accordance with FSOP 2.2.2, Ground Water Level Measurement.
- 7.2 Assemble the pump per the manufacturer's instructions, taking care to prevent potential cross-contamination (e.g., assembling the pump over a clean sheet of plastic to prevent direct contact with the ground).
- 7.3 Calculate the well volume, even if low-flow sampling. (If the well yield is too low to stabilize the water level for low flow sampling, the volumetric sampling technique will need to be used.)
- 7.4 Using the safety cord, slowly and carefully install the pump in a manner that minimizes disturbance to the water column in the well. The pump should be installed in the approximate center of the screened interval. Avoid placing the pump at the bottom of the well to avoid increasing turbidity.
- 7.5 When low flow sampling, measure the static water level with the pump in the well. Monitor the static water level during sampling to ensure that drawdown is minimized. Follow other low-flow sampling procedures as described in FSOP 2.2.6, Low-Flow Ground Water Sampling.
- 7.6 Bladder pumps operate by alternating between refill and discharge cycles, which are measured in cycles per minute (CPM). (Each round of refill and discharge is one cycle.) Adjust the CPM control to increase or decrease the pumping or discharge rate. One CPM pressurizes for a longer time and should be used on deeper or lower yielding wells, while 4 to 6 CPM may be used on shallow or higher yielding wells.

- 7.7 The discharge rate may be optimized by adjusting the refill and discharge cycle lengths (measured in seconds on the control box readout).
- 7.8 The volume of water purged in one discharge cycle multiplied by the CPM equals the pumping rate (e.g., 75 ml/cycle x 4 CPM = 300 ml/min). Measure the volume being discharged per cycle at the start of purging and periodically afterwards.
- 7.9 Increase the refill time or reduce the pressure to reduce the pumping rate.
- 7.10 Refer to the pump's manual as needed for operating instructions.
- 7.11 After purging criteria have been met, collect ground water samples in accordance with FSOP 2.2.4, Ground Water Sampling (General Practices). Handle ground water samples in accordance with FSOP 1.5, Sample Custody and Handling.
- 7.12 Decontaminate pump between sampling locations following the manufacturer's instructions and in accordance with FSOP 1.6, Sampling Equipment Decontamination. Replace the bladder if required based on the SSWP DQOs.
- 7.13 Dispose of investigation derived waste in accordance with FSOP 1.7, Investigation Derived Wastes.

## **8.0 Data and Records Management**

Refer to FSOP 1.3, Field Documentation.

## **9.0 Quality Assurance and Quality Control**

Refer to the SSWP and FSOP 2.2.4, Ground Water Sampling (General Practices).

## **10.0 Attachments**

None

## **11.0 References**

FSOP 1.3, Field Documentation.

FSOP 1.5, Sample Custody and Sampling

FSOP 1.6, Sampling Equipment Decontamination

FSOP 1.7, Investigation Derived Wastes

FSOP 2.2.2, Ground Water Level Measurement

FSOP 2.2.4, Ground Water Sampling (General Practices)

FSOP 2.2.6, Low-Flow Ground Water Sampling

Ohio EPA, May 2012, Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring, Chapter 10, Ground Water Sampling: Ohio EPA Division of Drinking and Ground Waters

U.S. EPA (D. Yeskis and B. Zavala), May 2002, Ground Water Sampling Guidelines for Superfund and RCRA Project Managers (Ground Water Forum Issue Paper): Office of Solid Waste and Emergency Response, EPA 542-S-02-001

U.S. EPA, November 1992, RCRA Ground -Water Monitoring: Draft Technical Guidance: Office of Solid Waste