HydraSleeve™

A New No-Purge, Non-Displacement Groundwater Sampler

What Is It?

The HydraSleeve sampler is designed to collect representative water samples from monitoring wells without purging. The disposable sampler collects a discreet sample from only the "fresh formation" water in the screened interval of the well. It is fast, inexpensive, simple to use, generates no purge water and collects a sample suitable for all analytical parameters.

Why It Works

The accepted protocol for sampling monitoring wells has required the removal of 3 to 5 times the volume of standing water in the well screen, casing and the surrounding filter pack prior to collecting a sample for analysis. This was done to assure that the fluid collected came from the formation and did not contain stagnant water from the non-perforated portion of the well. Using traditional sampling devices such as bailers or various pumping systems made this a time consuming (usually 1 to 2 hours per well) and costly process. If the well was contaminated, the water had to be containerized and disposed of in an acceptable manner. Disposal of groundwater that qualifies as a hazardous material can cost over $200 for a 55 gal drum. When multiple wells are sampled the costs quickly mount. Obviously, the less water that has to be removed prior to collecting a sample the better.

There has always been a strong interest in simplifying groundwater sampling by reducing the purge water and time required to complete a traditional sampling event. Over the past several years new methods and tools have been introduced to accomplish these objectives. Low flow sampling, passive diffusion sampling and, in special cases, no purge sampling using conventional bailers have been tested. These technologies are gradually being accepted as alternatives to the traditional purge and sample methods.

The underlying principal behind all of these new sampling methods is based on the premise that the screened interval is constantly in dynamic equilibrium with the aquifer. Numerous studies have shown that the flow of groundwater through the screen is mostly horizontal and laminar, with little or no mixing with the overlying water column. The HydraSleeve Sampler utilizes this principal to provide an inexpensive tool to sample monitoring wells for all parameters without generating purge water.

How Does It Work?

Operation of the HydraSleeve Sampler is simple. It is only open during sample collection, not during placement or retrieval of the sampler. After lowering the sampler into the screened interval, the mixed well water is allowed to return to equilibrium. During this period, usually a minimum of one day, the sampler remains closed. To collect a sample the device is repeatedly pulled upward about six inches and allowed to drop back down using the suspension line.

As it is pulled upward the top loading check valve opens and allows water to be "pumped" downward into the flexible chamber. On the downward cycle the check valve closes trapping the sample within the chamber. The next upstroke repeats the process and the cycle continues until the bag is completely full. Water is collected from immediately above the check valve. During the filling of the sample chamber there is no draw down in the well and minimal agitation in the well bore. The elasticity of the bag permits it to expand slightly, like a balloon.

When full, the internal pressure and the floating ball keep the check valve closed as the device is pulled upward through any stagnant water in the casing, preventing mixing with the sample. Once withdrawn from the well the fluid can be transferred from the sample tube to holding vials for analysis. The sampler can be made any diameter or length to accommodate various sample volume or well diameter requirements. For repetitive sampling, the HydraSleeve can be left sealed in screened interval for indefinite periods between sampling events.

Why Use It?

- Generates no purge water
- Inexpensive to use; Can cut sampling costs by more than 50%; Disposable samplers cost less than $25 each.
- Easy to use; No training required.
- Accurate; Thus far has shown good correlation with samples collected using traditional purge and sample procedures.
- Can collect samples suitable for all types of chemical analyses.
- Fast; Average time to collect a sample is approximately 5 minutes; Total field time can be cut in half.
- Easy concept to understand; Similar to bailing, the most common sampling method but without the purge water.

Other Technologies

Low Flow Sampling

Low flow sampling (see Micro Purge document) is increasingly accepted by our industry and regulators as an alternative to conventional purge and sample methods. Low flow sampling consists of slowly removing a very limited volume of water from the well, inducing little or no draw down of the water column within the well. Low flow sampling is based on the rationale that the screened section of a well is constantly replenished with fresh water flowing through the screen from the formation. Water in the screened interval also remains in equilibrium with formation water through molecular diffusion. Water in the non-slotted portion of the well casing, above the slotted screen, is usually stagnant and not representative of in-situ conditions.

To implement low flow sampling, a dedicated pump (one that is left in the well for sampling purposes) is lowered into the screened interval. As the pump is lowered, it first passes through the stagnant water in the non-slotted casing mixing it with the fresh formation water in the slotted portion below. Due to mixing, the pump must sit undisturbed until the well once again reaches equilibrium. After stabilizing, usually after a day or more, sampling can begin. The pump is started and water is withdrawn from the well at a rate, which does not result in lowering and mixing of the stagnant water column into the screened interval. As the water is slowly pumped from the well it is monitored for stabilization of indicator parameters.

As soon as parameters have stabilized, indicating that the pumping system has been purged of extraneous water and water is coming from the formation, a sample is collected. Low flow sampling is a comparatively complex procedure and the capital costs of equipment used to conduct it can be high. The dedicated pump and tubing can cost between $400 and $800 per well. Reusable surface instrumentation which can be used at each individual well costs between $2,500 and $6,000.

No Purge Sampling With Conventional Bailer

A paper was presented at the 1997 Outdoor Action Conference by SECOR that took low flow sampling a step further to no purging at all. Like low flow sampling the "No Purge" concept is based on the premise that a well's intake screen and filter pack are more permeable than the formation being sampled and that water is constantly flowing through the screened interval. If there is no stagnant water in the casing, as when the slotted well screen extends above the top of the water table, it has been purposed that purging is not needed.

A conventional bailer is dropped into the water column and a sample of the groundwater is immediately collected. Analyses of 556 UST wells that had no purge samples collected and were subsequently purged and sampled showed very similar analytical results. To use this methodology, the screened interval of the well must extend above the water table, eliminating the presence of stagnant water, which would mix with the formation water as the bailer is lowered and can contaminate the sample in the bailer as it is recovered.

Diffusion Samplers

Another emerging technology is groundwater sampling using a diffusion sampler (see attached literature). Diffusion sampling is a passive sampling system that uses a sealed polyethylene (PE) bag filled with deionized water and suspended in the screened
interval of a monitoring well. Volatile organic contaminants (VOC's) in the formation water flowing through the screened interval diffuse into the PE bag and reach equilibrium with the water in the bag.

After allowing approximately 14 days for the process to equilibrate the sampler is withdrawn and the water in the bag is removed and analyzed. Only specific VOC contaminants will diffuse through the PE walls of the bag and different contaminants diffuse at different rates. Varying diffusion rates mean that the sampler must remain in the well long enough to allow time for the contaminant with the slowest diffusion rate to equilibrate.