

# Demonstration/Validation of the Snap Sampler Passive Groundwater Sampling Device (ER-200630)

## Background and Objective of the Demonstration

Low-flow purging and sampling methods are commonly used to monitor groundwater but are expensive because of the time required for parameter stabilization during purging and costs of purge water handling and disposal. Alternative no-purge methods are now available, but some are limited by analyte type<sup>1</sup> and others are limited due to concerns about where in the well bore the sample comes from<sup>2</sup> and whether they can accurately represent certain DoD-critical compounds such as TCE<sup>2,3</sup>. Given the high costs associated with long-term monitoring, a sampling method that is less costly but still able to yield high quality data is clearly needed. The objectives of this project were to demonstrate that the Snap Sampler can provide technically defensible analytical data at substantial cost savings for the wide spectrum of analytes that are of concern to DoD.

## Technology Description

The Snap Sampler is a passive groundwater sampling device that can be used to obtain whole water samples at a specific point in time—not a time-averaged result. The device consists of a system that holds single or multiple bottles that are open at both ends during deployment and equilibration. The equilibration period allows three things: 1) recovery from disturbance caused by placing the device in the well; 2) reestablishment of the natural flow pattern in the well; and 3) chemical equilibration of the materials in the sampler and bottles with analytes in the well. Predeployment prevents data quality degrading losses of analytes due to sorption by the sampler materials—a potential problem for plastic sampling devices and even pump discharge tubing<sup>4,5</sup>. Also, by allowing time for the well to recover prior to collecting the sample, the well is not agitated during sample collection, thus particles are less likely to be entrained in the sample. Once the equilibration period is complete, the Sampler is triggered and the sample is sealed under *in situ* conditions. In the case of Snap Sampler VOA vials, samples can be prepared for laboratory submittal without exposing sample, further reducing potential for analyte losses and variability associated with well-head sample handling<sup>6</sup>.

## Demonstration Methods and Results

Laboratory comparisons were conducted at the Cold Regions Research Laboratory (CRREL) in Hanover, New Hampshire. Multiple comparisons were conducted in the lab using a standpipe and measured control samples. Dissolved concentrations of several VOCs, metals, and explosives were tested. Field demonstrations were conducted at CRREL and other field locations, including: the former Pease Air Force Base (AFB) in Portsmouth, New Hampshire; the former McClellan AFB in Sacramento, California; the Louisiana Army Ammunition Plant (LAAP) in Minden, Louisiana; and the Silrism Sanitary Landfill and Lowell, Massachusetts. Field comparisons included multiple well comparisons at each site. Each monitoring well was sampled using a combination of Snap Samplers, Regenerated Cellulose (RGC) passive diffusion samplers, and USEPA low-flow purging and sampling protocol. Analytes measured at the Pease site included total and dissolved concentrations of As, Ca, Fe, Mg, Mn, K, and Na. At LAAP, explosives were sampled. At Silrism, VOCs were sampled. At McClellan, samples were collected for a range of analyte types including dissolved and total inorganics (non-metal anions, metalloids, and metals), three chlorinated solvents, and MTBE. The performance criteria included the following: 1) could the method be used to collect samples for a range of contaminants; 2) could the method provide reproducible results; and 3) was there agreement between the passive sampling methods and low-flow purging and sampling for the analytes of interest.

For the laboratory study, the Snap Sampler and control samples matched for all analytes tested, including VOCs, explosives, perchlorate, metals and other inorganics, showing no statistical difference in paired samples for all analyte types.

For the field sampling, there was excellent agreement between analyte concentrations in the Snap Sampler and low-flow sampling. These relationships were linear with the slopes nearly equal to 1.0. There were no statistically significant differences between analyte concentrations in the Snap Sampler and the low-flow sampling for the VOCs, dissolved inorganics, total non-metal anions, and most of the total metals and metalloids. The exceptions to this were for unfiltered Fe (at Pease and McClellan sites) and unfiltered Mn (at the McClellan site) where concentrations were statistically higher in the Snap Sampler samples. However, this result may have been an artifact of turbidity associated with installation of multiple devices. There were no differences found in filtered metals samples. In some cases, there was high variability in duplicates for both the low flow and Snap Samples, although these were often for concentrations near the reporting limit. Overall, the field implementation showed consistently good agreement between the Snap Sampler and the low flow comparator.

### Implementation and Cost Savings

The Snap Sampler was found to be relatively easy to use, yielded results equivalent to low flow sampling, and provided substantially lower sampling costs. Long-term monitoring costs were extrapolated for two demonstration sites assuming that there were 50 wells and that quarterly sampling was conducted over 10 years. The cost savings associated with using the Snap Sampler was 46% and 67% for McClellan and Pease, respectively. Much of the cost savings was a result of the reduced sampling time needed to collect samples and reduction of waste handling and disposal cost. Compared to other no-purge sampling methods, the Snap Sampler yielded very similar long term cost advantage, without a risk of analyte limitation or divergence from equivalence to low flow purging and sampling techniques. Limitations of the Snap Sampler method include a requirement for 2-inch or larger monitoring wells and a sample volume constraint for certain analytes or longer analyte lists.

### Conclusion Points

- The Snap Sampler proved equivalent to controls in the laboratory for all analytes tested, including VOCs, explosives, perchlorate, metals and other inorganics.
- The Snap Sampler proved equivalent to controls in the field for all analytes tested, including VOCs, explosives, metals and other inorganics, except where turbidity in both purge and no-purge samples didn't allow positive conclusion of equivalence for some metals analytes.
- The Snap Sampler was demonstrated to be a significant cost-saving measure when compared to low flow sampling methods and a similar cost saving measure when compared to other passive sampling techniques.
- The Snap Sampler has a lower risk profile than other no-purge techniques because of its proven analytical capability; and with this Demonstration/Validation, it should require less prove-out effort at individual installations.

### Points of Contact

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