TechData Sheet

Naval Facilities Engineering Service Center
Port Hueneme, CA

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Multi-Level Groundwater Monitoring System at Hunters Point Shipyard

A Demonstration of the Continuous Multichannel Tubing System

Conducted by: Precision Sampling Inc., Richmond, CA and Conor Pacific/EFW, Palo Alto, CA
In cooperation with: Bay Area Defense Conversion Action Team Environmental Technology Partnership

INTRODUCTION

A Continuous Multichannel Tubing (CMT®) System was installed at the Hunters Point Shipyard by Precision Sampling Inc., and Conor Pacific/EFW on 27 January 2000. The project was sponsored by the Bay Area Defense Conversion Action Team Environmental Technology Partnership (BADCAT ETP).

HUNTERS POINT FIELD DEMONSTRATION

The Hunters Point Shipyard is located along the western shore of the San Francisco Bay. The site is contaminated with a variety of chlorinated and non-chlorinated volatile and semi-volatile organic compounds. Groundwater sampling was necessary in order to characterize the site for remediation. Conventional monitoring wells have a single, often broad, sampling depth. Conventional wells with screen zones greater than 2 feet can yield diluted contaminant concentrations based on varying concentrations within the screen depth range. This can lead to inaccurate assessment of the vertical contaminant concentration distribution.

A demonstration of the CMT® System was performed at the Hunters Point Shipyard. The CMT® System was used to take seven separate groundwater samples from one well. The first sample was taken 8 feet below ground surface (bgs), followed by samples at 11 feet bgs, 16.5 feet bgs, 22.5 feet bgs, 25.5 feet bgs, 29.5 feet bgs, and 34.5 feet bgs. The CMT® System was installed next to an existing well, with a 10-foot screen between 15 and 25 feet bgs, which was concurrently sampled to serve as a comparison. By sampling multiple depths from a single well, this system provides a better understanding of the 3-dimensional contaminant distribution and the hydrologic conditions of the aquifer. The demonstration activities and objectives are summarized in Table 1.

CMT® SYSTEM TECHNOLOGY

The CMT® System allows access to different depths with one device. The key design component consists of a customized multi-chamber tubing. The device is a 1.7-inch OD polyethylene tubing, internally partitioned to form seven separate internal chambers within the larger tube. Each chamber is approximately a ½-inch in diameter and extends the length of the tubing (Figure 1).

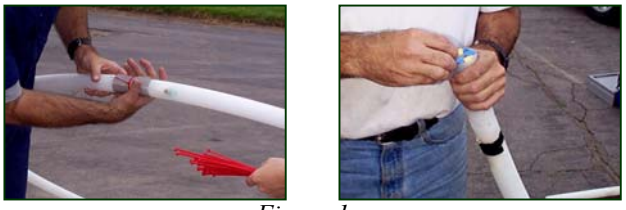

Figure 1

The multi-level tubing is designed to be assembled at the ground surface and inserted into a boring or temporary casing (Figure 2). For each desired sampling depth, a set of three 7/16-inch diameter holes are drilled into one of the chambers to serve as a water sample entry port. A polyethylene plug is inserted to prevent the accumulation of stagnant water in the chamber below each port. A sand pack is attached at each sampling port, and serves as a filter to remove fine particulates. In order to isolate aquifers or other hydrogeologic features, bentonite packers are positioned along the CMT® well between the ports.

Figure 2

COST

The cost for the CMT tubing ranged from $3.95 to $6.50 per linear foot (1999 U.S. dollars). Cost savings is site-specific, however, the CMT® system has proven to be a highly cost effective technology to delineate the vertical profile of the contamination.

	Activities	Objectives
1	Drill and Core Logging	Helped identify subsurface features and well design.
2	Well Construction	Installed access ports and sealing packers above ground.(Figure 1)
3	Well Installation	Used direct push method (Figure 2).
4	Evaluation of Bentonite Packer Seal Integrity	No mixing between any sampling zones except two zones closest to ground surface. Mixing in upper zones indicated a faulty seal or two sampling zones accessing the same aquifer.
5	Groundwater Sampling	Groundwater retrieved successfully with bailer and peristaltic pump system (Figure 3).
6	Chemical Assessment of Injected Polyethylene Seal	Polyethylene seal found to have no impact on quality of water samples.
7	Water Level Measurements	Showed method is compatible with conventional approaches.
8	Graphing of Contaminant Concentration Data with Sample Depth	Graphs gave 3-dimensional understanding of plume for better site characterization and cost-effective cleanup. Showed maximum contaminant concentration between 11 and 17 feet bgs. (Resolution of measurements not available with traditional wells.)
9	Comparison of Conventional Monitoring Well Results and CMT Monitoring Results	Must be qualitative because conventional wells take composite samples from 5 or more feet of screen depth while CMT wells take separate 1-foot screen interval samples.

Table 1

ADVANTAGES OF CMT® SYSTEM

- Up to seven discrete depth zones can be monitored at each borehole location.
- 1/2-inch diameter chambers reduce the amount of purge water generated to about a tenth of conventional 2-inch diameter well of equal depth.
- System allows repeated collection of water or vapor samples from known points in aquifer and vadose zones.
- One piece, continuous construction increases reliability by eliminating joint leakage.
- System is less expensive than traditional monitoring wells because it gives access to seven sampling locations with the installation of only one well.
- Wells can be installed by direct-push and conventional drilling methods.

MORE DEVELOPMENTS FROM OTHER SITES

- Larger diameter tubing has been developed for use with conventional bladder pumps. This tubing has only four chambers, but reduce the need to purchase specialized sampling equipment.
- CMT® Systems have been successfully installed at depths up to 200 feet.
- Larger diameter bentonite seals are now commonly used for a better seal.

Figure 3

LIMITATIONS OF CMT® SYSTEM

- More samples generated per well.
- Bladder pumps or submersible pumps do not fit in the small diameter chambers. But small diameter equipment is commercially available for sample retrieval and water level measurements.
- Compared to standard monitoring wells, results of samples may be different since conventional wells are not discrete devices and samples represent an average concentration in the larger screened zone.
- Historical data from conventional wells cannot be compared.
- Some contaminants may diffuse across polyethylene structure and affect adjacent chambers.
- EPA expected to issue guidance discouraging use of peristaltic pump for VOCs. Therefore, other water retrieval methods may be required.

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BADCAT ETP:
Bay Area Defense Conversion Action Team Environmental Technology Partnership is a public/private partnership of the Bay Area Regional Technology Alliance, Bay Area Economic Forum, California Environmental Protection Agency, San Francisco State University, Center for Public and Environmental Oversight, U.S. Environmental Protection Agency, U.S. Navy, Chevron and other experts working together to promote the cleanup and conversion of closed military bases in the San Francisco Bay Area through the application of innovative environmental technologies.