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Soil and Groundwater Cleanup

CASE AND BAIL METHOD FINDS DEEP DATA

YIELDS MAXIMUM DEEP GROUNDWATER INFORMATION

AT SHALLOW COST

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Whenever a large area with deep groundwater contamination must be characterized, environmental consultants face the challenge of thoroughly and cost-effectively investigating the area without creating a "pincushion" of monitoring wells. For a comprehensive site characterization, vertical chemical profiling of deep groundwater is required, but is difficult to accomplish without numerous monitoring wells completed at varying depths.

An alternative to the conventional overuse of monitoring wells is the case-and-bail method, which maximizes the amount of data collected and minimizes investigation costs.

The case-and-bail method uses an air-rotary, casing-hammer-drill rig to drive a column of 250 or 300-millimeter pipe into the subsurface as the drill bit advances. When the pipe reaches the desired depth, the drill rods and water that fill the pipe are removed. A sampling device is lowered to the bottom of the pipe, and a sample of the groundwater at that discrete depth is collected and retrieved to the surface. The sample is analyzed on site by a mobile laboratory.

The process is repeated at increasing depths until derived cut-off levels are reached. Once a pre-defined cut-off level is attained, boring and sampling are terminated, and the hole is either plugged and abandoned or completed as a monitoring well.

At a site where releases of volatile organic compounds (VOCs) have occurred over the past 30 years, GCL of Albuquerque, New Mexico, is using the case-and-bail method to characterize the lateral and vertical extent of VOCs that have migrated off site in groundwater, which occurs at a depth of over 75 meters below the ground surface.

GCL chose the case-and-bail method because depth-discrete samples can be collected and real-time decisions made as to whether to plug a boring or install a monitoring well. If a

monitoring well is deemed necessary, the most appropriate depth of completion can be determined without installing numerous unnecessary and costly monitoring wells at varying depths.

For the case-and-bail method to be most effective, it is necessary to understand the physical environment being investigated. Since no specific information about the geology beneath the site existed, GCL initially drilled one corehole to the top of the regional aquitard using core drilling to generate actual samples of the aquifer matrix. A suite of geophysical logs was completed for the corehole to create a baseline comparison between direct coring and indirect geophysical logging investigation techniques. This preliminary work established the basic guidelines the investigation would follow.

With a clear understanding of the site geology, case-and-bail sampling found VOCs at the top of the water table and traced them downward for an additional 30 meters. Two consecutive non-detect samples occurred before the top of the regional aquitard, which was determined by the coring to occur at approximately 60 meters below the top of the water table. A geophysical log of the boring, compared to direct observation of the cuttings and correlated with the original corehole and geophysical logs, showed the depth of the VOCs correlated to a clay-rich zone that also occurred at approximately 30 meters below the top of the water table.

Using the results of the case-and-bail sampling, GCL determined that since the horizontal limits of the plume were not discovered, a single completion groundwater monitoring well would be installed at the top of the water table, and the case-and-bail program would continue further downgradient.

To help determine the lateral and vertical limits of the plume, the next case-and-bail boring was completed more than 300 meters downgradient from the first location. The case-and-bail sampling again traced VOCs from the top of the water table at 75 meters to approximately 106 meters below ground surface. The same clay-rich zone found in the first boring also occurred in the second, and appeared to impede the downward migration of VOCs below that zone. Since the horizontal limit of the plume was not found, the borehole was plugged and abandoned, and the investigation moved still further downgradient.

Another case-and-bail boring was completed 900 meters downgradient from the site. The results of this boring indicated that the horizontal limit of the VOC plume was near, and vertical migration of the VOCs was more extensive than observations made during the previous borings. In the upper 30 meters of the aquifer, VOCs were discovered to be below regulatory standards, however, VOCs occurred at concentrations just above the regulatory standard in the lower 30 meters of the aquifer.

Because data indicated the VOC plume was dipping slightly downward as a function of distance from the site, a monitoring well was installed to monitor groundwater chemistry in the deeper portion of the aquifer over time. A 20 millimeter piezometer was installed into the same borehole to allow the top of the water table to be measured so the direction of groundwater flow could be recalculated. The piezometer was used because the case-and-bail sampling determined that VOCs were insignificant at shallow depths and all that was

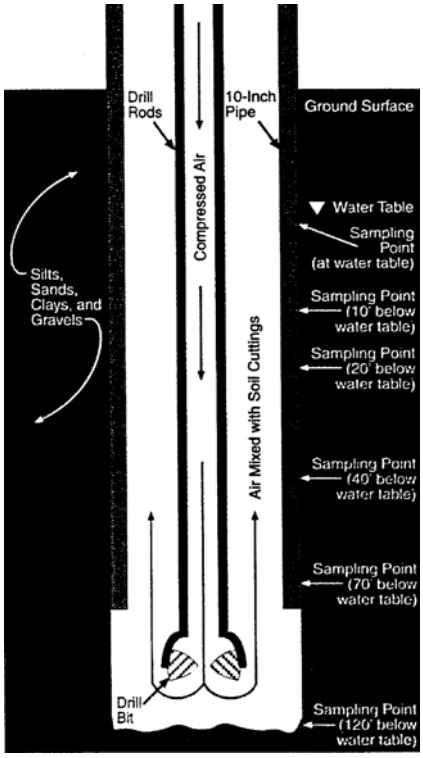
necessary for continuation of the investigation of the shallow plume was the ability to measure the depth to groundwater. This well design is substantially less costly than a conventional monitoring well cluster.

To date, the ability to determine a vertical profile of the groundwater chemistry without installing a costly series of monitoring well clusters will save more than $1 million in characterization costs. These savings are the result of the elimination of unnecessary monitoring wells, as well as elimination of the expense of ongoing sampling that would be required for those monitoring wells for an indefinite time.

This investigation is continuing. So far, it includes one corehole and five case-and-bail borings – three were completed as shallow monitoring wells, one as a deep monitoring well, and one was plugged and abandoned. It is anticipated that three to five more borings will be required to complete characterization of the plume.

While the case-and-bail method is not feasible for all site characterizations, it is a practical solution for medium-to-large-scale groundwater characterization where the potential for vertical migration of contaminants exists.

DIAGRAM OF DRILL-BIT & BOREHOLE:



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