Is the Clay Layer Really a Barrier: DPT Provides the Answer

by
Daniel Pardieck, Joseph Guarnaccia (Ciba Specialty Chemicals),
and Seth Pitkin (Stone Environmental)

At a Superfund site in New Jersey, industrial wastes, including DNAPLs, were disposed of in an unlined area over a period of 20 years. During several remedial investigations aimed at characterizing the extent of the problem, soil borings were analyzed in and around the waste disposal area. From these data, it was discovered that a clay layer of limited areal extent, but supporting a perched water table, was present between the disposal area and the unconfined sandy aquifer below. It was theorized at the time that the clay unit represented an effective barrier for the downward migration of DNAPL. It was further theorized that the source of contamination in the aquifer was dissolved-phase contamination in the perched water flowing to the edge of the clay several hundred feet down-gradient of the source where it "spilled off" into the aquifer.

During the soil-boring program, the clay unit was not breached because of the potential to mobilize DNAPL. As a result, much was learned about the extent and surface of the clay layer, but relatively little was learned about its stratigraphy, and the potential for internal sand stringers with sufficient continuity to transmit either dissolved phase contamination or DNAPL.

Direct Push Technology (DPT) was used to verify the conceptual model of a competent clay layer. The probes provided real-time vertical profiles of hydraulic conductivity, hydraulic head, and water quality to depths of 70 to 100 feet. The combination of these data in transects of several push locations was necessary to determine how contaminant mass reached the aquifer. Profiles were completed along the down-gradient edge of the clay to determine the location of dissolved mass entry points and through the clay layer itself to assess the stratigraphy. It was discovered that in general the clay was an effective barrier for DNAPL migration, but the existence of significant sand stringers provided conduits for mass transport to the aquifer at locations other than expected.