Successful Closure of a DNAPL Site: Lessons Learned

Craig A. Cox (Craig_Cox@CoxColvin.com)
(Cox-Colvin & Associates, Inc., Plain City, Ohio, USA)

Background/Objectives. In 1985, a catastrophic release of 500 gallons of TCE occurred within a process room at an industrial site in central Ohio. Initial remedial efforts conducted by an environmental consulting firm were able to reduce a small portion of the contaminant mass located in the immediate vicinity of the building. However, it was suspected that the majority of the mass remained trapped beneath the building slab and foundation.

The site was assessed and a long-term groundwater monitoring program ensued under a consent order. A proposed remedy for the site would have required demolition of the facility, which was unacceptable to the site owner. At the end of the proposed groundwater monitoring period, site remediation would be required. The site owner's objective was to successfully obtain RCRA close without the need to demolish the site and abandon its operations.

Approach/Activities. In 2002, the site owner hired Cox-Colvin & Associates to investigate and remediate the release without jeopardizing the industrial operations. The released TCE presented itself as a dense non-aqueous phase liquid (DNAPL) beneath the building and in perched water bodies within a glacial till setting. After completing the final two years of groundwater monitoring required by the consent order, a cooperative approach to site remediation was negotiated with Ohio EPA to complete the final investigation and remediation phase on a voluntary basis.

Membrane interface probe (MIP) and high-resolution soil sampling techniques were used to refine the understanding of the DNAPL configuration. Remediation consisted of a combination of high vacuum dual phase extraction (HVDPE) followed by potassium permanganate flooding. Mass reduction was assessed using continuously monitored vapor stream concentrations, recovered fluid concentrations and the results of phased three-dimensional soil sampling efforts.

Results/Lessons Learned. By 2007, following the remediation efforts, the site was closed under RCRA and is currently in post-closure care and monitoring. Using multiple lines of evidence (vapor stream contaminant calculations, produced liquid concentrations, and high-resolution soil sampling) estimates of the mass removal ranged from 89% to 96%. The results of pre- and post-injection MIP evaluations demonstrated that the DNAPL was forced into new areas ahead of the injectate, which resulted in change in the remedial approach. Reducing the DNAPL mass and creating void space through the use of dual-phase SVE, followed by potassium permanganate flooding proved to be effective. Working with the agency to establish realistic remedial goals at a DNAPL site is essential.