Use of Electrical Conductivity Logging for Risk Evaluation at a Gasoline Spill Site

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Background/Objectives. Risk is the combination of hazard and exposure. Risk characterization at UST release sites has traditionally emphasized hazard (presence of residual fuel) with little attention to exposure. Exposure characterization is often limited to a one-dimensional model such as the RBCA equations, or a two-dimensional model such as the BIOSCREEN model applied to groundwater from traditional monitoring wells that are screened across the water table. At many UST release sites, the fuel is spilled into geological material with low hydraulic conductivity. This situation is particularly common in flood plain landscapes. It is very difficult to clean these sites to MCLs. Exposure through extraction of groundwater for use as drinking water may be minimal, even though the hazard exceeds concentration-based standards.

Approach/Activities. We conducted a survey of electrical conductivity in sediment at the Brown's Ashland site in Friendly, West Virginia. The site is on a terrace of the Ohio River. The water table is in the clay overburden and a release of motor gasoline is confined to the clay overburden. The shallow groundwater at the site is contaminated with benzene at 5,240 to 18,250 µg/L and TPH-GRO at 47,00 to 80,00 µg/L. Groundwater is produced for domestic use from a high-quality aquifer in sands and gravels below the clay overburden.

We evaluated the lithology from electrical conductivity logs to produce a site conceptual model for groundwater flow. We collected groundwater samples from temporary push wells, and compared the vertical distribution of benzene in groundwater to the capacity to move groundwater and produce a plume. We collected core samples at various depths, extracted the cores and determined concentrations of TPH and benzene in the sediment (mg/kg), and calculated the concentration of benzene in the pore water from the composition of the NAPL hydrocarbon. We then confirmed and validated the water well samples by comparing the calculated concentration of benzene in water based on the NAPL in core samples to the measured concentration in the well samples.

Results/Lessons Learned. Based on the vertical distribution of electrical conductivity, there is 30 feet of clay between the land surface and the top of the aquifer. Based on the analysis of the core samples, there is 20 feet of uncontaminated clay between the depth interval with gasoline contamination and the interface between the bottom of the clay layer and the top of the aquifer. Based on the distribution of TPH and the lithology, there is a minimal chance that fuel contamination at the Brown's Ashland site can enter the aquifer and find its way to a water supply well. Measured concentration of contaminants in temporary wells at the bottom of the clay layer are below the MCLs. There was hazard at the site, but no exposure and no risk to drinking water.