

Pore Water Sampling and Analysis Confirm Solute Transport Modeling Predictions

Russell A. Short, CH2M HILL, 115 Perimeter Center, Suite 700, Atlanta, Georgia, 30346.
770 604-9095. rshort@ch2mhill

Steven S. Brown, PhD, Rohm and Haas Company, 727 Norristown Road, Building 5, Spring House, Pennsylvania, 19477. 215 619-5323, stevenbrown@rohmmaas.com

An environmental investigation was performed at a former azo dye facility located adjacent to the Passaic River in Paterson, New Jersey to evaluate the potential transmission of Contaminants of Potential Concern (COPCs) from site groundwater to the Passaic River via sediment pore water. COPCs associated with the facility included volatile organic compounds and aromatic amines. A Conceptual Site Model (CSM) of the shallow overburden, deep overburden, shallow bedrock, and weathered bedrock defined the potential movement of groundwater toward the river. Groundwater monitoring and fate and transport modeling suggested that aromatic amines in the overburden might discharge to the river at the ground water/surface water interface. Historical groundwater COPC concentrations were used together with BIOSCREEN, a one-dimensional solute transport model, to simulate the migration of COPCs through the overburden and into sediment pore water. Verification of pore water concentrations was required to confirm ecological risks.

Six pore water sampling technologies were considered for collection of pore water samples to verify the BIOSCREEN results. The Trident Probe® was selected to collect pore water samples from 4 near-shore locations for laboratory analysis of COPCs in May 2006. Samples were collected from the interval 6-12 inches below the sediment/water interface. This interval was selected to measure the COPC concentrations affecting the biologically active zone. At this depth interval, the sediments were typically silty sands or sandy silts. An impermeable membrane was fabricated and placed on the sediment surface to prevent draw down of surface water and subsequent dilution of the pore water sample. Two samples were collected at each of the 4 stations. The membrane was relocated prior to collection of each sample. Temperature and conductivity data were collected in order to distinguish between surface water and pore water and to verify the collection of pore water. Surface water temperature ranged from 15.6-18.5 °C and conductivity ranged from 0.515-0.578 µS/cm. In comparison, pore water results were 14.4-15.7 °C and 0.6-1.2 µS/cm.

Pore water concentrations were predicted for 10 aromatic amines with BIOSCREEN, and these predicted values ranged from 0.82 to 214 µg/L. The observed concentrations ranged from 1.2 to 160 µg/L. Measured concentrations exceeded predicted (modeled) values for 4 specific aromatic amines. Measured concentrations were less than modeled concentrations in 82 out of 90 analyses. The greatest difference between predicted and observed concentrations occurred for compounds with predicted concentrations close to the practical quantification limit. These results indicate that the site specific solute transport model developed to simulate pore water concentrations provided close approximations of the actual results.