Optimizing Groundwater Contaminant Capture in a Variable, Semi-Confined Geologic Environment

Rod R. Rustad (rod.rustad@amecfw.com) and Scott Calkin (scott.calkin@amecfw.com)
(Amec Foster Wheeler, Portland, ME, USA)
Dan Groher (daniel.m.groher@usace.army.mil) (United States Army Corps of Engineers New England District, Concord, MA, USA)

Background/Objectives. Trichloroethene (TCE) was detected in groundwater in 1992 at the U.S. Army Cold Regions Research and Engineering Labs (CRREL) located in Hanover, New Hampshire. High-resolution characterization of the overburden groundwater has defined a plume approximately 900 feet long with TCE concentrations as high as 50,000 micrograms per liter. As part of mission support, CRREL extracts groundwater from five production wells for use as non-contact cooling water. Since 1994 between 500,000 and 1,000,000 gallons a day of extracted groundwater have been treated at an on-site treatment facility. Optimization activities have been undertaken to investigate and implement ways to reduce the amount of groundwater being treated while still allowing the facility to perform its mission.

Approach/Activities. Groundwater is currently being pumped from five production wells in the high yield esker deposits which abut the Connecticut River. Modeling has shown that most of the extracted groundwater is supplied directly from the river resulting in unnecessarily large treatment volumes. Optimization efforts have been focused on extracting contaminants from the lower yield glacio-alluvial deposits which occur immediately upgradient from the esker deposits. Capture of contaminants prior to discharge to the esker would allow for discontinuing non-contact cooling water treatment while still being protective of potential downgradient receptors. A 30-day constant rate aquifer test was performed to assess the potential for hydrogeologic capture as well as monitor for changes to contaminant distributions resulting from pumping within the esker and glacio-alluvial deposits. Two extraction wells were installed in each core of the groundwater plume. Sixteen wells/piezometers were equipped with water level transducers and barometric changes were monitored over a 30-day pumping period and a 5-day recovery period. Four of the five production wells were operating during the constant rate aquifer test.

Results/Lessons Learned. Preliminary results of the aquifer testing have indicated variable, semi-confined to confined conditions for much of the glacio-alluvial deposits. It was necessary to calculate and apply varying degrees of barometric efficiency to the various areas of the aquifer, ranging from near 0 (unconfined) at the esker to over 80 percent in finer grained glacio-alluvial portions of the aquifer in upgradient areas. Additional factors taken into account were the presence of an underlying coarse grained glacial deposit which was directly connected to the esker and allowed for propagation of production well influence beneath the glacio-alluvial deposits. Assessment is ongoing with initial results showing promise for successful groundwater treatment optimization.