ORGANOCLAYS: NOVEL BARRIER MEDIA FOR MANAGING GROUNDWATER FLOW AND TRANSPORT AT NAPL-SITES

by
Craig H. Benson, PhD, PE, NAE
Wisconsin Distinguished Professor
University of Wisconsin-Madison

Controlling flow and transport of non-aqueous phase liquids (NAPLs) and organic aqueous-phase contaminants simultaneously can be challenging, particularly at locations where hydrological isolation is not practical or will adversely affect the surrounding hydrological environment. One strategy is the variably permeable reactive barrier (VPRB), which blocks the flow of NAPL, allows the flow of water, and sorbs dissolved organic constituents in water passing through the barrier. This presentation describes a case history where organoclay was evaluated as a VPRB medium to manage creosote NAPL and dissolved polycyclic aromatic hydrocarbons (PAHs) in groundwater at a former railroad tie-treating facility. Both NAPL and dissolved-phase PAHs from the facility were seeping into a bay on Lake Michigan, severely affecting water quality and public use of the lake. The VPRB was required to block flow of both NAPL and dissolved-phase PAHs into the lake without appreciable impact on local groundwater flow patterns. Three commercially available organoclays were evaluated. Each was found to be nearly impermeable to NAPL (NAPL conductivities less than $10^{-8}$ cm/s) and very permeable to groundwater (hydraulic conductivities on the order of 0.1-1 cm/s), permitting a barrier that blocks NAPL flow while permitting free flow of ground water and removing dissolved PAHs. Water migration in NAPL-solvated organoclay was minimal, but PAHs were released into water contacting NAPL-solvated organoclay. Column tests using dissolved PAHs showed that breakthrough of PAHs did not occur for at least 240 pore volumes of flow (PVF) for two of the organoclays and that all three organoclays maintained high hydraulic conductivity even though they were sorbing PAHs. Numerical simulations showed that an organoclay barrier at the tie-treating site should have a service life of approximately 10 yr.

Wednesday November 20, 2013
Reception 4:00 to 4:30 in CEE Conference Room (2355 GGB)
Seminar 4:30 to 5:30 room 2315 GG Brown

More information on this seminar series: http://www.umich.edu/~geotech/lecture.html