Large Full-Scale In Situ Remediation of Groundwater with High Concentrations of PFAS Using PlumeStop™

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Background/Objectives. Per- and polyfluoroalkyl substances (PFAS) are considered an emerging contaminant in groundwater at many military and industrial sites. Aqueous film-forming foam (AFFF), used to extinguish fires, is a major source of PFAS in groundwater worldwide. PFAS has been shown to be effectively removed from groundwater using several different types of adsorptive media, including activated carbon. PlumeStop™ is a remediation product composed of very fine particles of activated carbon suspended in polymer that can be injected into the subsurface to facilitate in situ remediation of PFAS. After injection, the PlumeStop™ binds to the aquifer matrix and serves as an in situ filter to remove PFAS from groundwater as it comes in contact with the activated carbon particles. This project was performed at a former Fire Training Area (FTA) where groundwater is contaminated with PFAS from historic AFFF usage. Elevated PFAS concentrations were identified (generally greater than 10 parts per billion) in a shallow (0.5 to 3 feet below ground surface), perched aquifer. The subsurface consists of a fairly permeable industrial fill and sand, underlain by a continuous clay layer. Due to a regulatory driver, the remedial objective for the site was to reduce PFAS groundwater concentrations that were migrating from the perched aquifer to a nearby surface water body.

Approach/Activities. The approach for achieving the remedial objective was to install an in situ permeable treatment barrier perpendicular to groundwater flow along the perimeter of the FTA, upgradient of the surface water body. Prior to full-scale implementation, a pilot study was implemented to evaluate whether PlumeStop™ could 1) be adequately distributed in the subsurface and 2) effectively remove high concentrations of PFAS from site groundwater. Based on the pilot study results, a full-scale PlumeStop™ remedy was designed and implemented. The full-scale approach consisted of injecting over 292,000 pounds of PlumeStop™ into over 650 injection points to create a 1,625-foot long barrier perpendicular to groundwater flow. PlumeStop™ loading in certain areas was modified based on the presence of co-contaminants. To date, this is the largest application of PlumeStop™ to treat PFAS-contaminated groundwater.

Results/Lessons Learned. Data collected during the pilot study indicated that PlumeStop™ could be distributed at least 4 feet radially away from each injection point and PFAS concentrations in groundwater (specifically PFOS and PFOA, which are regulated in surface water) were reduced by more than 99.5 percent. Upon initiating full-scale implementation, several challenges were encountered due to the heterogeneous nature of the subsurface and shallow groundwater. Innovative techniques and best practices, developed to address these field challenges throughout the remainder of the full-scale implementation, will be shared at the conference. While performance monitoring data within the first 6 months showed significant (>99%) reductions in PFAS groundwater concentrations, additional localized injections were performed to reinforce certain areas of the barrier where subsurface challenges had been encountered. At the conference we will present more than 1.5 years of performance monitoring data from the full-scale implementation as well as results of predictive modeling.