Using Colloidal Activated Carbon to Reduce PFAS and PCE Concentrations in Groundwater to below Michigan's Drinking Water Limits for over Four Years

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Background/Objectives. Camp Grayling in Crawford County, Michigan is a year-round training center for the Michigan Army National Guard. The Michigan Department of Military and Veteran Affairs (DMVA) has been remediating chlorinated solvents in the site groundwater from historical operations at the facility since the 1990s. In 2016, the DMVA became aware of the potential contamination of PFAS from historical operations such as onsite firefighting training activities and began testing. PFAS was found commingled with a chlorinated solvent plume that was migrating towards the property boundary. The DMVA reviewed potential remedial options to test in the field such as pump and treat, but ultimately decided to test an in situ reactive barrier application of colloidal activated carbon, an approach that is first of its kind in the State of Michigan.

Colloidal activated carbon was selected because of the expected rapid reductions of PFAS by removal from the dissolved mobile phase and well-established uses for chlorinated solvent sites. Colloidal activated carbon effectively increases the retardation factor of PFAS migration contaminants by multiple orders of magnitude and eliminates the exposure to down-gradient receptors through an enhanced natural attenuation remediation strategy.

This presentation will review the project design considerations, field activities, and 4.5 years of post-application data. Additionally, the presentation will answer questions related to the distribution of the colloidal activated carbon in the subsurface and expected long-term efficacy at the site.

Approach/Activities. The project area was treated with a single application of colloidal activated carbon to address PFAS and chlorinated impacts in groundwater. Mass flux and predictive competitive sorption modeling was utilized to determine the appropriate amount of colloidal activated carbon required. The remediation solution was applied under low pressure (non-fracking) conditions using direct-push technology with separate soil cores and monitoring well gauging to determine distribution. Prior to treatment, total PFAS levels were detected in site groundwater samples above the USEPA drinking water advisory limit of 70 ng/L.

Results/Lessons Learned. The mass flux and predictive competitive sorption modeling demonstrated a theoretical PFAS retardation span of greater than 50 years. Results from monitoring the field activities demonstrate distribution of the colloidal activated carbon has been achieved using low pressure injection methods. Furthermore, the post-application groundwater monitoring results demonstrate PFAS and chlorinated solvent concentrations have been reduced to below Michigan's Drinking Water Standard. The contaminant concentration reductions in groundwater were achieved within one month after the field activities and have been sustained for over four years.