A Study of the Effectiveness of Colloidal Activated Carbon as an In Situ Treatment to Mitigate PFAS Migration in Groundwater at a Michigan Army National Guard Site

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Background/Objectives. Camp Grayling in Crawford County, Michigan is a year-round training center for the Michigan National Guard. The Michigan Department of Military and Veteran Affairs (DMVA) has been remediating chlorinated solvent impacts 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 on-site 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. 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. In addition, colloidal activated carbon was selected due to its expected lower total project costs when compared to operating a mechanical system over a similar time.

This presentation will review the project design considerations, field activities, and 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. Historical total PFAS levels were detected in site groundwater samples as high as 114.8 ng/L, which is 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 the field activities demonstrate distribution of the colloidal activated carbon has been achieved using low pressure injection methods. This study indicates that an in situ application of colloidal activated carbon is a viable low-cost alternative to the established remediation method of a high-cost pump and treat system to address the risk associated with PFAS contamination at the site.