Mass Flux as a Tool for Evaluating and Demonstrating Remedial Objectives and Optimizing a Combined Remedy Hydraulic Containment and Bioremediation System

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Background/Objectives. Historic releases of trichloroethene (TCE) from incidental discharges resulted in the contamination of the surficial aquifer system at the Precision Fabricating & Cleaning Company site in Cocoa, Florida (Site). TCE was used at the site between 1964 and 1977 for the precision cleaning of aerospace equipment. Detailed investigations in the late 1990s through early 2000s documented the presence of a dense non-aqueous phase liquid (DNAPL) source area and associated dissolved plume extending approximately 1,200 feet downgradient. Following the completion of assessment activities, which included detail transect-based high-resolution characterization, a hydraulic containment system was installed and began operation in July 2002. During the course of 15 years of hydraulic capture system operations, mass flux assessments have been used to: (i) evaluate baseline (pre-remediation) downgradient property line mass flux, (ii) provide a mass flux based line of evidence that the hydraulic capture system was achieving the objective of mitigating mass discharge across the property line, and (iii) evaluate hydraulic containment system optimization strategies, including altering pumping rates, modifying recovery/injection well screen intervals, and implementing a source zone bioremediation strategy in 2015, with an intent of reducing Site contaminant concentrations to facilitate shutdown of the hydraulic capture system.

Approach/Activities. Mass flux considerations associated with initial site characterization, hydraulic containment system operations, and the optimized hydraulic capture system were evaluated as a component of Site activities. Mass flux was initially calculated via an array of bundle wells with discrete interval sample ports installed in a transect perpendicular to groundwater flow. The concentrations within the transect were then utilized in combination with the groundwater flow velocity to calculate mass flux across the property line. Upon installation of a hydraulic containment system at the Site, which included an innovative hydraulic barrier system, the influent concentration from the recovery wells was utilized to calculate mass discharge which was then compared to the baseline mass flux as a line of evidence to support project objective achievement. Mass flux evaluation was also used to demonstrate the effectiveness of optimization strategies including altering pumping rates and modifying recovery/injection well screens to target impacted intervals. During the current combined remedy phase, where bioremediation has been incorporated into the hydraulic containment system operations to facilitate source zone treatment, changes in mass flux are being used to demonstrate and document the equivalent flux reduction achieved compared to trends in the pre-bioremediation implementation mass flux rates.

Results/Lessons Learned. The mass flux data collected at the Site spanning a period of 15+ years will be presented to support the cost effectiveness of the combined remedy bioremediation strategy implemented at the Site and the associated reductions in project life-cycle costs. Ultimately, the mass flux data will be used to develop and support an acceptable mass flux reduction to facilitate the permanent shutdown of the hydraulic containment system and associated transition to natural attenuation monitoring.