Utilizing a Contaminant Transport Model to Assess Remedial Alternatives, Estimate Cleanup Times, and Ultimately Optimize the Existing Remedial System

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Background/Objectives. Traditional site characterization (multi-level monitoring well sampling, vertical aquifer sampling, pumping tests, etc.) identified trichloroethylene (TCE) in groundwater at depths ranging from 25 to 180 feet below ground surface (bgs) over an area of approximately 33 acres at an industrial processing plant in northwest Michigan (Site). The site hydrogeology consists of a sandy aquifer to a depth of approximately 500 feet bgs. Currently, the Site utilizes a recovery well at the down-gradient edge of the Site to capture the TCE impacted groundwater prior to migration off-Site and a second recovery well near the apparent source area. The purged groundwater is disposed in an on-Site Class I non-hazardous disposal well screened in the Dundee Limestone from approximately 2,305 to 2,603 feet bgs. The source of TCE is unknown; however, traditional site characterization obtained since 1993 show that TCE is being captured on-Site by the existing purge well system.

The 30-year cost to run the existing purge well system has been estimated at $4,500,000 to $6,000,000. A feasibility assessment was completed to evaluate whether cost savings could be realized by implementing remedial technologies that reduce the treatment timeline. Based on a 2005 pre-design investigation and feasibility assessment, ozone treatment appeared to have the best potential to significantly reduce TCE concentrations in the shortest time and at the lowest total cost. However, the delivery of ozone to treat the 33 acres at depths ranging from 25 to 180 feet bgs was never implemented beyond the pilot study phase. Groundwater monitoring at the Site continued until 2016 when it was agreed that a contaminant transport model would be the best approach to determining a proper delivery system.

Approach/Activities. In 2016, a contaminant transport model was created utilizing 25 years of Site monitoring and characterization data and the ozone pilot study results to determine TCE migration and treatment under various scenarios. The contaminant transport model ran various remedial scenarios including ozone treatment and the installation of various additional pumping wells. The contaminant transport model indicated a strong likelihood TCE would migrate off-Site to a sensitive receptor unless additional remedial options were initiated beyond the existing system. The contaminant transport model determined ozone and other approaches to remediate the TCE were not viable due to exorbitant costs and timelines. The most feasible alternative involved installation of a second recovery well approximately 150 feet north of the current recovery well. The model assumed the second recovery well would be installed with the same parameters and dimensions as the currently operating down-gradient well. Currently, additional modeling is being conducted to optimize recovery and injection rates.

Results/Lessons Learned. The transport model anticipates the entire plume would be controlled by the two down-gradient recovery wells and would reduce TCE concentrations below applicable cleanup criteria within 15 years. After 15 years, natural attenuation would effectively control the TCE plume and prevent further migration. In summary, the contaminant transport model utilized years of site characterization data to identify potential risk for off-Site migration and determine an appropriate remedial option that potentially saves the client millions of dollars in remedial cleanup costs.