

In Situ LNAPL Treatment Following Pipeline Transmission Rupture

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Description. Failure of a 16-inch (in) stopple fitting at a petroleum pipeline transmission meter station in Michigan resulted in the release of approximately 1,700 barrels of gasoline fuel in June 2000. Approximately 1,400 barrels of fuel were recovered using vacuum trucks, booms, and underlain dams. Approximately 30,000 tons of impacted soil were removed to approximately 4 feet (ft) where accessible. Free product recovery via groundwater extraction capable of up to 25,000 gallons per month and long-term groundwater monitoring was conducted at the facility following the release; the groundwater extraction system was shut down in 2012. Due to access issues and compatibility concerns with multiple buried pipelines through the area of remediation, an innovative technology was required that could be implemented within the constraints present at this facility. BOS 200® was selected as the remedial technology: the selected option had to remove LNAPL and provide significant reductions in total sorbed and dissolved phase mass, control further plume migration beyond the area of treatment, and be implemented without compromising the integrity of the buried petroleum transmission lines. Additional characterization was conducted in September 2013 to further quantify and define the vertical and horizontal extent of total mass at the facility. It was determined that two injection events of BOS 200® would be required to accomplish the site clean-up goals; measurable LNAPL was present in numerous soil borings/monitoring points completed during the characterization, VOC and TVPH concentrations in soil exceed C_{SAT} threshold guidelines. The initial injection was performed in April 2014. The second injection event was completed in April 2016.

Summary. One year following the completion of the first injection event, resampling of soil and groundwater was performed to determine mass removal and reestablish the baseline for the second injection event. Total sorbed mass removal estimates across the treatment area averaged approximately 85% and 65% for benzene and Total Volatile Petroleum Hydrocarbons (TVPH) respectively. Dissolved phase mass removal estimates averaged approximately 85% and 65% for benzene and TVPH respectively. Performance groundwater monitoring has continued quarterly since completion. Results as of the December 2018 groundwater monitoring event indicate average benzene removal at 82% and TVPH at 92% when compared to pre-injection analytical data. The occurrence of LNAPL is now sporadic and isolated to an occasional sheen in 2 monitoring wells within the source area compared to year-round persistence with measurable thickness in 5 monitoring wells prior to treatment.

Objectives.

1. Remediation is only effective if there is an accurate conceptual site model (CSM)
2. Infrastructure dictates the investigative and remedial objectives and efforts
3. Remediation of total contaminant mass is not confined within regulatory clean-up standards
4. Remediation technology and implementation is dynamic: there is no "One-Size-Fits-All" approach for every site