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Title: Use of a Two-Phase Barrier Approach to Address Mobile LNAPL and Residual Groundwater Impacts at a Refinery

Author's Names: Abby Small

Presenter's Name: Abby Small

Key Topic: Innovative Remediation Technologies

PDP Manager/Managing Principal's Name: Jim Hutchens/Jennifer Hagen

Client Name: Calumet Montana Refining (CMR)

Project Name: AOC-16 Interim Measures Design and Construction

Project Location: Great Falls, Montana

Primary Ramboll Project Staff (Office): Dave Heidlauf, Scott Tarmann, Ruta Deshpande, Phil Brochocki, Paul Lindquist, Heath Ward

ABSTRACT

Background/Objectives:

Ramboll was tasked with designing and implementing interim remedial measures to address potential dissolved-phase impacts to the Missouri River stemming from a petroleum release near CMR's Loading Rack. Site characteristics constraining design and implementation included: 1) heterogenous hydrogeologic unit of generally low hydraulic conductivity with narrow seams of higher conductivity with the potential to transmit light non-aqueous phase liquid (LNAPL); 2) property access constraints which limited work to a 23-foot-wide parcel with a high density of utilities.

Approach/Activities:

Ramboll's design included a series of two trenches perpendicular to the direction of groundwater flow. A LNAPL recovery trench was installed upgradient to recovery LNAPL and limit LNAPL from entering the downgradient permeable reactive barrier (PRB) and overrunning the sorption capacity of the reactive media. Because of the heterogenous lithology, if migrating LNAPL was present, it was likely in thin, higher conductivity zones. Because the exact location of the thin, higher conductivity zones was unknown, the trench was installed to protect the entire face of the PRB. Recovery wells outfitted with passive skimming canisters were installed within the trench to monitor and extract accumulating LNAPL. The downgradient PRB was backfilled with a reactive media consisting of a colloidal activated carbon plus terminal electron acceptors (Regenesis Product Petrofix) incorporated into coarse sand. Groundwater contamination that flows through the PRB partitions from the dissolved phase by adsorption to the activated carbon particles and are anaerobically biodegraded stimulated by electron acceptors.

Results/Lessons Learned:

In the approximately one year since installation, LNAPL has been identified in 9 of 11 recovery wells and 90.5 gallons of LNAPL have been passively recovered. The initial three rounds of verification groundwater sampling indicate that the concentration of dissolved phase petroleum constituents of concern decrease across the passive treatment trench, initially meeting the remedial goals.

Aspect of Work that Relates to Sustainability:

The groundwater treatment and LNAPL recovery are occurring passively requiring limited resources for operation and maintenance as compared to more resource intensive alternatives such as pump and treat systems. The specified reactive media treats groundwater through a dual approach of adsorption and biodegradation. Due to the continuous biodegradation processes, the reactive media should never be fully consumed and anticipated lifespan is greater than 30 years.