Sustainability as a Key Driver in Selecting a Site Remedial Strategy: Installing a Reactive Zone to Mitigate Off-Site Migration

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Background/Objectives. At an operating manufacturing plant in Western Europe, a multi-level remedial strategy has been developed to address chlorinated solvent impacts present in soil and groundwater. The main compounds observed at the Site are tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1,1-trichloroethane (TCA), and its breakdown products. The impacts are associated with historical degreasing activities performed at the Site, and remediation is required in order to address potential risks to human health and the environment. The Site remedial strategy included remediating the on-site source areas, and installing a pump and treat (P&T) system at the Site border to contain the groundwater plume leaving the Site. This approach had already been discussed and approved by the local regulators. In order to obtain a more sustainable remedial solution for the Site and reducing the long-term project costs associated with the operation and maintenance of the P&T system, an alternative approach considering the installation of an in situ reactive zone (ISRZ) at the Site border was presented to the regulators. Monitored natural attenuation (MNA) results and sustainability factors such as cost-effectiveness in terms of mass recovery, carbon footprint, and waste generation, were used to support the shift in remedial strategy, and a new remedial action plan was submitted to the environmental authorities. This presentation shall focus on the rationale behind the shift in remedial strategy at the Site and the results obtained thru the field pilot test performed at the Site, confirming that the installation of an ISRZ was a viable sustainable alternative to mitigate off-site migration.

Approach/Activities. The implementation of the MNA program at the Site happened in the early stages of the project, when the first evidences of natural attenuation processes were identified (decrease in concentrations of mother compounds and increase in concentrations of breakdown products). In addition to the MNA program, a field pilot test was implemented in order to confirm whether a significant mass reduction at the site border would be attainable through enhanced reductive dechlorination (ERD). Four separate field pilot studies were conducted to test different substrates as well as different injection techniques. The selection of substrates for the pilot was based on their estimated effectiveness for the compounds of concern and their applicability considering the local hydrogeological conditions.

Results/Lessons Learned. Only three out of the four selected substrates were able to be injected and met the established project goals. Both direct-push and vertical injections wells were considered viable options for delivering the substrates, and based on the groundwater monitoring results, a significant bio-stimulation and associated mass reduction were attainable by two out of the four tested substrates. The assessment on preferred substrate and injection technique for full-scale application was based on the contaminant mass reduction achieved by each product, and the associated costs for maintaining the ISRZ in place for a period of 10 to 15 years. The results of the pilot test confirmed that the installation of an ISRZ was a viable sustainable alternative to mitigate off-site migration, and the injection of the reagent 3-D Microemulsion™ via vertical injection wells was selected for full-scale implementation.