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Title: *In-Situ* Anaerobic Bioremediation and Chemical Reduction of PCE Impacted Groundwater

Authors' Names: Mark Mejac, David Lis, John Metzger, Eric Andruk

Presenter's Name: Eric Andruk

Key Topic: Innovative Remediation Technologies

PDP Manager/Managing Principal's Name: Tim Whiting/David Lis

Client Name: Confidential

Project Name: Former TCC – Branford

Project Location: Branford, Connecticut

Primary Ramboll Project Staff (Office): Hartford, Connecticut

ABSTRACT

Background/Objectives:

The approximately 30-acre Site consists of four adjoining industrial properties located in Connecticut. Past releases of chlorinated volatile organic compounds (CVOCs), specifically tetrachloroethene (PCE), were detected near former vapor degreasers and drum storage areas at several discrete locations across the site. CVOC groundwater plumes have been identified within shallow and deep heterogenous overburden soils and the underlying Middletown Formation, which is comprised of Ordovician-age weathered metamorphic bedrock. The releases of PCE migrated through the vadose zone into the saturated zone overburden and eventually into the weathered bedrock. Remedial objectives include reduction of CVOC concentrations in groundwater and to facilitate compliance with applicable Connecticut Department of Energy and Environmental Protection (CTDEEP) Remediation Standard Regulations (RSRs).

Approach/Activities:

Groundwater remediation using in-situ enhanced reductive dechlorination (ERD) technologies has been conducted since 2018 to treat the CVOC plumes within the shallow and deep heterogenous soils and weathered bedrock. In order to inject into low permeability soils within portions of the site, a method of discrete interval direct push injections were utilized. This approach reduced the potential for daylighting through cracks in the pavement, monitoring wells, or into nearby wetlands. Bioremedial injections were conducted in general accordance with a work plan and permits which were acquired from CTDEEP and municipal agencies. The injected amendments included an emulsified carbon substrate, which was composed of approximately 60% long-chain and 5% short-chain fermentable carbon to allow for both a short-term and long-term release. Sodium bicarbonate was co-injected as an aquifer pH buffer, and bioaugmentation using dechlorinating microbial cultures was conducted to enhance rates of biotic dechlorination. This approach allowed bioremedial amendments to be placed directly within the zones of interest in the overburden which would optimize remedial response. These discrete intervals varied per property and ranged between 10 and 30 ft bgs.

Results/Lessons Learned:

The results of post-injection overburden monitoring have identified significant reductive dechlorination of parent PCE concentrations with concurrent increases in degradation product concentrations. As the remedial efforts to date have primarily focused on impacted shallow and overburden groundwater, the following changes have been observed in CVOC concentrations in the most heavily impacted overburden monitoring well:

— PCE decreased from 1,710 micrograms per liter (µg/L) to 7.41 µg/L

— Trichloroethene decreased from 8,180 µg/L to 48.6 µg/L

— Cis-1,2-Dichloroethene decreased from 30,500 µg/L to 220 µg/L

— Vinyl chloride increased from <200 µg/L to 682 µg/L, then declined to 64.9 µg/L with concurrent generation of ethene.

Aspect of Work that Relates to Sustainability:

he rapid reductive dechlorination of PCE-impacted groundwater was achieved in the absence of operation and maintenance of a groundwater treatment system, and associated energy usage. The application of such direct injection approaches to achieve compliance with regulatory criteria via minimal environmental footprints demonstrates Ramboll's continued commitment to a sustainable future.