

## HIGHLY SUCCESSFUL ERD PILOT STUDY USING SIMPLE ADDITIVE DELIVERY SYSTEM LEADS TO FULL V3

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The site, a former dry cleaner, currently a vacant unit in a strip mall in Southern Ontario, Canada, area zoned commercial and residential. Subsurface investigations since 2006 document chlorinated volatile organic compound (cVOC) impacts to soil and groundwater. Contaminants-of-Concern (COC) include Tetrachloroethylene (PCE) and associated daughter products; concentrations above Ministry of Environmental & Climate Change (MOECC), Table 3 Site Condition Standards (SCS).

In October 2011 G2S Environmental, Inc (G2S), the consultant of record, completed 6½-month on-site Pilot-Study to evaluate the efficacy of BioStryke® biostimulant ERDenhanced™ to enhance cVOC reductive dechlorination by native microbial populations under actual biogeochemical conditions. In March 2011 additive deployment performed using two (2) passive release sock (PRS) units suspended vertically within the screened interval of saturated soil column of existing 2-inch groundwater monitoring well MW-2. Three (3) PRS replacement events were performed during the evaluation to replace additive depleted units. The last replacement performed week-20 of the 26-week evaluation.

Baseline monitoring, sampling-analytical testing was performed prior to additive deployment. Four (4) post-deployment performance monitoring/testing events were completed concurrent with PRS replacement, the final monitoring/sample event completed at week 26.

Pilot results confirmed introduction of ERDenhanced™ at MW-2 enhanced scavenging of alternative terminal electron acceptors, expedited residual mass solubilization, and enhanced cVOC reductive dechlorination by native dechlorinating populations. Specifically, [PCE] decreased 46.9% by week-8, increased 233.3% by week 14 due to solubilization owing to ERDenhanced™ stimulated surfactant/co-solvent effects, then decreased 89.6% by week-26. Total [cVOCs] similarly decreased 49.6%, increased 282.6% then decreased 77.4%; and, the molar fraction (Parent-Parent/Daughter Molar Ratio (P:PD Ratio) decreased from 100% to 29.1% (70.9%REDUCTION) confirming dehalorespiration of parent PCE. Geochemical data provided a secondary line of evidence of enhanced reductive dechlorination.

July 2013 G2S implemented a MOECC approved full-scale remediation strategy combining source removal by excavation and biostimulation using ERDenhanced™ to address remaining residual and dissolved phase cVOC contaminants. Approximately 90 m<sup>2</sup> (250 m<sup>3</sup>) of cVOC impacted soils were excavated to roughly 3 meters bgs. Structural constraints limited additional excavation. An injection gallery installed in excavation footprint consisting of clear stone and 6-inch slotted PVC pipe placed 2-3 meters bgs. A groundwater sump was installed to remove groundwater from the excavation after backfill operations. In March and July 2014, 990kg and 840kg of ERDenhanced™ respectively was gravity fed into the gallery using 11,000 Liters of make-up water creating an approximate 9% slurry.

Five (5) rounds of groundwater monitoring-sampling were completed between March 2014 and October 2015. The following results summarize performance over approximately 19-months of treatment at

monitoring wells MW-2, MW-3 and MW-6 located approximately 15-20 meters downgradient from the infiltration gallery.

With regards to [PCE], 99.9% (MW-2), 95.0% (MW-3), and 97.9% (MW-6) reductions were achieved. In terms of total [cVOC] 89.7% (MW-2), 75.8% (MW-3), and 88.1% (MW-6) reductions were achieved. In terms of molar parent fractions, ERDenhanced™ achieved a 99.0% (MW-2), 87.7% (MW-3), and 90.0% (MW-6) reduction, respectively.

Clearly, ERDenhanced™ expedited cVOC destruction within the desired treatment zone by increasing contaminant bioavailability via expedited solubilization and enhancing reductive dechlorination by native dechlorinating populations. As with the Pilot evaluation, secondary geochemistry metrics confirm enhanced reductive dechlorination achieved conducive conditions for reductive dechlorination including [Total Organic Carbon] (TOC) in the performance wells >100 mg/L.

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