Environmental Services Association of Alberta

Vertex Environmental Inc.



A Progressive In-Situ Remediation Approach for Dry-Cleaning Sites: Understanding The Subsurface

> EnviroTech Virtual Conference June 2, 2021 Patrick O'Neill, M.A.Sc., P.Eng.

Presentation Overview

- Vertex Environmental
- High Resolution Site Characterization (HRSC)
 - Deployment
 - Membrane Interface Probe (MIP) Overview
 - Typical MIP Output
- Edmonton, AB Case Study
 - Site History
 - HRSC Objective
 - HRSC Results
 - Remediation Optimization & Results
- Closing



Vertex Environmental Inc.

Specialized Contractors



- Founded in 2003
- Specialized Environmental Remediation Contracting Firm
- High Resolution Site Characterization (HRSC)
- Patrick O'Neill, M.A.Sc., P.Eng.
 - University of Waterloo (Environmental/Civil Engineering)
 - 10+ Years of Environmental Consulting & Contracting Experience



High Resolution Site Characterization (HRSC)

What is HRSC?

"High-resolution site characterization (HRSC) strategies and techniques use scale-appropriate measurement and sample density to define contaminant distributions, and the physical context in which they reside, with greater certainty, supporting faster and more effective site cleanup." – US EPA

- Rapid, efficient, high quality data collection (Supplement/Compliment Phase II ESA)
- Better Understand the Site subsurface complexities
- Make more informed/better decisions to lead to better/innovative remediation/site closure.





High Resolution Site Characterization - Deployment



VERTEX





- Three detectors within the Gas Chromatograph:
 - Photoionization Detector (PID)
 - Flame Ionization Detector (FID)
 - Halogen Specific Detector (XSD)
- Detection of VOCs:
 - Petroleum Hydrocarbons (PHCs)
 - Chlorinated Solvents (TCE, PCE, TCA, etc.)
 - ~200 ppb detection limit of total VOCs in subsurface
- Electrical Conductivity
 - Soil classification





MIP Output

HRSC Case Study Edmonton, AB

MIP Case Study – Site Background

Site Background:

- Edmonton, AB, historical dry cleaners
- Chlorinated Volatile Organic
 Compounds (CVOC) in soil and
 groundwater impacts
- Client had Phase II ESA's & monitoring completed from 1999 to 2014
- DNAPL suspected on-Site based on Tetrachloroethylene (PCE) concentrations on-Site
- Fractured Clays present across the Site
- PCE suspected to migrate along fractures and diffuse the into the soil matrix



MIP Case Study – Site Plan



MIP Case Study – Objectives

MIP Survey:

- Update the suspected source zone delineation
- Update the delineation to the downgradient on-Site CVOC plume
- Delineation both vertically and horizontally for the purposes of supplementing a future in-situ remediation program



MIP Case Study - Results



- Completed 33 locations for over 435 m (1,400 ft) of MIP survey total depth
- Average depths 13 mbgs (~43 ftbgs)
- Total of 9 days on-Site
- Source Zone(s) delineated on-Site
- Downgradient plume delineated on-Site



MIP Case Study - Results











MIP Case Study - Results



MIP Results Takeaways

- MIP identifies Source Zone and delineated highest impacts horizontally and vertically
- Elevated CVOC responses directly downgradient from source Zone next to former utility pathways → Previously unknown
- MIP data collected used for remediation bid package



MIP Case Study - Remediation Optimization & Results

Site Delineation:

- Nine (9) days on-Site to complete MIP Survey of CVOC soil and groundwater impacts
- Successful deployment of 33 locations for MIP
- On-Site horizontal and vertical delineation
- Isolated source zone(s) identified/discovered and delineated on-Site
- Client happy with delineation results of MIP

Remediation Optimization:

- In-Situ "design/build" remediation tender sent out bid → Vertex part of winning bid to execute remediation (Sept/Oct 2018)
- In-Situ Chemical Reduction (ISCR) Program executed on-Site which included Zero Valent Iron and Emulsified Vegetable Oil slurry
- Site subdivided into cells with varying ISCR loading concentrations and injection depth intervals
 - · Optimized ISCR program/subdivisions made possible from both MIP data and analytical data
- PCE concentration reductions from as high as 22,000 ug/L (2017) to 73.8 ug/L (from Spring 2019)
- Up to 99.7% Reductions of PCE in groundwater



Closing Thoughts

High-Resolution Site Characterization:

- Boreholes / Monitoring well (150 300 cm vertical resolution)
- MIP Boring (30 cm vertical resolution)
- Efficient delineation/screening with more information
- Used in conjunction with limited sampling program for optimized Site investigations/correlations
- Detailed data interpretation
 - Rapid and detailed contamination delineation
 - Produce 2D and 3D plots
 - Allows for more precise remedial design and increase likelihood for successful site closure



Understand the Site better!





Questions?

Thank You for Your Time

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